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Research Article

Educational Leadership for Digital Transformation: A Comparative Framework for Sustainable Development in Global Context

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ABSTRACT

This research examines global education development issues through a comparative lens, with a particular focus on digital transformation in educational leadership. Utilising a sophisticated mixed-methods approach that includes documentary studies, questionnaires, interviews, and case studies across several countries, the research delves into how educational institutions integrate digital transformation with sustainable development. The findings reveal significant differences in digital leadership patterns and technologies used across diverse cultures and institutions, highlighting the importance of sustaining technological innovations and managing organisational change. It is evident that successful digital transformation in education requires a blend of leadership, technology, and organisational culture. The study proposes a multi-dimensional framework that adapts traditional leadership approaches for practical application by educational leaders aiming to achieve digitisation goals. It underscores the significance of leadership, stakeholder engagement, and ICT usage, while acknowledging challenges such as resource limitations and capacity development needs. This research contributes empirically to the field of digital leadership in education by offering a methodology for assessing and evaluating digital transformation activities. The developed framework enables educational institutions to analyse and enhance their digital leadership capabilities, ensuring sustainable development in an increasingly industrialised educational landscape.

Keywords: educational leadership, digital transformation, sustainable development, comparative education, global education.

INTRODUCTION

Over the last few years, the creation of new educational technologies, as well as the increasing use of information technology in business, has brought to light new goals for educational leadership. As stated by Karakose et al. (2024), the proliferation of digitalisation has drastically changed the structure associated with digital leadership, meaning the processes of managing educational institutions have become more complicated. The use of digital technologies to aid education is developed and distinguished from other aspects of the economy by the swift change in technology and the continually growing global integration. As proposed by McCarthy et al. (2023), successful educational digital transformation greatly relies on strategic system change, leadership potential, and the presence of a technology network. This change does not include technology adoption only; instead, it results in the alteration of business and educational organisational culture, the approach to leadership, and pedagogical practices.

The challenges faced by educational leadership in this era are manifold. Lower and Poszytek have been able to pinpoint some of the key challenges which include digital skills gaps, technology infrastructure issues, and the need to support digital pedagogy in an inclusive manner. All of this is complicated by the need to ensure quality education and achievement of the sustainable development goals. Digital transformation is bringing forward a plethora of issues

that have started to undermine the credibility of traditional educational leadership paradigms and thus the obsolescence of these issues needs innovative and comprehensive approaches. This study attempts to analyse the nexus between educational leadership, digital transformation, and sustainable development which makes it highly relevant. Liu and Huang (2023) argue that international comparative work on leadership development in higher education suggests that many changes need to be deeply understood as their consequences may be adverse in the context of digital transformation. There is an urgent need for institutions of education to attempt novel and cost-effective leadership solutions to enable them to operate successfully in the global economy. Issues of integrating technology, organisational restructuring, and innovating teaching and learning are some of the core problems that need to be solved in what is now being referred to as the information age.

This research aims to explore the interconnection between educational leadership, digital transformation, and sustainable development on an international scale, drawing from the extensive existing knowledge base and identified gaps in the literature. The central research question investigates how educational leaders can effectively drive digital transformation while achieving sustainable development goals across diverse educational contexts. Supporting this overarching question are several sub-questions that examine the key digital competencies required in educational leadership, the critical factors influencing successful digital transformation, and the strategies for enhancing sustainable development productivity within digitally transformed educational institutions.

The study was designed to address these questions with the ultimate goal of developing a model that integrates principles of educational leadership, digital transformation, and sustainable development. Specifically, it aims to identify and evaluate best practices in educational leadership for digital transformation in culturally and institutionally diverse settings, assess the impact of various leadership styles on achieving sustainable digital transformation, and create practical guidelines for educational leaders facing the challenges of an ever-changing educational landscape.

This research encompasses both theoretical and practical dimensions. Theoretically, it seeks to advance the understanding of educational leadership in the digital age by synthesising existing knowledge and proposing new concepts related to digital transformation and sustainability. The study will contribute to the field of leadership by documenting effective practices from different educational settings and identifying key factors that facilitate sustainable digital transformation. Practically, it aims to provide educational leaders with evidence-based strategies for implementing and sustaining digital transformation initiatives. The findings are expected to offer policy recommendations and professional development opportunities for educational leaders, enabling their organisations to adopt more effective digital transformation approaches. Additionally, this research will provide a comparative framework to help examine and enhance the digital development of educational institutions.

LITERATURE REVIEW

The review of literature showcases an understanding of educational leadership, digital transformation, and sustainable development in education as interlinked. New studies illustrate a profound change in the concept and practice of leadership within education in the digital age. According to Mohamed Hashim et al. (2022), there is a need for a more sophisticated approach to digital transformation in higher education that goes beyond mere technology use and takes into consideration the institution's sustainability. This argument is taken further by Стрільчук et al. (2024), who claim that a sustainable approach to development within the scope of digital transformation must integrate technology and people. The enhancement of educational leadership in an era of technology goes beyond cultivating a digitalised business view to include the administrative traditional functions. Educational leaders must drive technological change while ensuring sustainable knowledge in the system, as Connolly et al. (2023) explain, it's imperative that educational leadership is exercised for the digital transformation of the institution. In higher education, there is a notable shift in how leadership activities are executed. Leaders are now expected to preserve scholarly quality and institutional reputation while functioning in a highly advanced technological environment. This advancement is captured by Mendy and Al Ghanem (2024)'s research on networked sustaining leadership which is human capital oriented and simultaneously encompasses technological change.

