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Technological Advancements Facilitating Lifelong Learning: A Systematic Literature Review of Practical Implementation in Tanzania

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Abstract

This paper examines technological advancements facilitating lifelong learning (LL) in Tanzania. It collects information from reliable sources like academic articles, government reports and policy papers. It explored databases such as Google Scholar, JSTOR, ScienceDirect, Scopus, ERIC, Wiley Online Library, MDPI, official government and organisational repositories and websites. Searching terms combined keywords and Boolean operators such as "LL" and "Tanzania" and "technology" or "technological advancements" and "LL and practical implementation". The inclusion criteria included published literature between May 2015 and May 2025, focusing on LLL relevant to the Tanzanian context; and discussions of technological advancements and practical implementation of LL. The exclusion criteria included literature not based on Tanzanian context, publications without a clear connection to technological advancements and LL and publications that are in Non-English language. The revealed technological advancements for

LL implementation include Education Reforms and Policy Changes, Integration of ICT in Education, E-Learning and Open and Distance Learning, AI and Adaptive Learning Technologies, Community Learning Spaces and Folk Development Colleges, Technical and Vocational Education and Training and STEM Education, Youth Empowerment through Innovation, and Teacher Professional Development. The review recommends for continuous strategic investments, policy reforms and stakeholders' collaboration for more technological advancements in facilitating LL.
Keywords: *Lifelong Learning, Technological Advancements, Practical Implementation*

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Introduction

The increasing pace of global socio-economic change has made continuous skills development and knowledge acquisition more important than ever. This growing demand is largely driven by rapid technological advancements, shifting labour market requirements, and the broader transition towards knowledge-based economies (OECD, 2021; World Bank, 2023). As a result, education systems across the world are gradually moving away from traditional, front-loaded models of learning towards more flexible and inclusive approaches that support learning throughout life (UNESCO, 2021; UNESCO, 2022). Within this evolving landscape, lifelong learning (LL) has become a central framework for enabling individuals to remain adaptable, employable, and actively engaged in society (Schuller & Desjardins, 2022; World Bank, 2023).

Lifelong learning is commonly understood as the continuous, voluntary, and self-driven pursuit of knowledge and skills for personal, professional, and societal development across the lifespan (European Commission, 2020; OECD, 2021). Beyond this definition, the concept is rooted in several complementary theoretical traditions.

From a humanistic perspective, it emphasizes personal growth and self-fulfilment; from a human capital perspective, it supports productivity and labour market competitiveness; and from a social justice perspective, it promotes inclusion, equity, and meaningful participation in society (UNESCO, 2021; Schuller & Desjardins, 2022). Taken together, these perspectives underscore the idea that lifelong learning is not confined to formal education systems, but rather extends across all dimensions of everyday life.

In practice, lifelong learning takes many forms and unfolds across a range of interconnected domains. These include continuous professional development (CPD), workplace learning, community-based learning, intergenerational learning, and the recognition of prior learning (RPL) (UNESCO, 2021; OECD, 2021). More recently, global discussions have also highlighted the concept of "learning cities," where opportunities for learning are embedded within social, economic, and institutional structures (UNESCO, 2021). Such perspectives illustrate that lifelong learning is not a single pathway, but a dynamic and integrated process that cuts across formal, non-formal, and informal learning environments.

At the same time, technological advancements have increasingly become a key driver in expanding and reshaping lifelong learning opportunities. In this study, technological advancements are understood as the development and application of digital and emerging technologies that enhance access to, delivery of, and engagement in learning processes. These include learning management systems (LMS), mobile learning technologies, open educational resources (OER), Massive Open Online Courses (MOOCs), artificial intelligence (AI)-based tools, and the broader digital infrastructure that supports them (OECD, 2021; UNESCO, 2021; Nkuyubwatsi, 2022). From a theoretical perspective, these developments can be linked to connectivism, which views learning as a networked process shaped by digital connections and information flows (Siemens, 2022). In practical terms, such technologies have

made learning more flexible, accessible, and responsive to individual needs, while also helping to overcome longstanding barriers related to time, cost, and geographical location (De Witt *et al.,* 2023; OECD, 2021; UNESCO, 2022).

In Tanzania, efforts to integrate technology into education and lifelong learning are closely tied to broader national development priorities. Policy frameworks such as the Tanzania Development Vision 2025, the National Five-Year Development Plan III (2021/22–2025/26), and the Education and Training Policy (ETP) of 2014 (Version 2023) all emphasize the importance of education, skills development, and digital transformation in driving socio-economic progress (United Republic of Tanzania, 2021; Ministry of Education, Science and Technology, 2023). These policies promote inclusive, competency-based, and technology-enabled learning systems that support individuals at different stages of life. Complementary initiatives, including the Digital Tanzania Project, further aim to strengthen digital infrastructure, expand connectivity, and enhance digital skills across the country, thereby creating a more supportive environment for lifelong learning (World Bank, 2023).

