The Influence of Institutional Constraints on Artificial Intelligence-Driven Innovation and its Impacts on Academic and Organisational Performance in Higher Learning Institutions

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Abstract: This paper examines how institutional constraints influence artificial intelligence (AI)-driven innovation and how such innovation affects academic and organisational performance in higher learning institutions. Using a systematic literature review methodology, the study synthesizes existing secondary data and scholarly work to analyze these relationships within the Tanzanian context. The findings reveal that financial limitations, regulatory gaps, and human resource deficits significantly hinder AI adoption in Tanzanian universities and colleges. Despite these constraints, pilot AI projects demonstrate positive impacts on academic performance indicators such as student engagement, pass rates, and research productivity when constraints are partially alleviated. The study concludes that AI-driven innovation serves as a potential mediator between institutional resources and performance outcomes, but this mediating role remains underdeveloped due to systemic barriers. Addressing these institutional constraints through targeted policy interventions, capacity building, and strategic leadership is crucial for maximizing the benefits of AI in higher education, particularly in developing countries.

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I. INTRODUCTION

The rapid advancement of technology has fundamentally reshaped various sectors worldwide, with education emerging as one of the most significantly affected domains. The development of Artificial Intelligence (AI) technologies, particularly generative AI tools such as ChatGPT and others developed since late 2022, has introduced transformative opportunities and unprecedented challenges for higher learning institutions (HLIs) globally (Kuleto et al., 2021). AI systems are designed to simulate and, in some cases, surpass human cognitive capabilities, enabling tasks such as information analysis, problem-solving, content generation, and personalized learning. Consequently, these technologies have the potential to enhance both academic and organizational performance by improving teaching efficiency, streamlining research processes, and supporting data-driven decision-making.

Despite these opportunities, the adoption of AI in higher education has raised significant concerns. Students may misuse generative AI tools to complete assignments and research tasks, resulting in academic dishonesty and erosion of ethical learning practices (Kasneci et al., 2023; Lund et al., 2025). Furthermore, academic staff face challenges in integrating AI responsibly while maintaining quality standards and assessment integrity (UNESCO, 2023). At an organizational level, increasing reliance on AI raises concerns related to job displacement, ethical governance, data privacy, and widening social inequalities (Dwivedi et al., 2023; Floridi et al., 2018). These concerns underscore the critical role of institutional constraints in shaping how AI-driven innovations are adopted and utilized within HLIs.

In Tanzania, as in many developing countries, the integration of AI in higher education occurs within a unique context characterized by specific socio-economic, infrastructural, and policy challenges. While global research highlights the transformative potential of AI in education, there remains limited understanding of how institutional constraints specific to the Tanzanian context influence AI adoption and its subsequent impact on academic and organizational performance. This paper addresses this gap by examining the interplay between institutional constraints, AI-driven innovation, and performance outcomes in Tanzanian HLIs.

> *Statement of the Problem*

Despite the global surge in AI adoption within higher learning institutions, Tanzanian universities and colleges continue to face significant challenges in leveraging AI-driven innovations to enhance academic and organizational performance (Kapinga & Suero Montero, 2023; Lwoga, 2020). While AI technologies such as adaptive learning systems, predictive analytics, intelligent tutoring platforms, and automated administrative tools offer immense potential to improve teaching quality, research productivity, and institutional efficiency (Dwivedi *et al.,* 2023; Holmes *et al.,* 2019), their effective implementation is frequently constrained by systemic institutional barriers. These include inadequate technological infrastructure, limited financial resources, underdeveloped policy and regulatory frameworks, and resistance to technological change among academic and administrative staff (Mtega, 2018; Sanga *et al.,* 2017). Consequently, the full potential of AI remains largely untapped, and institutions struggle to achieve the expected gains in learning outcomes, operational efficiency, and organizational competitiveness (Ishengoma, 2016; TCU, 2020).

Moreover, this situation underscores a critical research gap in understanding how specific institutional constraints influence the adoption and impact of AI-driven innovations within Tanzania's higher education context (Mtebe & Kissaka, 2021). While studies in other regions highlight the transformative effects of AI on educational and organizational performance (Floridi *et al.,* 2018; Luckin *et al.,* 2016), there is limited empirical evidence examining the Tanzanian context, where unique socio-economic, policy, and infrastructural factors shape technology adoption (Komba & Ngowi, 2022; Mwalemba & Kavishe, 2023). Addressing this gap is essential for guiding policymakers, institutional leaders, and stakeholders in designing strategies and frameworks that not only facilitate AI integration but also maximize its contribution to sustainable academic excellence, operational effectiveness, and long-term institutional development (Mohamed, 2023; UNESCO, 2023).

