Jurnal Pendidikan Manajemen Perkantoran (JP Manper)

Journal homepage: http://ejournal.upi.edu/index.php/jpmanper

Reimagining Academic Management in Higher Education: A Systematic Review on Data-Driven Digital Transformation

Adi Dadan Ramdana[1], Asep Wahyudin[2], Yudi Wibisono[3], Rasim[4]

[1]Faculty of Economics and Business Education, Universitas Pendidikan Indonesia
[2,3,4] Department of Computer Science Education, Universitas Pendidikan Indonesia

Correspondence: E-mail : adidadanr@upi.edu

ABSTRACT

This study presented a systematic literature review that examined how data-driven management and digital transformation are shaped operational, cultural, and pedagogical shifts within higher education institutions (HEIs). It aimed to identify the key enablers, innovation strategies, and barriers influencing this transformation. Using an integrative methodology, the review synthesized findings from peer-reviewed publications between 2015 and 2025, with a focus on functional process areas, leadership dynamics, digital readiness, and stakeholder engagement. Comparative insights from healthcare and business sectors were incorporated to highlight sector-specific challenges and contextual similarities. The review found that digital transformation in HEIs was largely driven by leadership styles, digital literacy, and organizational culture. While innovations like learning management systems and predictive analytics enhanced academic performance and operational efficiency, resistance from faculty and institutional inertia remained critical barriers. Leadership commitment, data literacy training, and participatory governance were identified as key success factors. This study extended theoretical models of digital change by framing digital transformation as an institution-wide shift, emphasizing stakeholder inclusivity and contextual adaptability. It provided actionable recommendations for academic leaders to bridge strategic vision with implementation.

ARTICLE INFO

Article History:
Submitted/Received 2 Sept 2025
First Revised 6 Oct 2025
Accepted 21 Nov 2025
First Available online 22 Jan 2026
Publication Date 30 Jan 2026

Keyword:
Diagnostics,
Efficiency,
E-university,
Information and communication space,
Management of higher education institutions,
Modernization of higher education institutions,
Quality of education,
Transformation of education.

1. INTRODUCTION

Higher education has been profoundly transformed by data-driven academic management, accelerated by technological advancements and evolving student needs. Digital tools and analytics enabled institutions (HEIs) to acquire insights into student performance, institutional efficiency, and resource management, reshaping pedagogical and administrative operations (Celik et al., 2023; Drwish et al., 2023). This became particularly evident during COVID-19, necessitating urgent transitions to online learning and digital frameworks (Carnicero et al., 2021; Mkrttchian et al., 2021). Post-pandemic, institutions increasingly adopted digital platforms enabling enhanced learning access, with implementation flexibility emerging as critical for success (Elugbaju et al., 2024; Gutiérrez et al., 2024; Honcharuk et al., 2024; Okunlola & Naicker, 2025; Osman & Yasin, 2024; Zhao, 2024).

Improved educational quality through personalized learning and streamlined administration drives this evolution. Data analytics enables continuous student progress monitoring, supporting at-risk learners and promoting inclusivity (Alenezi & Akour, 2023; Veseli et al., 2025). Universities leverage big data and intelligent platforms optimizing decision-making in resource allocation, curriculum design, and performance tracking, improving faculty productivity and efficiency (Adeniran et al., 2024; Chen & Chen, 2025; Rathod, 2025). Learning analytics—measuring, collecting, analyzing, and reporting learner data—personalizes experiences and fosters engagement, enhancing success and retention (Godínez et al., 2024; Hyder, 2025; Rahate et al., 2025; Tan & Chan, 2024; Wakeel et al., 2025). AI-powered adaptive systems tailor content to individual needs, improving motivation and performance (Silva et al., 2024; Sharif & Uckelmann, 2024), while AI-analytics intersections provide insights enabling personalized paths and optimized resource management (Hlazunova, 2024; Maqoqa, 2025). Predictive analytics identify at-risk students early, enabling interventions improving retention and completion (Daramola et al., 2025; Ismaili & Besimi, 2024), enhancing institutional accountability and operational effectiveness (Díaz-Garcia et al., 2023; Drwish et al., 2023; Rodin, 2025).

Despite advancements, persistent gaps require systematic attention. Strategic analytics applications aligned operational practices with institutional goals, reflecting Quality 4.0 principles emphasizing innovation and performance (Imran & Almusharraf, 2024; Shevtsova & Dneprovskaya, 2025). However, successful transformation requires comprehensive change management addressing technological and human factors (Aldoseri et al., 2024; Christ-Brendemühl, 2024). Literature reveals scarcity of longitudinal research examining sustained impacts on student learning and institutional change (Akintayo et al., 2024; Fernández et al., 2023; Hardini et al., 2025; Mexhuani, 2025). Studies overlook complexities integrating technological innovations into entrenched cultures, underestimating organizational resistance and faculty adaptation shaping transformation outcomes (Brdesee, 2021; Katsamakas et al., 2024; Kovačević et al., 2024). Cultural resistance emerged as significant impediment, with faculty reluctant adopting data-driven strategies due to inadequate training or fear of change (Chigbu & Makapela, 2025; Javed & Akhlaq, 2024). Enhancing digital literacy within faculty development became imperative, with tailored programs bridging educator digital divides (Chenchen, 2024; Martinović et al., 2025; Quraishi et al., 2024). Leadership dynamics, particularly transformational leadership fostering innovation cultures, remain underexplored (Azlan et al., 2024; Makanjuola et al., 2024; Niță & Guțu, 2023), with organizational resistance, inadequate training, and resource limitations hindering data-driven practice integration (Adanne, 2024; Davids et al., 2025).

