Navigating Digital Literacy Skills within the Public Sector in Tanzania: A Gap to Achieve Sustainable Digital Economy

Herman Mandari[‡] & Justus Mwemezi[†]

Abstract

This study explores the digital literacy skills of public sector employees in Tanzania and examines how education levels and internet connectivity influence digital skills development. The research investigates the role of digital literacy in supporting a sustainable digital economy. A cross-sectional survey collected data from 594 employees across various public service institutions. A structured questionnaire assessed digital skills such as communication, creativity, critical thinking, information management, and problem-solving. The data were analyzed using descriptive statistics and the Partial Least Square Structural Equation Modeling (PLS-SEM) was used to identify the relationships between the variables. The findings reveal that employees with tertiary education and regular internet access demonstrated significantly higher proficiency in advanced digital skills. Education and internet access emerged as key factors supporting the development of these skills. Additionally, advanced digital skills such as information skills, critical thinking, and creativity were found to significantly impact the fostering of a sustainable digital economy. This study highlights the need for targeted educational programs and improved digital infrastructure to bridge the digital literacy gap in Tanzania's public sector. The results provide valuable insights for policymakers aiming to enhance the effectiveness of public services through digital transformation and contribute to the broader discourse on sustainable digital economies.

Keywords: Digital Skills; Digital Literacy; Sustainable Economy; Public employees; Tanzania
JEL classification Codes:O33, O43, Q56

[‡] Corresponding author, Department of Computer Science, Institute of Finance Management (IFM),P.O. Box 3918, Dar es Salaam, Tanzania, Email: mandariherman@gmail.com
[†] Department of Banking and Financial Services, Institute of Finance Management (IFM), P.O. Box 3918, Dar es Salaam, Tanzania, Email: jmwemezitz@gmail.com

1. Introduction

A sustainable digital economy holds immense force and significance in today's world. It has the potential to steer a nation out of crises and towards sustainable growth while also establishing goals and objectives that apply to large-scale digital economies (Xianbin and Qiong, 2021). According to the African Union (2020), digitalization is one of the critical developments transforming the world economy. Digitalization is considered an essential tool for driving the digital transformation of African economies. Using ICTs throughout all economic sectors is the most extensive aspect of the digital economy, comprising the digital sector and economic segments that are primarily digital and lack analogue counterparts (Chigona, 2024; Hanna, 2020). Digitalizing the economy requires digital literacy skills. Vodă et al. (2022) expressed digital literacy skills as the fundamental knowledge and abilities of digital content creation, safety, online communication and teamwork, information and data literacy, and problem-solving. The concept of digital literacy is further backed by Martin (2008), who provides a holistic meaning of digital literacy as the awareness, attitude, and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze, and synthesize digital resources. Most public services, including higher education, healthcare, and administration, demand digital skills. Nowadays, most jobs demand at least a basic level of digital abilities. This trend is expected to continue in this era of the fourth industrial economy supercharged by artificial intelligence technologies (Bratianu et al., 2020; Bruno et al., 2023).

Consequently, most businesses now demand digital skills that require workers to be more practical and relevant in their roles. According to Phuapan et al. (2016), worldwide changes leading to the emergence of digital industries would cause one in two current occupations to disappear by 2025. Businesses need to adopt a digital attitude and increase the number of positions requiring innovation, growth, technology, creative ideas, and high productivity (Manana and Mawela, 2022). The extent to which employees can use Information and Communication Technologies (ICTs) for different purposes and what they can do with them depends on their digital abilities (Van Laar et al., 2019). Due to rapid technological advancements, organizations must provide their staff with the requisite digital skills. Previous research also suggests that the ongoing digital skills gap is an issue for businesses in the digital economy (Manana and Mawela, 2022). The authors contend that there are many job openings in businesses across the globe, mainly for individuals with advanced digital abilities, but there is an issue with the lack of qualified candidates to fill the roles.