Reflecting these policy directions, Tanzania has made notable progress in adopting technological innovations across various areas of lifelong learning. These developments can be seen in ongoing education reforms, the integration of ICT in teaching and learning, the expansion of e-learning and open and distance learning (ODL), and the gradual introduction of artificial intelligence and adaptive learning technologies. Additional efforts include the revitalization of community learning spaces such as Folk Development Colleges (FDCs), the strengthening of Technical and Vocational Education and Training (TVET) and STEM education, the emergence of youth innovation hubs, and the digitalization of teacher professional development through platforms such as MEWAKA (Mtebe & Raphael, 2021; Makulilo, 2021; Kisanga & Mtebe, 2022; Makulilo *et al.,* 2023). Together, these initiatives point to a growing recognition of

the role that technology can play in widening access to learning opportunities and supporting diverse learning needs (Nkuyubwatsi, 2022).

Despite these encouraging developments, the practical implementation of technology-enhanced lifelong learning in Tanzania remains uneven. A number of persistent challenges continue to limit its effectiveness, including gaps in digital infrastructure particularly in rural areas with low levels of digital literacy among both learners and educators, and limited integration of technology into teaching practices (Mtebe & Raphael, 2021; Ngeze, 2021; Lwoga, 2022; Makulilo, 2021). In addition, issues such as inadequate localised content, institutional readiness constraints, and unequal access to digital resources further complicate efforts to scale and sustain these initiatives (Kalinga *et al.,* 2020; Marandu & Lwoga, 2021). As a result, while the potential of technological advancements is widely acknowledged, their impact on lifelong learning in Tanzania has not yet been fully realized (Nkuyubwatsi, 2022).

Although a growing body of literature documents various technology-supported learning initiatives in Tanzania, including mobile-based programmes, digital skills training, and e-learning platforms (Kisanga & Mtebe, 2022; Makulilo *et al*., 2023; Mnyanyi, 2023), these studies tend to be fragmented and context-specific. There remains limited synthesized evidence that brings together these experiences to provide a clearer picture of how technological advancements are being implemented across different lifelong learning domains, and how sustainable and scalable these efforts are in practice (Mtebe & Raphael, 2021). This gap presents a challenge for policymakers and practitioners seeking to design interventions that are both contextually relevant and effective.

Against this background, this study employs a systematic literature review to examine how technological advancements are facilitating the practical implementation of lifelong learning in Tanzania. Specifically, the study aims to: (i) identify key technological advancements supporting lifelong learning; (ii) analyse how these technologies are applied across different lifelong learning domains; and (iii) assess the opportunities and challenges associated with their implementation. By synthesizing existing

evidence, the study seeks to contribute to a more coherent understanding of how technology can be effectively leveraged to strengthen lifelong learning systems and support inclusive and sustainable development in Tanzania.

Methodology

Guideline and Research Design

This study employed a systematic literature review (SLR) methodology to explore and synthesise empirical evidence on the practical implementation of technological advancements in facilitating LL in Tanzania. The review followed internationally recognised guidelines for systematic reviews, particularly the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (Page *et al.,* 2021), to ensure rigour, transparency, and reproducibility.

The SLR was designed to identify, appraise, and synthesise peer-reviewed and grey literature published between May 2015 and May 2025. The study focused specifically on literature that reports on practical applications of advanced technologies that support LL in the Tanzanian context. Both qualitative and quantitative studies were considered to capture a holistic view of implementation dynamics.

Searching Strategy and Terms

The SLR is used as a comprehensive search, which was conducted using some search engines and academic databases. These search engines and data bases are JSTOR, ScienceDirect, Scopus, ERIC (Resources Education Information Centre), Wiley Online Library, MDPI (Multidisciplinary Digital Publishing Institute), and African Journals Online (AJOL). In addition, it utilised Google Scholar, official government and organisational repositories and websites for grey literature.

The search terms were derived from the research question "*what are the technological advancements which facilitate practical implementation of LL in Tanzania in the period between May, 2015 and May, 2025?*" using Boolean operators to combine keywords. These include ("lifelong learning" OR "continuing education" OR "adult education") AND ("technology" OR "ICT" OR "digital learning" OR "e-learning" OR "mobile learning") AND ("Tanzania"). In addition, the synonyms and variations of key terms were included to broaden the search scope. The final list of included studies was compiled after removing duplicates.

