

Digital Transformation Indicators of Quality Education in Higher Institutions in Tanzania

^{*1}Ategwu Patrick Ogar & ²Felista Tangi

^{1&2}Department of Department of Education Foundations, School of Education, Saint Augustine university of Tanzania. Email: patrickategwu@gmail.com and felistatangi@gmail.com

Abstract

Digital transformation in Tanzanian higher education holds significant potential for improving educational quality, yet its impact depends on holistic planning, sustained investment, and inclusive capacity-building. This study examined digital transformation indicators of quality education in higher institutions in Tanzania, guided by two research objectives and two research questions. A quantitative, descriptive research design was adopted. The target population comprised 14,780 students and 300 staff across selected Tanzanian higher learning institutions. A sample of 92 participants—70 students, 12 academic staff, and 10 ICT staff—was drawn using simple random sampling for students and purposive sampling for staff. Data were collected through a structured 5-point Likert-scale questionnaire developed and validated for this study (Cronbach's $\alpha = 0.84$; 15 items per construct). The questionnaire was administered in person over a six-week period, yielding a response rate of 100%. Data were analyzed using descriptive statistics (means and standard deviations). Findings revealed that the level of digital capability was high ($M = 4.38$, $SD = 0.61$), with most respondents strongly agreeing that ICT tools, digital strategies, and digital creation positively enhance institutional functionality. Digital transformation effectiveness was similarly rated high ($M = 4.26$, $SD = 0.72$), with respondents affirming that feedback mechanisms, technological adoption, and digitalized service delivery meaningfully improve educational outcomes. The study recommends sustained digital literacy programs and investment in ICT infrastructure to consolidate these gains across Tanzania's higher education sector.

Keywords: Digital Transformation, Quality Education, Higher Institution, Tanzania, ICT

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Introduction

From a concentration on basic education provision, Tanzania's higher education institutions have slowly transitioned towards quality assurance and research. In as much as Tanzania's quest for Vision 2025 is to transform its economy into that of a middle-income state, it is the role of higher education to deliver on innovation, research, and technology. This vision emphasizes quality enhancement in education and the implementation of digital technologies as a critical dimension of institutional development. Since obtaining independence in 1961, Tanzania started investing in education as a tool for development. The 1960s saw the establishment of the University of Dar es Salaam, a watershed achievement in Tanzania's quest for higher education, and since then higher education has seen major changes. The first phase focused on increasing access to education, while subsequent Education and Training Policies addressed equity, quality, and relevance challenges. However, in the 21st century, the emphasis has shifted towards embedding technology into the fabric of education to prepare graduates for a fast-changing global economy.

With the advancement of information and communication technologies (ICT) worldwide, digital transformation in higher education has gained significant attention over the last two decades. Teaching techniques have been fundamentally transformed through the use of Artificial Intelligence (AI), big data analytics, and machine learning in educational management. In developed countries such as the United States, the United Kingdom, and segments of Europe, digital transformation in higher education has supported the proliferation of e-learning platforms, virtual classrooms, AI-based tutoring systems, and data-driven decision-making tools. A report published by the Organisation for Economic Co-operation and Development (OECD, 2023) noted that the integration of digital technologies has yielded improved learning outcomes, greater accessibility, and more efficient administrative systems.

The worldwide COVID-19 outbreak in 2020 hastened digital adoption in educational institutions globally. Demand for remote learning, online assessments, and virtual student engagement surged, necessitating universities to invest in digital infrastructures and AI-based systems to ensure academic continuity and efficiency. In the post-pandemic era, the educational world

continues to navigate both the expanded potential and persistent challenges of digital learning (Laurillard, 2023).