While numerous systematic reviews examined digital transformation, critical gaps persist. Prior reviews analyzed 1980-2019 papers but highlighted lack of post-2019 contemporary

DOI: https://doi.org/10.17509/jpm.v11i1
p- ISSN 2686-5491 e- ISSN 2656-4734

research, revealing gaps understanding recent technological impacts, particularly COVID-19 contexts (Hui et al., 2024). Recent reviews exploring specific technologies—AI transforming university education (Kazimova et al., 2025) and personalization tools (Du et al., 2024)—indicate integration into broader curricula and institutional strategies remains underexplored. Reviews emphasizing methodology adaptation (Gkrimpizi et al., 2024; Sánchez & Zataraín, 2024) reveal persistent gaps regarding faculty training needs implementing transformations (Sukandi, 2024). Studies outlining rural university challenges point to equity issues hindering transformation, yet barrier-overcoming strategies are scarce (Ajani, 2025; Hassan et al., 2024). Systematic reviews revealed data-driven management limitations including lack of robust implementation studies progressing beyond theoretical models (Barthakur et al., 2025), technological barriers like inadequate infrastructure and data quality issues (García-Vidal et al., 2025), and insufficient management frameworks (Hossain, 2024). Research often focuses on theoretical advancements without sufficient empirical validation, calling for larger-scale interdisciplinary studies (Dahuri et al., 2025). Critical gaps warrant investigation including sustainable approaches in developing countries (Omar & Abdullahi, 2024), synergy-based frameworks connecting digital and sustainability transformations (Hammerschmidt et al., 2025), and agendas aligning competencies with Industry 4.0 requirements (Piazer, 2025). Understanding digital confidence in tertiary contexts proves crucial for organizational transformation, with competence-employability relationship exploration informing faculty training strategies (Bancroft et al., 2024). Research should investigate barriers implementing successful strategies, including infrastructure deficiencies, faculty resistance, and institutional culture impacts (Bashiru, 2025).

Prominent themes emerged: digital technology adoption enhancing learning and administration (Fadlelmula & Qadhi, 2024; Fernández et al., 2023; Mexhuani, 2025), barriers posed by structural and cultural factors (Aditya et al., 2021a; Petchamé et al., 2023; Sukums et al., 2023), and assessment practice evolution in online learning (Gjika & Pano, 2023; Paredes-Chacín et al., 2023). While substantial research addresses technical and strategic dimensions, critical needs exist investigating how shifts affect student engagement, faculty roles, and graduate employability (Alenezi & Akour, 2023; Niță & Guțu, 2023). Digital learning platforms profoundly reshaped engagement, with Learning Management Systems playing pivotal roles streamlining content delivery and facilitating student-educator interactions (Hakimi et al., 2024; Koe et al., 2024). However, digital divide concerns remain critical, with technology access and literacy disparities particularly affecting marginalized populations from low-income backgrounds, rural areas, and minority communities (Assefa et al., 2024; Thapaliya & Panta, 2025). Digital competency integration into curricula is increasingly recognized as vital for enhancing employability, with research showing academic literacy training greatly improving workforce readiness (Anwar et al., 2025; Kania et al., 2025; Li & Fan, 2025). These shifts reflect broader strategic landscape changes, with research evolving from teaching efficiency to competition, student-centered strategies, and service quality as differentiators (Faldesiani et al., 2024).

This systematic review synthesizes empirical and theoretical developments in data-driven academic management, addressing gaps in technological integration, organizational culture, and leadership practices (Alenezi & Akour, 2023; Fernández et al., 2023). The review explores strategies overcoming transformation barriers, including innovative leadership models, data governance frameworks, and institutional readiness assessments (Aditya et al., 2021a; Alvarez-Icaza & Huerta, 2024; Baigabylov et al., 2025; Exarchou et al., 2024; Khurniawan et al., 2024; Mabić et al., 2024; Mexhuani, 2025). As universities increasingly leverage learning analytics, addressing data governance, privacy, and ethical considerations becomes essential,

DOI: https://doi.org/10.17509/jpm.v11i1
p- ISSN 2686-5491 e- ISSN 2656-4734

requiring open, transparent, participatory, and accountable frameworks (Ajuwon et al., 2024; Banihashem et al., 2025; Buragohain & Chaudhary, 2025). Return on investment proves crucial for assessing transformation effectiveness and sustainability, with investments correlating positively with financial outcomes through enhanced efficiency, reduced costs, and improved engagement (Akylbekova et al., 2025; Basu, 2024). This review offers evidence-based guidance to institutional leaders navigating transformation complexities and aligning practices with increasingly data-driven educational landscape demands (Hamdani, 2023; Valdés et al., 2021).

2. RESEARCH METHODOLOGY

2.1. Study Design

This systematic literature review (SLR) adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure a rigorous and transparent synthesis of existing studies (Page et al., 2021). The PRISMA framework offers structured guidelines for identifying, screening, assessing, and selecting relevant research, thereby enhancing the review's reproducibility and credibility. This study aims to consolidate fragmented insights on data-driven academic management within the context of higher education transformation, with a focus on functional areas, innovation drivers, and barriers. The Scopus database was chosen as the primary source due to its comprehensive indexing of peer-reviewed journals across various quality tiers (Q1–Q4). A PRISMA flow diagram (Figure 1) illustrates the review process, from initial identification to final inclusion. This methodological approach has enabled the identification of key trends, research gaps, and future directions in data-driven academic management.