This study aims to
- Examine the extent to which institutional constraints influence the adoption and implementation of artificial intelligence-driven innovations in higher learning institutions.
- Assess the effect of artificial intelligence-driven innovation on academic performance indicators within higher learning institutions.
- Analyze the mediating role of artificial intelligence-driven innovation in the relationship between institutional constraints and organisational performance outcomes in higher learning institutions.

II. LITERATURE REVIEW

In recent years, many higher learning institutions have struggled to cope with technological changes that have been the driving external factor shaping the progress of education for HLIs (Altbach *et al.,* 2019; UNESCO, 2023).

AI-driven innovation involves the deployment of intelligent systems capable of simulating human cognitive functions such as learning, reasoning, prediction, and decision-making to enhance organisational processes and outcomes (Dwivedi *et al.,* 2023). In HLIs, AI-driven innovation has increasingly become a strategic tool for improving both academic and administrative functions. Common AI applications in this context include adaptive learning platforms, intelligent tutoring systems, predictive analytics, automated assessment tools, chatbots for student support, and AI-enabled administrative systems (Kasneci *et al.,* 2023).

The integration of AI technologies in HLIs has been associated with enhanced personalised learning experiences, improved student engagement, and data-driven academic support mechanisms (Luckin *et al.,* 2016). Adaptive learning systems, for instance, analyse learners' behavioural and performance data to tailor instructional content to individual needs, thereby addressing learning gaps more effectively than traditional pedagogical approaches (Holmes *et al.,* 2019). Similarly, AI-driven analytics support early identification of at-risk students, enabling timely academic interventions (Seldon & Abidoye, 2018). Beyond teaching and learning, AI tools are increasingly used to support research productivity through advanced data analysis, automated literature reviews, and collaborative knowledge discovery (Floridi *et al.,* 2018). Despite these opportunities, scholars caution that AI-driven innovation in HLIs is not merely a technological process but an institutional transformation that requires supportive governance structures, ethical oversight, and organisational readiness (UNESCO, 2023).

Institutional constraints affecting AI-driven innovation are internal and external factors that limit an organisation's capacity to adopt, implement, and effectively utilise technological innovations (Scott, 2014). Drawing from institutional theory, these constraints can be categorised into regulative, normative, and cognitive dimensions, all of which significantly shape AI adoption in higher learning institutions (DiMaggio & Powell, 1983). Regulatory constraints remain one of the most prominent barriers to AI-driven innovation in HLIs. The absence of clear policies on data protection, ethical use of AI, intellectual property, and digital governance creates uncertainty and risk aversion among institutional leaders and academic staff (Floridi et al., 2018; UNESCO, 2023). Concerns over academic integrity, student data privacy, and algorithmic bias further complicate AI implementation in educational environments (Kasneci *et al.,* 2023).

Financial, human resource, and technological constraints significantly limit the adoption and sustainability of AI-driven innovation in higher learning institutions. The high costs associated with digital infrastructure, data systems, and skilled personnel make AI adoption difficult for many institutions, particularly in developing contexts, while inadequate funding also restricts staff training and long-term system maintenance (Altbach et al., 2019; Dwivedi et al., 2023). In addition, shortages of AI-skilled personnel, resistance to organisational change, and limited digital competencies among academic and administrative staff reduce institutional readiness for AI implementation (Holmes et al., 2019). These challenges are further compounded by weak technological infrastructure, unreliable internet connectivity, and poor data quality systems, which constrain the effective performance of AI applications in higher learning institutions (Seldon & Abidoye, 2018).

AI-driven innovation has been strongly associated with improvements in academic performance within higher learning institutions. AI-powered learning systems provide personalised instruction, adaptive assessment, and real-time feedback, which enhance student engagement and learning outcomes (Luckin et al., 2016). Empirical evidence indicates that adaptive learning platforms contribute to higher retention rates, improved educational achievement, and more inclusive learning environments (Holmes et al., 2019). In research, AI tools facilitate advanced data analytics, pattern recognition, and interdisciplinary collaboration, boosting research productivity and quality (Floridi et al., 2018; Dwivedi et al., 2023). Nonetheless, over-reliance on AI-generated content may threaten originality, critical thinking, and academic integrity if ethical and governance frameworks are not properly enforced (Kasneci et al., 2023; UNESCO, 2023). Therefore, the positive educational outcomes of AI adoption are contingent on effective institutional governance, staff competencies, and ethical oversight.

From an organisational perspective, AI-driven innovation enhances operational efficiency by automating routine administrative tasks, streamlining workflows, and supporting evidence-based decision-making (Dwivedi et al., 2023). AI-enabled administrative systems reduce processing time for admissions, examinations, human resource management, and student services, improving institutional responsiveness and service quality (Seldon & Abidoye, 2018). Furthermore, AI analytics provide accurate, real-time insights into institutional operations and resource utilisation, strengthening organisational agility and competitiveness in an increasingly digital higher education environment (Floridi et al., 2018). However, the realisation of these benefits depends on institutions' capacity to overcome structural, financial, and managerial constraints, as inadequate leadership, insufficient funding, and weak AI governance frameworks can limit the impact of AI on organisational performance (Scott, 2014; Altbach et al., 2019). Consequently, institutional constraints play a critical moderating role in shaping the effectiveness of AI-driven innovation in enhancing organisational outcomes.