The public sector is vital in upskilling workers to offer services using ICT-based systems, and digital skills are necessary for increasing access to employment possibilities (GSMA, 2024). However, there is a growing disparity between the available digital infrastructure and its utilization in developing nations like Tanzania. This is primarily because government employees lack the necessary digital skills and are unfamiliar with the latest technologies, limiting their effectiveness in providing public services (Eurostat, 2021). The Tanzanian government is working to improve the country's digital economy. Findings from the 2020 Tanzania Youth Digital Summit indicate that 41percent of participants did not know the advantages of the Internet, and 99 percent felt that improving their digital abilities would help them advance in their careers (GSMA, 2023). Furthermore, Tanzania scored 3.3 out of 10, which indicates low digital skills and awareness, placing it 13th out of 26 African nations on the Digital Skills Gap Index (GSMA, 2023). According to Tanzania Digest (2023), just 1.7 percent of Tanzanian young people work in the digital economy, compared to 3.2 percent in Kenya and 5.6 percent in Nigeria. To reap the benefits of digital technology and improve public sector

performance, which can propel Tanzania's economic, social, and cultural growth, the digital literacy gap must be closed (Cetindamar et.al, 2021; Vyas & Jain, 2021).

Therefore, studies that help organizations understand the primary digital needs and which tend to participate more in professional training in the digital field are crucial for facilitating and streamlining the digital transformation process, especially in light of the increased political relevance associated with digital transformation and training in the public sector (Lopes et al., 2023). This research attempts to close a gap in the literature by exploring the role of digital literacy among employees in promoting a sustainable digital economy. Some research has examined public sector employees' adoption of digital skills (Lopes et al., 2023; Manana and Mawela, 2022; Vodă et al., 2022). Unlike previous studies, the current study has made the connection between the source of employees' digital abilities and how those skills affect the sustainability of the digital economy.

Thus, this study makes the case that firms should consider their employees' degree of digital literacy to support the digital economy's long-term viability. Furthermore, it is well-recognized that, depending on the circumstances of each nation, the architecture and preparation of the essentials that contribute to digital literacy vary widely (Vodă et al., 2022). Thus, the following research questions guide this study: (a) How does education level impact employees in digital literacy acquisition? (b) How does internet accessibility support the development of digital skills among workers in the public sector? and (c) How does digital literacy skills influence sustainable digital economies?

The rest of the paper is organized as follows: Section one provides the introduction, and section two discusses the literature review. The research methodology is discussed in section three, followed by the data analysis in section four**.** Sections five and six provide the results and the discussion of the paper**.** Finally, section seven explains the conclusion and directions for future research**,** where limitations are acknowledged, and suggestions for further exploration are provided.

2.0 Literature Review, Development of Hypothesis and Conceptual Model

2.1 Educational Levels and Digital Literacy Skills

The extant body of literature consistently indicates that various factors, such as education and income, significantly influence the adoption of digital technology and digitization. Studies reveal that demographic characteristics highly influence employment in the digital economy and digital literacy. Key characteristics influencing digital literacy skills are age, gender, education level, and prior use of smartphones and the internet (Nooorrizki et al., 2022). However, Zhang (2023) discovered that demographic criteria like gender, education level, or prior teaching experience do not influence instructors' digital literacy skills. Economic elements, including money and social standing, are identified in the study of Caglayan-Akay and Oskonbaeva (2022) as impacting digital work chances. However, the value of education is highlighted by its capacity to help people comprehend and analyze digital content, which is often necessary for the effective use of technology (Eastwood et al., 2019; Kitole et al., 2024). Compared to others with less education, personnel who have received formal education can better adapt to technology changes since they have the requisite abilities. Digital skills "require background knowledge, experience, practical know-how, and creativity," and educational solutions are essential (Vodă et al., 2022). Comprehending these factors is crucial in creating efficacious digital literacy education initiatives and advancing financial inclusivity. Therefore, it is hypothesized that:

H1: Levels of Education of employees positively influence their digital Literacy

2.2 Access to Technology and Digital Literacy Skills

Due to widespread digitization, many workers spend their time online using different Internet options. Joshkun et al. (2024) claim that internet access is essential for boosting digital literacy because of the COVID-19 pandemic limits and the widespread shift of institutions and businesses to remote work. Previous research indicates that internet access is necessary for the economy to digitize and that in order to turn nations into digital economies, efforts should be taken to increase internet access at the lowest possible level (Gautam et al., 2022; Van Deursen and Van Dijk, 2015). The study by Zhang (2023) showed a clear correlation between teachers' digital literacy and their access to technology. The high price of internet-enabled devices, low levels of digital literacy, mistrust and insufficient online privacy protections, and a lack of basic infrastructure, such as electricity to power digital devices, are major obstacles to digital adoption in Tanzania (GSMA, 2023). Additionally, Vuorikari et al. (2016) state that while introducing the European Digital Competence Framework (DigComp 2.0), they make it clear that using digital tools for information processing, communication, content creation, safety, or problem-solving is associated with having access to the internet. Thus, it is proposed that:

H2: Access to internet connectivity at workplaces positively influences digital literacy skills

2.3 Digital Literacy Skills and Sustainable Digital Economy

Various theoretical frameworks are presented in the literature on digital skills and literacy evaluation, providing insights into employees' digital competencies' multi-dimensional character. These frameworks emphasize the need for a comprehensive approach to digital literacy by classifying and analyzing digital abilities from various angles. This helps us understand how people interact and manage the increasingly digital environment (Bawden, 2008; Vuorikari et al., 2016). Digital literacy is divided into three categories: technological capabilities, cognitive skills, and ethical knowledge (Calvani et al., 2008). This three-way paradigm emphasizes the significance of adaptability to adjust to new technology contexts, critical thinking skills to assess information, and the ethical obligation to act responsibly when using digital surroundings. Similarly, other earlier research divided digital skills into technical, social, critical, and creative domains, highlighting the complexity of digital literacy and the need for a multifaceted approach. This strategy is in line with the body of research, which continuously highlights the significance of having a comprehensive understanding of digital literacy that extends beyond technical competence (Helsper and Eynon, 2013). Further elaborating on these concepts, Vodă et al. (2022) described digital literacy as a broad set of competencies encompassing information management, communication, content production, safety, and problem-solving.

According to Vuorikari et al. (2016), the European Digital Competence Framework (DigComp 2.0) offers a thorough inventory of the 21 competencies necessary for digital literacy. This framework significantly influences European policy and educational activities by outlining essential competencies and highlighting the necessity of ongoing learning and adaptation in response to quickly changing technologies. DigComp 2.0 aligns with the broad definition of digital literacy and its importance for social inclusion, career advancement, and personal growth by emphasizing competencies including digital identity management, content creation, and problem-solving. Furthermore, in creating the frameworks for digital literacy, Van Laar et al. (2019) identified seven

fundamental digital skills necessary for the modern workforce in their systematic examination of workers' 21st-century and digital competencies. Their research reveals gaps in the literature, especially regarding creativity, critical thinking, teamwork, and communication. To work effectively in a digital culture, employees must understand digital abilities like using touch screens, organizing information, and interacting via digital platforms (Baptista et al., 2020). According to Cetindamar Kozanoglu and Abedin (2021), intermediate abilities are helpful for various careers, especially ones that require digital technologies for certain activities. Examples of these abilities include content creation and digital marketing. For experts and managers in charge of advancing digital innovation inside companies, advanced competencies in cyber security, big data analytics, and programming are essential. These advanced digital talents are becoming increasingly in demand as firms undergo digital transitions, but they are challenging to find in the public sector. Moreover, Stordy (2015) refers to digital literacy as the competencies people or social groupings utilize to interact with digital technologies. A stronger correlation exists between increased digital literacy among employees and more efficient use of these technologies (Cetindamar and Abedin, 2021).

Employees with digital literacy can identify the potential of digital technologies and modify their behaviour to incorporate them into their everyday routines in novel ways. Employees undergoing a digital transformation in their businesses need to adapt to take advantage of the affordances that come with new technology (Qin, 2023). Comprehending the degree of digital literacy within a company enables managers to enhance these abilities, thus equipping their staff for forthcoming digital requirements. Organizations may cultivate a culture in which workers are viewed as critical thinkers and innovators who add to the competitive edge of the company rather than as mindless machines by investing in digital literacy (Cetindamar and Abedin, 2021). Employees who lack digital literacy may find it challenging to keep up with changes in the digital landscape, which could make it difficult for them to adopt new technologies like chatbots, which are becoming more and more integrated into daily operations in businesses (Dearborn and Meister, 2017; Manana and Mawela, 2022). Drawing from the previously described arguments and extant literature, this study formulated the subsequent conceptual model (Figure 1) and hypotheses:

H3a: Employees' communication and collaborative skills are positively related to the sustainability of the digital economy.
H3b: The creativity skills of employees are positively related to the sustainability of the digital economy.
H3c: Employees' critical thinking skills are positively related to the sustainability of the digital economy.
H3d: Information skills of employees are positively related to the sustainability of the digital economy.
H3e: Employees' problem-solving skills are positively related to the sustainability of the digital economy.
H3f: Employees' technical skills are positively related to the sustainability of the digital economy.