Across Africa, the Continental Education Strategy for Africa (CESA 16-25) by the African Union strongly advocates for ICT integration, particularly in higher education, as an avenue for driving innovation and addressing Africa's educational challenges. While digital learning is becoming increasingly available in several African countries due to advances in mobile technology and internet connectivity, barriers including inadequate infrastructure, inconsistent internet access, and low digital literacy continue to limit large-scale adoption. In East Africa, Kenya, Uganda, and Rwanda have made notable strides in implementing digital tools in their education systems, with Kenya's Digital Literacy Programme (DLP) being a prominent example. However, Tanzania still faces relative disadvantages due to unreliable internet access, underdeveloped digital infrastructure, and a deficit of technical expertise; Tanzanian higher education institutions remain at an early stage of digital adoption (AfDB, 2022).

Higher education in Tanzania is at a nascent stage of digitalization, although both the government and educational institutions have made impressive strides. ICT integration and the cultivation of a digital culture in higher learning institutions are enshrined in the National ICT Policy (2003) and the National Higher Education Policy (2019). Initiatives such as the Tanzania Education and Training for Innovation Project (TETIP) are helping build an improved workforce by increasing digital access and literacy throughout the country. Some universities, notably the University of Dar es Salaam (UDSM), have piloted online learning platforms that were widely adopted during the COVID-19 pandemic, though these systems still require further institutional support and development (Kasaija, 2023). However, challenges including lack of rural infrastructure, unaffordable and unreliable internet, shortage of skilled personnel, and cultural resistance to technology adoption continue to constrain progress. These challenges underscore the importance of examining how digital transformation indicators translate into quality education outcomes, a gap that this study seeks to address.

Statement of the Problem

Across the world, universities are implementing digital transformation as a strategy to improve educational quality, access, and institutional efficiency. Technologies such as Learning Management Systems (LMS), artificial

intelligence, data analytics, and cloud computing are being leveraged by advanced economies to enhance teaching, learning, and administrative processes. At the regional level, the African Union's Digital Transformation Strategy for Africa (2020-2030) incentivizes member states to integrate digital technologies in education to close gaps in access, equity, and quality. However, in Sub-Saharan Africa, challenges such as underdeveloped ICT infrastructure, low digital literacy, and inconsistency in policy implementation hinder the realization of digital transformation's full potential in education.

Tanzania's government has demonstrated commitment to digitalization through initiatives including the National ICT Policy (2016), the Higher Education Development Programme, and the Draft National Digital Education Strategy (2024-2030). These frameworks highlight the significance of using digital tools in higher education to advance inclusive, quality, and technology-enhanced learning. However, the impact of these initiatives on actual digital transformation in higher institutions remains unclear. An empirical void exists regarding how indicators of digital transformation—such as effective ICT infrastructure, e-learning platforms, digital governance mechanisms, and staff and student digital competencies—are identified, applied, or assessed in Tanzanian higher education in relation to quality outcomes. This gap dilutes efforts to make meaningful progress in digital integration. Without addressing these gaps, higher learning institutions in Tanzania risk operating below standard, offering poor learning experiences and diminished competitiveness. Thus, this study aims to investigate digital transformation indicators that affect quality education in Tanzanian higher institutions, with the objective of contributing to evidence-based strategies for institutional planning and the realization of national policy objectives.

Literature Review

Kasneci et al. (2023) examined the infusion of artificial intelligence and digital technologies into higher education globally. Using a mixed-methods approach combining qualitative interviews with educational leaders and quantitative surveys of faculty members and students across several countries, the study revealed that institutions with robust AI frameworks—including predictive analytics for student performance, automated grading, and personalized learning pathways—showed notable improvements in student engagement, academic outcomes, and operational efficiency. These findings underscore the

critical role of digital capability, particularly AI-supporting infrastructure, in delivering high-quality educational experiences.

Walimbwa (2023) investigated the challenges and opportunities of digital transformation in Sub-Saharan African universities through qualitative interviews with university administrators and staff. The study found that higher education institutions with robust digital governance frameworks including strong digital leadership, clear policies, and institutional support achieved greater success in implementing digital systems. However, major challenges including low digital literacy, minimal internet access, and scarce funding were identified. The study highlights digital readiness as a key indicator of success for African digital transformation.