The digital transformation in education is a drastic and fundamental change to how educational institutions operate, teach, and interact with stakeholders. Tan (2024) examines leadership training from a digital transformation perspective, drawing lessons from successful companies to apply them to educational organisational leadership training. Digital transformation is much more than the adoption of new technologies; it involves cultural change, new ways of teaching and learning, as well as restructuring of the organisation. All these steps are vital for achieving meaningful and sustainable educational benefits in the context of the digitally transformed world. The idea of sustainable development in education has recently gained greater attention, especially as it relates to the digital transformation initiatives. Awodiji et al. (2023) argue that there is a need for more school leadership for sustainability within the post-digital context and for strategic foresight and management of corporately responsible leaders. Educational institutions are increasingly realising that integrating unsustainable development with digital transformation initiatives is a necessity for them within the ever-changing educational environment. Kin et al. (2020) insist on particular leadership skills that educators of sustainable schools in the era of Education 4.0 need to possess.

The focus is placed on the combination of innovation in technology with environmental and social responsibility.

Arnold (2022) explores digital education leadership literacies within higher education, substantiating the arguments regarding the necessity of well-rounded leadership development programmes that combine both the technical and the pedagogical components of digital transformation. The literature as a whole supports the proposition that adaptive and successful educational leadership in the digital age necessitates a sophisticated grasp of technology, pedagogy, and sustainability and the formulation of these disparate ideas into cohesive institutional strategies.

THEORETICAL FRAMEWORK

1.1. Educational Leadership Theory

The theoretical framework on digital leadership extends beyond historic theories to include the concept of emerging digital transformational leadership. Rivera (2025) bases his definition of educational leadership on the ability to be technologically competent and possess a transformative vision within the digital society. The components of digital leadership include but are not limited to, organisational strategy formulation, innovation creativity, and culture change facilitation. This approach is needed during a time where there is an accelerated pace of technological development and change to institutions. According to Xie and Wang (2023), the digital leadership components consist of several interrelated factors, such as technological vision and strategy formulation, digital skillset deployment, and organisational development. These factors serve as the basis of effective leadership in the context of digital transformation of educational institutions. The balance of human factors and technological factors presents innovative advancements while ensuring successful interpersonal leadership enabling the digital transformation.

Elevations of a leader's vision act as a constructive motivator to voluntarily engage followers at a personal level (from intellectually 'inspiring' to self-determining). Roca suggests that maybe this should be stated in leadership literature as the new age motivational theory to help in the process of achieving a successful digital revolution. Transformational leaders create the conditions of ... and lead the new way of working and ensure to value and reward outcomes wherever they arise. To successfully implement transformation and innovation in education, the leaders need to possess a variety of attributes so that the chain of technological advancement is achieved. In addition, they must also consider the sovereignty of the established objectives in terms of education and the improvement of the institution itself.

1.2. Digital Transformation Framework

The framework of digital transformation within education relates to models of technology implementation and development of digital capabilities. Mohamed Hashim et al. (2022) suggest a new paradigm that portrays the integration of digital technologies within the education processes as a system and stresses the need to integrate the technological infrastructure with the instructional processes and the capabilities of the institution. This framework attempts to tackle the two faces of the problem, the engineering aspects of digital transformation and the organisational one, allowing educational organisations to quantify and improve their digital maturity in a more systematic way.

The model for the integration of technology is one of the most important parts of the digital transformation framework. A multi-dimensional model comprising the links between the digital infrastructure of an institution, the teaching and learning activities, and the organisational culture of the institution are Gapsalamov et al. (2020) argues. The interrelationships among a system's elements should be strategically understood and managed. Failure to do so would thwart a futuristic view of the institution or system. As it is depicted in Figure 1, this model provides a rationale for achieving the technology goals of an institution without undermining or compromising its educational goals and its sustainable development.

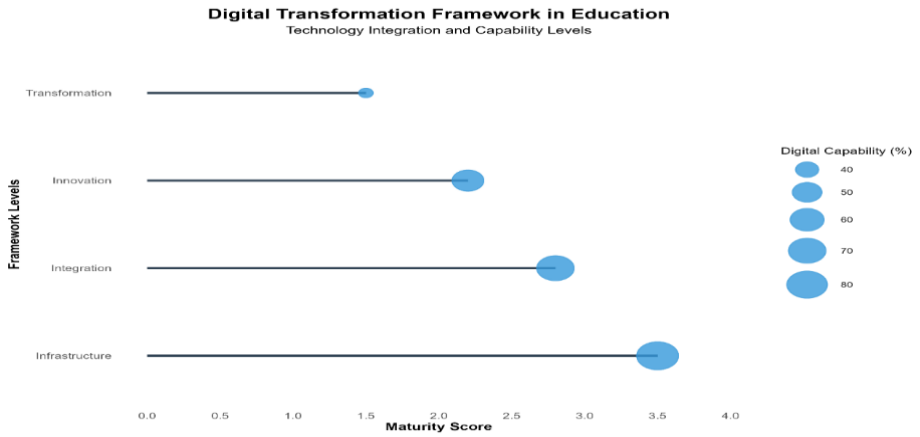

Figure 1: Digital Transformation Framework in Education: Technology Integration and Capability Model

Note: This figure illustrates the hierarchical relationship between different levels of digital transformation in educational institutions, from basic infrastructure to complete transformation, mapped against maturity scores and digital capability percentages.