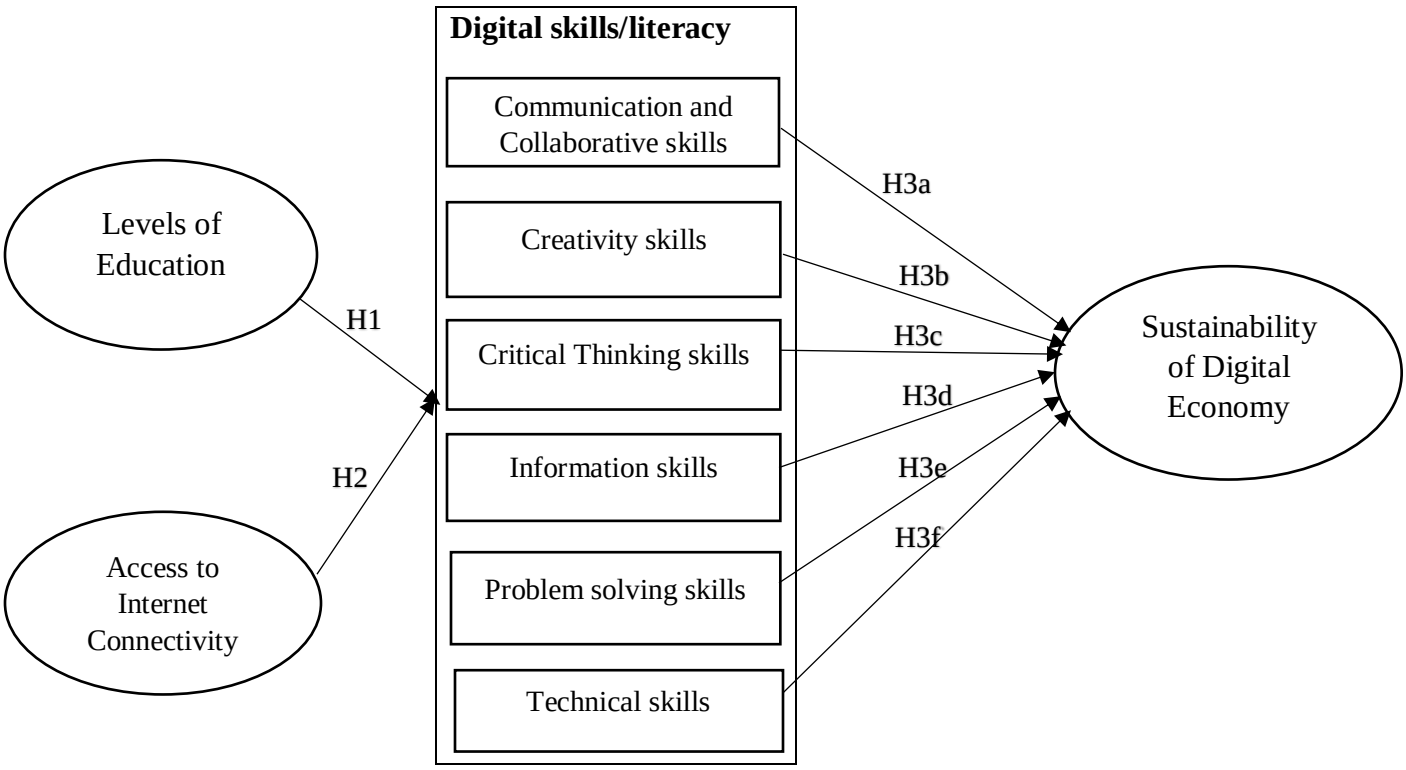

Figure 1: Proposed Conceptual Framework

3.0 Research Methodology

3.1. Research Instrument Development

The developed questions in the questionnaire were based on the elements considered in the conceptual model, as stipulated in Figure 1. Two factors were considered to ascertain the sources of employees' acquisition of digital skills: educational levels of education and internet connectivity. These were categorical variables that were constructed based on a multiple-answer question. The respondents were questioned about the kind of educational system through which they had learned digital abilities. The respondents' sources of digital skills accumulation are represented by the categorical variable, which has values of 1 for "primary education" (those who only mentioned primary school as the source of digital skills accumulation), 2 for "secondary education" (those who indicated that only secondary school was important in this aspect), 3 for "tertiary education" (those who mentioned only tertiary school), and between 4 and 6 for all combinations in between (4 = those who considered both primary and secondary school education as the sources of their digital skills; 5 = comprising the respondents who mentioned secondary and tertiary school as the source of their digital skills accumulation and 6 = those who considered all three levels of education as necessary in accumulating their digital skills). This study questioned the workers if their places of employment had internet connectivity. When a respondent selects "yes," a dichotomous variable receives the value "1," and when they select "no," the value is "0."

