

Review

Unveiling the barriers to digital transformation in higher education institutions: a systematic literature review

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Received: 10 September 2024 / Accepted: 7 February 2025

Published online: 18 February 2025

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Abstract

This study investigates the challenges hindering the implementation of Digital Transformation (DT) in Higher Education Institutions (HEIs) by thoroughly reviewing the literature. It identifies multiple dimensions and subdimensions of these barriers to offer valuable insights to help HEIs navigate their transformation processes successfully. By doing so, they can effectively address the changing requirements of students, faculty, administration, and other stakeholders in an increasingly digital environment. This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, synthesizing data from twenty (20) relevant peer-reviewed articles published between 2019 and 2024. The author employed NVivo and Zotero as methodological tools for coding, thematic analysis, and text mining to derive insights from the selected articles, thereby facilitating the development of a Concept-Centric Matrix of the Barriers to Digital Transformation (DT) in Higher Education Institutions (HEIs). The result of this study is summarized in a Concept-centric Matrix on Barriers to DT in HEIs consisting of nine (9) dimensions such as (i) Digital Vision, Strategy, and Policies; (ii) Digital Leadership and Management; (iii) Digital Organization; (iv) Digital Resources; (v) Digital Competence; (vi) Digital Stakeholder Management; (vii) Digital Culture; (viii) Digital Academic; and (ix) Digital Ethics. Each dimension has subdimensions of barriers ($n=80$). Despite various sectors anticipating significant DT, many HEIs feel inadequately prepared to adapt because of the barriers to its implementation. The ongoing DT within HEIs reveals a complex landscape marked by various intertwined barriers that necessitate a strategic reevaluation and a commitment to fostering an inclusive, responsive educational environment.

Keywords Barriers · Concept-centric matrix · Digital transformation · Education · Higher education · HEI · Higher education institutions · NVivo · PRISMA · Systematic literature review · University

1 Introduction

In today's higher education environment, the need for digital transformation (DT) has become more apparent, propelled by continuous technological progress and its significant societal impacts. A recent survey revealed that 87% of companies anticipate DT in their industries, but only half believe they are adequately prepared to manage these transformations [1]. This disparity underscores the pressing need for institutions, particularly Higher Education Institutions (HEIs), to rethink their operational models to remain relevant and competitive in evolving technological advancements. As we progress further into the Fourth Industrial Revolution, marked by digital paradigms such as artificial intelligence (AI), machine learning (ML), blockchain technology, 5G technology, quantum computing, augmented reality (AR), virtual reality (VR), the

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Internet of Things (IoT), edge computing, cybersecurity innovations, and big data, the education sector is also undergoing transformation [2]. The impact of digital technology is expanding swiftly on a global scale, impacting both existing and new activities in every sector [3], which is also prominent in the education sector.

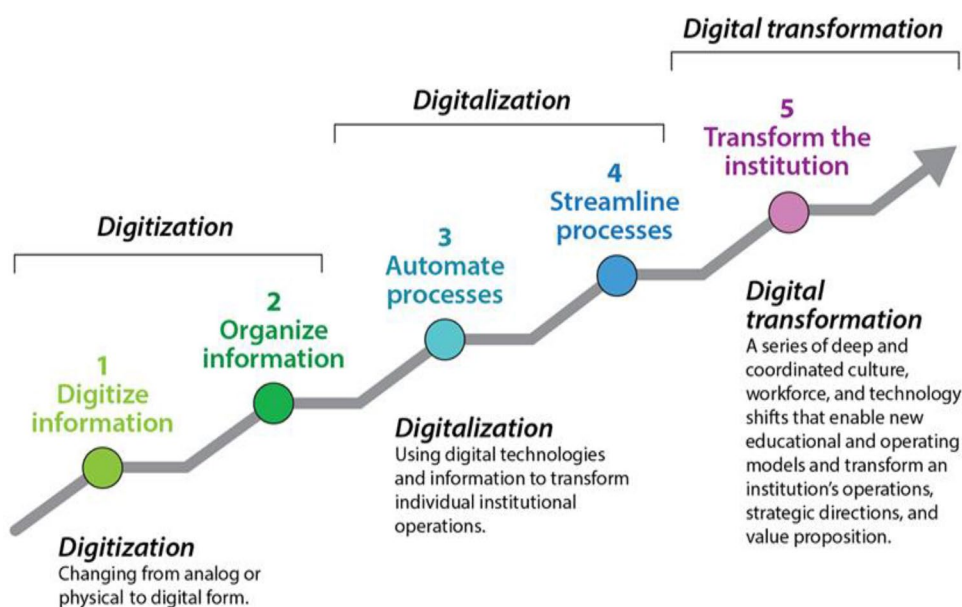
According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), digital innovation can support and improve education, helping to make quicker progress toward universal access to quality learning, as outlined in Sustainable Development Goal 4 [4]. It can make learning more effective and relevant, promote inclusivity, and improve how education is managed and organized. As noted by Mhlanga et al. [5], numerous HEIs strategically integrate digital technologies into their systems to transform conventional teaching and learning approaches, research processes, administrative tasks, and student services [6]. This is done to address the evolving demands of students for personalized learning experiences and research methodologies, enhance institutional management and operational strategies, and improve the quality and accessibility of education. Additionally, these efforts aim to enhance the effectiveness and efficiency of daily operations [7]. DT improves students' learning experience, streamlines administrative tasks, and fosters innovation within academic environments. It entails implementing new skills and approaches through digital technology to revolutionize organizational operations.

DT extends beyond the mere digitization of physical records or the implementation of technology to enhance business operation speed and efficiency [8]. It is not merely a matter of adopting innovative technologies; it encompasses a comprehensive rethinking of processes, pedagogies, and institutional cultures. From the initial phases of digitization and digitalization, which focused on automating processes and improving operations, the current phase seeks to redefine the core mission and business models of educational institutions [9]. DT entails significant shifts in culture, workforce dynamics, and technology that facilitate the implementation of innovative educational and operational frameworks, influencing an institution's operations, strategic objectives, and value proposition. Frequently confused with digitization and digitalization, Brooks & McCormack [8] clarify that DT is a distinct and multifaceted process that consists of different pathways and phases, as depicted in Fig. 1.

Unlike a single initiative, DT is an ongoing journey that drives increasingly significant organizational changes over time [8], as depicted in Fig. 1. This aligns with the perspective of Verhoef and colleagues [10] who adopt an interdisciplinary approach, stating that DT progresses through several distinct phases: digitization, involving the transition from analog to digital technology; digitalization, focusing on enhancing existing systems and processes through IT solutions; and DT, the most comprehensive phase encompassing the development of entirely new processes, disruptive technologies, and solutions based on the preceding phases.

Digitization is a way to facilitate change rather than a goal. By viewing digitization as a tool for improving organization, we can appreciate how digital technologies can enhance DT. This transformation requires a shift in culture and mindset, focusing on reducing bureaucracy and prioritizing users' needs while effectively managing information resources. For HEIs, embracing DT involves rethinking both current and future processes, leading to structural and cultural shifts that

Fig. 1 Stages of digital transformation [8]



create new opportunities. Ultimately, digitization serves as a way to innovate and enhance an institution's identity and operations, providing real benefits through improved systems and processes [11].

Identifying and tackling the key challenges that can emerge when starting DT initiatives in higher education is essential. A frequent reason for the failure of DT projects is insufficient comprehension and handling of these challenges [9]. This underscores the necessity for further research on how HEIs can enhance their comprehension of DT and meet the requirements of the fourth industrial revolution [12]. For HEIs that embrace DT, it is imperative to identify and address the barriers that could impede their progress toward achieving DT objectives [13].

Nevertheless, the path to achieving successful DT at HEIs is fraught with barriers. Recognizing and understanding the barriers is crucial for the progress of HEIs in developing a strong DT strategy. By tackling these barriers and crafting customized strategies, HEIs can aspire to cultivate a more flexible and resilient educational environment that aligns with the demands of students and society in the digital era. This research aims to illuminate the complexities related to DT in higher education by conducting a systematic literature review that answers the following research question: What are the barriers to digital transformation (DT) in higher education institutions (HEIs)?

This article is organized into distinct sections. The subsequent section outlines the methodologies employed in the study. Section 3 presents the outcomes derived from the systematic literature review. Section 4 delves into a detailed discussion and explanation of the findings. Finally, Sect. 5 provides conclusions, recommendations, reflections on limitations, and suggestions for future research.

2 Review methodology

The researcher used a systematic approach to examine pertinent literature related to the research query. The well-established Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [14], which guarantee a clear, comprehensive, and high-quality synthesis of existing evidence and enable critical evaluation of methodological rigor and relevance across diverse research fields, were used. This process involved creating a transparent flow diagram illustrating the study selection process and outlining each research step, as depicted in Fig. 2. A thorough search was conducted for original articles published from 2019 to 2024, leading to the selection of 20 pertinent studies for inclusion. The period from 2019 to 2024 was selected to ensure that the literature review includes the most relevant, high-quality, and current research. This approach provides a solid foundation for understanding contemporary issues and guiding future studies. The selected studies were summarized and analyzed to improve understanding of the topic.

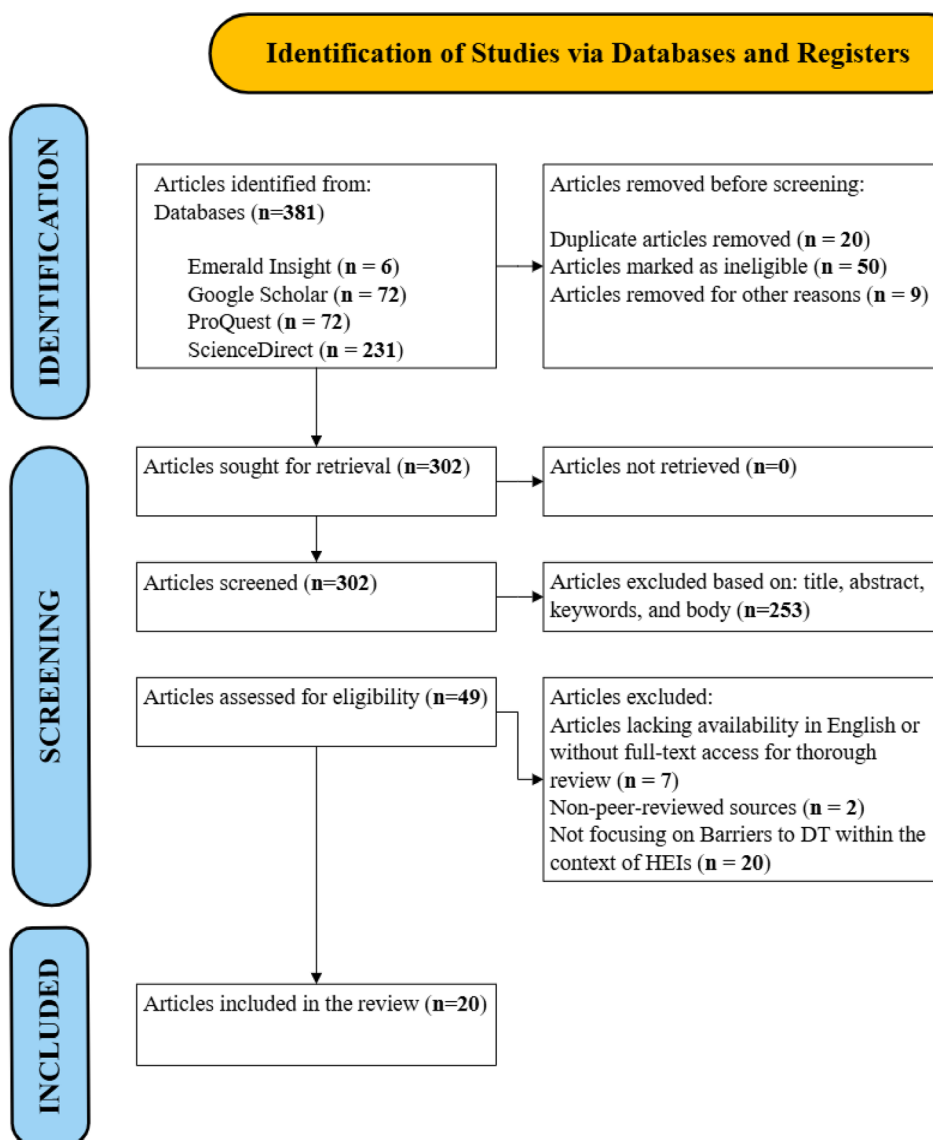
2.1 Information sources and search strategy

Table 1 shows that relevant studies were methodically gathered from four databases: Emerald Insight, Google Scholar, ProQuest, and ScienceDirect. These databases were selected due to their easy access to open-access scholarly articles across various academic fields, providing a dependable and extensive source of literature for research. It means that prioritizing open-access journals allows the author to develop a literature review that is both comprehensive and accessible, while also accurately reflecting the current state of knowledge across a diverse array of academic disciplines. The authors followed stringent selection criteria to ensure that the included publications met high-quality standards and underwent comprehensive peer reviews. Additionally, these databases allow for citation tracking of both articles and authors. The literature search used string construction and Boolean operators, specifically 'AND' and 'OR', to combine the selected variables effectively.

2.2 Selection process using the eligibility and quality criteria

Zotero, a complimentary reference management software, was utilized to systematically catalog and organize three hundred eighty-one (381) scholarly articles as samples, facilitating the citation and sharing of resources pertinent to the literature review. The initial collection excluded seventy-nine (79) articles from the sample due to duplication and ineligibility, as indicated in Fig. 2.

When searching for articles with keywords, most likely, some seem useful but are not. It is necessary to carefully review the articles manually after the initial search to assess their relevance to the research question. Subsequent analysis of

Fig. 2 Review protocol using PRISMA

titles, abstracts, keywords, and article contents eliminated two hundred fifty-three (253) other articles, leaving a subset of forty-nine (49) articles for further evaluation, as detailed in Fig. 2. The article quality was evaluated using the predefined inclusion and exclusion criteria outlined in Table 2 to determine the selection of articles for thorough reading and analysis. This resulted in the removal of twenty-nine (29) articles, yielding a final sample size of twenty (20) articles considered relevant to the research inquiry and incorporated into the review, as mentioned in Fig. 2.

2.3 Synthesis methods

The researcher employed NVivo, a qualitative data analysis software, as a methodological instrument for coding, thematic analysis, and text mining to derive insights from the selected articles. The researcher posits that utilizing this software may mitigate the potential for reporting bias. In this phase of the study, the researcher initiated the encoding and analysis of the outcomes from the SLR by employing a concept-centric matrix methodology. A concept-centric matrix was developed to methodically document the different variables linked to each identified construct [15]. Following the analytical phase, the researcher collectively synthesized the findings obtained from the analysis, as illustrated in Table 5.

The following charts generated by NVivo serve various purposes in qualitative data analysis:

Table 1 Search keywords

Database	Search keywords	Results
Emerald Insight	((abstract: "digital transformation") AND (abstract: "higher education" OR (abstract: "higher education institution" OR (abstract: "university")))) AND (abstract: "barriers" OR (abstract: "challenges" OR (abstract: "issues"))))	6
Google Scholar	Allintitle: "digital transformation" AND "higher education" OR "university" OR "HEI" AND "barriers" OR "challenges" OR "issues"	72
ProQuest	Ab ("digital transformation") AND (ab ("higher education") OR ab ("higher education institution") OR ab ("university") OR ab ("HEI")) AND (ab ("barriers") OR ab ("challenges") OR ab ("issues"))	72
ScienceDirect	("digital transformation") AND ("higher education" OR "higher education institution" OR "university" OR "HEI") AND ("barriers" OR "challenges" OR "issues")	231
	Total	381

Table 2 Inclusion, exclusion, and quality criteria

Inclusion Criteria	Exclusion Criteria	Quality Criteria
Peer-reviewed articles published in academic journals that meet the following specifications: a) Article publication dates range from 2019 to 2024. b) The articles are written in English and are available in full-text format. c) The articles are accessible as open-access publications Studies must conduct an in-depth analysis of barriers to DT across diverse dimensions within HEIs, including but not limited to teaching, learning, research, and administrative processes	Articles lacking availability in English or without full-text access for thorough review Non-peer-reviewed sources, including but not limited to blog posts, opinion pieces, and news articles Studies that do not centrally focus on the significance and scope of barriers to DT within the context of HEIs	Consistency between the article's objective, method, and results Article's compliance with the inclusion/exclusion criteria

- A word cloud that visually stands for text data, where word size shows frequency, highlighting keywords and themes. A heat chart that uses color to display individual data values helps find patterns in the articles under review.
- A cluster analysis chart summarizing key points and relationships was constructed to provide insights into the articles.
- A Sunburst Chart represents hierarchical data as concentric rings in a circle. The data values are encoded as arcs within each ring that organize and visualize the relationships among the coded themes.
- A project map that visually represents a project's structure and components enables the researcher to grasp an overview, manage complexity, explore data relationships, and communicate findings effectively.

Furthermore, the following charts were created using Tableau:

- A geographic map cloud that visually displays data in a geographical context.
- A line graph illustrates the trends in the volume of published reviewed articles over time.

3 Research findings

3.1 Demographics of reviewed articles

Table 3 presents an overview of the twenty (20) reviewed articles conducted across various continents, excluding Antarctica, Oceania, and South America, as illustrated in Fig. 3. Most of these articles did not specify the names of the Higher Education Institutions (HEIs) being studied and instead referred to them in general terms. Additionally, Table 4 summarizes the publication trends, showing a peak activity at the beginning of 2020, with continued momentum in later years, as illustrated in Fig. 4. This highlights the significance of DT in HEIs, particularly with the emergence of the COVID-19 pandemic [5, 16–18].