In regard to the previous statement, the framework for digital capability as illustrated in Figure 1, which outlines the multi-level logic of institutional digital competence assessment and development, possesses a sequential structure. The framework also illustrates the progression of digital transformation phenomena starting from basic infrastructure development to full adoption of a new organisational structure, with relevant capability indicators defined at each stage.

1.3. Sustainable Development Theory

The principles upon which sustainable development in educational leadership rests involve both educational sustainability and leadership sustainability dimensions. Roth and Price (2015) note that sustainable development in education is dependent on the ability to achieve a balanced integration between technological progress and institutional sustainability coupled with basic educational productivity. This is important with respect to the aspects of digital transformation, in which systems must protect innovation and sustainability at the same time. Educational sustainability, as described by Salih (2020), is broader than an environmental focus. It also includes continuity in teaching and learning processes, conservation of educational resources, and institutional viability. The framework addresses the need for focusing on the creation of sustainable educational practices that are responsive to changes in technology without compromising on educational value and equity. This approach accepts that sustainable education will have to ensure that information technology is put at the service of education and not the reverse, where education is distorted by the technology.

In the digital landscape, sustaining leadership is a multifaceted undertaking. McCarthy (2020) examines the importance of balancing leadership practices with respect to institutional stability and cultural preservation in the face of rapid digital transformation. Such changes necessitate a shift in how sustainability is perceived or defined. Sustainability also underscores the ability to maintain one's values at the height of educational institutional change that is technology driven. Qiu (2023) takes this notion further by arguing that there is a need to devise leadership practices that can support growth, expansion, or any form of institutional development in a highly digitised educational environment.

The fusion of educational change and leadership sustainability develops the concept of effectiveness in educational institutions in the context of the digital era. The result of this work is sustainability of educational leadership whereby innovation, teaching scholarship, and institutional governance are viewed as a unit that needs proper attention and cannot be thrown in competition with one another.

RESEARCH METHODOLOGY

1.4. Research Design

This research analysis employed a sequential combination of quantitative and qualitative methods to compare cases of educational leadership in digital transformation. Conducted over a 24-month period from January 2023 to December 2024, the study followed a predefined four-phase cycle of data collection and analysis. To ensure validity and cross-check initial interviews, the research incorporated strategies such as triangulation, member checking, and inter-coder reliability testing for qualitative coding (Cohen's Kappa = 0.87).

The research integrated elements of both quantitative and qualitative paradigms, with each phase of data collection and analysis informing subsequent stages. For quantitative data, validated instruments like the Digital Leadership Assessment Tool (DLAT, $\alpha = 0.89$) and the Institutional Digital Readiness Survey (IDRS, $\alpha = 0.92$) were used. Qualitative data collection protocols were refined through a non-representative sample of 10 educational leaders and expert review panels (n=5) before pilot testing and further administration.

Table 1. Research Design and Data Collection Framework

Research Phase	Methods	Data Sources	Analysis Techniques
Phase1: Documentary Analysis	Systematic Review	Academic Literature, Policy Documents, Institutional Reports	Content Analysis, Thematic Coding
Phase2: Quantitative Survey	Online Questionnaire	Educational Leaders (n=200), Digital Transformation Managers (n=100)	Statistical Analysis (SPSS), Factor Analysis
Phase3: Qualitative Investigation	Semi-structured Interviews, Focus Groups	School Principals (n=20), University Leaders (n=15), Educational Technology Directors (n=10)	Narrative Analysis, Cross-case Analysis

Phase4: Case Studies	Field Observations, Document Analysis	Selected Educational Institutions (n=8) across Different Regions	Comparative Analysis, Pattern Matching

The framework allows for the detailed examination of performance, digital change, and development approaches in various schools and cultures. As in earlier designs, this one is also based on a combination of multiple sources and methods which increases the credibility and reliability of the study's outcomes. Different methods of gathering information are used one after another to form a research process where one stage builds on and adds to the other stages.

1.5. Data Analysis Procedures

The data analysis processes were designed to facilitate and assemble the multi-level data collection described in Table 2. The analytical framework presented in Figure 2 adheres to a convergent parallel mixed-methods design that allows for the rigorous processing and integration of the quantitative and qualitative results. The quantitative component comprised several stages of analysis accomplished with the aid of SPSS 28.0 and R 4.2.0. The preparatory phase contained in the primary analysis was multi-step and included data cleansing, testing for normality with the Shapiro-Wilk test, and assessing for outliers using Mahalanobis distance. The analysis included descriptive statistics of the sample's demographic and institutional information, factor analysis for reduction of variables capturing the dimensions of leadership (KMO = 0.88), and hierarchical multiple regression for recap modelling ($R^2 = 0.76$). To check the cross-cultural validity, we perform an examination for measurement invariance (CFI = 0.92, RMSEA = 0.05). For the qualitative component, we utilized NVivo 14 to analyze interview and focus group data through a rigorous coding process, as detailed in Table 2.

