



Digital Transformation in Islamic Higher Education: E-Learning and Visionary Leadership at UIN Siber Syekh Nurjati Cirebon

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ABSTRACT

Purpose: This study aims to analyze the implementation of digital transformation management through e-learning optimization and visionary leadership at Universitas Islam Negeri Siber Syekh Nurjati Cirebon as an effort to strengthen the quality, effectiveness, and competitiveness of Islamic higher education in the digital era. **Methods:** This study employed a qualitative case study approach. Data were collected through semi-structured interviews with key stakeholders involved in the university's digital transformation process and supported by institutional documentation, including strategic plans, digital transformation policies, and academic governance reports. Informants were selected purposively based on their direct involvement in planning, implementing, and evaluating digital transformation initiatives. Data credibility was ensured through source triangulation and document verification, while data analysis followed the interactive model of data reduction, data display, and conclusion drawing. **Findings:** The study found that digital transformation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon has been implemented through the strengthening of digital infrastructure, optimization of the SPADA-based e-learning system, digitalization of academic services, and the development of a collaborative digital culture. The findings further indicate that visionary leadership has played a strategic role in formulating digital policies, encouraging institutional adaptation, and fostering stakeholder participation in transformation processes. Nevertheless, several challenges remain, including disparities in digital competencies among lecturers and students, limitations in technological infrastructure, and resistance to organizational change. The interaction between digital innovation and leadership commitment has become a key factor in sustaining institutional transformation. **Research Implications:** The findings provide practical insights for Islamic higher education institutions in designing sustainable digital transformation strategies through the integration of digital learning systems, capacity-building programs, and adaptive leadership practices. **Originality:** This study contributes to the growing literature on digital transformation in Islamic higher education by demonstrating how e-learning optimization and visionary leadership interact in supporting institutional transformation within a cyber-based university environment grounded in Islamic educational values.



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INTRODUCTION

The accelerated development of digital technologies has significantly reshaped higher education systems across the globe. Higher education institutions are increasingly expected to integrate digital technologies not only to facilitate teaching and learning processes but also to enhance institutional management, academic administration, and overall organizational performance (Amin et al., 2025). As a result, digital transformation has emerged as a critical strategic priority for universities striving to maintain relevance and competitiveness within an environment characterized by

technological advancement and global connectivity. Beyond the simple adoption of digital tools, digital transformation involves comprehensive organizational, managerial, and cultural adjustments designed to create educational ecosystems that are more responsive, efficient, and sustainable (Zhang & Chen, 2024; Elia et al., 2024).

Within the higher education sector, digital transformation is commonly reflected through the adoption of e-learning platforms, digital academic management systems, learning analytics, and data-informed decision-making mechanisms (Aspandi et al., 2025). The incorporation of digital technologies allows universities to broaden educational access, increase flexibility in learning delivery, and improve the effectiveness of academic administration. Nevertheless, these developments also require institutions to strengthen organizational preparedness, improve digital competencies, and redesign traditional governance structures to meet the evolving demands of the digital age (Omol, 2024; Chwiłkowska-Kubala et al., 2023).

The effectiveness of digital transformation depends not solely on technological infrastructure but also on the capacity of institutional leadership. Previous research highlights the importance of visionary leadership in guiding organizational change, encouraging stakeholder engagement, stimulating innovation, and cultivating a culture that supports digital advancement (Feliciano-Cestero et al., 2023; Sacavém et al., 2025). Institutional leaders are therefore required to establish strategic directions that effectively align technological innovation with organizational objectives while addressing resistance to change and strengthening institutional adaptability. Accordingly, digital transformation and leadership should be viewed as mutually reinforcing elements rather than isolated organizational initiatives (Ben Ghrbeia & Alzubi, 2024).

In the setting of Islamic higher education, digital transformation introduces both distinctive opportunities and complex challenges (AlNuaimi et al., 2022). Islamic universities are expected not only to adapt to technological developments but also to preserve their commitment to ethical principles, character development, and religious values. Consequently, the implementation of digital transformation within Islamic higher education requires an integrated approach that harmonizes technological progress with Islamic educational ideals (Yuliani et al., 2025; Van Veldhoven & Vanthienen, 2022). Such integration is essential to ensure that digitalization enhances not only institutional efficiency but also the achievement of value-oriented educational goals.