Using prior indicators from earlier studies,a Likert scale of five points, ranging from 1 (strongly disagree) to 5 (strongly agree), was used to rate the responses. Digital abilities related to communication and collaboration characterize an employee's capacity to cooperate with colleagues and effectively interact via digital platforms, including social media, email, and instant messaging

services. This study adopted six items from Vodă et al. (2022) for this construct. Creativity digital skills refers to the ability of employees to produce digital material based on their ideas and experiences. Six items modified from Vodă et al. (2022) were used to assess creativity. Digital critical thinking skills demonstrate an employee's capacity for introspection, opinion development, and evaluation of incoming web data. This digital competency demonstrates the worker's capacity to sort through and retrieve essential data while giving them a tangible setting and a reliable, long-lasting instrument. The six questions to test the critical thinking digital skills construct were modified by Vodă et al. (2022). The capacity of an employee to recognize, pick, and arrange digital information is referred to as information digital skills. The study adopted six items customized to measure this construct (Vodă et al., 2022),

An employee's capacity to handle issues in a digital setting is their problem-solving digital skills. The study modified six tasks from Vodă et al. (2022) to assess digital problem-solving abilities. Technical digital skills characterize an employee's aptitude for overcoming technological obstacles. Nine questions were modified from Vodă et al. (2022) to assess this construct. Lastly, a sustainable digital economy is frequently linked to environmental concerns. However, the broad connotation extends to other matters as well. According to Xianbin and Qiong (2021), the term "sustainable digital economy" describes digitalizing the economy to build on its vital strengths of innovation and business ecosystems. Four items modified by Xianbin and Qiong (2021) were used to assess the sustainability of the digital economy. Google form link was used to create an online version of the questionnaire (Jaiswal, 2024). The questionnaire contain one filtering question for filtering only public respondents was include to make sure that private and non-employes data are not included in data analysis.

3.2 Sample size

Tanzania Formal Sector Employment and Earnings Survey conducted on 2022/2023 indicates that the total public sector workforce comprises 1,140,446 employees (NBS, 2024). Given that the population size of public employee is known, the Yamane formula for finite population size was applied to determine an appropriate sample size. Based on a population of N = 1,140,446 and assuming a 5% margin of error, the calculated sample size is approximately 400 (Yamane, 1973).

3.3 Sampling and Data Collection

The study used a cross-sectional method to gather data from workers in various Tanzanian public service institutions, such as government ministries, local government authorities (LGAs), government agencies, and parastatals. To achieve this goal, a self-report questionnaire, the most widely used approach to assess digital abilities (Kuhlemeier and Hemker, 2007; Rodríguez-de-Dios et al., 2016). The Google form link was distributed via Whatsapp social media account to reach the intended respondents. Snowball sampling techniques was employed to identify targeted respondents for this study (Parker et al., 2019). The questionnaire link was shared with initial seeds which where identified by research assistants in different visited public institutions. The initial seeds were requested to share the same questionnaire with other coleague public employees and public employee social media accounts (Parker et al., 2019). Furthermore, physical copies of the questionnaire were also distributed to selected institutions to ensure inclusivity. This dual approach ensured comprehensive coverage and facilitated the participation of employees from diverse public service institutions across Tanzania.

3.4. Data Analysis

To analyse the collected data, this study have used IBM SPSS and structural equation modeling techniques (SEM). SEM has been adopted because it provide more acquarate predictive and take care of any measurement error on the analysis (Nachtigall et al., 2003). Since the study intents to predict the causal relationship between the digital skills and sustainable digital economy, the study has adopted partial least squares structural equation modeling (PLS-SEM) instead of Covariance Based structural equation modeling (CB-SEM)(Hair et al., 2019). IBM SPSS version 22 was used to data clean up and SmartPLS Version 4 was used for causal relationship analysis.