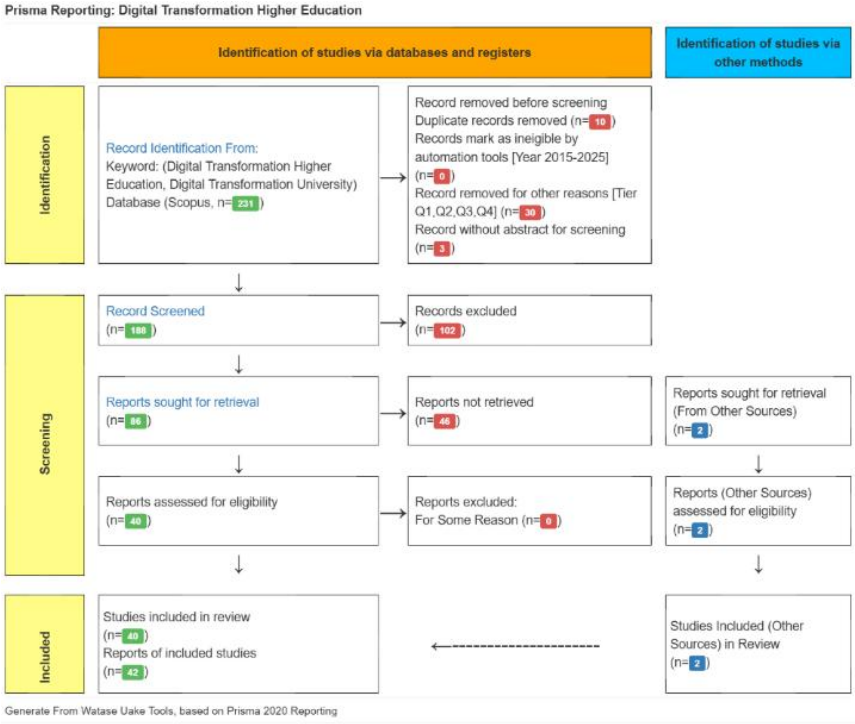

Figure 1. PRISMA Flow Diagram

2.2. Search Strategy

A focused search strategy was employed to ensure the inclusion of high-quality and relevant literature. The keywords "digital transformation higher education" and "digital transformation university" were applied to retrieve articles from Boolean operators were used to refine the search and eliminate irrelevant records. The initial search produced 231 records covering diverse dimensions of digital transformation in higher education. An

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p- ISSN 2686-5491 e- ISSN 2656-4734

iterative filtering process was conducted to retain only studies explicitly addressing data-driven academic management. This ensures alignment with the research objectives by narrowing the selection to articles providing substantial insights into functional improvements, innovation applications, and organizational challenges within HEIs.

2.3. Inclusion and Exclusion Criteria

Strict inclusion and exclusion criteria were established to guarantee the relevance and quality of the selected studies. Peer-reviewed articles published between 2015 and 2025 were included to capture the most recent developments in digital transformation. Eligible studies had to be indexed in Scopus and span journal quality tiers Q1 to Q4. Articles lacking abstracts, duplicated records, or lacking a specific focus on data-driven academic management were excluded. From the initial 231 records, 10 duplicate records, 30 due to journal tier exclusion, and 3 missing abstracts were excluded. After screening, 102 articles were discarded due to irrelevance. A further 46 could not be accessed, leaving 40 eligible studies for final inclusion. An additional 2 reports obtained externally brought the final number of studies to 42 for in-depth analysis.

2.4. Inclusion and Exclusion Criteria

A systematic data extraction process was implemented to ensure consistency and analytical depth. Titles, abstracts, and keywords were examined to confirm relevance to data-driven academic management. The extraction framework followed the PRISMA protocol, which documented each stage and captured key study characteristics. Content analysis and thematic coding were used to classify studies into three predefined categories: (1) functional process areas, (2) innovation focuses, and (3) transformation barriers. This approach facilitated the identification of dominant themes and research gaps. The synthesis integrates both qualitative and quantitative findings, offering a comprehensive perspective on how data-driven approaches have reshaped academic management in HEIs. Visual representations, including thematic maps and network diagrams, were utilized to clarify key findings.

2.5. Framework for Identifying Gaps

The PRISMA framework enabled a systematic identification of research gaps in the data-driven transformation literature. Thematic coding identified underexplored topics such as cross-platform system integration, predictive analytics, and institutional cultural readiness. While technological and process innovations, have been extensively explored, barriers such as organizational resistance and equity challenges warrant further investigation. The review also underscored the importance of integrating theoretical models like the Technology Acceptance Model, Resource-Based View, and Change Management frameworks to deepen future analyses and address these gaps.

3. RESULTS AND FINDINGS ANALYSIS

3.1. Framework for Identifying Gaps

The research landscape on data-driven academic management and digital transformation in higher education institutions (HEIs) shows a clear upward trajectory in publication volume over the past decade. As depicted in Figure 2, scholarly output has grown considerably from 2018 to 2024, with notable peaks in 2023 and 2024, reflecting a heightened academic interest in digital strategies and analytics following the COVID-19 pandemic. The number of studies, increased from just 5 in 2018 to 71 in 2024, indicating an expanding body of research examining how HEIs adapt technologically and culturally to new demands. Although there was a slight decline in 2025 (24 publications), this drop was likely due to a temporary lag in indexing or ongoing project completions rather than reduced interest. Figure 3, the word cloud visualization, illustrates this trend through recurring keywords and thematic clusters

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p- ISSN 2686-5491 e- ISSN 2656-4734

such as "digital transformation," "teaching intervention," "organizational readiness," and "stakeholder engagement."

These themes highlight the scholarly community's sustained attention to both the strategic and operational aspects of digital transformation. Concepts like transformational leadership, technological innovation, digital readiness, and perceived usefulness demonstrate a multidimensional focus, integrating organizational behavior theories with practical implementation concerns in educational contexts (Bond et al., 2018; Nițǎ & Guțu, 2023).