As the first state cyber Islamic university in Indonesia, Universitas Islam Negeri Siber Syekh Nurjati Cirebon offers a unique context for examining institutional digital transformation. The university has established digitalization as a central pillar supporting academic governance, educational innovation, and institutional growth. Numerous initiatives have been introduced, including the enhancement of Learning Management Systems (LMS), the digitalization of academic services, the improvement of information technology infrastructure, and the cultivation of a digitally oriented work culture facilitated by institutional leadership. These initiatives illustrate a comprehensive transformation effort encompassing both educational practices and governance systems (Butt et al., 2024; Bolotio & Yusuf, 2025).

Although scholarly attention to digital transformation has increased considerably, several research gaps remain evident. Existing studies generally investigate digital transformation, e-learning implementation, and leadership as separate constructs (Sinta Nurjanah & Acep Hermawan, 2025). Furthermore, much of the available literature focuses on conventional universities, public-sector institutions, or business organizations, whereas empirical investigations examining the interrelationship between digital transformation management, e-learning optimization, and visionary leadership within Islamic higher education settings are still relatively scarce. In addition, limited research has explored how Islamic educational values are embedded within digital transformation initiatives and leadership practices in cyber-based universities (Sharabati et al., 2024; Crusoe et al., 2024).

In response to these gaps, this research addresses the following questions: (1) How is digital transformation management implemented at Universitas Islam Negeri Siber Syekh Nurjati Cirebon? (2) In what ways does e-learning optimization support institutional digital transformation? and (3) How does visionary leadership contribute to the advancement and sustainability of digital transformation within an Islamic higher education environment?

Accordingly, the purpose of this study is to examine the implementation of digital transformation management through e-learning optimization and visionary leadership at Universitas Islam Negeri Siber Syekh Nurjati Cirebon. In addition, the study aims to identify the opportunities and challenges associated with institutional digital transformation and to explore the interaction between technological innovation, leadership practices, and Islamic educational values in shaping organizational change.

This research offers both theoretical and practical contributions to the ongoing discussion of digital transformation in higher education. From a theoretical perspective, it enriches existing scholarship by providing empirical insights derived from a cyber-based Islamic university and by illustrating the interconnected nature of digital transformation management, e-learning optimization, and visionary leadership. From a practical perspective, the

findings provide valuable guidance for Islamic higher education institutions seeking to establish sustainable digital transformation strategies that combine technological advancement, adaptive governance, and educational values grounded in institutional principles.

METHOD

This research adopted a qualitative methodology using a descriptive case study design to investigate the implementation of digital transformation management through e-learning optimization and visionary leadership at Universitas Islam Negeri Siber Syekh Nurjati Cirebon. The case study approach was considered appropriate because it facilitates a comprehensive exploration of institutional transformation, leadership dynamics, and the integration of digital technologies within the setting of Islamic higher education.

The study was carried out at Universitas Islam Negeri Siber Syekh Nurjati Cirebon, Indonesia, between January and April 2025. This institution was intentionally chosen due to its status as Indonesia's first state cyber Islamic university and its distinctive experience in systematically implementing digital transformation across academic governance, learning environments, and institutional administration.

Both primary and secondary sources of data were utilized in this study. Primary data were gathered through semi-structured interviews involving twelve participants, comprising university administrators, lecturers, educational personnel, and students who had direct engagement with digital transformation programs. Participants were selected through purposive sampling based on the following criteria: (1) active participation in digital transformation initiatives, (2) experience in operating or managing digital learning platforms, and (3) familiarity with institutional digitalization policies. Secondary data were obtained from a range of institutional documents, including strategic planning documents, digital transformation roadmaps, rector decrees, academic reports, and other official records relevant to the objectives of the study.

Data were collected using semi-structured interviews alongside document analysis. Each interview lasted between 45 and 90 minutes and was conducted either in person or through online communication media. The interview guide was structured around five principal themes, namely digital transformation policies, e-learning implementation, leadership approaches, institutional challenges, and future development strategies. Document analysis was undertaken to support and validate interview findings by reviewing official university records related to digital governance, academic digitalization initiatives, and institutional strategic planning.

The analysis process employed the interactive model developed by Miles and Huberman, which consists of data condensation, data presentation, and conclusion drawing with verification. During the initial stage, interview transcripts and documentary sources were examined, coded, and categorized into meaningful thematic units. Subsequently, the data were arranged into thematic matrices to identify recurring patterns, relationships, and key issues associated with digital transformation practices. In the final stage, conclusions were formulated through an ongoing comparison of empirical evidence and emerging themes, followed by a verification process to ensure the validity and consistency of the interpretations.