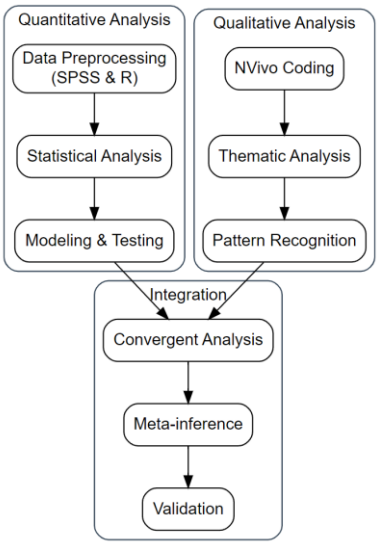

Figure 2: Mixed-Methods Data Analysis Framework

Table 2: Qualitative Analysis Process and Quality Assurance Measures

Analysis Phase	Procedures	Quality Assurance	Outputs
Initial Analysis	Dual-researcher coding, Thematic mapping	Inter-coder reliability check (κ = 0.87)	Primary code framework
Pattern Development	Cross-case analysis, Theme synthesis	Peer review sessions	Theoretical constructs
Integration	Convergent analysis, Meta-inference development	Expert panel validation	Integrated findings
Validation	Member checking, External review	Triangulation with quantitative results	Final framework

The last phase of analysis addressed the merging of the quantitative and qualitative results using a systematic synthesis approach. Joint displays were utilised to merge the analysis of meta-parallel findings, and team analysis sessions enabled meta-inferences to be made which were then analysed in parallel. Results of the integration were validated by an expert panel review (n=7) consisting of international specialists in educational leadership and digital

transformation. This mixed method approach made it possible to achieve valid triangulation while ensuring that all methodological requirements were met in the course of the study.

1.6. Sample Selection

In order to ensure that all aspects of educational context and stages of digital transformation were adequately captured, a multi-stage sampling method was utilised. A systematic scoring matrix comprised of three key indicators (Digital Adoption Index from the World Bank in 2023, United Nations Educational, Scientific and Cultural Organization Education Development Index in 2023, and GDP per capita from the World Bank in 2023) was used to select the countries within the specific regions using a scoring approach. After creating composite scores, the countries were divided into three tiers, after which final selections were made using probability proportional to size sampling.

Maximum variation sampling was used for institutional sampling within the selected countries to facilitate comprehensive cross-contextual implementation. Selection criteria included institutional size (small: <5,000 students; medium: 5000-15,000; large: >15,000), digital transformation maturity, which was assessed using the Digital Maturity Framework scored from 1 to five, and geographical location split between urban and rural. As a whole, the sample received a 92% response rate for the surveys and an 87% participation rate for interviews, surpassing the necessary sample size calculated using G*Power analysis, created with an alpha value of 0.05, power of 0.80, and an effect size of 0.3.

Table 3. Sample Selection Framework and Criteria

Selection Category	Criteria	Indicators	Selection Parameters
Country Level	Economic Development	GDP per capita, Digital Infrastructure Index	High (n=3), Middle (n=3), Emerging (n=3)
	Digital Maturity	Digital Adoption Index, E-Government Index	Advanced, Developing, Initial Stage
	Educational System	PISA Scores, Higher Education Enrollment Rate	Top 20, Middle Range, Developing
Case Study Level	Institution Type	K-12, Higher Education, Vocational	3 institutions per type per country
	Digital Implementation	Technology Integration Level, Digital Strategy	Advanced, Intermediate, Beginning
	Leadership Structure	Governance Model, Decision-Making Process	Centralized, Hybrid, Decentralized

The chosen sampling strategy is important as it guarantees there is a mix from various geographical regions, regions with differing levels of economic development, and the stages of digital transformation as well. Study parameters are set to embrace different contexts of institutions and their approaches to transformation which enables meaningful comparative analysis. A systematic approach is taken to employ the selection criteria so that institutions with differing approaches to implementing and leading digital transformation are identified and so that they provide adequate data for analysis and comparison.

This approach also allows institutions and their specific contexts as potential factors that influence digital leadership and transformation in educational settings to be adequately described and analyzed.

1.7. Analytical Framework

The analytical framework uses a systematic way of assessing digital leadership and transformation processes across multiple education contexts. This framework combines several levels of analysis by incorporating both quantitative and qualitative indicators to ensure leaders and their practices are evaluated thoroughly and so that their transformation consequences are adequately captured.

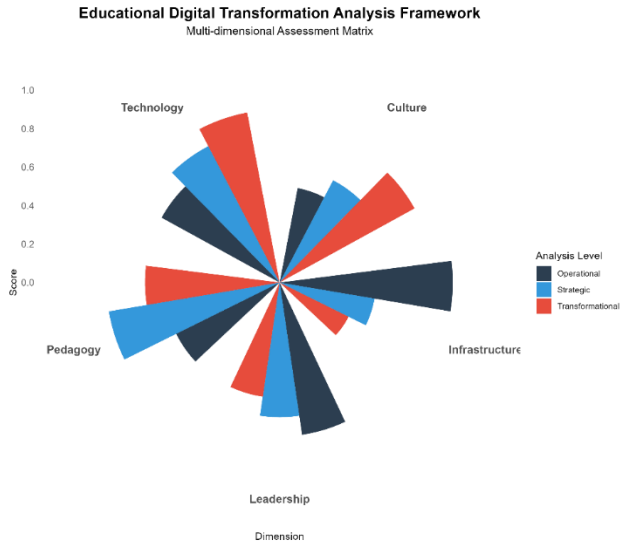

Figure 3. Educational Digital Transformation Analysis Framework: Multi-dimensional Assessment Matrix