3.2 What are the barriers to digital transformation (DT) in higher education institutions (HEIs)?

As shown in Fig. 5, the prominent terminologies extracted from the collection of scholarly articles for review include (i) Digital Transformation, (ii) Higher Education, (iii) Teaching and Learning, (iv) Technology, and (v) Online Technologies. Figure 6 presents the foremost barriers identified through coding mechanisms that comprise (i) limited ICT infrastructure, (ii) deficiency in digital literacy skills, (iii) abilities and competence, (iv) inconsistent strategies and reference models concerning digital vision, and (v) a culture that is averse to change. The cluster analysis illustrated in Fig. 7 reveals a significant interrelatedness among all coded classifications or themes within the articles examined. Furthermore, Fig. 8 presents a Sunburst Chart that highlights the most frequently coded dimensions, specifically (i) Digital Resources; (ii) Digital Vision, Strategy, and Policies; (iii) Digital Culture; and (iv) Digital Competence.

This systematic literature review found nine (9) dimensions of barriers to DT, such as Digital Vision, Strategy, and Policies; Digital Leadership and Management; Digital Organization; Digital Resources; Digital Competence; Digital Stakeholder Management; Digital Culture; Digital Academic; and Digital Ethics. Each dimension has subdimensions that outline the specific barriers, as shown in Table 5. Overcoming these barriers is essential for the effective execution of DT strategies in HEIs.

3.3 Digital vision, strategy, and policies

HEIs are urged to formulate a comprehensive vision and develop and implement policies, strategies, and operational plans to facilitate an advanced stage of DT.

3.3.1 Digital vision

As shown in Fig. 9, without a well-defined digital vision, there can be divergent interpretations and inconsistencies among vision, policy, and implementation, underscoring the significance of stakeholder engagement and awareness.

Table 3 Demographic information of the reviewed articles

Paper ID	Title	HEI	Country	Publication year
P1	Assessing Digital Transformation in Universities [2]	HEIs in Mexico	Mexico	2021
P2	Digital Transformation Blueprint in Higher Education: A Case Study of PSU [6]	Prince Sultan University	Saudi Arabia	2023
P3	Avoiding the Dark Side of Digital Transformation in Teaching. An Institutional Reference Framework for eLearning in Higher Education [20]	HEIs in Spain (Not Specified)	Spain	2021
P4	COVID-19 and the Key Digital Transformation Lessons for Higher Education Institutions in South Africa [5]	HEIs in South Africa (Not Specified)	South Africa	2022
P5	Digital Transformation in Higher Education: A Framework for Maturity Assessment [7]	HEIs in UAE (Not Specified)	United Arab Emirates	2020
P6	Classification of Barriers to Digital Transformation in Higher Education Institutions: Systematic Literature Review [9]	HEIs in Greece	Greece	2023
P7	Digital Transformation in Higher Education Institutions: A Systematic Literature Review [12]	HEIs in Colombia (Not Specified)	Colombia	2020
P8	Categories for Barriers to Digital Transformation in Higher Education: An Analysis Based on Literature [13]	HEIs based on literature	Indonesia	2021
P9	The Development of Agile Enterprise Architecture for Digital Transformation in Higher Education Institutions [16]	HEIs in Thailand (Not Specified)	Thailand	2023
P10	Managing Digital Transformation: A Case Study in a Higher Education Institution [17]	HEIs in Spain (Not Specified)	Spain	2023
P11	COVID-19 and the digital transformation of higher education: What insights Palestinian institutes can share? [18]	HEIs in Palestine (Not Specified)	Palestine	2020
P12	Dark side of digital transformation in online teaching–learning process considering COVID-19 [19]	HEIs in India (Not Specified)	India	2024
P13	The Barriers and Readiness to Deal with Digital Transformation in Higher Education [29]	HEI in Indonesia (Not Specified)	Indonesia	2024
P14	The Role of Educational Transformation in the Digital Era in Improving Student Quality [21]	Muhammadiyah University of Surakarta	Indonesia	2024
P15	The Impact of Digital Transformation in Higher Education: The Case Study from Vietnam [23]	HEI in Vietnam	Vietnam	2023
P16	Digitalization of Higher Education in Ethiopia [24]	HEI in Ethiopia	Ethiopia	2024
P17	University Teachers' Ambivalence about the Digital Transformation of Higher Education [25]	HEI in Sweden	Sweden	2019
P18	Trends in emergency higher education digital transformation during the COVID-19 pandemic [26]	HEI in Ukraine	Ukraine	2022
P19	The challenges of instructors' and students' attitudes in digital transformation: A case study of Saudi Universities [27]		Saudi Arabia	2021
P20	Digital transformation and digital literacy in the context of complexity within higher education institutions: a systematic literature review [28]	HEIs from the literature	Mexico	2023



Fig. 3 Map chart of reviewed articles

Table 4 Publication years of the reviewed articles

Publication year	Total	Percentage (%)	Paper No.
2024	4	20	P12, P13, P14, P16
2023	6	30	P2, P6, P9, P10, P15 P20
2022	2	10	P4, P18
2021	4	20	P1, P3, P8, P19
2020	3	15	P5, P7, P11
2019	1	5	P17
Total	20	100	

Fig. 4 Line chart showing publication years of reviewed articles

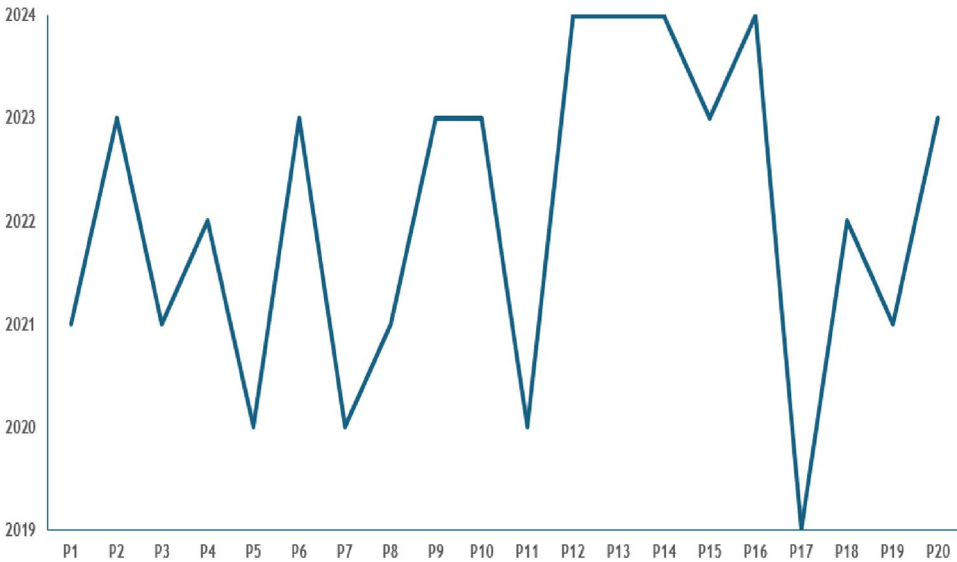


Fig. 5 Word cloud



Fig. 6 Heat chart

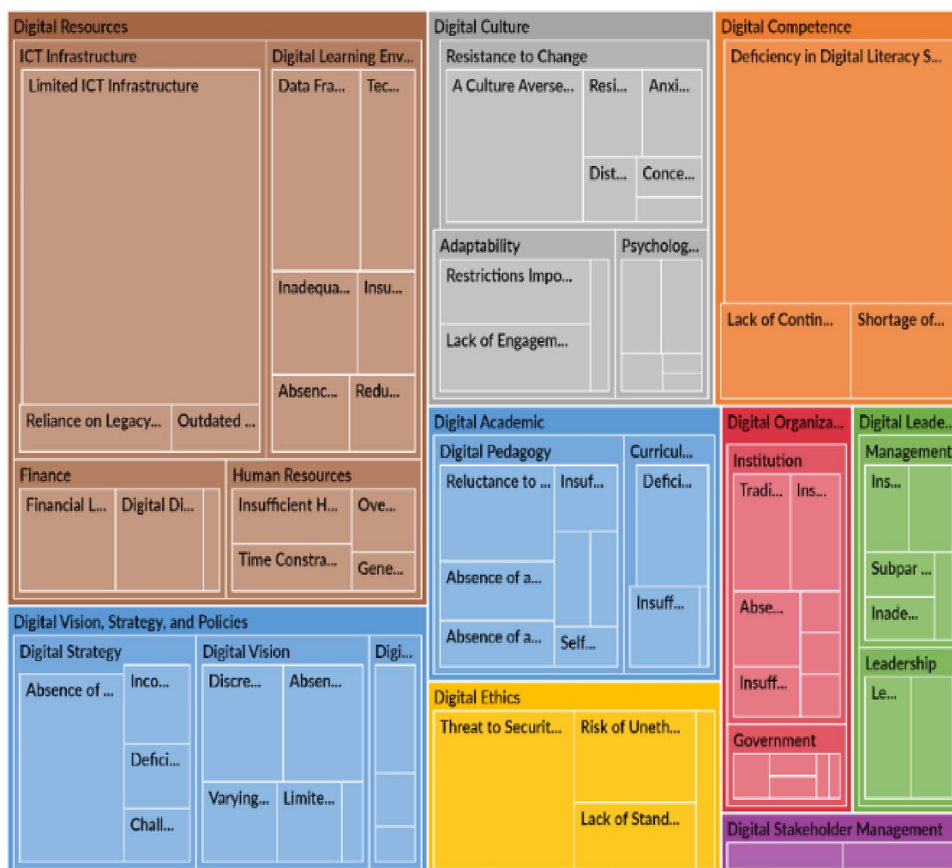


Fig. 7 Cluster analysis chart

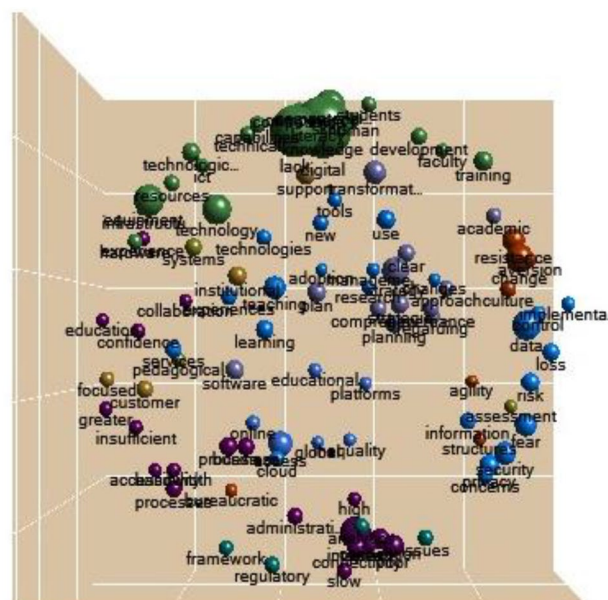


Fig. 8 Sunburst chart

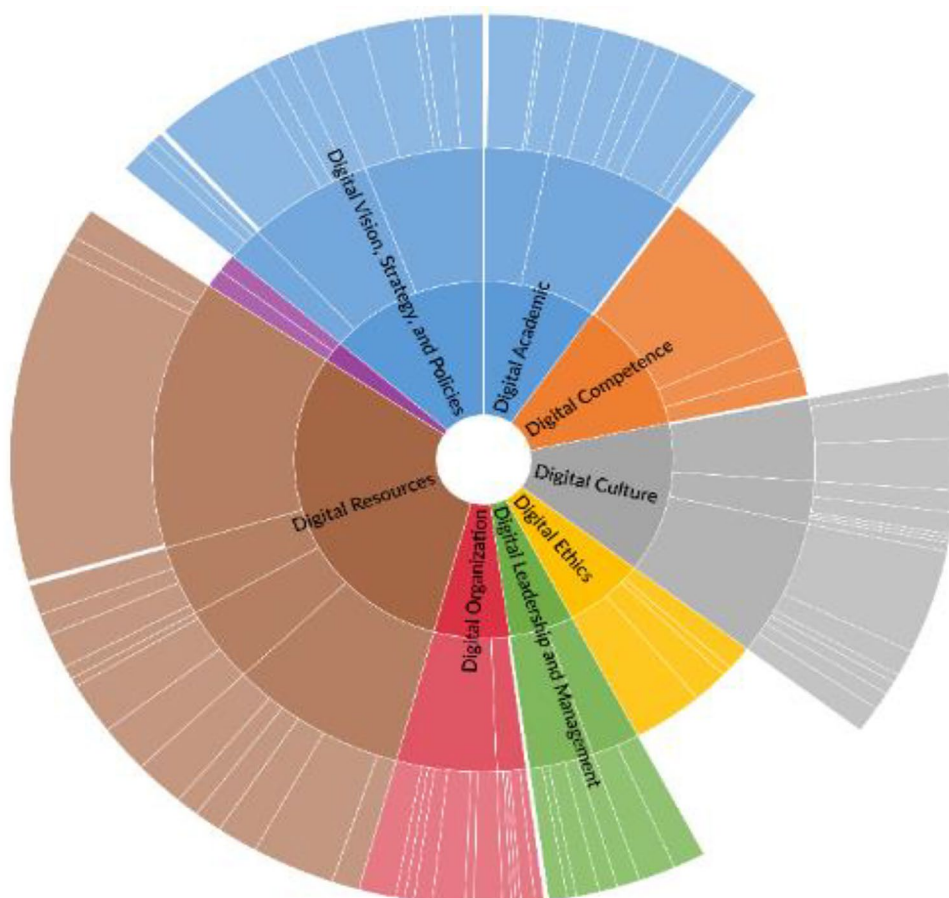


Table 5 Concept-centric matrix on barriers to DT in HEIs (2019–2024)

Dimension	Subdimension	Codes of Barriers	No.	Studies (n = 20)
I. Digital Vision, Strategy, and Policies (n = 85)	Digital Vision (n = 36)	• Absence of a Comprehensive Digital Vision	11	[6, 7, 9, 12, 13]
		• Discrepancies Between Vision, Policy, and Implementation	11	[7, 9, 19]
		• Varying Interpretations of the Digital Vision	7	[9]
		• Limited Awareness of the Digital Vision Among Stakeholders	6	[7, 9, 13, 29]
		• Lack of Stakeholder Engagement in Developing the Digital Vision	2	[6, 7, 9, 13]
	Digital Strategy (n = 38)	• Absence of Strategic Planning	23	[2, 6, 9, 12, 16]
		• Inconsistent Strategies and Reference Models concerning the Digital Vision	6	[7, 20]
		• Deficiency in Digital Strategy	5	[7, 12, 13, 16, 17]
	Digital Policies (n = 11)	• Challenges in Converting Strategies into Action Plans	4	[6, 7, 9, 13]
		• Absence of Clear Institutional Policies	6	[9, 13]
II. Digital Leadership and Management (n = 35)	Leadership (n = 15)	• Insufficient Enforcement of Digital Policies	3	[21]
		• Rigid Policy Implementation	2	[20]
		• Leadership Ineffectiveness	8	[9, 13, 16]
		• Lack of Leadership for Transformation	7	[2, 5, 6, 9, 12, 13]
		• Delayed Evidence-based Decision-making Processes	5	[2, 9, 12, 13, 16]
	Management (n = 20)	• Insufficient Management Support	5	[2, 6, 7, 12, 13, 16, 22, 23]
		• Inadequate Monitoring and Evaluation of Digital Transformation (DT) Initiatives	4	[2, 5, 6]
		• Subpar Analytics/Business Intelligence Practices	4	[7, 12, 20, 24]
		• Limited Perspective on Return on Investment (ROI)	2	[9]
		• Government Regulatory Framework and Legal Challenges	3	[5, 7, 9, 13, 25]; [13]
III. Digital Organization (n = 40)	Government (n = 9)	• Absence of Relevant Laws	2	[24]
		• Stringent Government Regulations	2	[12]
		• Inconsistent Standards Among HEIs	1	[6, 26]
		• Insufficient National Financial Assistance	1	[7, 9, 13, 25]
		• Traditional/Bureaucratic Environment	8	[2, 9, 9]
	Institution (n = 31)	• Institutional Regulations and Workflows	7	[6, 12, 20]
		• Absence of Collaboration and Integration Initiatives	6	[6, 7, 16, 24]
		• Insufficient Organizational and Structural Agility	4	[2, 7, 9, 18, 26]
		• Changes in Organizational Structures	2	[9]
		• Limited Willingness to Invest in Technology Utilization	2	[7, 9, 13, 18]
		• Quality Control and Accreditation Processes	2	[6, 18, 24]

Table 5 (continued)