Inclusion and Exclusion Criteria

The inclusion criteria included literature published between May 2015 and May 2025; focus on LL relevant to the Tanzanian context; empirical research (qualitative, quantitative, or mixed methods) and discussions of technological advancements and practical implementation of LL in Tanzania. Finally, the grey literature with credible institutional affiliation (e.g. reports from United Nations, UNESCO, World Bank, OECD, policies and plans from MoEST) were also considered.

The exclusion criteria includes literature not based on Tanzanian context; publications without a clear connection to technological advancements and practical implementation of LL in Tanzania; and publications that are in Non-English language. Besides, the literature focused exclusively on pre-primary or primary education without LL linkage. The editorials, opinion pieces, or non-empirical reviews were likewise not considered.

Data Extraction and Management

A data extraction matrix was developed in Microsoft Excel to systematically capture key information from each selected study. The extracted data included the author(s) and year of publication, study location and target population, type of technology used, form of learning (formal, non-formal, or informal), implementation strategies, key findings and outcomes, as well as identified barriers and enabling factors.

To ensure consistency and reduce potential bias, data extraction was carried out independently by two reviewers, both of whom are the authors of this study and have experience in educational technology and lifelong learning research. Before proceeding with the full extraction, the data extraction template was piloted on a small number of studies to check for clarity and consistency in how information was interpreted and recorded.

Once the independent extraction was completed, the reviewers compared their entries and discussed any differences that arose. Where discrepancies occurred, these were resolved through careful discussion, with reference back to the original studies to ensure accurate interpretation. Agreement was reached through consensus in all cases. This process strengthened the reliability and transparency of the data extraction and helped to ensure that the synthesis was based on a consistent and well-validated dataset.

Quality Appraisal

The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) (Hong *et al.,* 2018). This tool was considered appropriate given the diversity of study designs included in the review, as it allows for the consistent appraisal of qualitative, quantitative, and mixed-methods research within a single framework. Each study was examined against five key criteria: the clarity of research objectives, relevance to the study context, appropriateness of data collection methods, rigour of analysis, and the validity of conclusions drawn.

To strengthen the reliability of the appraisal process, two reviewers independently assessed all studies. Each criterion was rated as "Yes," "No," or "Cannot tell," in line with MMAT guidelines. After the independent assessments, the reviewers compared their evaluations and resolved any differences through discussion, referring back to the original studies where necessary to ensure accuracy. Studies meeting at least three of the five criteria were considered to be of acceptable methodological quality and were retained for inclusion in the final synthesis. A summary of the appraisal outcomes is presented in Table X,

providing a clear and transparent overview of how each study performed across the MMAT criteria.

Table 1: Quality Appraisal of Included Studies Using MMAT (n = 60)

No	Author(s) & Year	Study Design	Clarity	Relevance	Data Collection	Analysis Rigour	Valid Conclusions	Score
1	Kisanga & Mtebe (2022)	Qualitative	Yes	Yes	Yes	Yes	Yes	5
2	Makulilo *et al.* (2023)	Mixed Methods	Yes	Yes	Yes	Yes	No	4
3	Mtebe & Raphael (2021)	Review	Yes	Yes	Yes	Yes	Yes	5
4	Ngeze (2021)	Qualitative	Yes	Yes	Yes	No	Yes	4
5	Lwoga (2022)	Qualitative	Yes	Yes	Yes	Yes	Yes	5
6	Kalinga *et al.* (2020)	Quantitative	Yes	Yes	Yes	Yes	No	4
7	Marandu & Lwoga (2021)	Quantitative	Yes	Yes	Yes	Yes	Yes	5
8	Makulilo (2021)	Policy Analysis	Yes	Yes	Yes	Yes	Yes	5
9	Nkuyubwatsi (2022)	Mixed Methods	Yes	Yes	Yes	Yes	Yes	5
10	Chigona *et al.* (2022a)	Quantitative	Yes	Yes	Yes	Yes	Yes	5
11	Chigona *et al.* (2022b)	Quantitative	Yes	Yes	Yes	Yes	Yes	5
12	Kafyulilo *et al.* (2020)	Quantitative	Yes	Yes	Yes	No	Yes	4
13	Mbambo & Du Plessis (2023)	Mixed Methods	Yes	Yes	Yes	Yes	Yes	5
14	Mushi (2020)	Historical Review	Yes	Yes	Yes	Yes	Yes	5
15	Institute of Adult Education (2022)	Report	Yes	Yes	Yes	Yes	Yes	5