4. Results

4.1. Despondents' Characterististics

A set of data was received with a total of 663 respndents more than the required sample of 400. Nevertheless, after the data set was screened, a total of 594 responces were deemed complete and valid for subsequent data analyses. Table 1 provide participants' profiles in which 60 percent were male and most of the respondents are aged between 35 years and 44 years. Furthemore, most of the respondents are bachelor holders and 69 percent have access to internet on their workplace.

Table 1: Repondents Characteristics

Category	Groups	Frequency	Percentage (%)
Gender	Male	362	60.9
	Female	232	39.1
Age	18-24	92	15.5
	25-34	119	20.0
	35-44	146	24.6
	45-54	168	28.3
	Above 54	69	11.6
Education Level	Certificate	49	08.2
	Bachelor Degree	193	32.5
	Diploma	56	9.4
	Postgraduate	134	22.6
	Masters	162	27.3
Regular access to internet at workplace	Yes	410	69.0
	No	184	31.0

4.2. Levels of Education

The analysis revealed that education levels significantly impact employees' digital literacy in Figures 2 and 3. Employees with tertiary education showed higher proficiency in digital skills than those with only primary or secondary education. This finding supports the hypothesis (H1) that employees' education levels positively influence digital literacy. Vodă et al. (2022) similarly found that education is critical in equipping individuals with the necessary background knowledge to navigate digital environments effectively.

The respondents were asked to identify the educational level through which they primarily acquired digital skills. Overall, the results indicate that a significant of employees, about 70%, reported tertiary

education as the main source of their digital skills, 18% indicated secondary education, and 12% identified primary education. This distribution shows that higher levels of education are associated with more extensive digital skills accumulation, as employees with tertiary education demonstrated a higher proficiency in critical thinking, creativity, problem-solving and technical skills. This is consistent with prior studies indicating that education improves individuals' ability to comprehend and analyze digital content (Eastwood et al., 2019; Kitole et al., 2024). Furthermore, Vodă et al. (2022) argued that formal education settings, such as universities, provide structured opportunities to develop technical digital skills and cognitive and ethical dimensions of digital literacy.

However, it was also noted that employees with lower levels of education tend to rely more on basic digital skills, such as communication and collaboration, which are easier to acquire through informal means or workplace experiences. This suggests that while education is a crucial factor, there are alternative pathways to acquiring digital literacy, albeit for more basic competencies.