Dimension	Subdimension	Codes of Barriers	No. Studies (n=20)
IV. Digital Resources (n=191)	ICT Infrastructure (n=88)	• Limited ICT Infrastructure	77 [2, 5, 6, 9, 12, 13, 16, 17, 20, 22, 24, 25]
		• Reliance on Legacy and Third-Party Systems	7 [7, 9, 21]
		• Outdated ICT Infrastructure	4 [9]
	Human Resources (n=23)	• Insufficient Human Resources	8 [9, 12, 13, 16, 20, 21]
		• Time Constraints	7 [9, 13, 21]
		• Overwhelming Workload	5 [9]
	Finance (n=25)	• Generation Gap	3 [2, 9, 27]
		• Financial Limitations and Budget Challenges	12 [9, 13]
		• Digital Divide	11 [5, 17]
	V. Digital Competence (n=75)	Digital Learning Environments (n=55)	• High Initial Investment Costs
• Data Fragmentation			18 [6, 7, 9, 13, 17]
• Technology Dissonance			11 [9, 13, 17]
Digital Competence (n=75)		• Inadequate Technical Support	9 [9, 13]
		• Absence of Critical Systems (e.g., LMS, SIS, CRM)	6 [5-7, 12, 26, 28]
		• Insufficient and Underdeveloped Automation Initiatives	6 [2, 7]
		• Redundant Digital Services	5 [7, 9, 20]
		• Deficiency in Digital Literacy Skills, Abilities, and Com- petence	55 [5, 6, 9, 13, 16-18, 21, 25, 26, 28]
		• Lack of Continuous Training and Professional Develop- ment Opportunities	11 [2, 5, 13, 28]
		• Shortage of Digital Experience and Confidence in Innovation	9 [2, 7, 13, 24]
VI. Digital Stakeholder Management (n=12)	Digital Stakeholder Management (n=12)	• Insufficient collaboration and partnership with external organizations	6 [2, 5, 6, 12, 24]
		• Lack of Customer Experience Design	6 [16]

Table 5 (continued)

Dimension	Subdimension	Codes of Barriers	No. Studies (n = 20)
VII. Digital Culture (n = 86)	Adaptability (n = 27)	• Lack of Engagement and Enthusiasm	12 [7, 13]
		• Restrictions Imposed by Personal Habits	12 [9, 13]
		• Difficulties in Embracing New Teaching and Learning Approaches	3 [5, 13, 22]
	Resistance to Change (n = 45)	• A Culture Averse to Change	24 [7, 9, 13, 20, 25]
VIII. Digital Academic (n = 61)		• Anxiety Surrounding Technology	6 [9, 13, 16, 27]
		• Resistance to Modernization and the Adoption of Technology	6 [9, 12]
		• Distrust in Digital Services and Technological Solutions	4 [9, 13]
		• Concerns About the Negative Impact of Technology Adoption	3 [9, 13]
	Psychological (n = 14)	• Concern Over Job Security	2 [2, 5, 9]
		• Digital Isolation	5 [17, 20]
		• Excessive Screen Usage	5 [6]
		• Tech-Induced Stress and Anxiety	2 [17]
	Curriculum Modernization (n = 19)	• Heavy Reliance on Technology	1 [6]
		• Inactive Lifestyle	1 [17]
		• Deficiencies in Curriculum Modernization	11 [6, 7, 12, 16, 22, 24, 28]
		• Insufficient Assistance for Staff in Developing Digital Educational Materials and Instructional Design	7 [6, 7, 9, 12, 21, 24, 26, 27]
	Digital Pedagogy (n = 42)	• Diverse and Comprehensive Resource Requirements	1 [24]
		• Reluctance to Embrace Innovative Teaching Methods, Learning Environments, and Educational Models	13 [9, 16, 26, 28]
		• Absence of an Assessment Framework	8 [20, 24, 27]
		• Absence of a Quality-Based Pedagogical Framework	6 [20]
IX. Digital Ethics (n = 44)	Digital Ethics (n = 44)	• Insufficient Commitment to Teaching	5 [20, 22]
		• Diverse Student Population	4 [6, 22, 24]
		• Self-Directed Learning	3 [16, 21, 24]
		• Significant Flexibility in Learning Approaches	3 [12, 20, 21, 24]
		• Threat to Security, Privacy, Confidentiality and Compliance	22 [6, 7, 9, 12, 13, 16, 19–21, 27]
		• Risk of Unethical Use of Technology	11 [6, 9, 13, 20, 21]
		• Lack of Standards for Data Exchange	8 [6, 7, 9, 13, 16, 21]
		• Lack of Understanding of Intellectual Property Laws	3 [6, 9, 20]

1. *Absence of a comprehensive digital vision*

The process of DT in HEIs has evolved into a complex and challenging endeavor, as numerous institutions struggle to establish a coherent vision for their transformation efforts [12]. This lack of direction leads to confusion about what needs to be achieved and hampers the effectiveness of various initiatives [13]. Many HEIs seem unaware of the disruptive effects of digital innovations and lack meaningful plans or policies to adapt, leaving them struggling to maintain relevance in today's digital world [9]. To move forward, these institutions need strong leadership to develop a strategic vision that includes the whole academic community, not just IT departments. Without a solid plan, including governance structures and an assessment of current technologies, efforts at DT will be disjointed and ineffective [6]. Recent research highlights that many public HEIs have not even begun independent planning for their digital future, further emphasizing the urgency and necessity of a more coordinated approach [7].

2. *Discrepancies between vision, policy, and implementation*

The inflexible framework of HEIs poses challenges for achieving successful DT, as various departments frequently have divergent priorities and objectives, resulting in confusion and ineffective strategies [9]. Hiring experts in DT seems to be a necessary step, but it is not a guarantee that these professionals will be able to harmonize the various interests within the institution [7]. While having a clear digital strategy might sound good in theory, the reality is that many HEIs struggle to keep up with the rapidly changing educational landscape, leaving their digital initiatives misaligned and ineffective [19].

3. *Varying interpretations of the digital vision*

The often-ambiguous institutional policies related to DT goals suggest that many HEIs lack a comprehensive understanding of how to effectively implement such transformations. The absence of clear direction among senior management permeates the entire institution, affecting both academic and administrative staff and leading to uncertainty regarding DT goals. Furthermore, the autonomy of different faculties could impede the overall implementation process [9].

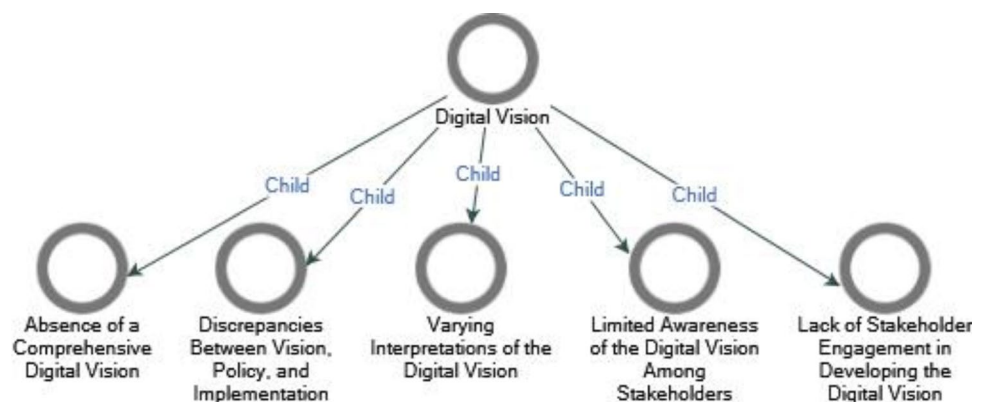
4. *Limited awareness of the digital vision among stakeholders*

HEIs struggle with the need for a sharp vision of DT, and the failure to communicate that vision effectively is a major issue. Numerous studies show that if employees do not understand a change message, they will not be ready to accept it [13]. HEI leaders need to exert more effort to ensure that this vision is effectively communicated to all stakeholders, thereby bridging the gap within the HEI services crucial for online education [20]. Different departments have conflicting views, causing further disengagement from DT initiatives. For any meaningful progress, leaders and the community must work together toward a common goal, but the usual lack of a cohesive vision makes this impossible. The complex structure of faculties only complicates the situation, making it difficult to create a shared vision [9]. Institutions are also expected to share their strategies and vision while gathering feedback from various stakeholders, but this process often falls flat and fails to deliver real change [7].

5. *Lack of stakeholder engagement in developing digital vision*

A study by [13] highlights a troubling lack of clarity from institutional management regarding DT goals, suggesting a chaotic and unfocused approach to these essential initiatives. There seems to be no cohesive vision that clearly outlines the benefits of DT, leaving students, faculty, and staff feeling excluded and unheard. This absence of collaboration only undermines effort, as successful transformation relies on the active involvement of the entire community [9]. Moreover, without the input of key stakeholders at the planning stage—gathering feedback through surveys, focus groups, and town hall meetings—the process risks losing momentum and support [6]. Additionally, treating

Fig. 9 Digital vision project map



DT as a realm solely for the IT department or splitting it among various data managers is a misguided approach; it should be viewed as a comprehensive, organization-wide effort [7].

3.3.2 Digital strategy

As presented in Fig. 10, challenges arise from the absence of strategic planning, deficiency in digital strategy, and difficulties in converting strategies into action plans, emphasizing the need for strategic support from stakeholders.

1. Absence of strategic planning

Many HEIs focus on immediate problems instead of addressing important long-term goals, which results in avoiding the tough challenges that require time and hard work. This short-sighted approach hinders the careful planning necessary for effective DT, pushing aside significant decisions that could have lasting impacts. Internal policies and governance issues make this situation worse, as DT is complicated and affects all aspects of higher education. Unfortunately, most administrations prioritize quick fixes, which means that vital strategic decisions are constantly postponed [6]. Additionally, the absence of a solid strategic approach to DT within HEIs only adds to the struggle, often leaving initiatives underdeveloped and failing to enhance crucial areas such as teaching and administration [9]. While some HEIs have vague digital strategies, they usually fall short of clearly defining their objectives with technology, often just focusing on building infrastructure rather than fostering innovative educational practices [2]. With the evolution of the digital landscape, institutions are under pressure to adapt their educational approaches to align with the requirements of the contemporary era [16]; however, many lack the commitment and foresight needed for a successful transition [12].

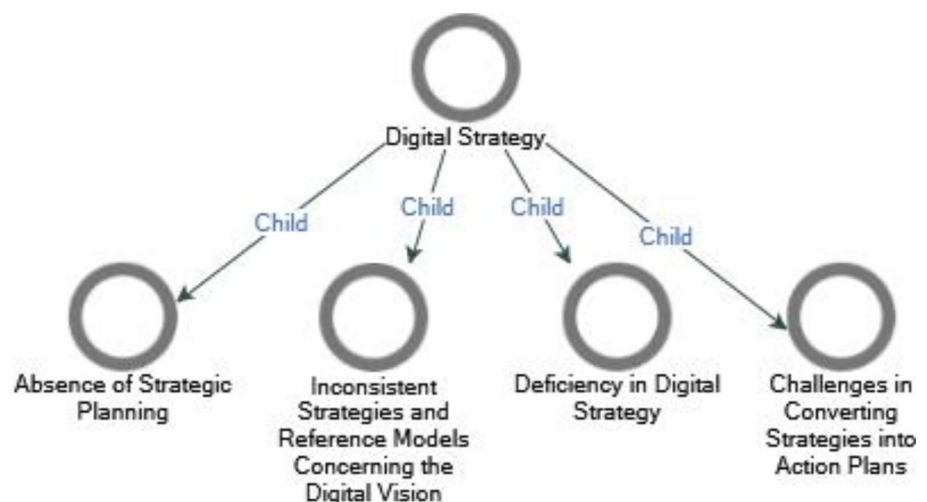
2. Inconsistent strategies and reference models concerning the digital vision

Institutions struggle with providing proper support and guidance to avoid the negative impacts of transformation. While there is a need for a solid reference model [20] to improve strategies and policies, most HEIs seem to be stuck in improving their operational processes without truly engaging in strategic planning, effective teaching methods, or meaningful research [7]. This narrow focus is problematic, and studies have uncovered numerous barriers hindering DT in these institutions. A DT maturity assessment could help them understand their strengths and weaknesses, but it is clear that many studies do not address the bigger picture [7].

3. Deficiencies in digital strategy

A study by [13] noted a glaring shortfall in planning for DT at many HEIs, which undermines both their organizational and technical approaches to teaching and learning. Although some HEIs are trying to adapt to our growing tech obsession, they often lack a clear vision and the necessary commitment, resulting in costly IT investments that do little to improve outcomes [17]. Instead of haphazardly developing a digital strategy, these institutions need to focus on a business strategy that fits the current digital landscape [12]. The lack of a solid plan to effectively incorporate technology into education highlights only how misguided their efforts are [16]. As HEIs rush to implement DT, they are merely tinkering with their existing frameworks rather than genuinely enhancing value for students and

Fig. 10 Digital strategy project map



staff. Additionally, these initiatives often overlook crucial areas such as how to teach and assess students effectively, which is frustrating for everyone involved [7].

4. *Challenges in converting strategies into action plans*

HEIs face significant hurdles when trying to transition to digital operations, as they often struggle to balance detailed planning with the practical realities of implementation [13]. Even those with strategic plans find it difficult to turn these into actionable steps, which reveals the overwhelming complexities and resource shortages associated with this process [9]. Without a clear, well-defined pathway that outlines goals, resources, and timelines, DT efforts can easily fall flat, leaving institutions uncoordinated and stakeholders disengaged [6]. Faculty involvement is crucial [12]; however, even regular evaluations are necessary to ensure that initiatives stay on track, adding to the burden facing these institutions. In reality, navigating the digital landscape is far from straightforward and often leaves HEIs feeling lost and underprepared [7].

3.3.3 Digital policies

As illustrated in Fig. 11, the absence of clear institutional policies, including those related to the development of the digital academic ecosystem and the privacy and security of user data, coupled with insufficient enforcement, underscores the importance of robust policy frameworks.

1. *Absence of clear institutional policies*

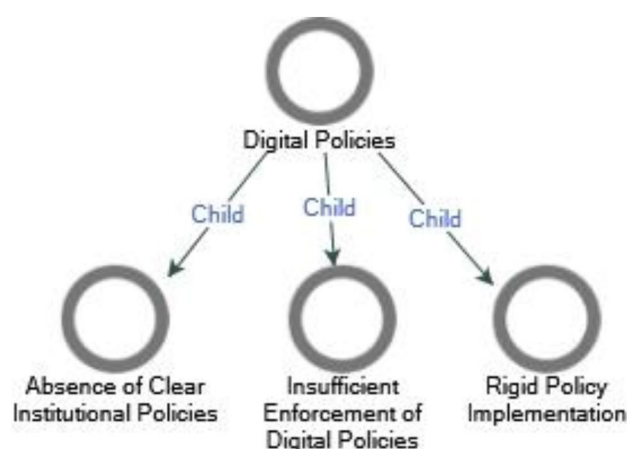
A study by [13] highlights the critical need for adequate institutional support in DT programs within higher education, emphasizing issues related to the workload of academic staff, the development of a digital academic ecosystem, and the fostering of institutional capacity for technological innovation in teaching and learning. They emphasize the importance of dedicated support from senior management in driving technological innovation during the DT process. To effectively align with DT objectives, HEIs need to establish thorough policies that involve faculty, staff, and stakeholders, covering critical areas that currently lack formal guidelines such as the digital academic environment, user data privacy, intellectual property, and academic workload. Moreover, adopting policies that promote collaboration with other HEIs, industry partners, and technology providers can help address these challenges and enable a smooth transition to DT [9].

2. *Insufficient enforcement of digital policies*

A significant challenge in the realm of DT in education stems from the insufficient implementation of digital policies. Although prioritizing students is considered crucial for success in this changing environment, the lack of efficient implementation and enforcement of HEI policies concerning digital platforms impedes advancement [21]. Despite the identification of key themes such as the creation and optimization of digital learning platforms, the inadequate enforcement of these policies undermines the readiness of HEIs to embrace DT. Without robust strategies and policies in place to address barriers and ensure compliance, the potential for achieving better compatibility and seamless integration of digital technologies remains elusive [21].

3. *Rigid policy implementation*

Fig. 11 Digital policies project map



The stringent implementation of policies can lead to a perception of inflexibility within institutions, posing difficulties in adjusting to evolving situations. It is essential to have a clear reference model to support institutional strategies and policies [20]; however, the communication and execution of these policies may lead to resistance, especially among teaching staff who might be reluctant to adopt new teaching approaches. This hesitance to change can obstruct the effectiveness of policy implementation, creating barriers to promoting a collaborative and innovative learning environment [20].

3.4 Digital leadership and management

Effective digital leadership and management are crucial for successful DT in HEIs, as inadequate leadership and management support can hinder progress, necessitating a shift toward agile practices, evidence-based decision-making, and a focus on user experience to drive meaningful change and overcome resistance to digital initiatives.

3.4.1 Leadership

As illustrated in Fig. 12, the ineffectiveness and absence of leadership in driving transformation can impede digital initiatives that require robust commitment from leadership.

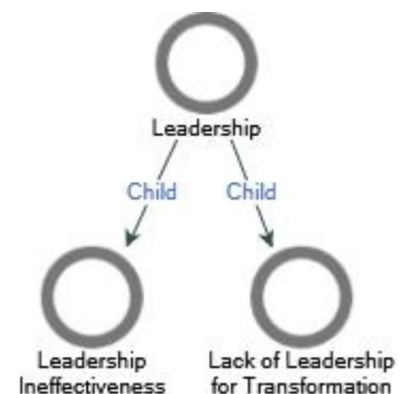
1. *Leadership ineffectiveness*

Ineffective leadership constitutes a significant barrier to successful DT within HEIs, necessitating strategic adaptations to address inherent cultural and behavioral shifts [13]. Strong leadership and governance are essential for aligning digital initiatives with institutional strategic goals. This involves setting clear goals, implementing accountability mechanisms, and providing necessary resources and support systems. HEI leaders are pivotal in fostering an environment that is conducive to DT; however, deficiencies in leadership skills or vision may incite resistance from faculty and staff and lead to suboptimal resource allocation for transformation initiatives [9]. In the sphere of research, learning, and teaching, effective digital leadership mandates the adoption of a data-driven approach centered on enhancing user experience [16]. Institutions recognized as digital leaders show agility, a propensity for calculated risk-taking, and the capacity to cultivate organizational cultures that empower and engage personnel. By maintaining a steadfast focus on user experience, these organizations exemplify a high digital quotient, which is essential for adeptly navigating the intricacies of DT [16].