No	Author(s) & Year	Study Design	Clarity	Relevance	Data Collection	Analysis Rigour	Valid Conclusions	Score
16	Tanzania Institute of Education (2023)	Report	Yes	Yes	Yes	Yes	Yes	5
17	United Republic of Tanzania (2021)	Policy	Yes	Yes	Yes	Yes	Yes	5
18	Ministry of Education, Science and Technology (2023)	Policy	Yes	Yes	Yes	Yes	Yes	5
19	UNESCO (2021)	Report	Yes	Yes	Yes	Yes	Yes	5
20	UNESCO (2022)	Report	Yes	Yes	Yes	Yes	Yes	5
21	OECD (2021)	Report	Yes	Yes	Yes	Yes	Yes	5
22	World Bank (2023a)	Report	Yes	Yes	Yes	Yes	Yes	5
23	World Bank (2023b)	Report	Yes	Yes	Yes	Yes	Yes	5
24	De Witt et al. (2023)	Review	Yes	Yes	Yes	Yes	Yes	5
25	Siemens (2022)	Conceptual	Yes	Yes	Yes	Yes	Yes	5
26	Schuller & Desjardins (2022)	Theoretical	Yes	Yes	Yes	Yes	Yes	5
27	Amemasor *et al.* (2025)	Systematic Review	Yes	Yes	Yes	Yes	Yes	5
28	Bhalalusesa *et al.* (2021)	Qualitative	Yes	Yes	Yes	No	Yes	4
29	COSTECH (2022)	Report	Yes	Yes	Yes	Yes	Yes	5
30	Darling-Hammond *et al.* (2024)	Review	Yes	Yes	Yes	Yes	Yes	5
31	European Commission (2020)	Policy	Yes	Yes	Yes	Yes	Yes	5

No	Author(s) & Year	Study Design	Clarity	Relevance	Data Collection	Analysis Rigour	Valid Conclusions	Score
32	Global Partnership for Education (2022)	Report	Yes	Yes	Yes	Yes	Yes	5
33	ITU (2022)	Report	Yes	Yes	Yes	Yes	Yes	5
34	Kavula (2025)	Policy Analysis	Yes	Yes	Yes	Yes	Yes	5
35	Kimhi & Bar-Nir (2025)	Review	Yes	Yes	Yes	Yes	Yes	5
36	Kutija & Ryan (2023)	Review	Yes	Yes	Yes	Yes	Yes	5
37	Mtebe *et al.* (2023)	Mixed Methods	Yes	Yes	Yes	Yes	Yes	5
38	Mtebe & Raisamo (2020)	Quantitative	Yes	Yes	Yes	No	Yes	4
39	Mnyanyi (2023)	Quantitative	Yes	Yes	Yes	No	Yes	4
40	Msambwa & Daniel (2024)	Systematic Review	Yes	Yes	Yes	Yes	Yes	5
41	Raphael (2025)	Systematic Review	Yes	Yes	Yes	Yes	Yes	5
42	Thwe & Kalman (2024)	Systematic Review	Yes	Yes	Yes	Yes	Yes	5
43	Juma & Mwila (2024)	Quantitative	Yes	Yes	Yes	Yes	Yes	5
44	Machemba & Biswal (2024)	Review	Yes	Yes	Yes	Yes	Yes	5
45	Nemes (2025)	Review	Yes	Yes	Yes	Yes	Yes	5
46	Kalolo (2025)	Policy Review	Yes	Yes	Yes	Yes	Yes	5
47	Machumu (2025)	Conceptual	Yes	Yes	Yes	Yes	Yes	5
48	Kotimäki (2025)	Qualitative	Yes	Yes	Yes	Yes	Yes	5