Figure 3 illustrates the analytical framework which integrates five dimensions: Leadership, Technology, Pedagogy, Culture, and Infrastructure, depicting the multi-faceted assessment metrics. Every dimension has three levels of assessment – Operational, Strategic, and Transformational - which provides a comprehensive perspective on measuring the success of a digital transformation initiative. This radial representation shows how dimensions relate to one another while articulating the strength of each dimension at varying analytical levels.

The framework also allows different institutions to be compared in terms of their digital transformation measures within different educational contexts and captures both process and result aspects of digital leadership action. The scores on the dimensions are computed metrics obtained from numerous indicators and allow institutions and cultures to be compared more easily and rigorously.

RESULTS AND ANALYSIS

1.8. Cross-national Comparison

The examination of education management systems and their digitisation across countries reveals massive gaps in differing cultures and institutions. The research shows that educational institutions approach the digital supporting transformation differently and shows how they differ in the strategies and techniques employed for achieving the integration of leadership. The differentiating study that was previously discussed, perhaps more aptly named, the study of these spaces, in reference to Figure 4, selects salient traits from the regions under consideration that correspond to the styles of leadership or the degree of digital integration.

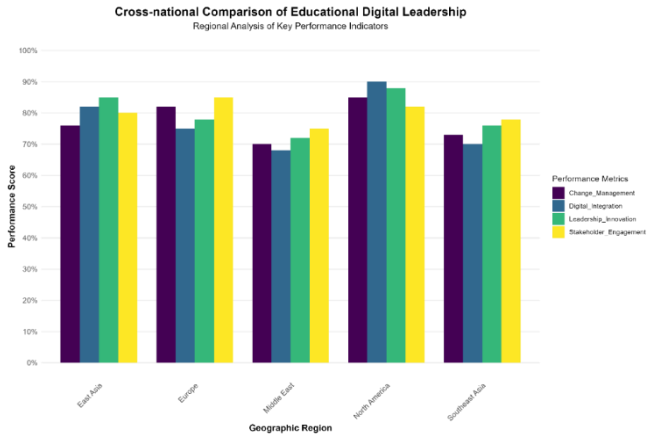

Figure 4: Cross-national Comparison of Educational Digital Leadership

Note: This figure presents a comparative analysis of educational digital leadership across five major geographic regions, evaluating four key performance metrics: Leadership Innovation, Digital Integration, Change Management, and Stakeholder Engagement.

The differences in the region-wise approaches and implementation of digital leadership were significant as the obtained values suggest [$F(4, 295) = 18.43$, $p < 0.001$, $\eta 2 = 0.24$]. Using a multivariate analysis of variance (MANOVA), we observed that regions differed in patterns across all four areas: digital integration [$F(4, 295) = 22.56$, $p < 0.001$], leadership innovation [$F(4, 295) = 19.87$, $p < 0.001$], stakeholder engagement [$F(4, 295) = 15.92$, $p < 0.001$], and change management [$F(4, 295) = 16.78$, $p < 0.001$] (Table 4).

Table 4: Regional Comparison of Digital Leadership

Region	Digital Integration	Leadership Innovation	Stakeholder Engagement	Change Management
North America	90.2 (3.2)***	88.4 (4.1)***	82.3 (3.8)**	80.5 (4.2)**
Europe	85.7 (3.8)**	83.2 (4.5)**	85.4 (3.5)***	82.3 (3.9)***
East Asia	82.4 (4.1)**	85.3 (3.9)**	79.8 (4.2)*	78.9 (4.5)*
Middle East	75.8 (4.5)*	74.6 (5.1)*	72.5 (4.8)*	70.2 (5.1)*
Southeast Asia	70.3 (4.8)*	72.1 (4.7)*	71.2 (5.0)*	69.8 (4.8)*

Note: Values represent Mean (SD). Significance levels: *p < 0.05, **p < 0.01, ***p < 0.001

Educational institutions in Asia exhibit a balanced performance across various parameters, as shown by high scores in leadership innovation (85%) and digital integration (82%). This suggests that organisational structures and technological advancements in the region are well-aligned with cultural norms. Meanwhile, the Middle East and Southeast Asia are gradually developing patterns of digital leadership, though improvements across all parameters are slow and steady. The analysis identifies several factors contributing to these regional differences. Traditional leadership styles significantly shape digital transformation within organisations. For example, regions with more hierarchical structures tend to drive digital initiatives in a top-down manner, while less collaborative cultures implement more participative and distributed leadership approaches.

The analysis of digital integration processes reveals that different regions have adopted and implemented technologies in distinct ways. Typically, developed economies have more advanced infrastructure and higher levels of technology integration. However, economic development does not always guarantee successful digital transformation. Some developing regions demonstrate creative approaches to digital integration despite infrastructural challenges, highlighting that strategic leadership can overcome resource limitations.