2. *Lack of leadership for transformation*

A study by [2] highlights a significant lag in the education sector's evolution compared to that of other industries, mainly due to ineffective leadership [2, 6, 9, 12, 13]. The bureaucratic structure stifles flexibility and innovation, hindering educational institutions—often seen as bastions of intellectual freedom—from promoting transparency, collaboration, and empowerment. While the education sector holds dynamic and digital potential like that of the business world, these opportunities have gone unexploited. This stagnation hinders leadership development and cultural shifts essential for considerable progress. Achieving successful DT in higher education requires strong leadership that inspires and empowers staff, emphasizing a bottom-up approach to generating ideas, as noted by [13]. However, prevalent leadership weaknesses exacerbate advancement barriers, often due to leaders' inadequate ability to navigate transformative challenges [9]. To genuinely elevate digital capabilities, leaders must engage their teams

Fig. 12 Leadership project map



in implementing appropriate technologies and strategies that align with both academic and administrative goals [5]. Effective transformation requires strong leadership and a skilled team focused on developing and executing strategies that address the complexities of digital work management and the diverse cultural, behavioral, and operational challenges posed by DT [12]; without such leadership, the transformative potential remains largely unrealized, perpetuating stagnation in the education sector.

3.4.2 Management

As represented in Fig. 13, insufficient management support, rigid bureaucratic structures, and limited perspectives on ROI highlight the importance of agile management practices and evidence-based decision-making.

1. *Delayed evidence-based decision-making processes*

The education sector is changing rapidly, but HEIs have stubbornly stuck in the past and are falling behind other industries in adopting digital solutions [2]. This lag is largely due to the incompetence of leadership, as many HEI executives underestimate the challenges of DT and are often resistant to change [9, 13]. To truly support their students, HEIs need to adopt advanced analytics that allows for better decision-making and tailored services, which requires tapping into new data sources such as social media and digital logs [16]. Without embracing digital systems and data-driven approaches, HEIs continue to struggle with inefficiencies and poor resource management [12].

2. *Insufficient management support*

Management support is crucial [2, 6, 7, 12, 13, 16, 22, 23]; however, many leaders at HEIs seem to overlook its role in driving DT. IT directors and chief information officers expect academic administrators to take the lead in identifying and prioritizing necessary changes, while these administrators wrongly believe that such transformations are solely the responsibility of IT management [7]. This disconnection leads to a lack of accountability and initiative, with some even viewing DT as a shared task that is poorly managed. The central issue here is inadequate backing from management to overcome resistance to change, which is essential for effectively demonstrating the long-term benefits of adopting new technologies [7].

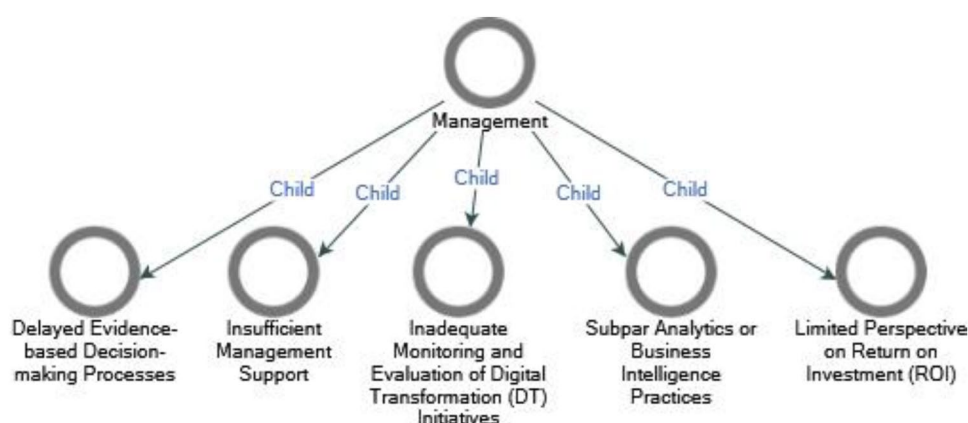
3. *Inadequate monitoring and evaluation of DT initiatives*

Creating a way to measure how well organizations are adapting to digital changes is important, but it is often inadequate, especially in education. Despite the many methods proposed for other fields, education has lagged, and the pandemic has only exposed its weaknesses [2]. This failure to evolve has highlighted how crucial technology is in the educational realm and how poorly many institutions respond to these challenges [5]. Ongoing assessments to gauge DT efforts are lacking, which hampers effective decision-making and hinders long-term planning. Instead of proactively identifying what needs improvement, many institutions are struggling with problems, and their strategies cannot often address student needs and advance new technologies [6].

4. *Subpar analytics/business intelligence practices*

Today, the pressure to produce and acquire knowledge is overwhelming, and both organizations and nations suffer when they cannot manage information effectively [7]. This constant push for DT only adds to the burden faced by institutions, as pointed out by [20], who asserts that academic and learning analytics play a vital role in decision-

Fig. 13 Management project map



making. He proposed the incorporation of sophisticated dashboards into institutional systems; however, the need to ethically manage personal data presents an additional challenge [12]. Information systems are supposedly vital for transforming higher education, but they often complicate decision-making processes instead of simplifying them [7]. Moreover, as in other sectors, higher education struggles to make prompt and informed decisions, often leading to mismanaged operations and lost opportunities. The ability of data to reveal hidden insights is often overshadowed by concerns over its reliability and accuracy in the current era, which is filled with misplaced optimism about future educational trends [24].

5. *Limited perspective on return on investment (ROI)*

Investing in educational technology can sometimes seem like an overwhelming task, particularly for HEIs that struggle to quantify tangible benefits. Many institutions focus solely on immediate costs, overlooking the broader perspective and missing essential tools and infrastructure essential for meaningful change. As DT progresses without immediate results, institutions may hesitate to allocate funds toward initiatives with long-term payoffs. This reluctance further compounds the issue, as HEIs that lag in digital advancements risk falling even further behind their more innovative peers. This cycle of stagnation can leave institutions feeling trapped, making it increasingly challenging to bridge the gap. Developing a clear plan for prioritizing digital investments might help, but it often feels like a weak attempt to fix a deep-rooted issue [9].

3.5 Digital organization

The challenges within the digital organization of government and HEIs underscore the need for streamlined regulations, financial support, organizational flexibility, and technology integration to overcome barriers such as insufficient national financial aid, bureaucratic environments, limited collaboration initiatives, and resistance to change, hindering progress in DT efforts.

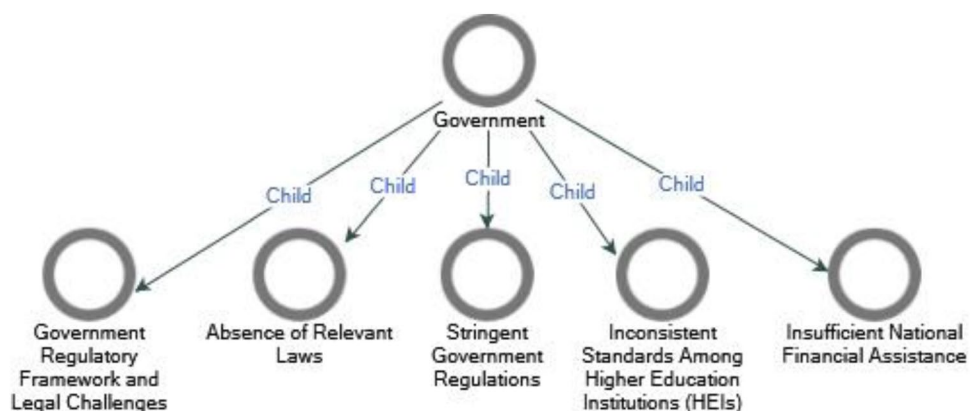
3.5.1 Government

As displayed in Fig. 14, insufficient national financial aid, regulatory challenges, and inconsistent standards among HEIs underscore the need for streamlined government regulations and financial support.

1. *Government regulatory framework and legal challenges*

The push for digitalization in higher education, driven by national and institutional policies [25], often feels more like a burden than a benefit, as these regulations can hinder rather than help. Constant changes in government policies create an environment of uncertainty for public HEIs, while private HEIs may enjoy slightly more freedom from these constraints [13]. However, overall, the regulatory frameworks surrounding these institutions can be stifling, placing unnecessary restrictions on technology use and creating barriers to implementing essential digital initiatives. Compliance with various accessibility and security regulations demands additional resources, making it harder for institutions to meet their internal needs while trying to satisfy external demands [9]. The chaotic and inconsistent nature of policies across different levels only adds to the confusion, leaving many institutions struggling to align with

Fig. 14 Government project map



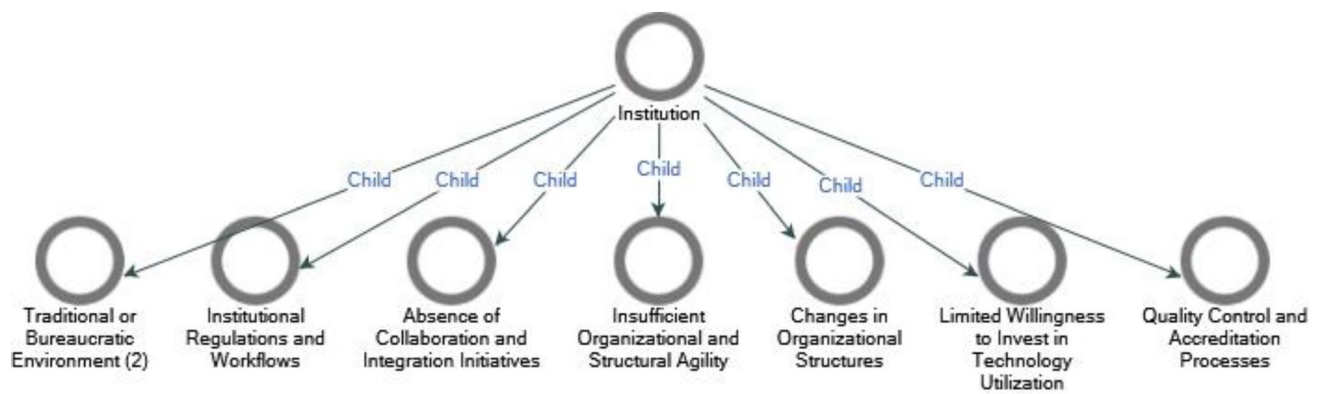


Fig. 15 Institution project map

the expectations imposed on them [5]. Instead of being a straightforward path to improvement, the DT process often feels convoluted and fraught with barriers that ultimately prevent meaningful progress in higher education [7].

2. Absence of relevant laws

It is frustrating that the government has not taken the necessary steps to update and improve the laws surrounding DT in education. Without these changes, there would not be a strong legal framework to support meaningful policies and efforts to raise awareness, leaving students and educators at a disadvantage in an increasingly digital world [24].

3. Stringent government regulations

Pressure from public politics is making it difficult for HEIs to keep up with constant changes in society and regulations, forcing them to rush into updating their processes and services. This hurried push for modernization often leads to frustration and chaos, as institutions struggle to adapt to new demands without the necessary support or resources. As a result, the quality of education and administrative efficiency may suffer, leaving many people feeling overwhelmed and underprepared for the challenges ahead [12].

4. Inconsistent standards among HEIs

HEIs are painfully stuck in a cycle of comparing themselves to other supposedly successful HEIs, hoping that by mimicking their models and outcomes, they can somehow fix their ongoing problems and tap into potential growth, which appears to be a long shot [6]. Furthermore, faculty members' struggles with integrating technology into their teaching are just a reflection of the greater disorganization within their institutions and the broader society, making it clear that they are not receiving the support they need to effectively engage with modern educational tools [26].

5. Insufficient national financial assistance

According to the study by [25] showed that simply having good plans for digitalizing higher education is insufficient; real change requires serious government commitment and a shift from just expanding educational institutions to truly enhancing quality through digital means [13]. The financial setup is a major stumbling block, with inadequate national funding and short-sighted budgets, making it difficult for HEIs to adopt new technologies [9]. Regulations from funding bodies can also slow progress by delaying tech implementation and hiring essential staff. While many countries recognize the need for DT, the gap between intention and execution is stark, especially in less developed nations, where people struggle to turn their ambitions into actions [7]. All the talk about digital change means little if it does not translate into genuine improvements in efficiency and effectiveness; otherwise, organizations will miss the advantages that come with it.

3.5.2 Institution

As detailed in Fig. 15, challenges such as insufficient organizational agility, bureaucratic environments, and limited collaboration initiatives emphasize the importance of organizational flexibility and technology integration.

1. Traditional or bureaucratic environment

Innovative technologies are emerging, but the education sector is often stuck in its old way and unwilling to change. Faculty members cling to outdated practices because of the prevailing culture, and many are resistant to innovative ideas [9]. Even though there is a growing awareness that alternative learning methods could better engage today's students, HEIs continue to struggle with bureaucratic systems and rigid structures that limit their ability to adapt [2]. This cautious approach to change could leave HEIs behind as they miss the opportunity to evolve and innovate, ultimately threatening their relevance in a fast-paced digital world [9].

2. *Institutional regulations and workflows*

Many HEIs are struggling to make their operations more efficient and effective because they are stuck in outdated systems and practices. Instead of adapting their degree verification and registration processes or updating examination rules, they seem to be dragging their feet on necessary changes [20]. Although some administrators recognize the possible advantages of DT—such as saving time and money—their progress is hindered by challenges such as budget constraints and insufficient technology [6, 12]. The task of completely overhauling their processes is daunting and often meets with resistance, making it even harder to embrace these changes. Moreover, even when technology is implemented, many institutions still face significant gaps, leading to inefficiencies and errors in decision-making. It is disappointing that despite the promise of improved data use and smart operational strategies, many HEIs remain stuck in a cycle of delays and redundancies [6].

3. *Absence of collaboration and integration initiatives*

The idea of adopting a service-centric architecture for integrating systems and custom development at the HEI sounds promising, but in reality, it seems more like an overcomplicated dream than a feasible plan [16]. While the intention is to make data accessible and functional and seamless for all users, this approach often leads to confusion and frustration, especially with issues such as data silos and outdated systems hindering progress [6]. The notion that a single sign-on and streamlined application integration will simplify the experience for students and staff is undermined by the actual chaos of different platforms not working harmoniously [6]. Instead of empowering users with consolidated data for better decision-making, stakeholders often experience disparate information and inefficient processes. Moreover, the suggestion that DT can occur simply by improving integration overlooks the fundamental challenges that institutions face, such as limited resources and the complex task of making technology work together effectively [7]. Ultimately, amid all the lofty goals, the reality is that significant barriers remain, making true integration feel more like an uphill battle than a path to progress [24].

4. *Insufficient organizational and structural agility*

Although there is an increasing demand for HEIs to adjust to the rapidly evolving digital landscape, many HEIs remain hindered by their inflexible frameworks and reluctance to embrace change [18, 26]. The common vertical hierarchy creates silos between departments, making it difficult for them to work together effectively and hindering DT efforts [9]. Faculty and staff often set in their way and resist innovative approaches, further obstructing progress. Bureaucratic decision-making processes add to delays, preventing prompt responses to emerging challenges. While collaboration and communication are essential for success, HEIs struggle with coordination and management links, leading to stagnation instead of innovation [2, 7]. Ultimately, without overcoming these entrenched practices and fostering a more flexible environment, HEIs risk falling behind in an ever-evolving landscape [2, 9].

5. *Changes in organizational structures*

DT needs major shifts in how organizations are set up, and this often leads to negative outcomes for many employees. While a few might feel empowered by the changes, most could end up feeling sidelined or diminished in their roles. Moreover, the current administrative setup often fails to adequately support the use of new technologies, leaving many people struggling to adapt and creating a pressing need for painful restructuring that many may not welcome [9].

6. *Limited willingness to invest in technology utilization*

The mindset of many HEIs is holding them back from digital progress, leaving them at a disadvantage compared to those who are willing to invest in new technologies [7]. Without proper funding for digital initiatives, these institutions risk falling further behind as competitors embrace change, leading to a downward spiral of stagnation that is hard to reverse. Their reluctance to prioritize digital investments is a major barrier, especially when they struggle to see clear returns on these initiatives, making it difficult to allocate resources wisely [13]. This narrow focus on investment not only creates gaps in essential technology but also delays necessary updates to curricula, hindering

adaptation to changing educational demands [9]. Many institutions were caught off guard in the rushed transition to digital, resulting in faculty members who were ill-prepared and lacking the skills needed for the digital age. Overall, the unwillingness to embrace DT and invest wisely could ultimately cripple these institutions in a fast-evolving landscape where immediate gains are prioritized over long-term growth [18].

7. *Quality control and accreditation processes*

The ongoing shift to digital education in HEIs is frustrating and reveals many shortcomings that institutions struggle to address [6]. There is a glaring need for HEIs to upgrade their training programs to properly incorporate technology; however, they often prioritize quantity over the quality and effectiveness of education [24]. This shift has severely compromised the quality of online learning, as faculty members have faced numerous hurdles during the rushed move to remote instruction, resulting in subpar teaching and a lack of proficiency with necessary digital tools [18].

3.6 Digital resources

HEIs face significant challenges in DT due to limited ICT infrastructure, insufficient human resources, financial constraints, and inadequate digital learning environments, highlighting the urgent need for investment in technology, workforce development, and strategic planning to enhance educational access and effectiveness.

3.6.1 ICT infrastructure

As shown in Fig. 16, challenges such as limited infrastructure, outdated systems, and unreliable connectivity underscore the need for robust ICT investments and modernization efforts.