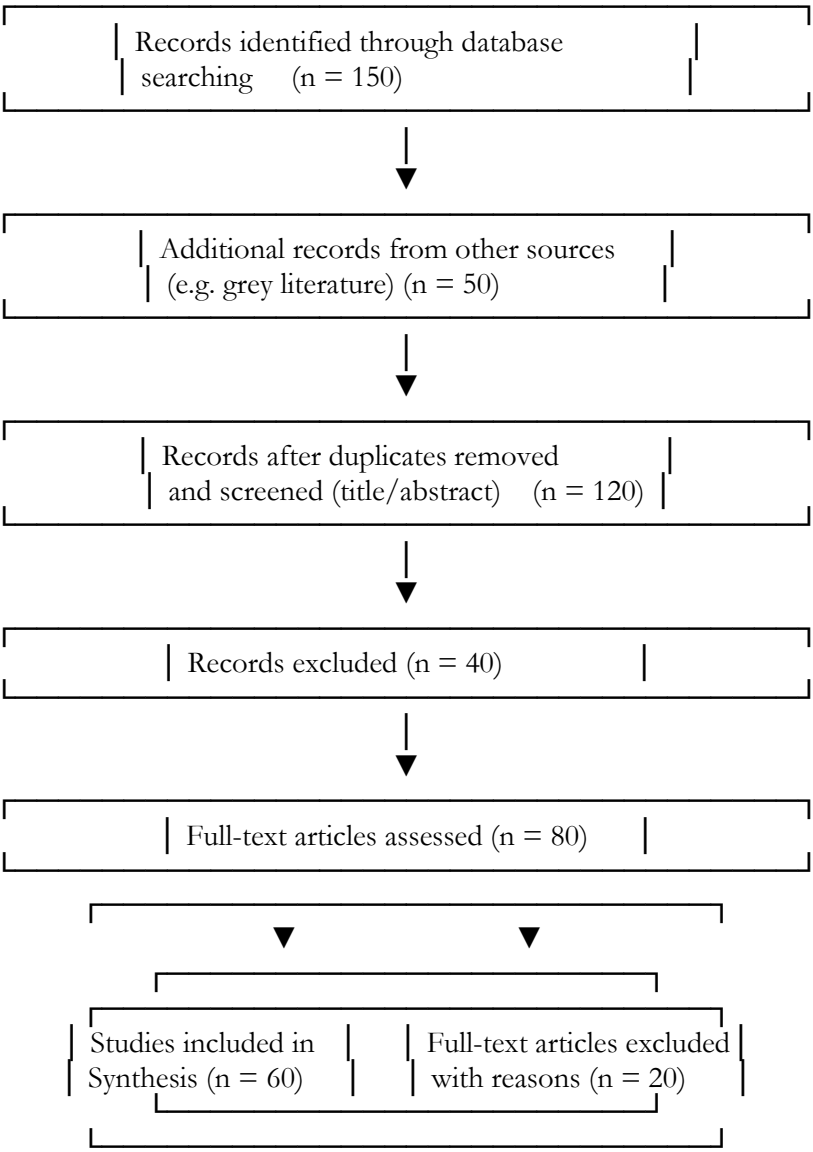
No	Author(s) & Year	Study Design	Clarity	Relevance	Data Collection	Analysis Rigour	Valid Conclusions	Score
49	do Nascimento & Valdés-Cotera (2018)	Report	Yes	Yes	Yes	Yes	Yes	5
50	Håkansson Lindqvist *et al.* (2024)	Review	Yes	Yes	Yes	Yes	Yes	5
51	Ng'umbi & Sanga (2025)	Book/Review	Yes	Yes	Yes	Yes	Yes	5
52	Maluleke (2025)	Systematic Review	Yes	Yes	Yes	Yes	Yes	5
53	Ambele et al. (2024)	Mixed Methods	Yes	Yes	Yes	Yes	Yes	5
54	Barakabitze *et al.* (2019)	Mixed Methods	Yes	Yes	Yes	Yes	Yes	5
55	Odularu (2025)	Review	Yes	Yes	Yes	Yes	Yes	5
56	Chasubuta (2023)	Case Study	Yes	Yes	Yes	Yes	Yes	5
57	Palmer (2020)	Review	Yes	Yes	Yes	Yes	Yes	5
58	Fulgence (2022)	Qualitative	Yes	Yes	Yes	Yes	Yes	5
59	Mwinuka & Farrelly (2023)	Qualitative	Yes	Yes	Yes	Yes	Yes	5
60	Ziraba *et al.* (2020)	Systematic Review	Yes	Yes	Yes	Yes	Yes	5

Data Synthesis

A thematic synthesis approach was employed to analyse and organise findings. Thematic coding was conducted using NVivo software, categorising evidence into thematic areas such as types of technologies deployed; learning modalities (mobile, online, blended); implementation strategies; barriers and challenges; success factors and outcomes. Narrative synthesis was used to present recurring patterns, contextual insights, and policy implications as shown in Figure 1.

Figure 1: PRISMA Flow Diagram (Textual Representation)

Identification



Results and Discussion

Drawing on the study objectives, namely to identify key technological advancements supporting lifelong learning (LL), examine how these technologies are applied across different learning domains, and assess the opportunities and challenges shaping their implementation, this section presents and reflects on the main findings of the review.