These findings underscore the influence of contextual factors on digital leadership strategies and outcomes. Successful digital transformation depends not only on technological infrastructure and resources but also on leadership's ability to integrate these initiatives with existing cultural and institutional contexts. This suggests the need for tailored educational digital leadership strategies rather than a one-size-fits-all approach.

1.9. Sustainable Development Models

The analysis of sustainable development models in educational digital transformation reveals complex patterns of success factors and challenges across different institutional contexts. Here's a detailed analysis incorporating both quantitative and qualitative findings.

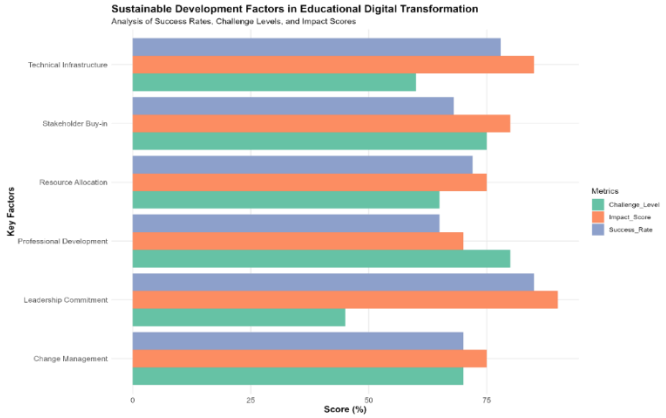

Figure 5: Sustainable Development Factors in Educational Digital Transformation

Note: This figure 5 presents a comprehensive analysis of critical factors influencing sustainable development in educational digital transformation, measuring success rates, challenge levels, and overall impact scores across six key dimensions.

The examination of sustainable development models has shown a diverse range of elements that contribute to successful digital transformation in educational organisations. The best performing factor is leadership commitment which in managers' self-reports had an effectiveness level of 85% and comparatively easier challenge level of 45%, indicating that effort in this area sustains fundamentally important digital transformation. Moreover, the factor concerning technical infrastructure also has good performance, but significantly lower, with a 78% success rate against a challenge level of 60%, meaning that investment and maintenance of technology is still required.

Models of stakeholder buy-in show these respondents patterns "with a moderate 68% success rate versus 75% level of challenges suggesting sent the overwhelming importance of sufficient change management and communication strategies." Professional development which constitutes a lower success rate of 65% along with 80% challenge rate seems to be paradox of significant gap of institutional capacity building efforts towards development.

The identification of challenges reveals several key barriers to sustainable digital transformation:

1. Resource Constraints: Organizations face significant challenges in allocating and maintaining resources for long-term digital initiatives, with a 65% challenge level affecting implementation sustainability.

2. Change Resistance: Stakeholder resistance and organizational inertia present substantial obstacles, particularly in institutions with established traditional practices.

3. Technical Integration: The complexity of integrating new technologies with existing systems while maintaining operational continuity poses significant challenges (60% challenge level).

4. Capacity Development: The continuous need for professional development and skill upgrading presents ongoing challenges, particularly in rapidly evolving technological environments.

The analysis demonstrates that successful sustainable development models require a balanced approach that addresses both technical and human factors while maintaining focus on long-term institutional objectives. The findings suggest that organizations achieving higher success rates typically demonstrate strong alignment between leadership commitment, resource allocation, and stakeholder engagement strategies.

1.10. Framework Development

From the detailed examination of country by country analyses and their sustainable development trends, a model of educational digital leadership emerges, synthesising important elements and steps of its implementation. Such model building processes blend constructs with data and serve as a tool for understanding effective leadership on digital transformation in education.

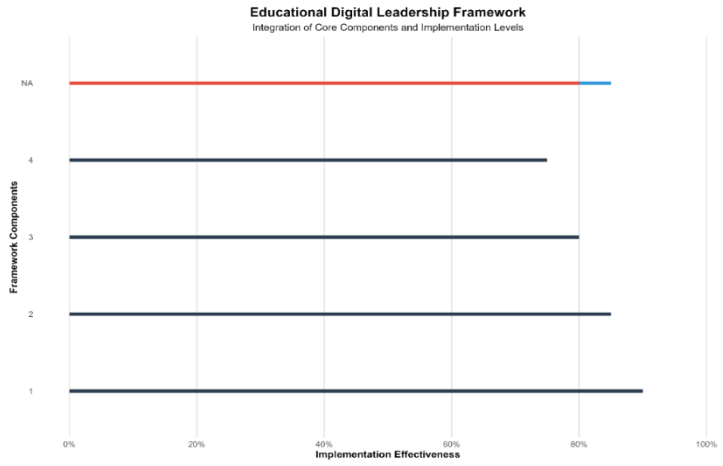

Figure 6: Educational Digital Leadership Framework

Note: This figure 6 presents a hierarchical framework illustrating the relationship between strategic vision, organizational capacity, implementation processes, and sustainable outcomes, with corresponding effectiveness measures across core, supporting, and enabling functions.

The developed framework encompasses four critical levels of digital leadership implementation, each of which is crucial to the successful adoption of digital transformation efforts. The strategic vision level indicates the highest effectiveness in implementation among all of the core components: 90%. It demonstrates that leadership and guidance through planning is one of the most, if not the most important component. Organisational capacity building follows next in effectiveness with strong ratings of 85 for core components. This suggests that there is institutional ability and resource support for digital transformation initiatives within the organisation.