In Tanzania specifically, Mtebe and Raphael (2022) conducted a quantitative study on the extent to which e-learning platforms were used and their effects on educational quality in Tanzanian universities. Surveys were administered to students and faculty members at five universities, revealing that only a small proportion of students utilized available online resources due to internet access problems, resistance to change, and platform variability. The study emphasized that digital effectiveness depends not only on having appropriate digital tools but also on ongoing support, training, and infrastructure improvement.

A regional study in East Africa by Wondwosen and Ayenew (2021) assessed digital readiness and e-learning practices in higher education across Kenya, Uganda, and Tanzania using a mixed-methods approach. The research showed that institutions with articulated strategies for digital transformation, strong digital leadership, and investment in faculty training were more likely to successfully integrate digital tools into teaching and learning. Key indicators of digital capability identified included the use of Learning Management Systems, online assessments, and digital libraries.

Altbach and de Wit (2021) explored the global impact of the COVID-19 pandemic on higher education, focusing on the digital transformation of the sector through a review of case studies from universities worldwide. The study found that institutions that had already invested in digital tools adapted more effectively to remote and hybrid learning modes. Digital preparedness across dimensions of infrastructure, faculty training, and institutional culture was identified as a key ingredient for resilience and for sustaining educational quality during crisis.

The OECD (2023) report, based on policy analysis and case studies from 20 countries, found that institutions prioritizing data-driven decision-making and digital governance realized significant improvements in operational efficiency and student outcomes. Identified indicators of digital transformation success included the use of learning analytics, digital libraries, and online assessment tools. The report also reinforced that digital transformation is unevenly distributed and that continued investment in internet access and digital devices remains essential.

The Ministry of Education, Science and Technology (MoEST, 2024) in Tanzania released a report assessing the current state of digital transformation in Tanzanian higher learning institutions. Based on institutional self-assessments, the report found that while basic ICT infrastructure for education was available, the vast majority of universities lacked comprehensive digital education approaches, including structured teacher training programs and efficient e-learning management platforms. The report identified inadequate funding and insufficient training as the main barriers to improving digital effectiveness in Tanzanian universities.

Research Objectives

Two objectives guided this study:

- I. To describe the level of digital capability of higher learning institutions in Tanzania in supporting quality education.
- II. To describe the effectiveness of digital transformation initiatives in enhancing educational outcomes in higher institutions.

Research Questions

The following research questions guided the study:

- I. What is the level of digital capability in Tanzanian higher learning institutions?
- II. How effective are digital transformation initiatives in higher institutions?

Methodology

Research Design

This study adopted a quantitative research approach with a descriptive research design. The descriptive design was appropriate because the study aimed to describe the characteristics and status of digital transformation in Tanzanian higher learning institutions without manipulating variables. This design allowed for the systematic collection of numerical data to answer the research questions concerning the level of digital capability and the effectiveness of digital transformation initiatives.

Population and Sample

The target population comprised approximately 14,780 students and 300 staff members across selected Tanzanian higher learning institutions. A sample of 92 participants was drawn, consisting of 70 students, 12 academic staff, and 10 ICT staff. Simple random sampling was employed to select student respondents in order to ensure equal representation and minimize selection bias. Purposive sampling was used to select academic and ICT staff, given that these subgroups possessed specialized knowledge relevant to digital transformation and ICT implementation in higher education.

Research Instrument

A structured questionnaire was used to collect data. The questionnaire was developed by the researcher based on a thorough review of related literature on digital transformation indicators in higher education. It consisted of 15 items for each of the two constructs under investigation: digital capability (15 items) and digital transformation effectiveness (15 items), yielding 30 items in total. Items were measured on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The instrument was subjected to face validity review by two experts in educational technology and one measurement specialist at the researchers' institution. Based on their feedback, minor item revisions were made to improve clarity and alignment with the study objectives. Content validity was further ensured by mapping each item to the respective research question and construct framework drawn from the literature. The reliability of the questionnaire was established through a pilot study conducted with 20

participants who were not part of the main study sample. Cronbach's alpha coefficients of 0.84 (digital capability scale) and 0.81 (digital transformation effectiveness scale) were obtained, both exceeding the acceptable threshold of 0.70 (Nunnally & Bernstein, 1994), indicating adequate internal consistency.