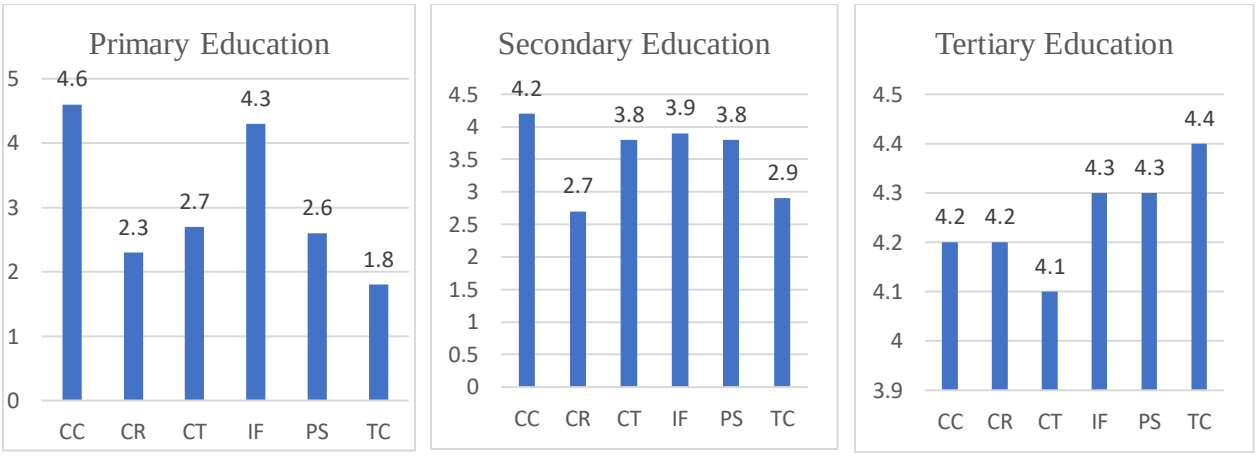

Figure 2: Primary, Secondary and Tertiary Education Skills

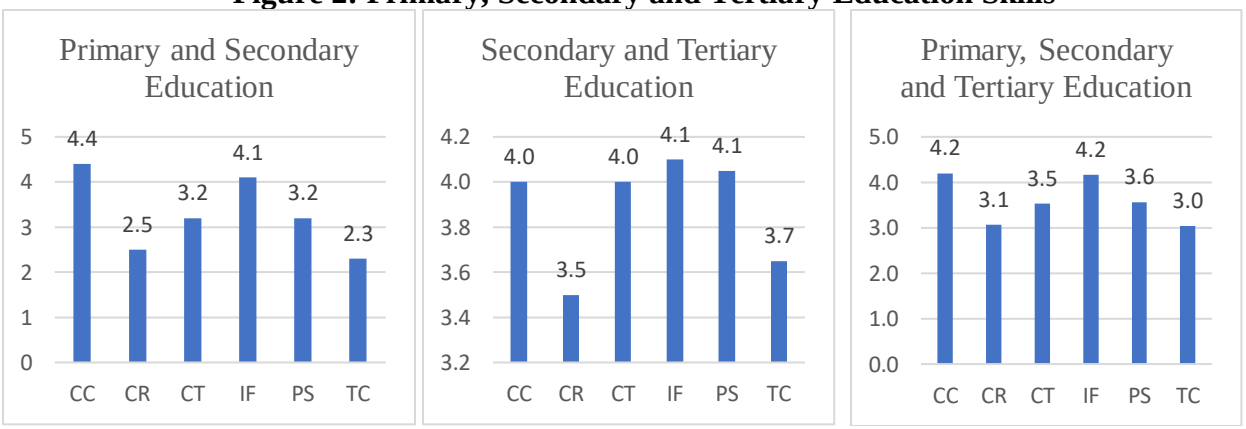

Figure 3: Primary, Secondary and all-level Skills

Key: CR: Creativity; CT: Critical Thinking; CC: Communication and Collaboration; PS: Problem-solving; IF: Information; TC: Technical; SDE: Sustainable Digital Economy

4.3 Access to Internet Connectivity

In Figure 4, access to internet connectivity at the workplace was also found to significantly influence digital literacy skills, supporting the second hypothesis (H2). Employees with access to the Internet were more likely to demonstrate higher proficiency in a range of digital skills, including information management and problem-solving. The analysis examined how access to internet connectivity at the workplace influenced digital skills accumulation. Approximately 69% of respondents reported having regular access to the Internet, and this group demonstrated significantly higher proficiency in information management, creativity, and problem-solving skills. In contrast, 31% of employees without internet access relied more on communication and collaboration skills, as shown in Figure 4. This aligns with the previous studies emphasizing that access to digital tools, such as the Internet, is fundamental for developing the ability to search for, evaluate, and apply digital content effectively for the sustainability of the digital economy (Manana and Mawela, 2022; Vodă et al., 2022). Our findings are also consistent with the literature, which suggests that internet access provides a broader range of opportunities to engage with diverse digital tools, thereby facilitating the development of more advanced digital competencies (Joshkun et al., 2024; Vuorikari et al., 2016). The lack of internet access hinders the ability to engage with new digital content and technologies, essential for cultivating more sophisticated skills, such as critical thinking and creativity. These results indicate that ensuring workplace internet access is crucial for developing comprehensive digital literacy among public sector employees. Without such access, individuals are restricted to basic digital functions, which limits their ability to participate fully in the digital economy. The digital divide caused by limited access to internet connectivity is also a significant barrier to equitable digital transformation, as highlighted by (GSMA, 2023)