To strengthen the trustworthiness of the research findings, source triangulation was applied by comparing information obtained from various groups of participants, including university leaders, lecturers, administrative personnel, and students. Documentary materials were also used to corroborate and reinforce the evidence derived from interviews. Furthermore, member checking was conducted by sharing summaries of the interview results with selected participants to confirm the accuracy of interpretations and minimize potential researcher bias. These measures were implemented to enhance the credibility, dependability, and confirmability of the study.

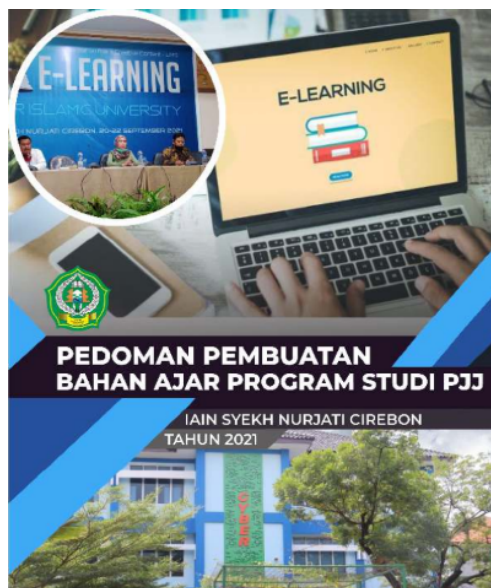
RESULTS

Based on interview and documentary data, the findings reveal that digital transformation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon has evolved through four interrelated phases: (1) initial digitalization and infrastructure development, (2) e-learning optimization, (3) strengthening visionary leadership and digital culture, and (4) digital innovation and sustainability. The transformation process demonstrates that digitalization within the university extends beyond technological adoption and encompasses organizational governance, leadership practices, and institutional culture.

Table 1. Phases of Digital Transformation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon

Phase	Year	Main Focus	Key Outcomes
Phase 1	2020–2021	Initial Digitalization and Infrastructure Development	Strengthening ICT infrastructure and digital academic services
Phase 2	2022–2023	E-Learning Optimization	Development of SPADA and enhancement of digital learning practices
Phase 3	2023–2024	Strengthening Visionary Leadership	Development of collaborative digital culture based on Islamic values
Phase 4	2025 onwards	Digital Innovation and Sustainability	Preparation for AI integration, learning analytics, and adaptive learning

The four phases presented in Table 1 were identified through the triangulation of interview findings and institutional documents. While interview data provided insights into stakeholders' experiences and perceptions regarding the digital transformation process, documentary evidence offered formal records of policies, guidelines, and quality assurance mechanisms supporting these initiatives. The analysis of institutional documents was therefore conducted to validate and strengthen the findings obtained from interviews, particularly regarding the implementation of distance learning and digital governance practices.



(a) *Pedoman Pembuatan Bahan Ajar Program Studi Pendidikan Jarak Jauh (PJJ) Tahun 2021*



(b) *Buku Standar Mutu Pendidikan Jarak Jauh Tahun 2021*

Source: Institutional Documents of Universitas Islam Negeri Siber Syekh Nurjati Cirebon (2021).

Figure 1. Institutional Documents Supporting Digital Transformation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon

The documentary evidence presented in Figure 1 demonstrates the university's formal commitment to digital transformation. The *Pedoman Pembuatan Bahan Ajar Program Studi PJJ Tahun 2021* provides guidelines for developing digital learning materials, online instructional design, and distance education implementation. Meanwhile, the *Buku Standar Mutu Pendidikan Jarak Jauh Tahun 2021* establishes quality assurance standards governing online learning delivery, evaluation mechanisms, and digital academic services. These documents indicate that digital transformation was supported not only by technological infrastructure but also by institutional regulations and quality assurance frameworks.

Phase 1: Initial Digitalization and Infrastructure Development

Interview findings indicate that the first phase focused on building the technological and regulatory foundations necessary for institutional transformation. Participants consistently emphasized the importance of infrastructure readiness before implementing broader digital initiatives.

One university leader stated: *“Digital transformation began with infrastructure readiness. Before implementing advanced digital systems, we focused on ensuring that internet access, academic services, and administrative processes could operate effectively through digital platforms.”* (Informant 1)

The interview findings were consistent with the documentary evidence presented in Figure 1. The existence of institutional guidelines and quality assurance standards demonstrates that digital transformation was accompanied by formal governance mechanisms. Thus, the first phase was characterized not only by infrastructure development but also by the establishment of policies that facilitated the transition from conventional to digital academic systems. Several participants also noted that digital administrative services improved operational efficiency and accelerated service delivery processes. Consequently, this phase became the foundation for subsequent digital transformation initiatives.