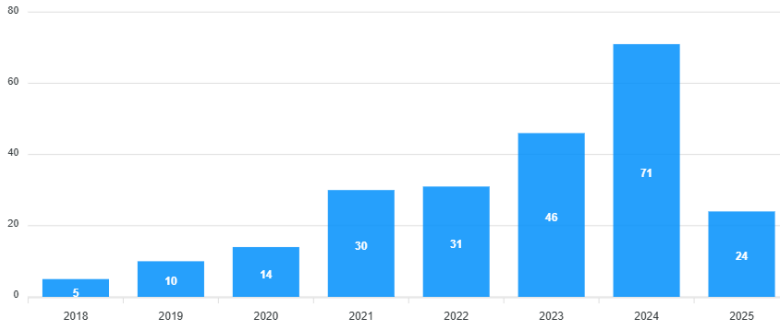

Figure 2. Number of publication over the years

In terms of geographic distribution, Figure 4 indicates that China, Spain, and Saudi Arabia lead in publication frequency, while Figure 5 reveals that Germany, Singapore & Vietnam, and Spain command the highest citation impact. This evidence suggests that while countries like China and Colombia contribute substantially to the volume of studies, nations such as Germany are more influential in shaping the global academic discourse. Germany's focus on stakeholder engagement and digital competence in higher education has made it a key reference point (Bond et al., 2018), while Spanish institutions offer profound insights into administrative reform and implementation challenges (Luque-Martínez et al., 2025). Public research universities dominate the sample in many studies, given their scale and strategic focus on digital innovation (Almatrodi & Skoumpopoulou, 2023).

Methodologically, the field favors qualitative and mixed-methods research. Researchers often employ case studies and interviews to capture institutional narratives, complemented by performance metrics and readiness assessments in quantitative strands (Antonopoulou et al., 2023; Lahme et al., 2023). Key publication outlets include Sustainability, Cogent Education, and Education Sciences, reflecting the interdisciplinary nature of the topic, which spans education, information systems, and institutional management (Rof et al., 2020; Veseli et al., 2025; Zhang & Wu, 2025).

Figure 3. WordCloud Based On Variabel Extraction

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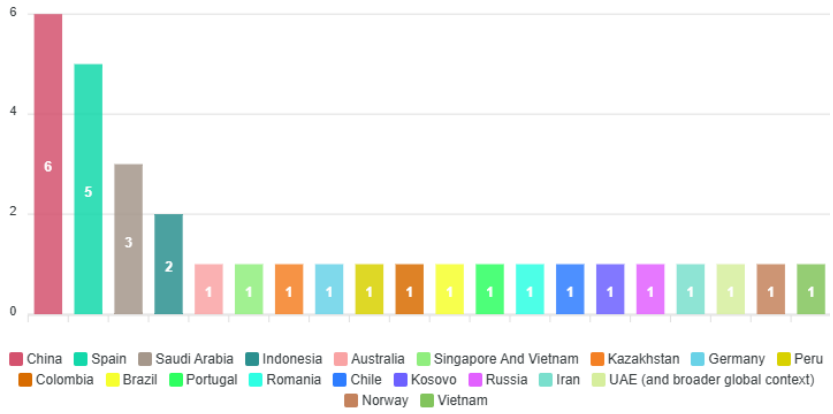

Figure 4. Country Classification

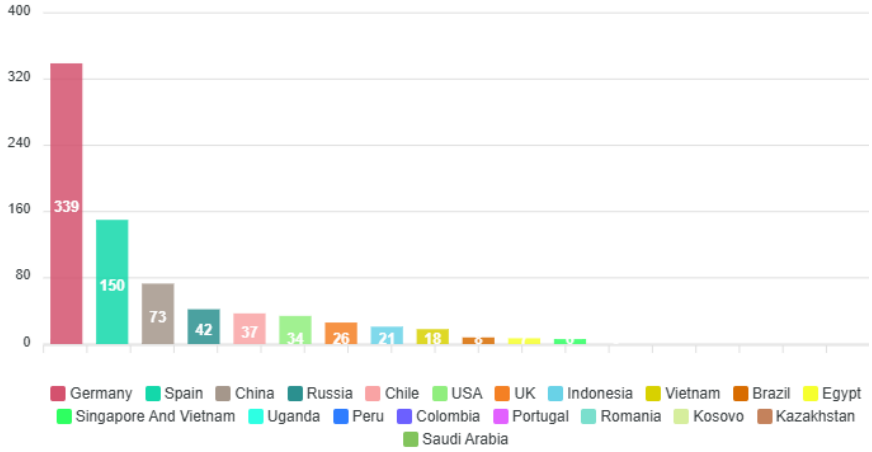

Figure 5. Citation for Country Classification

3.2. Functional Process Area

The integration of data-driven systems in higher education institutions (HEIs) has most significantly impacted the domain of academic process and learning management, as illustrated in Figure 6 and further detailed in Table 1. Of the 41 reviewed studies, 35 (85%) fall within this functional process area, underscoring the centrality of academic functions—such as grading, curriculum design, and personalized learning—in digital transformation efforts. The dominance of this category reflects a global prioritization of improving educational outcomes and instructional practices through technological innovation.

Table 1. Functional Process Area

Functional Process Area	Count	Authors
Academic Process And Learning Management	35	Bond et al., 2018; Liu et al., 2019; Xiao, 2019; Rof et al., 2020; Bonzanini et al., 2020; Aditya et al., 2021; Mikheev et al., 2021; Mohamed et al., 2021; Pham et al., 2021; Valdés et al., 2021; García-Peñalvo, 2021; Teixeira et al., 2021; Langseth et al., 2022; D`Ambra, 2022; Nguyen-Anh et al., 2022; Lahme et al., 2023; Taher, 2023; Wang et al., 2023; Petchamé et al., 2023; Antonopoulou et al., 2023; Evans and Miklosik, 2023; Niță and Guțu, 2023; Díaz-Garcia et al., 2023; Laorach and Tuamsuk, 2023; Khoeini et al., 2024; Luque-Martínez et al., 2024; Carrasco-Beltrán et al., 2024; Liu and Zhou, 2024; Zhang, 2024; N.A., 2024; Zarubina et al., 2024; Abou and Alnajjar, 2024; Kayanja et al., 2025; Zhang and Wu, 2025; Veseli et al., 2025