III. METHODOLOGY

This study employed a systematic literature review (SLR) methodology to synthesize existing secondary data and scholarly work, providing a comprehensive and critical analysis of the influence of institutional constraints on AI-driven innovation in Tanzanian higher learning institutions. The systematic review approach is distinguished by its purpose to answer focused research questions through an explicit, replicable search strategy, using predetermined criteria to identify and appraise relevant studies (Gough, Oliver, & Thomas, 2017). This approach is particularly suited to mapping a complex, emerging field like AI in education within a specific national context, as it allows for the rigorous aggregation of fragmented evidence to identify overarching themes, contradictions, and critical gaps.

➢ *Search Strategy and Selection Criteria*
A comprehensive search was conducted across multiple academic databases including Google Scholar, Scopus, Web of Science, and JSTOR. The search was limited to publications from 2014 to 2024 to ensure relevance to current technological and policy contexts. Key search terms included: "artificial intelligence," "AI," "higher education," "institutional constraints," "Tanzania," "academic performance," "organizational performance," and "innovation." The initial search yielded 387 potentially relevant sources.

➢ *Inclusion and Exclusion Criteria*
Studies were included if they: (1) focused on AI in higher education contexts, (2) addressed institutional factors affecting technology adoption, (3) examined performance outcomes, (4) included Tanzanian contexts or comparable developing country settings, and (5) were published in English. Exclusion criteria eliminated studies that were: (1) focused solely on technical aspects of AI without institutional analysis, (2) limited to primary or secondary education, (3) lacking empirical or conceptual grounding, or (4) published before 2014. After applying these criteria, 52 studies were selected for in-depth analysis.

➢ *Data Extraction and Synthesis*
Data were extracted using a standardized template capturing: author(s), year, study context, methodology, key findings, and theoretical frameworks. Thematic analysis was employed to identify patterns across studies, with findings organized according to the three research objectives. The synthesis process involved iterative coding, categorization, and interpretation of findings within the conceptual frameworks of institutional theory and the Technology-Organisation-Environment (TOE) framework.

IV.   FINDINGS

This part indicates the major findings and analysis of the synthesis of available secondary data, including national policy documents, institutional reports, and academic studies, which reveal a challenging yet evolving landscape for the integration of AI in Tanzanian higher learning institutions.

➤ *The Institutional Constraints Influence the Adoption and Implementation of Artificial Intelligence-Driven Innovations in Higher Learning Institutions*

The analysis of secondary data, including national policy documents, institutional reports, and academic studies, reveals that institutional constraints constitute the primary impediment to AI adoption in Tanzanian higher learning institutions. Financially, analyses of public expenditure show that investment in advanced ICT infrastructure for universities remains a low national priority, with the bulk of education funding directed towards basic access and primary education, leaving minimal capital for high-performance computing or cloud-based AI tools (World Bank, 2019; TCU, 2020). This scarcity is compounded by a critical deficit in human capital, as national assessments of science and technology capacity consistently note a severe shortage of professionals with expertise in data science, machine learning, and AI systems development, a gap not adequately addressed by current postgraduate programs (COSTECH, 2022; Mkude & Cooksey, 2019).

Regulatory and policy frameworks further constrain progress. While the National ICT Policy (URT, 2016) and the Education and Training Policy (URT, 2014) provide a foundation for digitalization, they are largely silent on the governance, ethics, and strategic promotion of emerging technologies like AI, creating a vacuum that fosters institutional risk aversion (Mtebe & Kissaka, 2021; Sanga et al., 2017). At the organizational level, this manifests as a lack of specific policies on data protection for AI research and algorithmic accountability, alongside a cultural and leadership tendency towards cautious, top-down decision-making that is often resistant to disruptive pedagogical and administrative change (Kapinga & Suero Montero, 2023; Lwoga, 2020).

These findings indicate that a significant number of institutions in Tanzania struggle to adapt to technological advancements due to various internal constraints. Similar to other organisations across sub-Saharan Africa, these institutions face challenges such as inadequate infrastructure, limited technical expertise, insufficient managerial support, and resistance to change. Such barriers hinder their capacity to effectively implement new technologies that could enhance operational efficiency, improve service delivery, and ultimately meet the evolving needs of stakeholders.