Phase 2: E-Learning Optimization

The second phase focused on optimizing e-learning through the implementation of SPADA as the university’s official Learning Management System (LMS). Interview data revealed that SPADA became the primary platform for learning delivery, academic communication, assessment, and instructional management.

A lecturer explained: *“The implementation of SPADA has significantly changed teaching practices. Learning materials, assignments, attendance records, and evaluations can now be managed within a single integrated system.”* (Informant 5)

A student similarly stated: *“SPADA makes learning more flexible because materials can be accessed anytime. Communication with lecturers and submission of assignments also become more efficient.”* (Informant 10)

These findings indicate that e-learning optimization contributed to greater learning flexibility, broader access to educational resources, and more effective academic interaction. The interview data were reinforced by documentary evidence presented in Figure 1(a). The *Pedoman Pembuatan Bahan Ajar Program Studi PJJ Tahun 2021* outlines standards for digital instructional design, online teaching materials, and distance learning implementation. This document demonstrates that the optimization of e-learning was systematically supported through institutional policy rather than relying solely on technological availability. Nevertheless, participants also reported challenges associated with digital literacy disparities among lecturers and students, indicating that technological adoption required continuous capacity-building efforts.

Phase 3: Strengthening Visionary Leadership and Digital Culture

The third phase shifted attention from technological implementation toward leadership and organizational transformation. Interview findings reveal that visionary leadership played a strategic role in directing institutional change and fostering commitment to digital innovation.

One university administrator explained: *“Technology alone cannot transform an institution. Leadership is required to establish a clear direction, build commitment, and encourage collaboration among all members of the academic community.”* (Informant 3)

Participants emphasized that institutional leaders actively promoted digital literacy programs, professional development activities, and innovation-oriented policies. Such initiatives contributed to the development of a digital culture characterized by collaboration, adaptability, and continuous learning.

A lecturer stated: *“Training programs and institutional support have increased our confidence in integrating technology into teaching and academic administration.”* (Informant 6)

The findings further indicate that leadership played an important role in minimizing resistance to organizational change while ensuring that digital transformation remained aligned with Islamic educational values and institutional objectives.

Phase 4: Digital Innovation and Sustainability

The final phase reflects the university’s commitment to ensuring the long-term sustainability of digital transformation. Interview participants indicated that future institutional development is directed toward integrating emerging technologies such as artificial intelligence, learning analytics, and data-driven decision-making systems.

One university leader explained: *“Our future objective is not only to digitize services but to develop intelligent systems that support learning personalization and evidence-based institutional decision making.”* (Informant 2)

Participants viewed these initiatives as essential for strengthening institutional competitiveness and improving educational quality. However, they also emphasized the need for continuous investment in technological infrastructure, human resource development, and organizational adaptation to sustain transformation efforts. Overall, the findings demonstrate that digital transformation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon has evolved from infrastructure preparation toward sustainable innovation. The triangulation of interview and documentary data confirms that the success of digital transformation is supported by the interaction of technological readiness, e-learning optimization, visionary leadership, institutional governance, and the integration of Islamic educational values within the university's digital ecosystem.

DISCUSSION

The results indicate that digital transformation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon encompasses more than the implementation of technological applications; it reflects a comprehensive institutional change affecting governance structures, organizational culture, leadership approaches, and educational innovation (Shanti et al., 2023). The four phases of transformation identified in this research illustrate that digitalization evolved through a gradual and systematic process rather than through a single technological intervention. This finding reinforces the view that digital transformation in higher education is a multidimensional process that requires concurrent adjustments in technological, organizational, and managerial domains. Nevertheless, unlike many earlier studies that place primary emphasis on technological preparedness, this study demonstrates that institutional regulations and quality assurance systems were instrumental in guiding the transformation process from its initial stages (Senadjki et al., 2024; Qiao et al., 2024).

An important finding relates to the contribution of institutional governance in facilitating digital transformation. The documentary analysis revealed that the university developed formal policies governing distance education and quality assurance before expanding its digital learning initiatives. This evidence suggests that the success of transformation was influenced not only by technological infrastructure but also by institutional commitment and regulatory readiness. Although prior research frequently identifies infrastructure as the principal prerequisite for digital transformation, the present findings indicate that governance mechanisms may serve an equally critical enabling role. Consequently, digital transformation appears more sustainable when it is supported by well-defined policies, standardized procedures, and institutional regulations (Pricopoaia et al., 2025; Plekhanov et al., 2023).