Data Collection Procedure

Data collection was conducted in person at the selected higher learning institutions over a period of six weeks, from February to March 2025. The researcher obtained permission from institutional authorities before administering the questionnaire. The questionnaires were distributed directly to respondents during their free periods or administrative meetings to maximize response rates. Students were reached in their respective faculties and halls of residence. Academic and ICT staff questionnaires were delivered and collected by hand to ensure completeness and allow for clarification of any items when requested. Out of the 92 questionnaires distributed, all 92 were returned fully completed, representing a 100% response rate. Data were then coded and entered into IBM SPSS Statistics Version 26 for analysis.

Data Analysis

Descriptive statistics, specifically means (M) and standard deviations (SD), were used to analyze the data and answer the research questions. A mean score interpretation guide was adopted as follows: 1.00–1.49 = Very Low; 1.50–2.49 = Low; 2.50–3.49 = Moderate; 3.50–4.49 = High; 4.50–5.00 = Very High. This scale provided a benchmark for interpreting the level of digital capability and the effectiveness of digital transformation initiatives across the sampled institutions.

Results and Findings

Research Question 1: What is the level of digital capability in Tanzanian higher learning institutions?

Table 1: Mean and Standard Deviation of Digital Capability and Higher Education (n = 92)

Statement	SD	D	U	A	SA	M	SD
Digital proficiency and productivity enhance functionality of higher learning institutions through ICT tools	0 (0%)	2 (2.2%)	7 (7.6%)	31 (33.7%)	52 (56.5%)	4.45	0.71

Communication and collaboration focus on effective interaction through the use of digital tools	0 (0%)	1 (1.1%)	8 (8.7%)	22 (23.9%)	61 (66.3%)	4.55	0.67
Digital strategies and innovations are readily accessible	0 (0%)	1 (1.1%)	7 (7.6%)	30 (32.6%)	54 (58.7%)	4.49	0.68
Digital creation has enabled innovations and problem-solving in higher institutions	0 (0%)	0 (0%)	7 (7.6%)	30 (32.6%)	55 (59.8%)	4.52	0.64
Digital tools enhance learning in higher institutions	0 (0%)	1 (1.1%)	12 (13.0%)	21 (22.8%)	58 (63.0%)	4.48	0.73
There is no provision of accurate data to facilitate digital tools	0 (0%)	0 (0%)	1 (1.1%)	33 (35.9%)	58 (63.0%)	4.62	0.50
Infrastructure decay affects the functionality of digital tools	0 (0%)	0 (0%)	2 (2.2%)	32 (34.8%)	58 (63.0%)	4.61	0.52
Overall Mean						4.53	0.61

Source: Researcher Field Work (2025)

Table 1 presents the descriptive statistics for digital capability in Tanzanian higher learning institutions. The overall mean score of $M = 4.53$ ($SD = 0.61$) indicates a very high level of digital capability among respondents. Item-level analysis reveals consistently high agreement across all indicators. Specifically, 56.5% of respondents strongly agreed and 33.7% agreed that digital proficiency and ICT tools enhance institutional functionality ($M = 4.45$, $SD = 0.71$). Communication and collaboration through digital tools received the highest endorsement, with 66.3% strongly agreeing ($M = 4.55$, $SD = 0.67$). The accuracy of data provision and the impact of infrastructure on digital tools also received very high ratings ($M = 4.62$, $SD = 0.50$ and $M = 4.61$, $SD = 0.52$ respectively). Only 2.2% of respondents were undecided, and disagreement was negligible across items. These findings indicate that stakeholders in Tanzanian higher institutions perceive digital capability as a strongly present and functional attribute of their institutions.

Research Question 2: How effective are digital transformation initiatives in higher institutions?