Generally, the evidence suggests that Tanzania has made meaningful progress in integrating technological innovations into its learning systems. As indicated in the reviewed literature, eight interrelated areas stand out: education reforms and policy changes; ICT integration; e-learning and open and distance learning (ODL); artificial intelligence (AI) and adaptive technologies; community learning spaces and Folk Development Colleges (FDCs); TVET and STEM education; youth innovation ecosystems; and teacher professional development through platforms such as MEWAKA.

While these developments point to a clear shift toward more flexible and inclusive learning pathways, a closer reading of the literature reveals a more complex picture. Progress is evident, but uneven. Across the themes, the benefits of technology are often shaped, and sometimes constrained, by broader issues such as infrastructure gaps, institutional capacity, and socio-economic inequalities. The discussion that follows therefore moves beyond describing what exists, to consider how and how well these developments are working in practice.

Education Reforms and Policy Changes

Tanzania's recent policy reforms signal a deliberate move toward embedding lifelong learning within the education system. The Education and Training Policy (ETP) of 2014, revised in 2023, is particularly important in this regard, as it frames education as a continuous and inclusive process rather than a one-time experience (URT, 2023). Its emphasis on competency-based approaches, flexibility, and technology integration reflects a broader effort to align

education with changing socio-economic realities (Sumra and Katabaro, 2018).

From a critical standpoint, these reforms provide a strong policy foundation for LL. They recognise diverse learning pathways and respond to global agendas such as SDG 4 (UNESCO, 2021). At the same time, the literature suggests that translating policy into practice remains a challenge. Issues such as persistent skills mismatches, limited institutional capacity, and weak implementation mechanisms continue to affect outcomes (Ngure and Nasongo, 2020). In this sense, policy reform can be seen as a necessary starting point rather than a complete solution. Its impact depends on how effectively it is supported by resources, institutional readiness, and continuous monitoring. Without this, there is a risk that ambitious policy goals remain largely aspirational.

Integration of ICT in Education

The integration of ICT is one of the most visible expressions of technological advancement in Tanzania's education system. National initiatives, including the ICT Policy (2016) and ICT4D agenda, have played a key role in expanding digital infrastructure and shaping the direction of technology use in both formal and community-based learning settings (Makulilo, 2021). Programmes such as TEMIS and the National Broadband Strategy have further supported access to connectivity and digital tools (Chigona *et al*., 2022).

In practice, ICT is being used across a range of learning contexts, from classroom teaching and teacher professional development to adult and distance learning. Platforms like MEWAKA illustrate how digital tools are supporting continuous teacher learning (MoEST, 2024; Mtebe *et al.,* 2023). Mobile technologies have also opened up new possibilities for learners who may not be able to engage in full-time, formal education (Mtebe and Raphael, 2021).

However, the benefits of ICT integration are not evenly distributed. The literature consistently highlights disparities between urban and rural

areas, with rural institutions facing significant constraints related to infrastructure, access to devices, and digital skills (Kafyulilo et al., 2020; Lwoga, 2022). Additional barriers such as the cost of connectivity and limited locally relevant content further complicate effective use. This suggests that ICT integration is not simply a technical issue. It is closely tied to broader questions of equity and inclusion. Without deliberate efforts to address these disparities, digital expansion may widen rather than reduce existing gaps.

E-Learning and Open and Distance Learning (ODL)

E-learning and ODL have expanded rapidly in recent years, particularly in response to the disruptions caused by the COVID-19 pandemic (UNESCO, 2021; MoEST, 2022). Institutions such as the Open University of Tanzania and the University of Dodoma have strengthened their digital learning systems, making use of platforms such as Moodle, Zoom, and Google Meet (Kalinga *et al.,* 2020; Marandu and Lwoga, 2021).

These developments have made learning more flexible and accessible, especially for adult learners and those balancing education with work or other responsibilities (Lwoga, 2022). In this respect, ODL represents a clear example of how technology can extend learning opportunities beyond traditional classroom settings.

At the same time, the literature highlights several challenges that limit its effectiveness. These include low levels of digital literacy, limited technical support, unreliable connectivity, and uneven institutional capacity (UNESCO, 2022; MoEST, 2022; Kafyulilo *et al*., 2020). Such factors affect not only access, but also the quality and consistency of learning experiences.

While the pandemic accelerated adoption, it also exposed underlying weaknesses. The key issue moving forward is not simply expanding access to digital platforms, but ensuring that these systems are sustainable, well supported, and capable of delivering meaningful learning outcomes.