DOI: https://doi.org/10.17509/jpm.v11i1
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Financial And Administrative Management	4	Maltese, 2019; Brdesee, 2021; Purwanto et al., 2023; Miao et al., 2024
Infrastructure And Campus Operations	1	Almatrodi and Skoumpopoulou, 2023
Student Support Services	1	Hasan et al., 2024

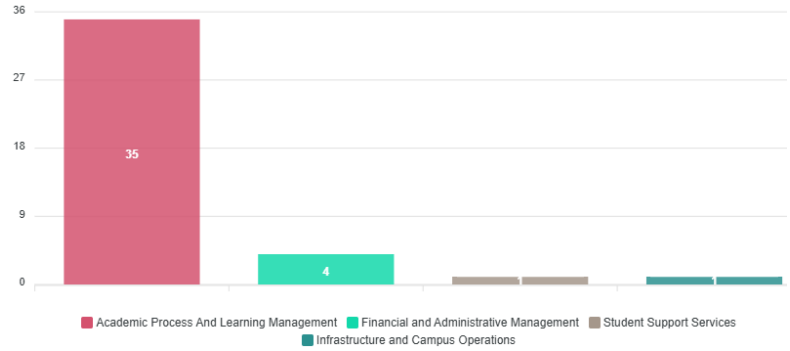

Figure 6. Functional Process Area

Data-driven enhancements to grading systems have made evaluations more objective, efficient, and adaptive. Automated grading software and learning analytics allow for rapid, formative feedback, which can be used by educators to refine teaching strategies in real time (Abou Hashish & Alnajjar, 2024; García-Peñalvo, 2021). These tools support a continuous learning loop that fosters better academic performance and more tailored instructional delivery. Curriculum design has also been significantly influenced by data analytics. By examining student engagement, performance metrics, and learning pathways, institutions can adjust curriculum content to meet the evolving needs of learners and industry demands (Valdés et al., 2021; Veseli et al., 2025). This results in more responsive and outcome-oriented academic programs, a trend observed across a wide array of countries as presented in Table 2, which lists contributions from 30+ nations, including Australia, China, the USA, and Spain.

Personalized learning is another key innovation area. AI-driven platforms allow for adaptive learning experiences that respond to the individual needs of students. These systems not only enhance student engagement but also support retention and satisfaction by customizing instruction (Aditya et al., 2021a; Nguyen-Anh et al., 2023). The impact of digital systems extends beyond student outcomes to faculty workload. While automation can reduce administrative burden—particularly in grading and assessment—it simultaneously introduces challenges related to training, technological fluency, and pedagogical adaptation (Almatrodi & Skoumpopoulou, 2023; Petchamé et al., 2023).

Faculty must engage in ongoing professional development to utilize these tools effectively, requiring institutional investment in capacity building and support. Comparatively fewer studies address Financial and Administrative Management (4), Infrastructure and Campus Operations (1), and Student Support Services (1), as indicated in Table 1. This distribution suggests that while academic transformation is well-studied, non-academic functional areas remain underexplored and present opportunities for future research.

DOI: https://doi.org/10.17509/jpm.v11i1
p- ISSN 2686-5491 e- ISSN 2656-4734

3.3. Innovation Focus: Data-Driven Management and Analytics

The adoption of data-driven management and analytics in higher education institutions (HEIs) has emerged as a central innovation strategy, fundamentally reshaping institutional processes, leadership decisions, and academic engagement. As shown in Figure 7 and detailed in Table 3, the most prominent innovation theme across the literature is organizational change and digital culture, with 17 studies addressing how HEIs are transforming internal cultures, governance, and management models to support digital transitions. This study highlights the importance of fostering digital readiness and adaptive leadership to embed analytics into core academic and administrative practices (Aditya et al., 2021a; Veseli et al., 2025; Xiao, 2019).

Table 2. Functional Process Area by Country

Functional Process Area	Count	Country
Academic Process And Learning Management	35	Australia, Brazil, Chile, China, China, Malaysia, India, Colombia, Egypt, Germany, Germany, Finland, Croatia, Indonesia, Iran, Kazakhstan, Kosovo, Norway, Peru, Portugal, Romania, Russia, Saudi Arabia, Singapore And Vietnam, Spain, Thailand, UAE (and broader global context), Uganda, UK, USA, Vietnam
Financial And Administrative Management	4	China, Indonesia, Italy, Saudi Arabia
Infrastructure And Campus Operations	1	Saudi Arabia
Student Support Services	1	Yemen

Figure 7. Digital Transformation Innovation Focus

Student experience and learning impact constitute the second most cited innovation focus (12 studies), emphasizing how analytics-driven insights enhance learning personalization, engagement tracking, and timely academic interventions (Bond et al., 2018; Hasan et al., 2024). Tools such as Learning Management Systems (LMS)—including Canvas, Blackboard,

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p- ISSN 2686-5491 e- ISSN 2656-4734

and Moodle—serve as foundational platforms in this regard, enabling educators to monitor real-time student performance and tailor pedagogical responses accordingly (Veseli et al., 2025). Beyond educational delivery, business intelligence dashboards such as Tableau, Power BI, and Google Data Studio allow administrators to process and visualize institutional data across multiple functions—ranging from enrollment forecasting to faculty workload analysis. These technologies support process innovation and efficiency gains (4 studies), aligning institutional planning with performance indicators and operational outcomes (Brdesee, 2021; Miao et al., 2024).