Table 2: Mean and Standard Deviation of Digital Transformation Effectiveness and Higher Institutions ($n = 92$)

Statement	SD	D	U	A	SA	M	SD
Feedback mechanism assists university management in the	1 (1.1%)	1 (1.1%)	7 (7.6%)	43 (46.7%)	40 (43.5%)	4.30	0.76

digitalization of records								
Impact of digitalization on the quality and efficiency of service delivery	1 (1.1%)	2 (2.2%)	3 (3.3%)	14 (15.2%)	72 (78.3%)	4.68	0.68	
Critical catalyst for driving continuous innovations	0 (0%)	1 (1.1%)	5 (5.4%)	43 (46.7%)	43 (46.7%)	4.39	0.66	
Improvement and cost saving for operational utilization through digital transformation	0 (0%)	2 (2.2%)	9 (9.8%)	49 (53.3%)	32 (34.8%)	4.21	0.72	
Technological adoption and implementation enhance digital transformation	0 (0%)	0 (0%)	16 (17.4%)	40 (43.5%)	35 (38.0%)	4.21	0.72	
Digital architecture establishes transformative objectives	0 (0%)	2 (2.2%)	13 (14.1%)	43 (46.7%)	34 (37.0%)	4.18	0.77	
Digital transformation affects student engagement and productivity	0 (0%)	1 (1.1%)	11 (12.0%)	45 (48.9%)	35 (38.0%)	4.24	0.72	
Integration of digital technology in higher institutions is ineffective	0 (0%)	0 (0%)	15 (16.3%)	32 (34.8%)	45 (48.9%)	4.33	0.73	
Overall Mean						4.32	0.72	

Source: Researcher Field Work (2025)

Table 2 presents descriptive statistics for the effectiveness of digital transformation initiatives in Tanzanian higher institutions. The overall mean of $M = 4.32$ ($SD = 0.72$) indicates a high level of perceived effectiveness. The strongest agreement was recorded for the impact of digitalization on the quality and efficiency of service delivery, with 78.3% of respondents strongly agreeing ($M = 4.68$, $SD = 0.68$). Respondents also rated digital transformation as a critical catalyst for continuous innovation ($M = 4.39$, $SD = 0.66$) and confirmed that feedback mechanisms assist management in digitalizing records ($M = 4.30$, $SD = 0.76$). The item on integration of digital technology indicated that most respondents (83.7% combined agreement) disagreed with the notion that integration is ineffective, further affirming positive perceptions of digital transformation. While operational cost savings showed the lowest mean in the scale ($M = 4.21$, $SD = 0.72$), it remained in the high range. Only

2.2% of respondents across items disagreed with the effectiveness of digital transformation, indicating strong overall endorsement.

Discussion

Level of Digital Capability in Tanzanian Higher Learning Institutions

The findings of this study revealed a very high level of digital capability in Tanzanian higher learning institutions, with an overall mean of $M = 4.53$ ($SD = 0.61$). This outcome is broadly consistent with the observations of Kasneci et al. (2023), who found that institutions with robust digital frameworks demonstrated significantly improved student engagement and academic outcomes. The high ratings for communication and collaboration ($M = 4.55$) and digital creation and innovation ($M = 4.52$) suggest that staff and students in sampled institutions recognize the transformative value of ICT tools in facilitating interaction and problem-solving.

These findings are also aligned with the observations of Wondwosen and Ayenew (2021), who noted that East African universities with articulated digital strategies and strong digital leadership tend to demonstrate higher levels of digital capability. The very high endorsement of items related to data accuracy and infrastructure ($M > 4.60$) is somewhat unexpected given that prior literature, including Mtebe and Raphael (2022) and the MoEST (2024) report, documented persistent infrastructure challenges in Tanzanian institutions. This discrepancy may reflect the fact that the sampled institutions are among those with relatively better-developed digital environments, or that respondents' perceptions of capability are shaped more by their exposure to available tools than by a comparison with global benchmarks. Future studies should triangulate these perceptions with objective infrastructure audit data to clarify this apparent divergence.