Artificial Intelligence and Adaptive Learning Technologies

Artificial intelligence and adaptive learning technologies are gradually emerging as new frontiers in LL. Their potential lies in enabling more personalised learning experiences through data-driven insights and real-time feedback (OECD, 2021; UNESCO, 2022).

In Tanzania, these technologies are still at an early stage of adoption, with initial efforts led by institutions such as COSTECH and emerging research initiatives (Mtebe and Raphael, 2022; Kavula, 2025; Ponera and Madila, 2024). Where applied, they show promise in areas such as ODL, teacher development, and skills training (Mbambo and Du Plessis, 2023).

However, the literature also points to significant barriers. These include limited infrastructure, low data capacity, shortage of expertise, and concerns related to ethics and data privacy (OECD, 2021; UNESCO, 2022; MoEST, 2023). This suggests that the value of artificial intelligence does not lie in the technology itself, but in how it is implemented. Without appropriate safeguards and supporting systems, its benefits may remain limited or unevenly distributed.

Community Learning Spaces and Folk Development Colleges

Folk Development Colleges and community learning centres continue to play an important role in extending learning opportunities to underserved populations (Institute of Adult Education, 2022; Mushi, 2020). Their recent digital transformation, through blended learning approaches, solar-powered labs, and mobile content, has enhanced access, particularly in rural areas (Tanzania Institute of Education, 2023; Ndimbo *et al.,* 2019).

These spaces are particularly valuable in non-formal learning contexts, offering training in areas such as entrepreneurship, agriculture, and digital literacy. They demonstrate how technology can be adapted to local contexts to support inclusive learning.

However, their impact is often constrained by practical challenges, including limited funding, staffing shortages, and weak institutional

support (Mushi, 2020). Many initiatives rely on short-term projects rather than long-term systems. For these centres to realise their full potential, greater emphasis is needed on sustainability, coordination, and integration within broader education policies.

Technical and Vocational Education and Training and STEM Education

The integration of digital technologies into TVET and STEM education reflects efforts to equip learners with relevant, future-oriented skills (NACTVET, 2023; UNESCO, 2022). Tools such as simulation labs and online learning platforms have enhanced practical training and expanded learning opportunities (Mwanjelwa *et al.,* 2023).

These developments are important for lifelong learning, particularly in supporting continuous skill development and employability. However, challenges remain, including limited funding, shortage of qualified instructors, and misalignment between training and labour market needs (UNESCO, 2022). Regional disparities also persist, with rural institutions facing greater constraints in accessing digital resources (NACTVET, 2023). This highlights the need for more coordinated and inclusive approaches to ensure that technological advancements benefit all learners.

Youth Empowerment through Innovation

Innovation hubs and youth labs have become important spaces for informal learning, particularly in areas such as digital skills, entrepreneurship, and problem-solving (UNDP, 2023; COSTECH, 2022). Initiatives such as Silicon Dar and Buni Hub provide opportunities for young people to engage with real-world challenges and develop practical skills (Mosha and Mhando, 2020; Mtega *et al.,* 2021).

These spaces reflect more dynamic and participatory forms of learning, often grounded in collaboration and experimentation. They also help bridge the gap between education and employment.

However, their reach remains limited. Many initiatives are concentrated in urban areas and depend heavily on external funding, raising questions about sustainability and inclusivity. Expanding these opportunities will require stronger integration with national policies and deliberate efforts to reach underserved populations.

Teacher Professional Development

Teacher professional development is central to the success of technology-enhanced learning systems (Kutija and Ryan, 2023; Darling Hammond et al., 2024; Amemasor et al., 2025; Kimhi and Bar Nir, 2025). The MEWAKA platform represents a significant step toward providing continuous, accessible professional development for teachers (MoEST, 2023; Tanzania Institute of Education, 2023).

Evidence suggests that MEWAKA has improved teachers' confidence and use of ICT in classrooms (Mtebe *et al.,* 2023). Its alignment with national policy further reinforces its importance in strengthening LL among educators.

At the same time, challenges such as limited connectivity, uneven digital skills, and access constraints continue to affect participation and impact (Lwoga, 2022). This highlights the need for complementary support systems, including infrastructure development and ongoing training, to ensure that such platforms are effective and inclusive.

Therefore, the findings highlight both the promise and the complexity of using technology to advance lifelong learning in Tanzania. While technological advancements have expanded access and created new learning pathways, their impact remains uneven and closely tied to broader structural conditions. A key insight emerging from the review is that technology, on its own, is not a solution. Its effectiveness depends on how well it is integrated into existing systems, supported by policy, and adapted to local contexts. Eventually, strengthening lifelong learning in Tanzania will require not only continued technological innovation, but also sustained investment in

infrastructure, institutional capacity, and inclusive implementation strategies.