1. *Limited ICT infrastructure*

The lack of sufficient ICT infrastructure presents a major barrier to DT in higher education. Research emphasizes the necessity of dependable technical support, including robust Wi-Fi and stable Internet connections [20], to move forward with digital initiatives. Unfortunately, many public HEIs in developing countries struggle with inadequate technology and low digital literacy among both faculty and students, which severely limits the adoption of online education [2, 20]. There are consistent worries that current IT systems are not ready for a digital shift, leaving many institutions unable to make the most available technologies available [9]. The COVID-19 pandemic brought these issues to the forefront, revealing critical deficiencies in digital infrastructure and a troubling absence of reliable internet access and essential educational resources [25].

- Limited energy supply. Many HEIs have limited internet access, and in some areas, there is simply insufficient electricity. As education moves toward digital methods, these communities will continue to fall behind. Additionally, many HEIs in remote locations cannot participate in online learning because they lack sufficient laptops, reliable energy, and stable internet connections [25].
- Lack of robust software infrastructure—DT in education often appears to be more of a challenge than an advantage, as it requires the incorporation of multiple digital technologies into an intricate system [13]. Instead of genuinely enhancing learning, the focus on aligning software architecture to improve student outcomes feels overly

Fig. 16 ICT Infrastructure project map

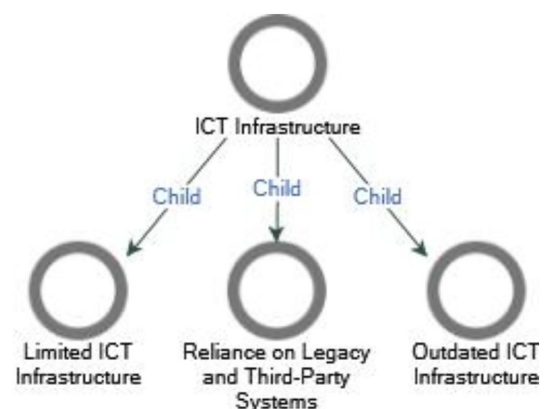
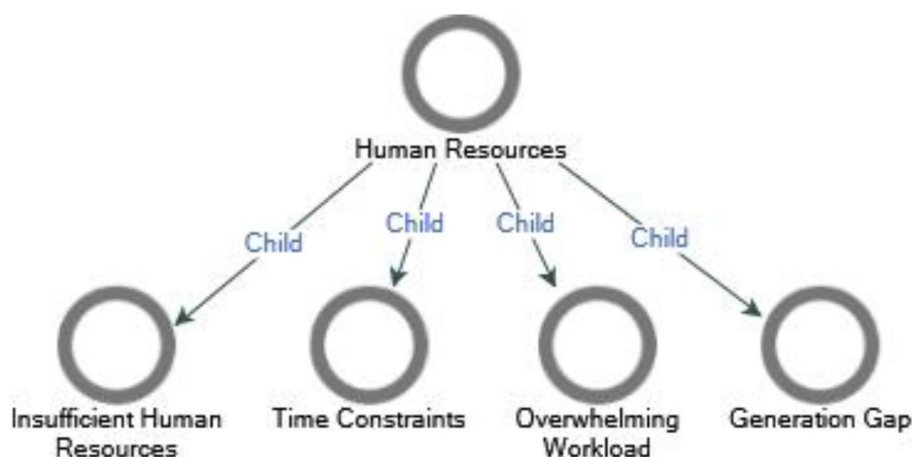


Fig. 17 Human resources project map



bureaucratic and convoluted. While theoretically, good architecture might promise personalized experiences and better course delivery, it often leads to confusion and frustration as it tries to keep up with ever-changing technology. The emphasis on integrating existing systems for scalability and customization does little to ease the process, as it creates more challenges than solutions [6]. Ultimately, the push for an agile platform and flexible architecture makes it clear how unprepared the education sector is for actual innovation [12].

- **Inadequate processing and storage capabilities**—It is disappointing that HEI has not yet put together a solid plan for using the cloud or adopting the necessary software solutions and platforms. Without a clear strategy, any potential growth in services provided through the cloud will likely suffer, especially since the HEI lacks the qualified staff, proper processes, and technology needed to make this work effective [16].
- **Weak network infrastructure**—The glaring disparities in internet access perpetuate unequal opportunities for accessing information and connecting with global networks, severely hindering HEIs in the process [9], such as: (1) Unreliable or poor internet connectivity (connectivity issues) [17, 25], (2) Insufficient bandwidth for multiple users (accessibility issues) [13, 24], and (3) Unequal access to the internet (affordability issues) [5, 16, 22].

2. *Reliance on legacy and third-party systems*

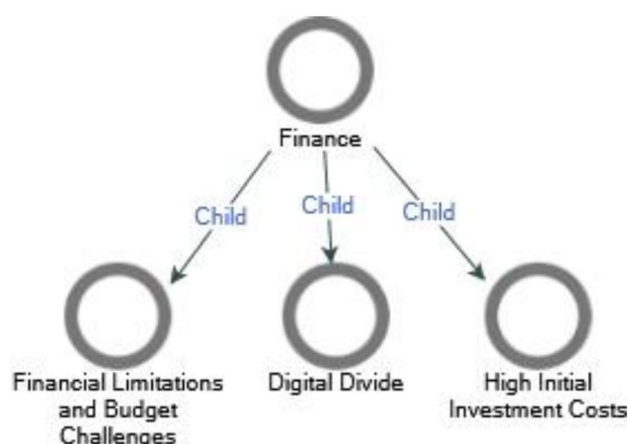
HEIs face a multitude of hurdles in their efforts to go digital, due to the many external systems that they cannot control. Many HEIs are stuck using outdated technology that does not work with newer tools, making it difficult to successfully implement modern solutions [9]. This results in a messy situation with different data formats that require tedious manual handling to gather the necessary information. Relying on third-party systems for tasks such as finance or library management complicates matters further, introducing security risks and inconsistencies in digital setup, which wastes precious time and resources. Additionally, the constant need to generate reports for various external agencies forces institutions to extract and reformat data from their systems, often leading to errors due to a lack of collaboration among staff [7]. Opinions vary on the suitability of off-the-shelf systems, with some seeing them as inadequate for customs needs while others question the job security of IT personnel who promote these temporary solutions. Overall, the limited maintenance capabilities of digital platforms push educators to depend on external systems, even when they have their HEI tools at their disposal [21].

3. *Outdated ICT infrastructure*

HEIs are stuck in their old way, clinging to slow and tedious procedures that threaten to leave them behind in a world that is rapidly advancing in technology. The outdated systems of these countries create a mess of inefficiencies and complicated processes, leading to lower productivity and highlighting how these institutions need to update their operations to stay relevant [9].

3.6.2 Human resources

As shown in Fig. 17, issues such as an insufficient workforce, an overwhelming workload, and time constraints highlight the importance of investing in human resource development and support.

Fig. 18 Finance project map

1. *Insufficient human resources*

Despite the supposed importance of lecturers in advancing digital services and learning in HEIs [21], there is a glaring issue with the insufficient number of qualified educators equipped for this DT [13]. The relationship between DT and human resources is anything but smooth. Although digital initiatives require skilled professionals, organizations face difficulties in both recruiting and keeping individuals with the right expertise. Recognizing the necessity for all employees to be proficient and confident in utilizing digital tools is a crucial first step [12]; however, realizing this goal is challenging due to insufficient personalized support and customized services. The emphasis on enhancing employee experience is often overlooked, resulting in a disjointed work environment that hampers productivity [16, 20]. Moreover, HEIs face significant hurdles in aligning their workforce's outdated skills with the digital demands of today's educational landscape, and with limited resources, attracting and maintaining talent has become an uphill battle [9]. The emphasis on creating a digitally skilled workforce appears to be more of an unfulfilled promise than a tangible reality since many educators do not have the essential technical and pedagogical support needed for effective teaching in today's digital landscape [12].

2. *Time constraints*

Time limitations pose a significant challenge to DT in higher education. Faculty members face demanding workloads that encompass research, teaching, and administrative responsibilities, which restrict their ability to investigate or implement new technologies [13]. The lack of time hampers creative reflection and hinders collaboration between various HEI departments, making it even more challenging to integrate digital innovations. Consequently, the heavy burdens faced by higher education staff impede substantial progress in adopting DT [9]. Additionally, understanding and applying digital technology is a time-consuming process that requires instructors to carefully consider its pros and cons, a task that is often impossible to tackle due to the relentless demands on their time [21].

3. *Overwhelming workload*

Academic staff are often overwhelmed by demanding workloads that include teaching, research, and administrative tasks, which means that they have little time or energy left to become involved in DT efforts. These initiatives demand considerable time and resources for planning and support; however, without proper incentives and support from their HEIs, professors are unlikely to feel motivated to engage. If they cannot find the time to focus on these projects, it is unlikely that they will engage in DT at all [9].

4. *Generation gap*

The persistent disparity in digital skills between students and faculty within higher education institutions is concerning. Numerous faculty members meet challenges in keeping pace with the swift advancements in technology, thereby impeding their capacity to adequately meet the demands of the contemporary digital environment. Unlike tech-savvy students, these educators often lack the necessary proficiency in accessing digital tools [9], making it difficult to drive meaningful change in education. As they age, their resistance to adopting new technologies only adds to the challenge [27], putting institutions at a disadvantage in an era where adaptability is essential [2]. Decision makers need to consider the limitations posed by faculty experience and age or risk further impeding progress in the DT journey [27].

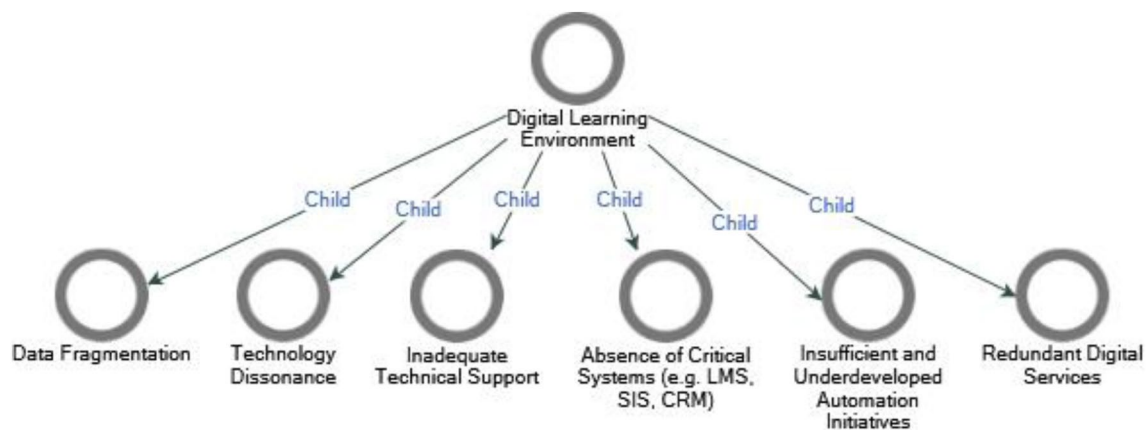


Fig. 19 Digital learning environment project map

3.6.3 Finance

As presented in Fig. 18, financial limitations, high initial costs, and digital divide concerns emphasize the need for sustainable financial strategies and equitable access to resources.

1. Financial limitations and budget challenges

Financial problems prevent DT in HEIs, making it impossible to keep pace with the times. A major issue is the ongoing lack of funding, which prevents institutions from investing in technology and skilled people necessary to make meaningful progress. As a result, they cannot even acquire or maintain the essential tools that would help them improve operations [9]. Additionally, the way funding is spread among different departments leads to competition for resources, complicating efforts to launch digital projects that involve multiple areas [9]. With the pressing need for upfront investment in digital initiatives, institutions are often forced to delay or lessen their transformation plans, especially considering shrinking public support for education. Leadership struggles further complicate matters, and while the pandemic pushed many institutions to adopt digital solutions much faster, financial strain and limited internal resources continued to hinder real change [13].

2. Digital divide

The digital divide is a frustrating reality that leaves many people behind, with an increasing number of individuals unable to access the internet and digital technologies while the rest of society moves ahead. This lack of access only deepens feelings of isolation, pushing those without proper connections further away from a world that increasingly depends on online communication [17]. The gap illustrates significant inequalities, especially between wealthy and poorer nations, and highlights how these disparities often align with socioeconomic factors, creating further social divides. The impact of this divide is especially clear in political engagement and education, as seen during the COVID-19 pandemic when students in rural areas struggled to keep up with remote learning while their more connected peers thrived. As education systems scramble to adapt, the disconnect between students who are digital natives and educators lacking the necessary skills further complicates the situation, emphasizing a dire need for better infrastructure and teaching methods that are relevant to today's students [5].

3. High initial investment costs

In today's digital world, businesses are struggling to keep up with the overwhelming demands of DT, facing numerous barriers that hinder their progress. The study by [9] highlights the serious financial burdens that come with adopting new technologies, revealing that many organizations find it difficult to muster the necessary funds for initial investments, as noted by [6]. Instead of reaping the promised benefits of improved efficiency and innovation, many people are trapped in a cycle of excessive costs and uncertainty, making it hard to see any clear path forward.

3.6.4 Digital learning environments

As illustrated in Fig. 19, challenges such as poor planning, redundant services, and data fragmentation underscore the importance of streamlined digital environments and technical support.

1. *Data fragmentation*

Data fragmentation poses a significant challenge for HEIs because of the intricate IT ecosystems that characterize these organizations. The use of multiple disjointed information technology systems to manage core functions—such as institutional communication, library operations, and financial services—creates a fragmented data landscape [9]. This disarray leads to reliance on ad hoc queries and data extraction, undermining the quality and consistency of the information gathered. As critical data assets are scattered across diverse platforms, verifying data validity becomes increasingly problematic, leading to inconsistencies and duplicated efforts that hinder faculty members' ability to manage and utilize information effectively [13, 17]. Furthermore, the lack of a unified framework for data analysis exacerbates these challenges, complicating decision-making processes and limiting the potential of advanced digital tools such as analytics and artificial intelligence [7]. In addition to the integration of fragmented systems, effective governance of data is essential for navigating ethical issues related to data privacy and transparency, ultimately enabling HEIs to harness their data resources more effectively for operational efficiency and strategic decision-making [6].

2. *Technology dissonance*

Technology dissonance in educational institutions stems from the challenges posed by multiple incompatible learning management systems, resulting in a fragmented technological landscape that hinders both administrative efficiency and educational effectiveness. This disjointed experience affects students and staff alike, as platforms fail to integrate and communicate seamlessly, complicating the delivery and accessibility of learning resources [17]. Moreover, a study by [13] highlights that the adoption of new digital technologies does not automatically ensure compatibility with existing systems. This challenge necessitates institutions to redirect resources toward data organization and custom integration strategies. This issue is further compounded by educators who, uncertain about the compatibility of their content with available tools, often create materials in varying formats. These inconsistencies can lead to a misalignment of ICT tools across different educational departments, ultimately hindering the successful integration of technology in higher education [9].

3. *Inadequate technical support*

Insufficient technical support in higher education poses major barriers to effective DT. The successful integration of innovative technologies relies on dedicated support systems that enable educators to build confidence in using digital tools. Without sufficient assistance, many teaching staff may feel overwhelmed and reluctant to adopt these innovations, which can diminish the overall educational experience and effectiveness [13]. [9] highlighted that comprehensive and consistent technical support is essential as HEIs navigate their transition to digital frameworks, enabling faculty to use technology effectively while allowing students to dedicate their focus to learning. However, challenges such as unresponsive support, lack of personalized aid, and a fragmented IT service approach can stifle the integration of systems and complicate data analysis. To overcome these hurdles, HEIs must prioritize adequate IT resources and training for students, faculty, and administrative staff, ensuring that technical challenges do not impede the progress of DT initiatives.

4. *Absence of critical systems*

An emphasis on digital technologies within HEIs often prioritizes organizational efficiency over meeting the pedagogical needs of individual educators, which poses a significant barrier to DT in higher education [26]. The lack of essential systems, such as learning management systems (LMSs), student information systems (SISs), and customer relationship management (CRM) platforms, hampers efficient operations and negatively impacts the overall student learning experience [5, 6, 28]. Although technological progress presents opportunities for innovation [7, 12] and enhances teaching practices [5], it is vital to integrate digital tools thoughtfully into curriculum design to boost student engagement and cultivate dynamic learning environments [6]. Technology should serve as a facilitator of learning rather than an end in itself [28], emphasizing the importance of balancing educational standards with contemporary methods to meet the needs of tech-savvy learners.

5. *Insufficient and underdeveloped automation initiatives*

Insufficient and underdeveloped automation initiatives in HEIs underscore a critical misunderstanding of the imperative distinction between mere automation and comprehensive DT. [7]. While many HEIs have pursued ad hoc automation efforts driven by IT staff, these initiatives often lack strategic coherence and do not provide meaningful value or enhance customer-centric services. The foundational goals of DT extend beyond technological efficiency to encompass significant improvements across infrastructure, business processes, and academic engagement, demanding a comprehensive approach that integrates effective communication, training, and awareness among all stakeholders. Additionally, [2] emphasize that effective DT depends on a wide range of technologies, including digital

education tools, learning management systems, cloud computing, and the Internet of Things. Each of these factors plays a crucial role in improving the educational environment. As a result, HEIs need to implement a more strategic approach to automation that aligns with their broader DT goals. This strategy should ensure that initiatives are not only technically robust but also genuinely enhance the educational experience of both students and faculty [7].