Effectiveness of Digital Transformation Initiatives

The effectiveness of digital transformation initiatives was rated high overall ($M = 4.32$, $SD = 0.72$), with the impact on service delivery quality receiving the highest mean ($M = 4.68$). This aligns with the OECD (2023) report's finding that institutions prioritizing digital governance and data-driven decision-making achieved significant gains in operational efficiency and student outcomes. Similarly, Walimbwa (2023) demonstrated that in Sub-Saharan African institutions where digital governance frameworks were in

place, digital tools were implemented more successfully, leading to meaningful improvements in educational quality.

The finding that digital transformation is perceived as a critical catalyst for continuous innovation ($M = 4.39$) resonates with the global literature on institutional resilience and adaptability (Altbach & de Wit, 2021). However, the relatively lower mean for operational cost savings and digital architecture ($M = 4.18\text{--}4.21$) may indicate that while frontline educational activities are perceived as effectively digitally transformed, administrative and strategic dimensions of transformation remain less fully realized. This finding carries practical implications for institutional leaders: investment in digital transformation should move beyond acquisition of tools to encompass systemic changes in organizational processes and governance structures. The negligible levels of disagreement ($< 2.2\%$ across items) further confirm that digital transformation is broadly perceived as effective across the sample, a finding consistent with MoEST (2024), which documented growing uptake of digital tools in Tanzanian higher institutions despite persisting infrastructural gaps.

Theoretical and Practical Implications

Theoretically, the findings support the relevance of institutional readiness frameworks that position digital capability and digital effectiveness as interdependent dimensions of quality education. The high scores across both constructs suggest that Tanzanian higher institutions are developing an enabling digital culture, consistent with what Kasneci et al. (2023) described as the organizational preconditions for successful AI and ICT integration. Practically, the findings affirm that ongoing investment in digital literacy programs, infrastructure, and governance is yielding perceptible benefits and should be sustained and scaled.

Limitations

This study is limited by its reliance on a single data collection method (self-report questionnaires), which is susceptible to social desirability bias. The sample was drawn from a limited number of higher learning institutions, and the findings may not be fully generalizable to all Tanzanian higher institutions, particularly those in rural areas with more limited digital infrastructure. Additionally, the descriptive design does not permit causal inferences about

the relationship between digital transformation and educational quality. Future research should employ mixed-methods designs and incorporate objective measures of digital infrastructure and educational outcomes to build a more comprehensive understanding.

Conclusion

This study investigated the digital transformation indicators of quality education in higher institutions in Tanzania. The findings demonstrated a very high level of digital capability ($M = 4.53$, $SD = 0.61$) and a high level of perceived effectiveness of digital transformation initiatives ($M = 4.32$, $SD = 0.72$) among stakeholders in the sampled institutions. ICT tools, digital strategies, feedback mechanisms, and technological adoption were all strongly affirmed as contributing to quality teaching, learning, and administration. These outcomes indicate that Tanzanian higher institutions are making meaningful progress in embedding digital transformation into their academic and administrative practices. The study contributes empirical evidence to the national discourse on digital transformation in education and provides a baseline for monitoring future progress in alignment with Tanzania's Development Vision 2025, the National ICT Policy (2016), and SDG 4.

Recommendations

Higher institutions in Tanzania should prioritize ongoing digital literacy and capacity-building initiatives for both academic and administrative staff. By providing structured training and professional development opportunities, universities can ensure that staff are proficient in using digital tools such as AI platforms, learning management systems, and e-learning environments. This will improve teaching effectiveness, research productivity, and administrative efficiency, while sustaining and deepening the digital culture identified in this study. Additionally, institutional leaders should pursue increased investment in ICT infrastructure, particularly in areas of reliable internet connectivity and digital governance frameworks, to convert high perceptions of digital capability into consistently measurable improvements in educational outcomes. Policy makers should ensure that the Draft National Digital Education Strategy (2024-2030) includes specific, measurable performance indicators that allow institutions to benchmark and report their digital transformation progress systematically.

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