Table 3. Digital Transformation Innovation Focus

Digital Transformation Innovation Focus	Count	Authors
Organizational Change And Digital Culture	17	Xiao, 2019; Rof et al., 2020; Bonzanini et al., 2020; García-Peñalvo, 2021; Valdés et al., 2021; Aditya et al., 2021; Teixeira et al., 2021; Langseth et al., 2022; Antonopoulou et al., 2023; Evans and Miklosik, 2023; Almatrodi and Skoumpopoulou, 2023; Laorach and Tuamsuk, 2023; Díaz-Garcia et al., 2023; N.A., 2024; Khoeini et al., 2024; Luque-Martínez et al., 2024; Veseli et al., 2025
Student Experience And Learning Impact	12	Bond et al., 2018; Mohamed et al., 2021; Mikheev et al., 2021; D`Ambra, 2022; Lahme et al., 2023; Niță and Guțu, 2023; Petchamé et al., 2023; Carrasco-Beltrán et al., 2024; Liu and Zhou, 2024; Zhang, 2024; Hasan et al., 2024; Zarubina et al., 2024
Process Innovation And Efficiency Gains	4	Brdesee, 2021; Miao et al., 2024; Abou and Alnajjar, 2024; Kayanja et al., 2025
Technology Adoption And User Acceptance	4	Pham et al., 2021; Nguyen-Anh et al., 2022; Taher, 2023; Wang et al., 2023
Service Quality And Performance Improvement	2	Purwanto et al., 2023; Zhang and Wu, 2025
Equity, Access, And Digital Inclusion	1	Liu et al., 2019
Technology Ecosystem And System Integration	1	Maltese, 2019

Geographically, innovation themes are broadly distributed, with organizational change and digital culture being investigated across countries such as Australia, China, Chile, Indonesia, and the UK, while student experience and learning impact are a focus in Germany, Spain, Colombia, and the UAE (Table 4). This diversity illustrates the global resonance of data-centric strategies in educational reform. Moreover, predictive and prescriptive analytics are playing an increasingly pivotal role in institutional strategy. Predictive models help identify at-risk students and forecast trends in enrollment or course demand, allowing institutions to act preemptively (Brdesee, 2021).

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Prescriptive analytics advance the subject further by recommending evidence-based actions—such as optimal course configurations or resource allocation—grounded in historical and real-time data (Almatrodi & Skoumpopoulou, 2023). Collectively, these innovations reflect a strategic pivot from reactive to proactive institutional management. By integrating analytics into digital transformation efforts, HEIs enhance operational agility, support evidence-based decision-making, and reinforce a culture of continuous improvement (Evans & Miklosik, 2023).

3.4. Barriers: Organizational Resistance and Cultural Barriers

Organizational resistance and cultural barriers emerge as the most dominant obstacles in the digital transformation of higher education institutions (HEIs). As shown in Figure 8, this category accounts for 28 out of the total studies reviewed, making it by far the most frequently cited barrier, followed by skills and competency gaps (8 studies), user acceptance challenges (4), and technological barriers (1). The concentration of research on this theme, as detailed in Table 5, highlights the widespread struggle HEIs face in shifting long-standing institutional cultures toward a data-driven paradigm.

Table 4. Digital Transformation Innovation Focus by Country

Digital Transformation Innovation Focus	Count	Country
Organizational Change And Digital Culture	17	Australia, Brazil, Chile, China, Indonesia, Iran, Kosovo, Norway, Peru, Portugal, Saudi Arabia, Spain, Thailand, UK
Student Experience And Learning Impact	12	China, Colombia, Germany, Germany, Finland, Croatia, Kazakhstan, Romania, Russia, Spain, UAE (and broader global context), USA, Yemen
Process Innovation And Efficiency Gains	4	China, Saudi Arabia, Uganda
Technology Adoption And User Acceptance	4	China, Malaysia, India, Egypt, Singapore And Vietnam, Vietnam
Service Quality And Performance Improvement	2	China, Indonesia
Equity, Access, And Digital Inclusion	1	China
Technology Ecosystem And System Integration	1	Italy

A primary source of resistance is the entrenched mindset among academic staff, who often adhere to traditional pedagogical practices and express reluctance to embrace new technologies (Aditya et al., 2021a). This reluctance may stem from skepticism regarding digital tools' efficacy, apprehension about technological competence, or concerns over the implications for academic autonomy and workload (Abou Hashish & Alnajjar, 2024). Leadership shortcomings compound these challenges. In many institutions, administrative leaders either lack a coherent vision for digital transformation or fail to engage stakeholders effectively in the change process, leaving faculty without direction or motivation (Aditya et

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al., 2021b). The global relevance of this barrier is evident in Table 6, which shows contributions from a diverse range of countries, including Australia, Brazil, China, the UK, and the UAE. The evidence suggests that cultural resistance is not confined to a specific region but reflects a universal tension between innovation and tradition within academia.

Figure 8. Transformation Barriers

Table 5. Transformation Barriers

Transformation Barriers	Count	Authors
Organizational Resistance And Cultural Barriers	28	Xiao, 2019; Rof et al., 2020; Bonzanini et al., 2020; Mikheev et al., 2021; Mohamed et al., 2021; Aditya et al., 2021; Valdés et al., 2021; García-Peñalvo, 2021; Teixeira et al., 2021; Brdesee, 2021; Langseth et al., 2022; Antonopoulou et al., 2023; Petchamé et al., 2023; Laorach and Tuamsuk, 2023; Almatrodi and Skoumpopoulou, 2023; Díaz-Garcia et al., 2023; Evans and Miklosik, 2023; Purwanto et al., 2023; Hasan et al., 2024; N.A., 2024; Khoeini et al., 2024; Carrasco-Beltrán et al., 2024; Zhang, 2024; Zarubina et al., 2024; Abou and Alnajjar, 2024; Miao et al., 2024; Kayanja et al., 2025; Veseli et al., 2025
Skills And Competency Gaps	8	Bond et al., 2018; Liu et al., 2019; Taher, 2023; Wang et al., 2023; Lahme et al., 2023; Liu and Zhou, 2024; Luque-Martínez et al., 2024; Zhang and Wu, 2025
User Acceptance Challenges	4	Pham et al., 2021; Nguyen-Anh et al., 2022; D`Ambra, 2022; Niță and Guțu, 2023
Technological Barriers	1	Maltese, 2019