6. Redundant digital services

Redundant digital services present a major challenge for HEIs as they work through the complexities of DT, especially regarding integrating online degree programs. The prevalence of shadow systems and overlapping software applications often leads to confusion about ownership and responsibility [7], resulting in inefficiencies and a fragmented approach to data management. Many institutions lack robust information and data governance frameworks, which exacerbate issues of data consistency, reliability, and integrity. This situation is further complicated by poorly defined processes for system acquisition, fostering redundant services that hinder effective data integration. Such redundancies not only strain resources but also diminish the quality and reliability of reports generated for internal and external stakeholders. To achieve successful digital integration, HEIs must prioritize streamlined operations and eliminate service duplication; thereby, ensuring that their DT efforts are cohesive and aligned with the broader goals of academic service delivery [9, 20].

3.7 Digital competence

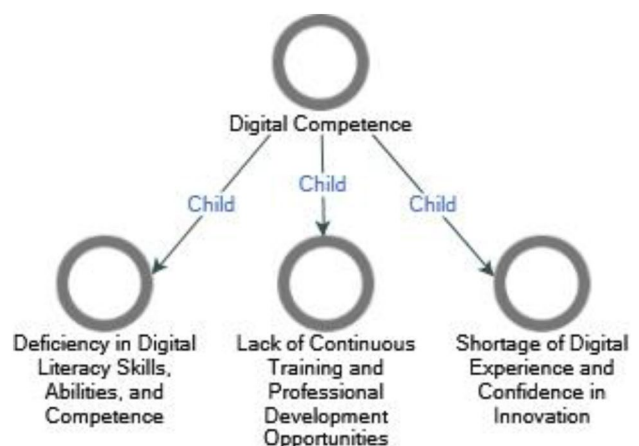
As shown in Fig. 20, the significance of digital skills in higher education is paramount. A lack of digital literacy among faculty and students poses barriers to the effective execution of DT efforts, underscoring the urgent need for continuous professional development and training programs to address the skills gap and improve teaching and learning outcomes.

1. Deficiencies in digital literacy skills, abilities, and competence

A lack of digital literacy skills, abilities, and competence presents a major barrier to effectively executing DT initiatives in higher education [13, 17]. As institutions increasingly rely on advanced technologies to facilitate learning and teaching, the lack of foundational digital skills among both faculty and students threatens to undermine these efforts. Research indicates that many educators are unfamiliar with the latest digital tools, hampering their ability to integrate these resources effectively into their curricula [28]. This skill gap not only affects the adoption of innovative educational strategies but also limits the potential for enhanced teaching and learning outcomes [18, 21]. Moreover, the inability to effectively harness information and communication technologies (ICTs) results in missed opportunities for academic enrichment, necessitating targeted training programs to cultivate digital proficiency [5, 9, 16, 25]. Without continuous professional development and institutional support, stakeholders may find it challenging to adapt to rapidly changing technological environments, which can negatively impact their academic performance and the overall effectiveness of DT in higher education [6, 26].

2. Lack of continuous training and professional development opportunities

Fig. 20 Digital competence project map



The implementation of new teaching methods in HEIs without a proper plan to address students' learning needs highlights the lack of adequate training for lecturers. This situation underscores the failure of HEIs to collaborate effectively with educational technology providers and online learning companies, particularly in the aftermath of the pandemic. Unfortunately, HEIs often neglect the essential need for ongoing professional development for their educators, resulting in a deficiency of technology skills and effective teaching practices [5]. There is a critical lack of awareness about the advantages of innovative teaching methods [13], and without organized workshops and seminars to showcase their benefits, this gap will only widen. It is troubling that HEIs seem to focus solely on enhancing students' digital skills and critical thinking, overlooking the urgent need for robust training for their faculty members [2]. Without significant improvements in teaching strategies or the integration of new tools into lessons, the learning experience of students will inevitably suffer [28].

3. *Shortage of digital experience and confidence in innovation*

HEIs often struggle to adapt to the digital world because they have traditionally focused on teaching and may lack experience with new technologies [13]. Many faculty members feel unsure about using digital tools, which makes it difficult for these institutions to change their teaching methods and incorporate technology effectively [2]. Additionally, the staff responsible for technology often does not have a background in education, leading to challenges in creating a clear plan for this transformation [7]. To succeed, faculty members need to understand the changes brought about by technology, maintain their skills up to date, and shift toward teaching methods that encourage students to take initiative in their learning [24].

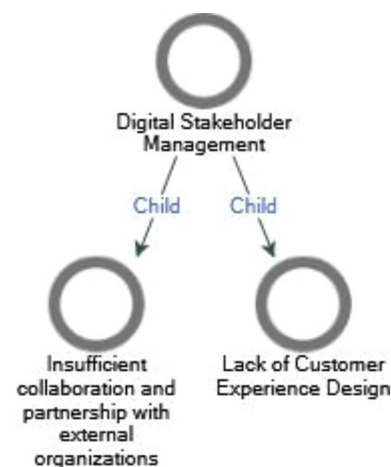
3.8 Digital stakeholder management

As depicted in Fig. 21, insufficient collaboration and customer experience design underscore the importance of effective stakeholder engagement and partnerships. Lack of adequate collaboration and partnership with external organizations in HEIs hinders adaptation to changing student and societal needs, emphasizing the importance of involving stakeholders in DT to promote innovation and collaboration and improve learning outcomes.

1. *Insufficient collaboration and partnership with external organizations*

HEIs must adjust to the evolving demands of students and society, especially considering the insights gained from the COVID-19 pandemic [2, 6]. A broad range of individuals and groups, including students, alumni, faculty, employers, and administrators, can benefit from the ongoing DT in education. By involving these stakeholders in the transition, institutions can create an environment that promotes innovation and collaboration, ultimately improving learning outcomes [5, 16]. Partnerships with other institutions, industry players, and technology providers are essential for accessing expertise and resources that can enhance educational offerings. Moreover, by engaging with various external partners, HEIs can strengthen their reputation and global presence [24] while ensuring that their strategies align with stakeholder interests. Finally, to support student success, HEIs should focus on integrating systems that prioritize user needs and foster a digital ecosystem that encourages communication, sharing of best practices, and the co-creation of value among all participants [6, 12].

Fig. 21 Digital stakeholder management project map



2. *Lack of customer experience design*

To truly focus on the needs of its users, the HEI must ensure that its services and systems are accessible and inclusive for everyone. This means creating a way to design experiences that prioritize the user's perspective. The HEIs should adopt a thoughtful strategy that uses data to understand how customers interact with their services and continuously update the paths they take through these processes. Collaborating with customers in the design phase allows the HEI to create enhanced experiences that address the varied needs of its community [16].

3.9 Digital culture

Challenges in adapting to technology in education, marked by resistance to change and cultural barriers, underscore the necessity of fostering an initiative-taking mindset toward innovation and teamwork among educators.

3.9.1 Adaptability

As represented in Fig. 22, challenges in adapting to change and embracing innovative approaches highlight the importance of fostering a culture of innovation and openness.

1. *Lack of engagement and enthusiasm*

Many faculty members lack enthusiasm for incorporating technology into their classrooms, which poses a significant obstacle to modernizing education. Some educators even oppose using technological tools, often because they prefer adhering to their usual teaching methods and are not keen on innovative ideas. This reflects a larger issue where there is a lack of personal investment in keeping up with advancements in technology and teaching techniques [13]. Moreover, a study [7] revealed that some faculty members are paying for licenses for systems they do not even use, highlighting the disconnect between available resources and their actual implementation.

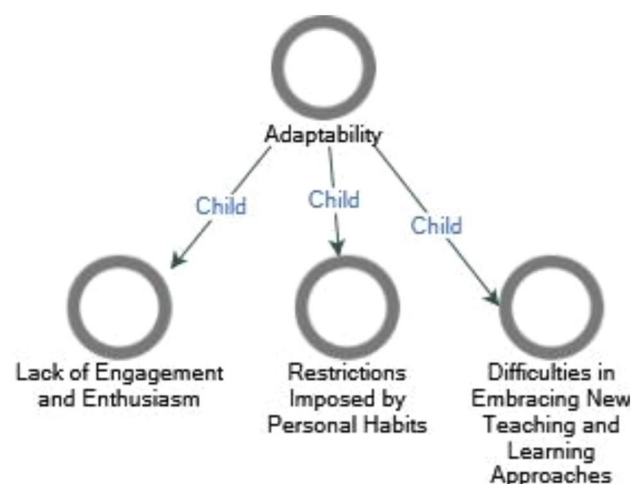
2. *Restrictions imposed by personal habits*

Weak relationships among colleagues in HEIs can create challenges in implementing changes, particularly in adopting new technology for teaching [9]. Many faculty members are set in their way, which can affect how they feel about introducing digital tools in their classrooms. Their openness to using technology is important for good teaching. Even faculty members who may not feel comfortable with tech can learn and adapt if they are willing to try [13]. Moreover, how faculty members view the use of technology can significantly affect their ability to make necessary changes. Individuals who may not be particularly tech-savvy but have a positive outlook on digital tools are more likely to get the necessary skills more easily. Therefore, changing negative attitudes about technology is key to helping faculty members improve their use of it. The main challenge is to create a mindset that welcomes change and teamwork, especially among those who are hesitant about new approaches [9].

3. *Difficulties in embracing new teaching and learning approaches*

HEIs often encounter significant barriers when trying to adopt new teaching and learning approaches, particularly in the context of DT. Resistance to change can hinder progress, making it difficult for educators to successfully

Fig. 22 Adaptability project map



integrate technology into their teaching methods [5]. Although technology has the potential to enhance teaching and support educators, some staff members' reluctance to adopt new methods can stall the digitization of education [22]. A lack of interest and motivation to incorporate technology can create barriers to the DT process, leading some individuals to feel apprehensive about getting new skills and processes. This hesitation and fear of failure can further obstruct the adoption of technology in education, underscoring the challenges institutions face in modernizing their teaching approaches [13].

3.9.2 Resistance to change

As displayed in Fig. 23, concerns over modernization and technology adoption underscore the need for addressing resistance and building trust in digital solutions.

1. *A culture averse to change*

Cultural barriers significantly hinder efforts to change HEIs, affecting both individuals and the organization as a whole [9]. Many faculty and staff hesitate to adopt new methods brought about by technological advancements, mainly because they feel comfortable with traditional practices [9]. On a larger scale, institutions often prioritize stability, which can prevent them from adapting to necessary changes [13]. This creates dual resistance [20], where both personal comfort and institutional culture resist innovation. Faculty members, in particular, may view new technologies as disruptions rather than helpful tools [25], making it essential for institutions to address these deep-rooted attitudes to effectively transition into more modern educational practices. Moreover, social considerations, such as concerns about communication dynamics and respect for cultural norms [7], can further complicate the implementation of digital changes. Therefore, overcoming this resistance is crucial for HEIs to thrive in a rapidly evolving digital world.

2. *Anxiety surrounding technology*

Many students today feel anxious about technology, but since they grow up with gadgets and social media, they often adapt better than older generations [27]. However, faculty members still worry about using technology, fearing it might disrupt their traditional way of teaching. While some people find joy and ease in learning new tech skills, others feel overwhelmed and afraid of failing, which can hold them back [13]. This discomfort is rooted in the anxiety of trading familiar methods for something new and uncertain [9]. Additionally, when educators and students attempt to explore innovative uses of technology, they sometimes face pushback from IT departments, which prioritize control and risk management over experimentation and growth [16].

3. *Resistance to modernization and the adoption of technology*

Many educational institutions face challenges regarding adopting new technology because some faculty members are hesitant or uninterested in using these tools [9]. To successfully manage transformation efforts that involve significant changes, it is crucial to address any potential issues caused by this shift. Strong leadership is needed to

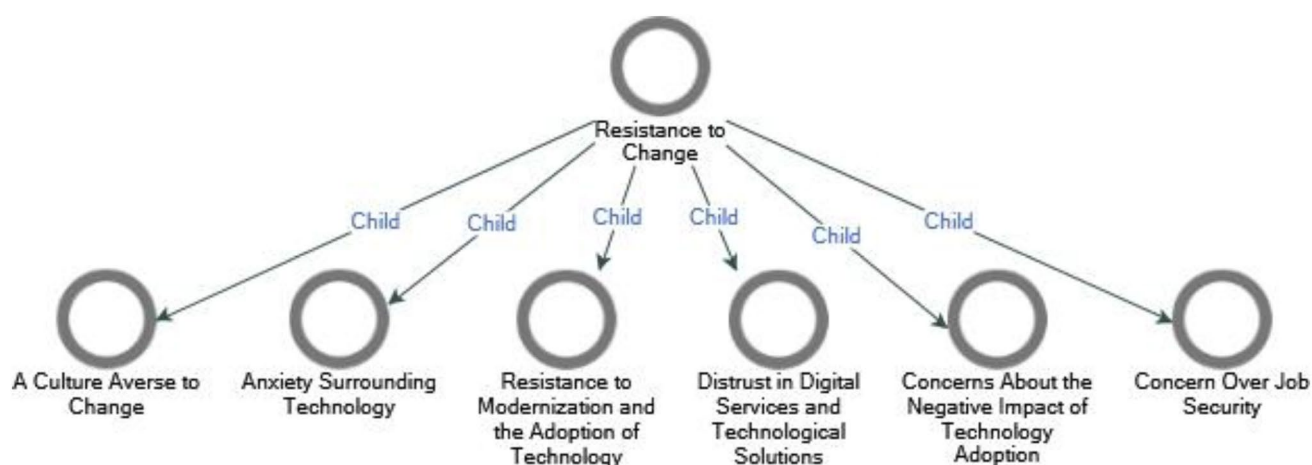


Fig. 23 Resistance to change project map

guide the process and help everyone understand that changes can cause confusion and require careful attention [12].

4. *Distrust in digital services and technological solutions*

A widespread sense of distrust exists regarding digital services and technological solutions, particularly due to concerns about reliability and security, as noted by [9]. Barriers to transformation often stem from internal factors, including people's attitudes and beliefs about the value of technology and their abilities. This skepticism toward digital services and cloud technologies, along with fears about credibility and security, can significantly hinder the adoption of digital solutions. Academics who may not have advanced technological skills but support a positive outlook on ICT are likely to find it easier to develop the necessary expertise for integrating technology into their teaching practices. Despite the growing availability of digital tools, a considerable number of educators continue to depend on traditional teaching methods and communication styles, as highlighted by [13]. Differences in faculty members' readiness and experiences with technology contribute to a lack of confidence and anxiety when navigating digital environments.

5. *Concerns about the negative impact of technology adoption*

Many people, including those in academia, often feel hesitant about embracing modernization due to fears and concerns surrounding technology [9]. Such anxiety can stem from worries about the potential negative impacts of innovative technologies, leading to reluctance to learn new skills and avoidance of change. As a result, some individuals may fear falling behind or failing in the face of these advancements [13]. This leads to feelings of uncertainty about the reliability and safety of online services and cloud technologies [9, 13].

6. *Concern over job security*

Jobs in academia are often viewed as some of the safest positions available [2, 2], [5]; these jobs can lead to resistance against new teaching methods, especially if these changes threaten job stability. When people feel that their job security is at risk, they are much more likely to resist new changes [9]. This resistance is compounded by a lack of innovative planning and financial resources about adopting new digital tools in education. Therefore, it is important to provide support and guidance for educators, helping them see the advantages of technology while addressing their concerns about job security [5].

3.9.3 Psychological

As detailed in Fig. 24, issues such as digital isolation and tech-induced stress emphasize the importance of promoting healthy technological habits and well-being.

1. *Digital isolation*

The rise of digital technology was intended to bring people closer, yet it has ironically led to a feeling of isolation among many people [17, 20]. Even with countless ways to communicate online, many individuals find themselves lacking real connections and meaningful conversations. Moreover, working from home has further increased this sense of isolation, as people miss daily interactions with coworkers. Experts warn that this disconnection can lead

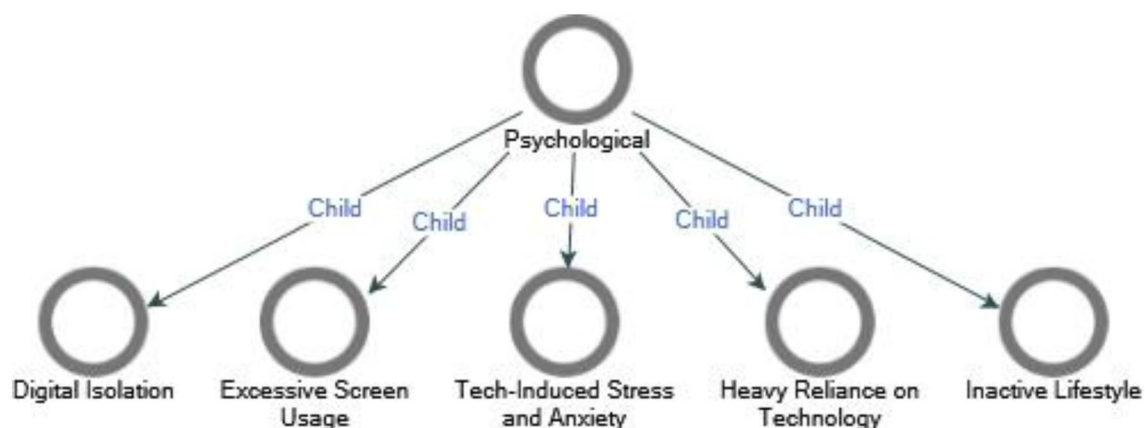
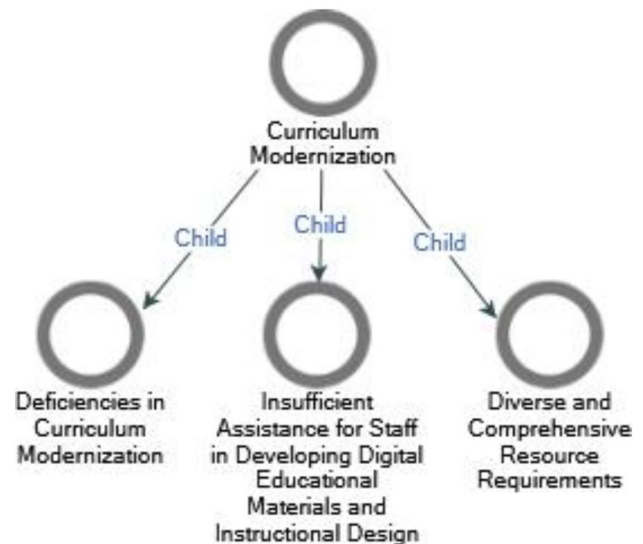


Fig. 24 Psychological project map

Fig. 25 Curriculum modernization project map



to mental health issues such as loneliness and depression [17, 20]. To address this challenge, it is essential to foster improved digital communication, promote face-to-face interactions, and create technology that genuinely strengthens our connections instead of merely scratching the surface of relationships. Effectively addressing this multifaceted issue will necessitate collaboration among technology developers, policymakers, and community leaders [17].