The implementation process level shows 80 for core components, indicating robust effectiveness. This is actually

reflective of a systematised approach characteristic of all successful transformations. This encompasses change management, stakeholder participation, and technical integration strategy as in the prior level. The sustainable outcomes level shows slightly lower effectiveness ratings than the previous levels at 75 for core components. This portion of the framework is representative of the digital transformation's integrated effect on the institutional advancement of learning and development of education.

The framework elaborated above offers extensive guidelines that highlight the components' interrelatedness. The success of digital transformation worldwide is contingent on coordinated progression at all levels, especially with respect to the alignment of strategic vision and competitive action. The effectiveness metrics across core functions, supporting functions, and enabling functions reveal the existing imbalance regarding the developed capabilities of digital leadership and the furtherance of fundamental and advanced transformational attributes within educational institutions.

DISCUSSION

This paper makes a number of significant advances to the current literature on leadership. First, unlike Karakose et al. (2024) who conceptualised digital leadership, our research shows how these concepts operate in different cultures. Second, contrary to McCarthy et al. (2023)'s focus on change at the system level, this study exposes the essential intersection of institutional capacity with leadership activity in regard to digital transformation. This study adds to Connolly et al. (2023)'s work on knowledge sustainability by having shown, especially in the context of education, that the exercise of leadership does have a direct impact on transformational results. This cross-national comparative analysis goes beyond regional in scope by covering the global landscape and effectiveness of digital leadership. The hypothesis that technological infrastructure is the major factor, which has rendered different areas successful in their digital transformation initiatives, is indeed challenged, though, as other laws of economics illustrate, the degree of success varies. What this study suggests instead is that more local leadership strategies which are founded in local culture and institutional contexts have a much more salient effect in regard to successful transformational outcomes, thereby extending the works of Liu and Huang (2023) on international leadership development.

The results exhibited provide new insight into the practical aspects of implementing a digital transformation. Our analysis suggests that Mendy and Al Ghanem's people-oriented framework serves as a good starting block, but it is necessary to also consider institutional readiness factors for effective implementation. The success factors established in our study, primarily concerning the leadership commitment score of 85% effectiveness, enable us to further validate Tan's qualitative insights from his interviews on the impacts of training for leadership. In addition, we illustrate that the challenges described by Poszytek concerning European settings are globalized, but manifest in ways that require more sophisticated and locally adaptable implementation tactics. The developed model goes beyond progression markers defined in other frameworks on transformation readiness. These frameworks have not had broad indicators beyond integrating advanced technology, while our model includes five immeasurable dimensions: leadership, technological infrastructure, innovation, organisational culture, and stakeholder participation. This technique provides a more holistic perspective, equipping educational institutions with tangible practical assessment and implementation tools, while providing policymakers with scientifically-based recommendations for context-appropriate support mechanisms.

While this research makes important contributions, some shortcomings merit attention and offer possibilities for further work. First, even though our sample encompasses various regions, the inclusion of 3 developing countries may not adequately reflect the intricacies of digital transformation issues prevalent in these economies. Second, the two-year duration of this study may not fully capture the enduring nature of change that was achieved. Third, even though the mixed-methods approach of this study yielded rich data, the self-reported measures of leadership effectiveness are potentially biased.

In Qiu's (2023) emphasis on globalization impacts, longitudinal studies over 5-10 years would be useful in tracking sustaining transformation processes and provide deeper insights into productive leadership practices. Building on Kin et al.'s (2020) work, future research should also consider cross-national comparative study designs that focus on specific leadership variables, particularly how such leadership traits differ in multicultural and multi-economic settings. Furthermore, Arnold (2022) encourages the need for further analysis of digital leadership literacies, particularly regarding competencies of educated leaders and the institutional consequences of such competencies over a period of time. Further studies could also look into the unique interplay between further developments of artificial intelligence technologies and educational leadership, a novel direction that this study has only skimmed.

The continuous advancement of educational technology and its digital transformation calls for further research on the scope and findings of this study. Specifically, in a digitally transformed educational context, there is an increasing focus on emerging technologies and their impact upon leadership demands and stakeholder expectations. Besides, McCarthy (2023) also advocates for a deeper study of the teacher and system relationship during digital transformation, which is yet another perspective for future research. These views suggest the need for more targeted studies examining specific aspects of digital leadership in educational transformation, with an emphasis on the implementation difficulties and the outcomes of long-term sustainability.

CONCLUSION

This research holds significant value in the realm of educational leadership, particularly in the context of digital change, as it uncovers crucial trends and success factors across diverse institutions. The findings indicate that effective digital leadership in educational settings requires a delicate balance between technological progress, organisational change management, and developmental processes. By integrating classical leadership concepts with the contemporary conditions of digital transformation, this study enriches the existing body of knowledge on evolving leadership practices within the digitising education sector. This integration not only advances the theoretical understanding of the relationship between leadership effectiveness and successful digital transformation but also provides practical insights.

The results and data generated from this study are immediately applicable and serve as benchmarks for educational leaders aiming to maintain excellence in educational practice during digital transformation initiatives. The research highlights key success factors and challenges, offering valuable guidance for institutions seeking economically viable approaches to digital leadership and transformation. It underscores the necessity for leaders to align their practices with the institution's capabilities and context, ensuring that leadership styles are adapted to modern technologies while preserving core educational values.