The findings also underscore the strategic importance of e-learning in accelerating institutional transformation. The adoption of SPADA as an integrated Learning Management System not only changed the delivery of instructional activities but also reshaped patterns of academic interaction between lecturers and students. Existing literature commonly highlights e-learning as a means of increasing accessibility and learning flexibility (Ologeanu-Taddei et al., 2025). While this study confirms those advantages, it additionally reveals broader organizational implications. E-learning served as a vehicle through which digital transformation became embedded within institutional practices, encouraging modifications in instructional design, communication methods, and academic administrative processes. Therefore, the role of e-learning extends beyond pedagogical enhancement and becomes an integral component of organizational transformation strategies within the university (Paul et al., 2024).

Another significant finding concerns the development of student-centered learning practices supported by digital platforms. Interview results suggest that students gained greater independence in accessing educational resources and organizing their learning activities. This observation aligns with previous studies emphasizing the ability of digital learning environments to foster learner autonomy and active engagement. However, the findings also reveal an issue that has received limited attention in earlier research. Greater flexibility in learning does not necessarily lead to uniform learning outcomes because levels of digital literacy among lecturers and students remain uneven. As a result, the effectiveness of e-learning depends not only on the availability of digital technologies but also on the ability of users to utilize those technologies effectively and productively (Nadkarni & Prügl, 2021; Müller et al., 2024).

The study further demonstrates that digital transformation continues to face challenges associated with human resource capacity and organizational adaptation. Although digital technologies have been broadly accepted within the institution, differences in digital competencies still influence the quality and consistency of implementation among various stakeholder groups (Mualifah et al., 2023). This finding is consistent with previous studies identifying digital literacy as a crucial factor in determining transformation success. However, the present research suggests that competency gaps should not be viewed solely as technical deficiencies. Such disparities also reflect variations in institutional readiness, motivation, and individual attitudes toward technological change (Montero Guerra et al., 2023). Accordingly, digital transformation should be understood as an ongoing learning process that requires continuous organizational development rather than isolated training initiatives (Michelotto & Joia, 2024).

Beyond issues of competency, resistance to organizational change emerged as another challenge throughout the transformation process (Deskasari et al., 2025). Consistent with observations in other higher education contexts, certain individuals were hesitant to move away from established working practices and conventional approaches. Nevertheless, the findings indicate that this resistance gradually diminished through leadership support, institutional facilitation, and sustained capacity-building efforts. This finding supports the socio-technical perspective of digital transformation, which emphasizes the importance of balancing technological advancement with cultural and behavioral adaptation (McCarthy et al., 2023). Technological innovation alone is insufficient to transform an institution if its members are unwilling to embrace new methods of working and learning.

One of the most significant contributions of this study concerns the role of visionary leadership in maintaining and advancing digital transformation. In contrast to studies that define leadership primarily as an administrative or managerial function, the findings suggest that leadership acted as a transformative force linking technological initiatives with institutional objectives and organizational culture. University leaders were not limited to formulating digital policies; they also encouraged collaboration, supported professional development, and cultivated a shared commitment to digital transformation. These findings indicate that visionary leadership contributes to transformation not only through strategic direction but also by fostering institutional legitimacy and collective engagement in change initiatives (Martins et al., 2024).

The results further reveal that leadership influenced digital transformation indirectly through its role in shaping organizational culture. Training programs, capacity-building activities, and innovation-focused policies encouraged members of the academic community to perceive digitalization as a valuable opportunity rather than a potential threat. This finding extends previous research by demonstrating that leadership effectiveness is strongly associated with its ability to promote cultural acceptance of technological change. Therefore, leadership should be viewed not only as a catalyst for innovation but also as an intermediary that aligns institutional vision with organizational behavior (Ellström et al., 2022; Dritisas & Trigka, 2025).

Another distinctive aspect identified in this study is the integration of Islamic educational values into the digital transformation process. Unlike many studies conducted in secular educational contexts, the findings show that technological innovation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon was deliberately aligned with ethical, social, and spiritual principles. Consequently, digital transformation was positioned not merely as a modernization initiative but also as a mechanism for reinforcing institutional identity and educational values. This finding challenges the assumption that digitalization inevitably leads to technological determinism or diminishes traditional educational principles. Instead, the study demonstrates that digital innovation and religious values can coexist harmoniously and strengthen one another when supported by effective governance and leadership (Gligorea et al., 2023).