2. *Excessive screen usage*

As digital technology becomes a bigger part of our lives, some people might start to rely on it too much. This reliance can damage how people interact with each other and communicate, which are important skills for learning and working together effectively [6].

3. *Tech-induced stress and anxiety*

Anxiety and stress from using digital technology [17] can turn into chances for thoughtful reflection, engaging in activities that build relationships, changing teaching methods, prioritizing mental health in online environments, encouraging collaboration between parents and faculty members, and finding a balance between online interactions and face-to-face experiences.

4. *Heavy reliance on technology*

As the digital landscape continues to evolve, overreliance on technology can undermine essential interpersonal and communication skills vital for effective learning and collaboration. In higher education, this dependency may lead to diminished face-to-face interactions, resulting in students lacking the foundational ability to engage meaningfully within teams or communicate effectively in professional settings. Consequently, while institutions must harness the benefits of DT to enhance educational offerings and support competitiveness, they must also implement strategies to balance technology use with opportunities for in-person engagement. This approach ensures that graduates not only possess technical competencies but also thrive in their ability to connect, collaborate, and lead in an increasingly complex world [6].

5. *Inactive lifestyle*

Mental health experts caution about the lasting consequences of extended isolation associated with a sedentary lifestyle. To alleviate the isolating effects of digital advancements, it is crucial to prioritize efforts that enhance digital literacy, support face-to-face interactions, and develop technologies that foster genuine connections rather than superficial exchanges. Engaging in activities that promote a sense of community and belonging is essential for combating the negative effects of excessive screen time and inactivity, as highlighted by [Maurya & Yadav \[17\]](#). By actively nurturing meaningful relationships and encouraging social participation, individuals can mitigate the detrimental effects of isolation and pursue healthier, more fulfilling lives.

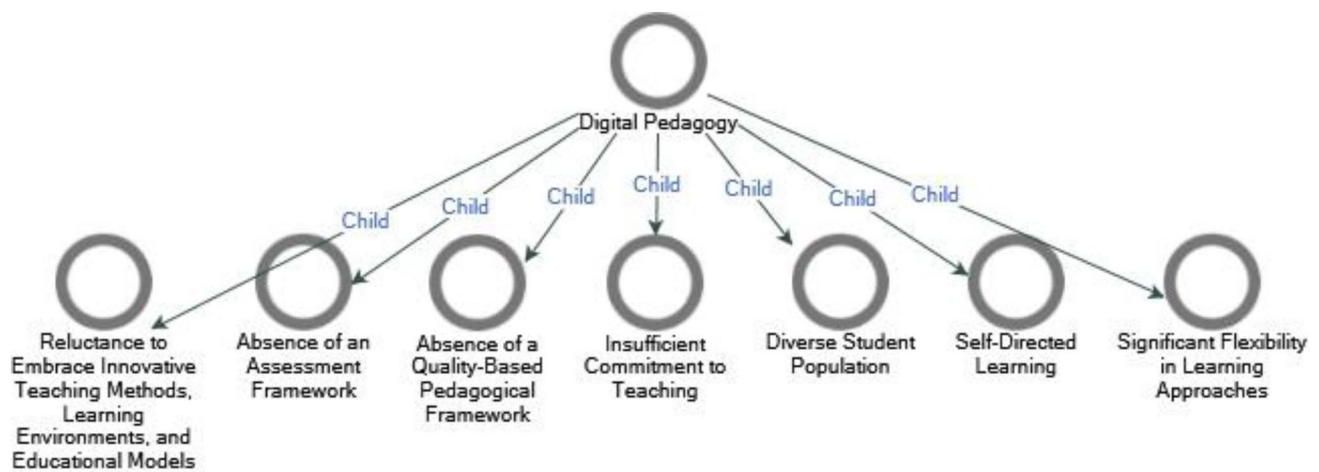


Fig. 26 Digital pedagogy project map

3.10 Digital academic

The modernization of curricula and the adoption of digital pedagogy in higher education meet several major barriers. These include pushing against new teaching methods, inadequate support for faculty, varied resource requirements, and difficulties adjusting to flexible learning settings. These challenges impede the successful incorporation of digital tools and tailored learning experiences.

3.10.1 Curriculum modernization

As shown in Fig. 25, concerns over modernization and technology adoption underscore the need for addressing resistance and building trust in digital solutions.

1. *Deficiencies in curriculum modernization*

Updating educational curricula to align with contemporary standards and methodologies, including the creation of international curricula and the incorporation of digital learning and information and communication technology (ICT), presents several challenges [7, 12, 24]. Students are increasingly looking for enhancements in their educational experiences, such as digitized processes and round-the-clock access to information [12]. The transition to DT in higher education necessitates revisions in teaching methods and content to keep pace with the changing demands of various industries [24]. However, the shift to a digital society introduces barriers, particularly in preparing both students and faculty for the requirements of a globalized education. The incorporation of digital tools and adaptive learning aims to foster a more dynamic educational system that responds to the needs of the modern job market [6]. Nonetheless, many students find it challenging to adapt to online learning due to ingrained traditional learning habits and limited technological access [28]. Adjusting to a digitally transformed educational environment involves a move toward active participation and independent thinking [16, 24]. Ultimately, the DT of education is crucial for addressing market demands and ensuring that graduates possess the essential skills for thriving in the digital economy [22].

2. *Insufficient assistance for staff in developing digital educational materials and instructional design*

The lack of sufficient support for faculty in creating digital educational materials and effective instructional design is a major barrier for HEIs striving to improve student learning experiences through DT [27]. This challenge is compounded by evolving student literacy and the obligatory use of administrative tools within learning management systems, highlighting the urgent need for adequate resources and support [26]. While HEIs recognize the necessity of online course development, educational platforms, and staff training to facilitate successful DT [21], individual lecturers often bear the burden of producing engaging digital content. This can lead to issues such as content redundancy and increased workloads, as incorporating technology into pedagogy requires more time and effort from academics already navigating new teaching methods. Collaborating with content providers can enhance the

quality and accessibility of educational materials [12], but insufficient support and training in instructional design impede the effective integration of technology into teaching practices [9, 12]. As HEIs work to utilize technology for better student outcomes [6], broaden access to education, and bolster academic research, addressing the difficulties faculty face in developing digital educational resources is essential for the successful execution of DT initiatives [7, 24].

3. Diverse and comprehensive resource requirements

A variety of comprehensive resources are vital for enhancing student learning in the digital age, especially in higher education. This requires the incorporation of a wide range of digital tools to develop the human capital essential for societal progress. This strategic approach enables effective transmission, orientation, and construction of a sustainable knowledge framework. Moreover, this approach offers a crucial opportunity for HEIs to revamp their curricula and teaching methods, improving the cultivation of skilled human resources that align with the tenets of sustainable development. Such initiatives ultimately affirm the capacity and prominence of educational institutions in synchrony with global educational trends [24].

3.10.2 Digital pedagogy

As shown in Fig. 26, challenges in embracing innovative teaching methods and assessment frameworks underscore the importance of pedagogical innovation and student-centered approaches.

1. Reluctance to embrace innovative teaching methods, learning environments, and educational models

Reluctance to embrace innovative teaching methods, learning environments, and educational models hinders the success of DT among HEIs [5, 6, 9, 12, 17, 17–20, 26, 28]. Faculty members in higher education are now expected to embrace digital tools and active learning tactics, which pressures them to shift their roles into guides with advanced tech skills, a challenging and overwhelming expectation [26]. While some confident faculty members may know when technology truly benefits learning, many struggle with the belief that digital tools can also hinder their teaching or complicate the learning process, especially in a culture resistant to change and lacking time for collaboration or experimentation [26]. The gradual shift toward DT, which was characterized primarily by traditional lecture methods, has left HEIs ill-equipped to effectively incorporate new technologies, particularly in light of the disruptions brought about by the COVID-19 pandemic [24]. This struggle is exacerbated by a noticeable reluctance among faculty to adopt these technologies, which stifles innovation and maintains obsolete teaching practices [9]. Numerous professors prioritize research over teaching, often overlooking valuable digital platforms that could improve the learning experience. This results in underutilized resources and a disconnect between students and their instructors [16]. If adequate investment in these digital solutions is not made, along with recognition of their importance, higher education may struggle to address the changing needs of students and the requirements of contemporary workplaces [28].

2. Absence of an assessment framework

Studies [6, 18, 20, 27] show that creating an assessment framework to support DT is challenging. A study by [20] revealed the numerous difficulties that arose from moving assessments online during the COVID-19 pandemic. The assessment methods employed failed to sufficiently accommodate the diverse needs of students and did not align exams effectively with the skills being evaluated. There were also significant issues with proving students' identity and preventing cheating, which are crucial for fair assessments. Similarly, Alhubaishy & Aljuhani [27] noted that students' poor learning performance negatively affects their acceptance of digital services in education, ultimately undermining their attempts to modernize teaching approaches. Furthermore, even with attempts at reform, there remains an absence of clear laws and regulations governing teaching and assessment in the digital era. As a result, online exams often lack formal recognition, leaving institutions stuck with outdated practices and incurring unnecessary costs related to proctoring and grading [24].

3. Absence of a quality-based pedagogical framework

According to previous studies [5, 12, 17, 20, 26], without a quality-based pedagogical framework, HEIs may struggle to ensure consistent teaching standards, leading to varied student outcomes and a lack of accountability in the learning process. In online courses, the lack of clear guidelines and effective teaching models is concerning, as highlighted by [20].

4. Insufficient commitment to teaching

There has been an insufficient commitment to teaching that hinders the implementation of DT [2, 6, 17, 20, 27]. While digital education systems could help faculty members use new methods and technologies, the reality is that many educators still struggle to stay engaged and creative in their teaching because their commitment is not valued [22]. It is disappointing that faculty members' dedication to their work has not been acknowledged properly [20]. This lack of clear definition has made it even harder for their efforts to be recognized.

5. *Diverse student population*

While DT is often celebrated for personalizing learning, it raises concerns about the diverse student population that creates disparities in educational quality and individual attention [6, 19, 22, 24, 27]. Educators who depend on data and algorithms might find it difficult to understand the unique complexities of each student's needs, resulting in a standardized approach that does not effectively connect with numerous learners [6]. This supposed improvement in the learning environment often results in disengaged students drowning in a sea of multimedia distractions without meaningful interaction [24]. Furthermore, the focus on inclusivity can feel superficial, as the true individual needs of students are often overlooked, leaving many feelings lost and unsupported [22].

6. *Self-directed learning*

Studies [7, 20, 21, 24] highlight the challenging effort to achieve a balance in self-directed learning within the digital learning environment, which is considered crucial for reaching educational objectives and cultivating essential skills. Despite claims that digital environments can be tailored to meet varied needs, including real-time interaction [16], it is clear that many students still lack the independence and time management skills required as they face increasingly daunting challenges [21]. DT in HEI seems to impose more pressure on students, who are expected to be autonomous while tackling complicated problems and fostering critical thinking, accountability, and teamwork. While the idea is that these technological advancements would make learning easier, they often feel like a burden, with students struggling to keep up and engage meaningfully in a landscape that promises much but frequently falls short [24].

7. *Significant flexibility in learning approaches*

Significant flexibility in learning approaches is often unregulated [12, 21, 24, 29]. For instance, online students often find that the flexibility of online degree programs is not as beneficial as it seems, as it comes with serious drawbacks and limits. This flexibility can lead to feelings of isolation, which increases the likelihood of students dropping out. Another example is managing time effectively, which becomes a major struggle in this environment that is meant to be adaptable [20]. While institutions promote their use of technology to offer flexible learning opportunities, this often fails to address the fundamental challenges faced by students, such as a lack of connection and support. Ultimately, the promise of a personalized education experience with such much flexibility can feel overwhelming and detrimental rather than helpful, leaving students feeling more lost than empowered [12, 21, 24].

3.11 Digital ethics

As presented in Fig. 27, the risks of unethical technology use and lack of data standards highlight the importance of ethical guidelines and compliance in digital practices.

Fig. 27 Digital ethics project map



1. *Threat to security, privacy, confidentiality, and compliance*

The rise of digital technologies and interconnected systems is creating significant problems related to security, data protection, and compliance, with many HEIs lacking the necessary infrastructure to tackle these issues effectively [6, 9, 12, 13, 16, 19, 21, 27, 30]. The growing threats to HEIs, whether online or on campus, highlight a serious need for better security and intelligence for students and staff [7]. The absence of standardized data protocols and legal frameworks heightens the risk of data breaches and unauthorized access to sensitive information, putting individuals at risk and diminishing their control over their data [20]. Institutions must prioritize security and privacy above all else in online education, yet many seem ill-prepared to handle the risks that come with DT [20]. HEIs such as those in a study by [7] are understandably worried about whether their current hardware and networks can withstand the growing array of security threats linked to their increased digital presence.

2. *Risk of unethical use of technology*

The integration of new technologies in academia possibly creates complex and troubling risks that cannot be ignored [6, 9, 13, 20, 21]. While DT is considered essential for progress, it often leads to the unethical use of technology, which can compromise the integrity of educational institutions. These risks, especially concerning the abuse of data, highlight the need for strong safeguards to prevent exploitation in the educational sector. Instead of promoting a supportive and inclusive atmosphere, the focus on technology often overlooks the human aspect, leaving institutions vulnerable to serious threats such as data breaches and identity theft [20]. Furthermore, if HEIs fail to carefully check that their digital practices meet ethical standards, they risk harming both student privacy and their reputations. In brief, without strict adherence to security protocols, the integration of digital tools could do more harm than good, undermining trust and safety in the educational environment [9].

3. *Lack of standards for data exchange*

Information and data governance and management are key issues in DT, leading to ethical dilemmas surrounding data privacy, transparency, and the need for clear data policies [6, 7, 9, 9, 13, 16, 21]. The rise in IT risk associated with DT in higher education is a major concern that must be addressed [13]. Both faculty and students should remain attentive in confirming the accuracy of the data and information on their academic platforms [6]. The fragmentation and diversity of data across various IT systems pose challenges, with regulations complicating data collection and usage [9]. Ensuring the security of scattered data and addressing ethical considerations in decision-making processes is essential for HEIs navigating digital transitions [16].

4. *Lack of understanding of intellectual property laws*

Legal problems concerning intellectual property and copyrights can create significant barriers for HEIs looking to embrace DT [6, 9, 20]. Issues related to copyright can hinder these institutions in their efforts to adopt innovative technologies and methods. These stringent regulations often hinder HEIs from fully leveraging digital resources such as online courses and e-books. They may encounter restrictions on the use of specific materials or be obligated to pay high licensing fees, which ultimately escalates costs and limits access to critical educational tools [9].

4 Discussion

This review reveals critical insights into the ongoing barriers of DT within HEIs. It underscores the prevalent lack of cohesive vision and strategic planning [2, 6, 7, 9, 12, 13, 16, 17, 17, 19–21, 29], which contributes to ineffective and disjointed digital initiatives across various departments. The absence of institutional clarity about transformation goals not only fosters confusion among faculty and administrative staff but also creates barriers to collaborative efforts necessary for a successful transition. Additionally, the focus on immediate issues and quick fixes often detracts from essential long-term strategic considerations, leaving many institutions unprepared to adapt to the rapidly evolving digital landscape. The calls for broad stakeholder engagement are essential, as they highlight the necessity for inclusive processes that incorporate feedback from across the academic community and beyond. Furthermore, a robust institutional policy framework is vital to ensure that DT efforts align with overarching academic and operational goals, thereby enhancing both teaching and learning experiences while addressing crucial areas such as user data privacy and academic workload. Overall, the insights prompt a reevaluation of existing approaches, urging higher education leaders to prioritize strategic coherence, stakeholder collaboration, and comprehensive policy formulation to navigate their digital futures effectively.

The successful execution of DT in higher education greatly depends on strong leadership and management [2, 5–7, 9, 12, 13, 16, 20, 22–24]; however, major barriers remain due to poor leadership practices and insufficient accountability. Research shows that many leaders in HEIs often underappreciate their role in driving change, leading to a disconnect

between IT departments and academic administrators, where the latter may mistakenly assume that digital initiatives are solely the responsibility of the IT department. This misalignment results in a culture resistant to change, further exacerbated by a bureaucratic structure that stifles innovation and effectively undermines transparency and collaboration. As institutions struggle to harness their ultimate digital potential, the need for leaders to adopt a comprehensive, data-driven approach becomes paramount; they must prioritize user experience and effectively engage teams in the pursuit of digital capabilities that align with academic goals. In the absence of strong leadership capable of managing the challenges of transformation and insufficient oversight of initiatives, higher education may fall behind as other sectors progress, resulting in institutions being unprepared for the changing needs of students and the future landscape of education.