➤ *The Effect of Artificial Intelligence-Driven Innovation on Academic Performance Indicators Within Higher Learning Institutions*

The study findings reveal that where AI-driven innovations have been piloted, typically through donor-funded projects or isolated departmental initiatives, their effect on academic performance indicators is demonstrably positive but geographically and programmatically limited. In the domain of teaching and learning, studies on the implementation of adaptive learning platforms and intelligent tutoring systems in select Tanzanian universities report measurable improvements in student engagement, pass rates for difficult STEM modules, and the personalization of learning support (Mtebe & Raphael, 2018; Komba & Ngowi, 2022).

Administratively, institutions that have integrated AI-enhanced modules into their library systems or student record management report significant gains in operational efficiency, resource tracking, and data-driven decision-making. For research performance, the application of machine learning techniques in data-intensive fields such as public health, agricultural science, and biodiversity has led to an increase in publication output, enhanced data analysis capabilities, and stronger international research collaborations, as evidenced by co-authored papers in indexed journals (Mboera et al., 2021; Nyambo et al., 2020). However, these successes are frequently unsustainable, relying on temporary external funding and the dedication of individual "champion" faculty, leaving them vulnerable to collapse once project cycles end (Sanga & Magesa, 2019).

➤ *The Mediating Role of Artificial Intelligence-Driven Innovation in the Relationship Between Institutional Constraints and Organisational Performance Outcomes in Higher Learning Institutions*

The analysis of the proposed mediating role of AI-driven innovation suggests it operates as a significant but currently underpowered mediator in the relationship between institutional constraints and broader organizational performance. The evidence supports a model where pervasive constraints have a direct and negative effect on organizational outcomes such as institutional ranking, research commercialisation, graduate employability in tech sectors, and operational agility (Ishengoma, 2016).

Case study evidence indicates that in contexts where specific constraints are partially alleviated for instance, through a university-private sector partnership that provides AI software access or a capacity-building program for lecturers the subsequent deployment of even basic AI tools (e.g., for plagiarism detection, learning analytics, or research data mining) creates a measurable pathway to improved performance (Mwalemba & Kavishe, 2023). This confirms that AI adoption is a potent mechanism through which resource investments can be translated into tangible gains. However, the overarching reality is that the mediating variable itself widespread, institutionalized AI innovation remains too weak due to the very constraints it is supposed to help overcome. Thus, the mediating effect is more latent than fully realized; the potential pathway exists in theory but is often blocked in practice before meaningful organizational transformation can occur (Mtega, 2018).

V. DISCUSSION

These findings position Tanzanian HLIs within a cycle where institutional constraints (regulatory gaps, financial limits, skill shortages) mutually reinforce each other, stifling innovation. This dynamic aligns with Institutional Theory, as the weak regulatory pillar (national policy), underdeveloped normative pillar (lack of AI-literate academic leaders), and resistant cultural-cognitive pillar (traditional teaching ethos) collectively inhibit change (DiMaggio & Powell, 1983). The isolated "islands of success" from AI pilots validate the core premise of the Technology-Organisation-Environment (TOE) framework that the technology has global potential, but they starkly illuminate the unsupportive organizational structures and national environment in Tanzania (Tornatzky & Fleischer, 1990).

To break this cycle and empower AI to act as a true mediator of performance, a deliberate, dual-pronged strategy is essential. At the national level, policymakers must move beyond generic ICT policies to formulate a dedicated National Strategy for AI in Education and Research, which would provide funding guidelines, ethical standards, and mandated capacity-building targets (Mohamed, 2023). Concurrently, university leadership must adopt a strategic, rather than reactive, posture towards AI. This involves proactively forging partnerships with technology firms and diaspora networks to access resources and expertise, while internally incentivizing AI-related curriculum reform, establishing interdisciplinary AI labs, and fostering a culture that rewards pedagogical and administrative innovation (Kapinga & Suero Montero, 2023). Only through such synchronized, systemic efforts can the foundational constraints be sufficiently lowered to allow AI-driven innovation to fulfil its necessary mediating role in enhancing the performance and global competitiveness of Tanzania's higher education sector.

VI. CONCLUSION

This paper concludes that AI-driven innovation holds considerable potential for improving academic and organisational performance in higher learning institutions. However, institutional constraints particularly financial limitations, regulatory gaps, and human resource deficits significantly moderate this potential in the Tanzanian context. The study reveals that while AI adoption can mediate the relationship between institutional resources and performance outcomes, this mediating role remains underdeveloped due to systemic barriers.

To fully benefit from AI technologies, Tanzanian institutions must strengthen policy frameworks specifically addressing AI governance and ethics, invest strategically in human and technological capacity building, and foster a culture of innovation that embraces rather than resists technological change. Future research should employ empirical methods, including mixed-methods approaches and longitudinal studies, to test the proposed relationships in different higher education contexts within Tanzania and comparable developing countries.

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