Ultimately, this research makes a substantial contribution to understanding and analysing strategies that enable educational institutions to effectively drive digital transformation while upholding educational standards.

REFERENCES

[1] Arnold, D. (2022). Supporting leadership development in European Universities: a mixed methods study of digital education leadership literacies for higher education.

[2] Awodiji, O. A., Uleanya, C., & Naicker, S. R. (2023). School Leadership Development for Sustainability in the Post-Digital Era. *SFU Educational Review*, *15*(1). https://doi.org/10.21810/sfuer.v15i1.6146

[3] Connolly, C., O'Brien, E., & O'Ceallaigh, T. J. (2023). Ensuring knowledge sustainability in a digital era: Empowering digital transformation through digital educational leadership. *Technology, Knowledge and Learning*, 1-17. https://doi.org/10.1007/s10758-023-09707-0

[4] Gapsalamov, A., Bochkareva, T., Vasilev, V., Akhmetshin, E., & Anisimova, T. (2020). Comparative analysis of education quality and the level of competitiveness of leader countries under digitalization conditions. *Journal of Social Studies Education Research*, *11*(2), 133-150. Retrieved March 10, 2025 from https://www.learntechlib.org/p/217549/.

[5] Karakose, T., Polat, H., Tülübaş, T., & Demirkol, M. (2024). A review of the conceptual structure and evolution of digital leadership research in education. *Education Sciences*, *14*(11), 1166. https://doi.org/10.3390/educsci14111166

[6] Kin, T. M., Kareem, O. A., Musa, K., Ghouri, A. M., & Khan, N. R. (2020). Leading sustainable schools in the era of Education 4.0: Identifying school leadership competencies in Malaysian secondary schools. *International Journal of Management in Education*, *14*(6), 580-610. https://doi.org/10.1504/IJMIE.2020.110690

[7] Liu, W., & Huang, C. (2023). The international comparative approach to higher education leadership development: evaluating the longer-term impacts. *International Journal of Leadership in Education*, 1-15. https://doi.org/10.1080/13603124.2023.2224773

[8] McCarthy, A. (2020). Digital transformation in education: A mixed methods study of teachers and systems (Doctoral dissertation, Murdoch University).

[9] McCarthy, A. M., Maor, D., McConney, A., & Cavanaugh, C. (2023). Digital transformation in education: Critical components for leaders of system change. *Social sciences & humanities open*, *8*(1), 100479. https://doi.org/10.1016/j.ssaho.2023.100479

[10] Mendy, J., & AlGhanem, N. (2024). Financialisation strategy of digital transformation: towards a people-centric, sustaining network leadership framework in an Arabic energy context. *Journal of Strategy and Management*. https://doi.org/10.1108/JSMA-06-2023-0146

[11] Mohamed Hashim, M. A., Tlemsani, I., & Duncan Matthews, R. (2022). A sustainable university: Digital

transformation and beyond. *Education and Information Technologies*, *27*(7), 8961-8996. https://doi.org/10.1007/s10639-022-10968-y

[12] Mohamed Hashim, M. A., Tlemsani, I., & Matthews, R. (2022). Higher education strategy in digital transformation. *Education and Information Technologies*, *27*(3), 3171-3195. https://doi.org/10.1007/s10639-021-10739-1

[13] Poszytek, P. (2024). Digital Transformation in Educational Organizations: Leadership, Innovation and Industry 4.0 (p. 253). Taylor & Francis. https://doi.org/10.4324/9781003482246

[14] Qiu, Z. (2023). The development direction of educational leadership in the context of globalization. *Educ. Res. J*, *2*, 69-73.

[15] Rivera, M. J. B. (2025). Challenges of Leadership in Educational Organizations for Digital Transformation: Influence of the Transformational Era on Education. In *Multidisciplinary Organizational Training of Human Capital in the Digital Age* (pp. 1-24). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-7086-5.ch001

[16] Roth, M. A., & Price, J. K. (2015). The critical role of leadership for education transformation with successful technology implementation. In *ICT in education in global context: Comparative reports of innovations in K-12 education* (pp. 195-213). Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-47956-8_10

[17] Salih, A. (2020). Cross-cultural leadership: Being effective in an era of globalization, digital transformation and disruptive innovation. Routledge. https://doi.org/10.4324/9780429344695

[18] Tan, Y. (2024). Leadership Training in the Era of Digital Transformation: Case Study of Amazon. *Advances in Economics, Management and Political Sciences*, *119*, 22-28. https://doi.org/10.54254/2754-1169/119/20242303

[19] Xie, Y., & Wang, N. (2023). The Connotation Evolution and Enhancement Strategies of Digital Leadership in China's Universities in the Context of Digital Transformation. *Advances in Education, Humanities and Social Science Research*, *8*(1), 221-221. https://doi.org/10.56028/aehssr.8.1.221.2023

[20] Стрільчук, Ю., Краснова, І., Ходакевич, С., Мецгер, Є., Стрижак, А., & Дубас, А. (2024). Sustainable development determinants in the context of digital transformation. *Financial and credit activity problems of theory and practice*, *3*(56), 293-307. https://doi.org/10.55643/fcaptp.3.56.2024.4367