Addressing these barriers requires targeted cultural change management strategies. HEIs must cultivate an institutional culture that encourages innovation, risk-taking, and openness to technological integration (Veseli et al., 2025). This includes involving faculty in decision-making processes, creating feedback mechanisms, and ensuring that digital initiatives align with pedagogical values. Equally important are structured professional development programs that build digital competencies among educators and administrators, helping to mitigate fears and skill gaps (Abou Hashish & Alnajjar, 2024). Transparent communication about the objectives and benefits of data-driven transformation can further ease cultural

DOI: https://doi.org/10.17509/jpm.v11i1
p- ISSN 2686-5491 e- ISSN 2656-4734

tensions. Demonstrating how these changes enhance teaching effectiveness and student success can help shift attitudes (Brdesee, 2021). Finally, transformational leadership plays a crucial role in guiding institutions through cultural shifts. Leaders who emphasize vision, collaboration, and shared purpose can unify stakeholders around common digital goals, reinforcing alignment between institutional identity and innovation (Niță & Guțu, 2023).

Table 6. Transformation Barriers by Country

Transformation Barriers	Count	Country
Organizational Resistance And Cultural Barriers	28	Australia, Brazil, Chile, China, Colombia, Indonesia, Iran, Kazakhstan, Kosovo, Norway, Peru, Portugal, Russia, Saudi Arabia, Spain, Thailand, UAE (and broader global context), Uganda, UK, Yemen
Skills And Competency Gaps	8	China, China, Malaysia, India, Egypt, Germany, Germany, Finland, Croatia, Spain
User Acceptance Challenges	4	Romania, Singapore And Vietnam, USA, Vietnam
Technological Barriers	1	Italy

4. DISCUSSION

4.1. Integration Across Categories

The dynamic interaction between functional processes, innovation drivers, and transformation barriers creates a complex adaptive landscape in the digital transformation of higher education institutions (HEIs). As visualized in Figure 9, digital transformation is a central node, interconnected with a range of elements—including technological innovation, leadership, learning systems, and decision-making—that collectively shape institutional change. The figure highlights that successful transformation involves synchronizing multiple components rather than progressing through isolated initiatives.

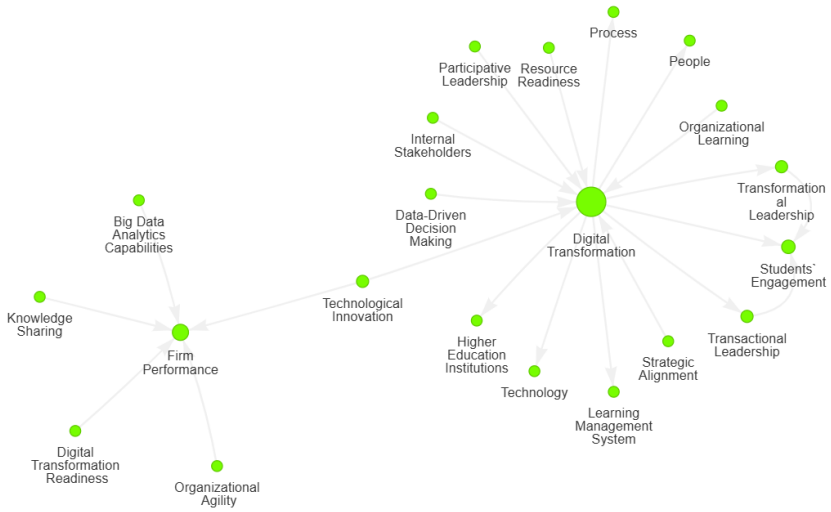

Figure 9. Integration Across Categories

DOI: https://doi.org/10.17509/jpm.v11i1
p- ISSN 2686-5491 e- ISSN 2656-4734

Functional processes such as teaching, grading, and academic management are being transformed through innovations like Learning Management Systems (LMS), which automate assessments, facilitate personalized learning, and enable real-time feedback (Brdesee, 2021). However, these advancements often confront persistent barriers such as cultural resistance and faculty skepticism toward new pedagogies (Aditya et al., 2021b). These barriers point out the importance of change-readiness attributes such as digital competence, mindset flexibility, and leadership vision. Figure 10 complements this understanding by detailing the dimensions of organizational change readiness, a pivotal enabler of digital transformation. Variables such as vision clarity, organizational flexibility, the presence of a change champion, and top-management support are essential in overcoming resistance. When these factors are aligned, institutions are more likely to successfully integrate innovative tools and practices (Almatrodi & Skoumpopoulou, 2023; Khoeini et al., 2025).

Institutional context plays a key role in shaping these interactions. Public universities, typically characterized by rigid bureaucracies, face more pronounced resistance than their private counterparts, which often exhibit agility in adopting new technologies (Teixeira et al., 2021). Geographically, institutions in developed regions benefit from superior infrastructure and funding, while those in developing contexts often struggle with limited resources and slower adoption cycles (Díaz-Garcia et al., 2023; Purwanto et al., 2023).

Governance models further influence these dynamics. Centralized HEIs may experience delays in innovation due to top-down decision bottlenecks, whereas decentralized institutions can facilitate more responsive, department-level adoption of technologies (García-Peñalvo, 2021; Rof et al., 2020). Thus, the integration of categories reflects both systemic interdependence and contextual variability, calling for flexible, inclusive, and adaptive strategies to enable sustainable digital transformation across the higher education sector.