The struggles faced by HEIs in their DT journey reveal a complex interplay of insufficient government support, bureaucratic rigidity, and a lack of effective collaboration. Studies [2, 5–7, 9, 12, 13, 16, 18, 20, 24–26] indicate that mere intentions to digitize education remain unfulfilled due to inadequate national funding, regulatory burdens, and outdated legal frameworks that fail to address the rapid pace of technological change—especially in less developed nations. Furthermore, a prevalent bureaucratic culture within HEIs stifles innovation, as faculty and staff grapple with integrating innovative technologies while adhering to archaic organizational structures. The result is a damaging cycle where institutions strive to mimic the success of their peers yet are ill-equipped to adapt their practices to fit the contemporary educational landscape. As a result, if there is no unified initiative to dismantle silos, encourage collaboration, or make significant investments in digital tools and training, these institutions may jeopardize their relevance and effectiveness in a progressively digital environment, undermining the quality of education they offer.

The challenges facing HEIs amidst the push for DT underscore a multifaceted crisis exacerbated by limited resources, outdated technology, and a prevailing digital divide [2, 5–7, 9, 12, 13, 16, 17, 20–22, 24–28]. The pandemic has magnified gaps in ICT infrastructure, revealing significant disparities in access to digital tools and reliable internet, particularly in underserved regions. Moreover, the reliance of institutions on legacy systems and lackluster integration of innovative technologies impede effective teaching and learning processes, while faculty members face overwhelming workloads and insufficient digital skills that hinder their ability to embrace innovative educational practices. This scenario needs prompt, multifaceted actions, such as strategic infrastructure investments, extensive training programs for faculty members, and policies that foster equitable technological access. These measures will ensure that all students, irrespective of their backgrounds, can succeed in a progressively digital educational environment. Without addressing these systemic issues, the promise of digital tools to enhance learning and improve educational outcomes will remain unfulfilled, perpetuating existing inequalities.

The challenges associated with digital competence [2, 5–7, 9, 13, 16–18, 21, 24–26, 28] in higher education highlight the urgent need for comprehensive strategies that emphasize faculty training and enhance student engagement in digital learning environments. The noticeable lack of digital literacy among both educators and students points to a systemic issue that hampers institutional efforts toward DT. Institutions must focus on giving targeted professional development opportunities for faculty to improve their technological skills and teaching methods while also creating an environment that promotes innovation and adaptability. This could involve setting up collaborative partnerships with educational technology providers to create customized training and support resources. Additionally, HEIs should transition from simply teaching digital skills to nurturing a broader culture of digital fluency, which prioritizes continuous learning and collaboration. By doing so, they can better prepare both educators and students to succeed in an ever-changing digital landscape, enhancing academic performance and ensuring that graduates have the skills needed to excel in a technology-driven world.

In the rapidly evolving digital landscape, HEIs face a critical challenge in harmonizing the diverse needs of their stakeholders [2, 5, 6, 12, 16, 24], including students, faculty, and industry partners, amidst a backdrop of clunky digital transitions. To thrive, HEIs must shift their focus from internal processes to a more collaborative, stakeholder-centered approach that prioritizes user experience. This necessitates embracing customer experience design as a core principle, wherein data-driven insights guide efforts to create accessible and inclusive services tailored to individual needs. By engaging a diverse group of community members, including students, alumni, and employers—during the design and implementation stages, HEIs can cultivate a culture of innovation that improves learning outcomes. Additionally, forging partnerships with external organizations and leveraging technological expertise could pave the way for improved educational offerings while elevating institutional reputation and global standing. This transition not only aims for institutional advancement but also aligns closely with the mission to meet the evolving demands of society, ensuring that the digital ecosystem within higher education becomes a true facilitator of learning and growth for all constituents.

Resistance to DT in educational institutions highlights a complex interplay of cultural, psychological, and practical challenges [2, 5–7, 9, 12, 13, 16, 17, 20, 22, 25, 27]. At the heart of this resistance is a deeply ingrained aversion to change characterized by reluctance to deviate from traditional methods that have long defined their teaching practices. This discomfort is compounded by fears about job security and the negative impact of technology, resulting in many faculty members viewing new tools as disruptions rather than enhancements. The disconnect between available digital resources and their actual implementation exacerbates these issues. Faculty members may even invest in technologies they do not use, revealing a significant gap between intent and action. Moreover, psychological factors such as anxiety over technological adaptation and the isolation spawned by increased screen time contribute to a climate of detachment that undermines collaborative efforts. To foster a digital culture conducive to meaningful transformation, institutions must cultivate supportive environments led by strong leadership prioritizing continuous training, open dialog, and a collective willingness to embrace new practices while addressing underlying concerns related to job stability and technological reliability. By shifting attitudes from resistance to engagement, HEIs can harness technology as a catalyst for enhanced educational outcomes.

The current landscape of digital academic transformation highlights significant deficiencies and challenges that plague the modernization of educational curricula [6, 7, 9, 12, 16, 20, 21, 21, 22, 24, 26–28], necessitating a deeper examination of the roles of both educators and students in this evolving context. While digitization promises accessibility and personalized learning experiences, the reluctance of faculty to fully embrace innovative teaching methods, coupled with inadequate institutional support for course development, undermines the effectiveness of these digital initiatives. The pressure on students to engage in self-directed learning—while simultaneously juggling teamwork—often exacerbates feelings of isolation and overwhelm, leading to disengagement. Furthermore, the one-size-fits-all approach emerging from reliance on data and algorithms risks diluting the nuanced understanding of individual student needs, alienating learners. To effectively address the challenges in digital pedagogy and assessment, educational institutions need to focus on collaboration, invest in faculty members' training, and create strong frameworks that truly meet the varied needs of their students. By taking this approach, they can foster a more dynamic, equitable, and effective educational atmosphere that equips graduates to meet the challenges of today's job market.

The transition to online assessments and the DT in education, hastened by the COVID-19 pandemic, has revealed substantial ethical dilemmas and operational inefficiencies that HEIs must urgently tackle. Assessment methods often fail to meet diverse student needs while struggling with integrity issues such as identity verification and cheating prevention. Compounding this problem is the inherent risk of unethical technology use, primarily relating to data privacy and security breaches, which threaten the foundational trust essential for educational environments. Additionally, the lack of consistent regulations and standards concerning data exchange, intellectual property, and compliance [6, 7, 9, 12, 13, 16, 19–21, 27] has left many institutions ill-equipped to navigate the complexities of digital integration. This highlights the pressing need for stronger governance frameworks, improved security infrastructure, and a focus on ethical standards to safeguard both student welfare and institutional integrity during this transformative era in education.

5 Conclusion

The ongoing DT within HEIs reveals a complex landscape marked by various intertwined challenges that necessitate strategic reevaluation and a commitment to fostering an inclusive, responsive educational environment. This study highlights critical deficiencies in leadership, institutional clarity, and stakeholder engagement, each contributing to an environment resistant to change. As institutions grapple with bureaucratic rigidity, outdated technologies, and insufficient support, it becomes imperative for leaders to adopt holistic approaches that prioritize open communication and collaborative engagement. To effectively leverage the potential of digital tools, academic leaders need to create a unified vision while empowering faculty and staff through focused professional development and the implementation of strong frameworks that encourage continuous innovation.

Addressing the ethical challenges associated with digital assessment methods is essential for enhancing governance that safeguards student interests and institutional integrity. Institutions must adopt data-driven strategies that improve user experience while ensuring equitable access and privacy, as failure to do so could undermine their mission to deliver high-quality education in a rapidly digitizing world. Successful DT in higher education will depend on cultivating engaged, adaptive communities that integrate technology seamlessly into academic life, taking into consideration a fundamental shift in mindsets and practices to enable all stakeholders to thrive in the digital landscape.

To effectively navigate the complexities of DT in higher education, institutions must adopt a holistic approach that prioritizes strategic coherence and institutional clarity. Academic leaders must collaboratively engage all stakeholders—including faculty, staff, students, and industry partners—to create a shared vision for digital initiatives. This can be carried out by organizing facilitated workshops and focus groups and establishing regular feedback mechanisms to ensure that different perspectives are considered during the planning and implementation phases. Furthermore, setting up a comprehensive policy framework that aligns DT efforts with the institution's overarching academic and operational goals is vital. Such a framework should also incorporate guidelines for data privacy, institutional accountability, and equitable access to digital resources, ensuring that all community members can participate meaningfully in the transformation process.

Additionally, addressing the systemic barriers that hinder effective DT requires a commitment to professional development and support for educators and administrators alike. Institutions should invest in targeted training programs designed to enhance both digital literacy and pedagogical skills, enabling faculty to leverage technology effectively in their teaching methodologies. Moreover, creating an environment that encourages innovation, and experimentation can help to alleviate resistance to change, fostering a culture where embracing new tools is seen as an opportunity for growth rather than a threat. By focusing on continuous learning and adaptive strategies, HEIs can transform their digital landscapes into vibrant ecosystems that foster academic success and cater to the evolving needs of students, positioning themselves at the forefront of educational excellence in the technology-driven future.

This study points out several limitations that can be fixed in future reviews. First, this review does not include articles from the Web of Science and Scopus, which are paid databases with a lot of peer-reviewed literature. Second, this literature review only looks at a specific period. However, an analysis of recent data shows that research is increasing, which highlights the need for regular updates. Third, the qualitative findings in this review could be turned into testable ideas through quantitative research, which would strengthen the conclusions of other studies. Lastly, this research only focuses on HEIs. Including insights from other sectors involved in DT could provide a broader understanding. Future research will aim to confirm the findings of this review through studies conducted in HEIs. To advance this research, it would be beneficial to consider how specific legislative frameworks, and the governance structures of public sector entities influence barriers to DT. This exploration may reveal distinctive challenges faced by institutions running under varying regulations and funding models. It would be fruitful to compare these findings with those from more conventional HEIs, enabling a more comprehensive understanding of the broader landscape. Incorporating stakeholder perspectives through qualitative methods, such as interviews and surveys, will enrich the research. Stakeholders may include faculty, administrators, IT staff, and students, each bringing unique insights into the DT process. This multifaceted approach could reveal not only how barriers are perceived and experienced but also which strategies are considered effective in overcoming them. Moreover, documenting successful case studies could give practical examples of effective DT strategies. By illustrating what works in different contexts, institutions can learn from each other and develop tailored approaches that consider their unique challenges and opportunities.

Author contribution The author conducted the research using PRISMA. Coding, thematic analysis, and text mining were performed by the author using NVivo and Zotero. Tableau was also used in data visualization. The author reviewed and approved the final manuscript.

Funding Not Applicable.

Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

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References

1. World Economic Forum, "Accelerating Digital Transformation for Long Term Growth," World Economic Forum. Accessed: Jul. 08, 2024. [Online]. Available: <https://initiatives.weforum.org/digital-transformation/home>
2. Rodríguez-Abitia G, Bribiesca-Correa G. Assessing digital transformation in universities. *Future Internet*. 2021;13(2):52. <https://doi.org/10.3390/fi13020052>.
3. OECD, "Digital transformation," OECD. Accessed: Aug. 02, 2024. [Online]. Available: <https://www.oecd.org/en/topics/policy-issues/digital-transformation.html>
4. UNESCO, "Digital learning and transformation of education | UNESCO." Accessed: Jul. 30, 2024. [Online]. Available: <https://www.unesco.org/en/digital-education>
5. Mhlanga D, Denhere V, Moloi T. COVID-19 and the key digital transformation lessons for higher education institutions in South Africa. *Edu Sci*. 2022;12(7):464. <https://doi.org/10.3390/educsci12070464>.
6. Alenezi M, Akour M. Digital transformation blueprint in higher education: a case study of PSU. *Sustainability*. 2023;15(10):8204. <https://doi.org/10.3390/su15108204>.
7. Marks A, AL-Ali M. Digital Transformation in Higher Education: A Framework for Maturity Assessment. *Int J Adv Comput Sci Appl* 2020;11(12) [Online]. Available: https://orca.cardiff.ac.uk/id/eprint/139830/1/Paper_61-Digital_Transformation_in_Higher_Education.pdf
8. Brooks DC, McCormack M. Driving Digital Transformation in Higher Education. CO: ECAR, Louisville, 2020. Accessed: Aug. 12, 2024. [Online]. Available: <https://www.educause.edu/ecar/research-publications/driving-digital-transformation-in-higher-education/2020/defining-digital-transformation>
9. Gkrimpizi T, Peristeras V, Magnisalis I. Classification of barriers to digital transformation in higher education institutions: systematic literature review. *Edu Sci*. 2023;13(7):746. <https://doi.org/10.3390/educsci13070746>.
10. Verhoeft PC, et al. Digital transformation: a multidisciplinary reflection and research agenda. *J Bus Res*. 2021;122:889–901. <https://doi.org/10.1016/j.jbusres.2019.09.022>.
11. Bucăta G, Popescu F, Tileagă C. Digital transformation of higher education system. *Int Conf Knowl Based Organ*. 2022;28(1):158–68. <https://doi.org/10.2478/kbo-2022-0025>.
12. Benavides L, Tamayo Arias J, Arango Serna M, Branch Bedoya J, Burgos D. Digital transformation in higher education institutions: a systematic literature review. *Sensors*. 2020;20(11):3291. <https://doi.org/10.3390/s20113291>.
13. Aditya BR, Ferdiana R, Kusumawardani SS. Categories for barriers to digital transformation in higher education: an analysis based on literature. *IJJET*. 2021;11(12):658–64. <https://doi.org/10.18178/ijjet.2021.11.12.1578>.
14. Page MJ, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021. <https://doi.org/10.1136/bmj.n71>.
15. Morakanyane R, Grace A, O'Reilly P. Conceptualizing digital transformation in business organizations: a systematic review of literature. In *Digital Transformation—From Connecting Things to Transforming Our Lives*, University of Maribor Press, 2017, pp. 427–443. <https://doi.org/10.18690/978-961-286-043-1.30>.
16. Obaid T, Abdaljawad R, Abumandil M. COVID-19 and the digital transformation of higher education: What insights Palestinian institutes can share? 2020 [Online]. Available: <https://www.academia.edu/download/104179994/6-7-137-958.pdf>
17. Maurya SK, Yadav A. Dark side of digital transformation in online teaching-learning process considering COVID-19. *Environ Soc Psychol*. 2024. <https://doi.org/10.54517/esp.v9i4.2115>.
18. Mospan N. Trends in emergency higher education digital transformation during the COVID-19 pandemic. *JUTLP*. 2022;20(1):50–70. <https://doi.org/10.53761/1.20.01.04>.
19. Sararuch S, Wannapiroon P, Nilsook P. The development of agile enterprise architecture for digital transformation in higher education institutions. *HES*. 2023;13(3):69. <https://doi.org/10.5539/hes.v13n3p69>.
20. García-Peñalvo FJ. Avoiding the dark side of digital transformation in teaching. An institutional reference framework for elearning in higher education. *Sustainability*. 2021;13(4):2023. <https://doi.org/10.3390/su13042023>.
21. Budiyanto CW, Latifah R, Saputro H, Prananto A. The barriers and readiness to deal with digital transformation in higher education. *TEM J*. 2024. <https://doi.org/10.18421/TEM131-35>.
22. Aditya RQ, Suranto S. The role of educational transformation in the digital era in improving student quality. *AQ* 2024;18(3):1756. <https://doi.org/10.35931/aq.v18i3.3301>
23. Gkrimpizi T, Peristeras V, Magnisalis I. Defining the meaning and scope of digital transformation in higher education institutions. *Adm Sci*. 2024;14(3):48. <https://doi.org/10.3390/admsci14030048>.
24. Tri NM, Hoang PD. The impact of digital transformation in higher education: the case study from Vietnam. *JHETP*. 2023. <https://doi.org/10.33423/jhetp.v23i5.5922>.
25. Adamu AY. Digitalization of Higher Education in Ethiopia. 2024, [Online]. Available: <https://eric.ed.gov/?id=EJ1427232>
26. Sjöberg J, Lilja P. University teachers' ambivalence about the digital transformation of higher education. *IJLTER*. 2019;18(13):133–49. <https://doi.org/10.26803/ijlter.18.13.7>.
27. Alhubaishy A, Aljuhani A. The challenges of instructors' and students' attitudes in digital transformation: a case study of Saudi Universities. *Educ Inf Technol*. 2021;26(4):4647–62. <https://doi.org/10.1007/s10639-021-10491-6>.
28. Farias-Gaytan S, Aguaded I, Ramirez-Montoya M-S. Digital transformation and digital literacy in the context of complexity within higher education institutions: a systematic literature review. *Humanit Soc Sci Commun*. 2023;10(1):386. <https://doi.org/10.1057/s41599-023-01875-9>.
29. Díaz-García V, Montero-Navarro A, Rodríguez-Sánchez J-L, Gallego-Losada R. Managing digital transformation: a case study in a higher education institution. *Electronics*. 2023;12(11):2522. <https://doi.org/10.3390/electronics12112522>.
30. Gródek-Szostak Z, Niemczyk A, Siguencia LO, Suder M, Handzel JA. Strengthening digital transformation in adult education organisations. *ekon*. 2024;29(3):157–66. <https://doi.org/10.19195/2658-1310.29.3.11>.