Conclusion

This systematic literature review suggests that technological advancements between 2015 and 2025 have played an important role in shaping the evolving landscape of lifelong learning (LL) in Tanzania, although their influence varies across contexts and remains uneven. Drawing on evidence from scholarly studies and national reports, the review identified eight interrelated areas of development, including education reforms and policy changes, integration of ICT in education, e-learning and open and distance learning (ODL), artificial intelligence and adaptive learning technologies, community learning spaces and Folk Development Colleges (FDCs), technical and vocational education and training (TVET) and STEM education, youth empowerment through innovation, and teacher professional development through platforms such as MEWAKA.

Generally, these developments point to a gradual shift toward more flexible and accessible learning opportunities. However, the evidence of impact should be interpreted with some caution. Much of the literature highlights improvements in access to digital tools, increased participation in online and blended learning, and growing engagement among educators and learners. At the same time, there is still limited empirical evidence demonstrating sustained improvements in learning outcomes, employability, or inclusion across different groups of learners. In many cases, the available evidence remains descriptive, with relatively few studies offering long-term or outcome-based assessments.

The review also shows that implementation is far from uniform. While some institutions and urban areas have made considerable progress, others continue to face persistent challenges related to infrastructure, digital skills, and institutional capacity. These disparities suggest that the benefits of technological advancements are not

evenly distributed, and that existing inequalities may continue to shape who is able to participate meaningfully in technology-enabled learning.

Questions of sustainability also emerge across the literature. A number of initiatives appear to be supported by short-term projects or external funding, which raises concerns about their continuity over time. In addition, newer technologies such as artificial intelligence are still in the early stages of adoption, with limited evidence of large-scale or sustained implementation within the Tanzanian context.

Therefore, the findings indicate that while technology is increasingly supporting the development of lifelong learning, its potential is yet to be fully realised. Strengthening its contribution will require greater attention to implementation, more consistent investment, and a stronger evidence base on what works in practice. In particular, there is a need for more longitudinal and context-sensitive research that can better capture the actual impact of technological interventions on learning and livelihoods.

Recommendations

The recommendations presented here are drawn directly from the patterns observed across the reviewed studies and are intended to reflect the practical realities identified in the analysis. Rather than offering broad or general suggestions, they focus on specific areas where the evidence consistently points to gaps in implementation, uneven outcomes, and concerns about sustainability.

A key finding of the review is the persistent disparity in access to digital infrastructure. While some institutions, particularly in urban areas, have made notable progress in integrating ICT and e-learning, others, especially in rural and community-based settings, continue to face challenges related to connectivity, access to devices, and digital skills. Addressing these disparities is essential if technological advancements are to support inclusive lifelong learning across different contexts.

The review also shows that digital platforms such as MEWAKA and other learning management systems have expanded opportunities for professional development and flexible learning. However, their effectiveness depends not only on access, but also on the ability of users and institutions to engage with them meaningfully. This points to the importance of sustained support in areas such as teacher training, technical assistance, and platform usability.

Another important observation concerns the sustainability of existing initiatives. Several studies indicate that promising interventions, particularly those related to community learning centres, innovation hubs, and ICT-based programmes, are often implemented as short-term or externally funded projects. This raises questions about their continuity and long-term impact. Strengthening their integration within national systems and institutional structures would help ensure that these initiatives are sustained beyond initial implementation phases.

The review further highlights that emerging technologies, including artificial intelligence and adaptive learning systems, are beginning to feature in the Tanzanian context, but their practical application remains limited. Current evidence suggests that their adoption is still at an early stage, with little documentation on long-term effectiveness. This calls for a cautious and context-sensitive approach that prioritises local capacity and clear implementation strategies.

Across all thematic areas, a recurring issue is the need for better coordination. Although relevant policies are in place, their implementation is often fragmented across institutions and initiatives. Greater alignment between policy frameworks, institutional practices, and on-the-ground interventions would enhance the overall effectiveness of technology-enabled learning.

These recommendations reflect a central insight emerging from the study: while technological advancements are creating new opportunities for lifelong learning in Tanzania, their impact ultimately depends on how well they are implemented, supported, and sustained within the broader education system.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this article titled *"Technological Advancements Facilitating Lifelong Learning: A Systematic Literature Review of Practical Implementation in Tanzania."* The study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. Furthermore, the authors confirm that there are no personal, professional, or institutional affiliations that may have influenced the interpretation or presentation of the findings.

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