Figure 10. Organizational Change Readiness

4.2. Comparison with Prior Literature

The trajectory of digital and data-driven transformation in higher education institutions (HEIs) aligns in several respects with developments observed in sectors such as healthcare and business. In all three domains, data analytics has emerged as a cornerstone of operational enhancement, strategic planning, and performance optimization. For instance, predictive analytics is widely used in healthcare to anticipate patient outcomes and streamline care, a

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p- ISSN 2686-5491 e- ISSN 2656-4734

parallel to HEIs employing similar techniques to identify at-risk students and personalize academic interventions (Aditya et al., 2021a). Likewise, in the business sector, firms harness data to refine customer experiences and optimize logistics, mirroring how universities use analytics to improve curriculum design, learning environments, and administrative processes (Brdesee, 2021).

However, several distinctions set HEIs apart from these sectors. One key difference lies in institutional culture. While businesses and healthcare organizations are often driven by market or performance imperatives, HEIs operate within a more rigid academic framework that can delay innovation. Traditional pedagogical values, academic autonomy, and decentralized decision-making structures contribute to a slower, more complex adoption of data-driven tools (Almatrodi & Skoumpopoulou, 2023; Khoeini et al., 2025). Faculty members may resist technology integration due to varying levels of digital literacy or concerns over pedagogical integrity (Abou Hashish & Alnajjar, 2024). HEIs also face greater stakeholder complexity. Unlike businesses with hierarchical structures or healthcare institutions with clear regulatory directives, HEIs must navigate a mosaic of priorities across students, faculty, administrators, and external regulators. This diffusion of authority often results in fragmented strategies and longer timelines for implementation (Petchamé et al., 2023).

Furthermore, HEIs must balance academic goals with market demands, a dual priority rarely encountered in other sectors. Institutions are tasked not only with ensuring high-quality learning experiences but also with aligning programs to labor market expectations—complicating the transformation process (Rof et al., 2020; Veseli et al., 2025). Finally, governmental and regulatory constraints exert a significant influence on HEIs. Unlike businesses that can pivot rapidly in response to market shifts, HEIs frequently operate within bureaucratic environments governed by public funding and national education policies, further limiting agility (Evans & Miklosik, 2023). These sector-specific conditions point to the need for tailored transformation strategies that respect the academic context while fostering innovation.

4.3. Theoretical and Practical Implications

This systematic literature review (SLR) offers significant contributions to both the theoretical understanding and practical advancement of digital transformation in higher education institutions (HEIs). By integrating diverse insights across operational processes, technological adoption, and cultural barriers, the review underscores the multifactorial nature of digital change in educational contexts.

Theoretically, this SLR advances the discourse by emphasizing that digital transformation is not solely a technological endeavor but a systemic reconfiguration of institutional processes, pedagogical models, and organizational culture (Laorach & Tuamsuk, 2023; Valdés et al., 2021). The findings support an emerging theoretical perspective that digital change in HEIs is context-dependent, shaped by internal dynamics such as leadership and digital literacy, and external forces including policy and funding (Aditya et al., 2021a; Díaz-Garcia et al., 2023). In comparing HEIs with other sectors like healthcare and business, the review enriches existing frameworks by highlighting sector-specific constraints—such as academic autonomy and distributed governance—that complicate direct application of cross-sector models (García-Peñalvo, 2021; Khoeini et al., 2025).

Practically, this review provides several actionable strategies to overcome institutional resistance and foster innovation. First, continuous investment in digital literacy programs is essential for empowering faculty and staff with the confidence and skills to engage

DOI: https://doi.org/10.17509/jpm.v11i1
p- ISSN 2686-5491 e- ISSN 2656-4734

meaningfully with technology (Niță & Guțu, 2023). Second, adopting participatory change management frameworks helps build institutional trust by involving stakeholders in planning and decision-making (Luque-Martínez et al., 2025; Teixeira et al., 2021). Transparent communication and inclusive engagement contribute to a supportive innovation culture.Moreover, aligning digital initiatives with institutional missions and articulating their benefits in terms of learning outcomes can secure stakeholder buy-in (Taher, 2023; Veseli et al., 2025). Leadership is pivotal in this process; transformational leadership approaches that emphasize vision, collaboration, and empowerment can galvanize institutional commitment (Nguyen-Anh et al., 2023; Rof et al., 2020). Finally, pilot programs offer a practical pathway to test innovations incrementally, allowing institutions to evaluate impact and scale up successful practices with reduced risk.

5. CONCLUSION

This systematic literature review has presented a detailed picture of the way digital transformation is occurring in HEIs through the implementationn of data-driven systems, leadership models, and cultural shifts. The nature of the digital transformation goes beyond (far beyond) a technological advance and demands a comprehensive reconfiguration of the architecture of the institution, its pedagogical practices, and its governance. Transformational and transactional leadership styles are found to be fundamental for promoting engagement on the shop floor, inclusion in educational settings, and coherence at the institutional level between digital innovation and strategy. From practice and policy perspectives, the continued resistance to change needs to be tackled at the institutional level by investing in professional development, increasing digital literacy, and increasing openness and transparency to build trust between key stakeholder groups.

Developing a data-supported culture that is consistent with pedagogical objectives is necessary to ensure innovation persists. Pilot programs, faculty buy-in, and effective leadership are powerful tactics for promoting digital projects. Notwithstanding the progress, the review reveals important shortcomings—especially the absence of integrated frameworks that integrate technological adoption with organizational change management. It is even more acute in low-income and developing settings, where contextual problems such as lack of resources, poor infrastructure, and cultural diversity interfere with its adoption. Conclusion Future studies should consider a context-sensitive approach that will implement virtual realities in digital strategies as part of the socioeconomic environment of specific national educational systems.

6. AUTHOR'S NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The author confirms that this article is free from plagiarism.

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