From a theoretical perspective, this research contributes to the expanding body of knowledge on digital transformation in higher education by proposing that sustainable transformation is generated through the interaction of four interrelated dimensions: technological readiness, institutionalized e-learning, visionary leadership, and value-based governance (Li et al., 2025). Existing conceptual frameworks frequently treat technology and leadership as separate variables. In contrast, the findings of this study suggest that these dimensions operate dynamically and collectively influence transformation outcomes. Moreover, the incorporation of Islamic educational values broadens current theoretical frameworks by introducing ethical and cultural elements that remain underexplored in the literature (Kahveci, 2025).

From a practical standpoint, the findings imply that higher education institutions should not view digital transformation solely as a process of technology adoption. Instead, comprehensive transformation strategies should simultaneously address governance systems, leadership capacity, organizational culture, and human resource development. The study also highlights the necessity of establishing formal policies and robust quality assurance mechanisms to ensure the sustainability of digital transformation initiatives over the long term (Holmström, 2022; Hermawansyah, 2025).

Despite its contributions, this study is not without limitations. First, the investigation was conducted within a single Islamic higher education institution, which may restrict the broader applicability of the findings to different organizational contexts. Second, the analysis relied primarily on interview and documentary data, making the interpretation of transformation outcomes potentially influenced by participants' perspectives. Future research may benefit from employing comparative approaches involving multiple Islamic universities or incorporating quantitative methods to examine more comprehensively the relationships among digital transformation, leadership practices, and educational performance outcomes.

CONCLUSION

This study concludes that digital transformation at Universitas Islam Negeri Siber Syekh Nurjati Cirebon has evolved through a systematic process encompassing infrastructure development, e-learning optimization, visionary leadership strengthening, and sustainable digital innovation. The findings demonstrate that digital transformation is not merely a technological initiative but a multidimensional institutional process involving governance reform, organizational culture change, and human resource development. The implementation of SPADA, digital academic services, and technology-supported learning practices has contributed to greater learning flexibility, improved service efficiency, and increased institutional responsiveness in the digital era.

A significant finding of this study is that the sustainability of digital transformation is determined not only by technological readiness but also by the interaction between visionary leadership, organizational adaptability, and value-based governance. Within the context of Islamic higher education, digital transformation was found to be more effective when technological innovation was supported by institutional policies, quality assurance mechanisms, and Islamic educational values that promote ethical, collaborative, and human-centered practices.

Theoretically, this study contributes to the literature by proposing that sustainable digital transformation in Islamic higher education emerges from the interaction of four interconnected dimensions: technological readiness, e-learning institutionalization, visionary leadership, and value-based governance. This finding extends existing digital transformation frameworks, which often emphasize technological and managerial factors, by incorporating ethical and religious dimensions as integral components of institutional transformation.

Practically, the findings suggest several strategic actions for higher education institutions. First, universities should strengthen digital infrastructure and continuously improve access to reliable technological resources. Second, digital literacy and capacity-building programs should be institutionalized to reduce disparities in digital competencies among lecturers, staff, and students. Third, university leaders should develop clear digital transformation roadmaps supported by measurable performance indicators and sustainable quality assurance systems. Finally, Islamic higher education institutions should integrate technological innovation with institutional values to ensure that digital transformation contributes not only to efficiency and competitiveness but also to educational integrity and character development. This study is limited to a single institutional setting and therefore reflects the specific context of a cyber-based Islamic university. Future research is recommended to conduct comparative studies across multiple Islamic higher education institutions and to explore the impact of emerging technologies, such as artificial intelligence, learning analytics, and big data, on educational quality, institutional governance, and the long-term sustainability of digital transformation initiatives.

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AUTHOR CONTRIBUTION STATEMENT

SH conceived the research idea, designed the study, collected and analyzed the data, interpreted the findings, and prepared the original manuscript draft. AA contributed to the research design, literature review, data interpretation, manuscript revision, and critical review of the final version. Both authors discussed the results, contributed to the development of the manuscript, and approved the final version for publication.

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The authors used ChatGPT during the preparation of this manuscript for language refinement, grammatical editing, and manuscript organization. After using the tool, the authors carefully reviewed, revised, and validated all content to ensure its accuracy, originality, and academic integrity. The authors take full responsibility for the content and conclusions presented in this publication.

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