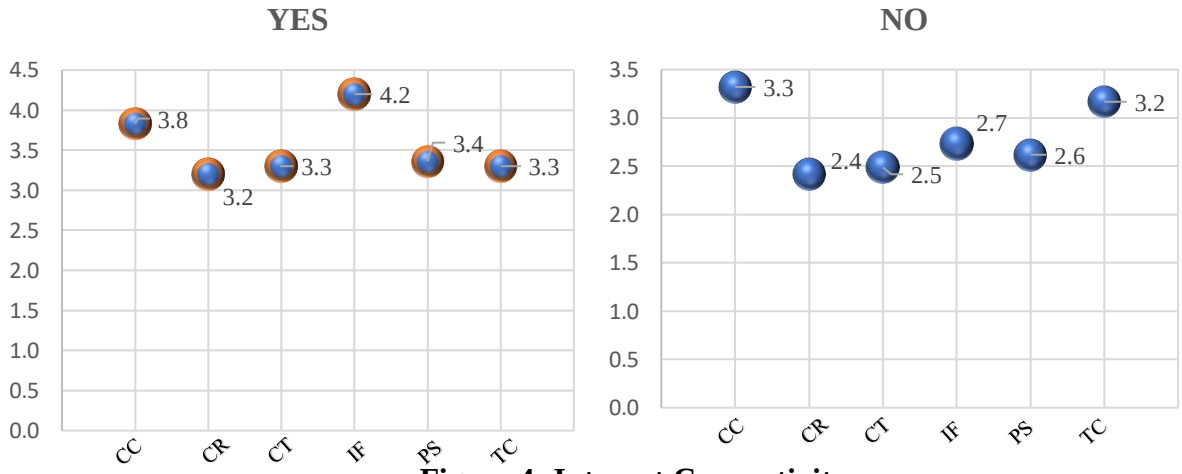

Figure 4: Internet Connectivity

4.4 Measurement Model Analysis

The study employed two-step data analysis to examine the model's reliability and validity and conduct path analysis. Table 2 shows the factor loadings, composite reliability (CR) and average variance extracted (AVE) values which are considered in examining the measurement model. Only items with factor loadings above 0.7 were retained as suggested by Henseler et al. (2015) except for items SDE3, TC2, and TC3, with loadings of 0.632, 0.661, and 0.657 respectively as per recommendation from Gefen and Straub (2005). The findings from this study show that all Cronbach alpha is greater than 0.7, which is the recommended threshold (Hair et al., 2011; Hair et al., 2014). This result confirms that all constructs have high internal consistency. Furthermore, the composite reliability shows that all values are higher than 0.6, considered as a threshold. This further confirms

the internal reliability and reliability level. Additionally, the result shows that the AVE is above 0.5, confirming that convergent validity is achieved.

Table 2: Measurement Model Analysis

Items	Loading values	CR	AVE	VIF
SDE1	0.786	0.788	0.556	1.483
SDE2	0.806			1.693
SDE3	0.632			1.576
CC1	0.739	0.866	0.618	1.244
CC2	0.832			1.253
CC3	0.836			1.148
CC4	0.732			1.513
CT1	0.793	0.856	0.665	1.733
CT2	0.845			1.771
CT3	0.808			1.465
TC1	0.774	0.820	0.535	1.629
TC2	0.661			1.616
TC3	0.657			1.374
TC4	0.82			1.722
IF1	0.813	0.850	0.587	1.889
IF2	0.797			1.692
IF3	0.73			1.414
IF4	0.721			1.607
CR1	0.823	0.854	0.662	1.598
CR2	0.784			1.641
CR3	0.833			1.705
PS1	0.754	0.889	0.669	1.727
PS2	0.729			1.601
PS3	0.867			1.392
PS4	0.907			1.367

Key: *CR: Creativity; CT: Critical Thinking; CC: Communication and Collaboration; PS: Problem-solving; IF: Information; TC: Technical; SDE: Sustainable Digital Economy*

To examine the discriminant validity, the study employed Heterotrait-Monotrait ratio (HTMT) criteria as recommended by Fornell and Larcker (1981). Findings from Table 3 show that discriminant validity is not a problem in this study because the highest value of HTMT is 0.657, below the recommended threshold of 0.85.

Table 3: Heterotrait-Monotrait ratio Analysis

	CR	CT	CC	IF	PS	SDE	TC
CR							
CT	0.507						
CC	0.281	0.212					
IF	0.257	0.346	0.175				
PS	0.062	0.078	0.053	0.076			
SDE	0.388	0.484	0.185	0.657	0.081		
TC	0.077	0.069	0.093	0.123	0.083	0.178	

4.5 Structural Model Analysis

The reliability and validity of the measurement model allow for subsequent path analysis. A 5000-sample complete bootstrapping with bias-corrected and accelerated (BCa) at a significance threshold of 0.05 was used to get t-statistics for all path coefficients. A one-tailed test was chosen because each hypothesis is directed (Ramayah et al., 2018). The internal variance inflation factor (VIF) value range is below the cutoff value of 5. (See Table 2). This shows no concerns with lateral collinearity in the study (Hair et al., 2021). Additionally, the results of this study show that the coefficient of determination (R-square) is 53.2% and the predictive relevance (Q2) is greater than zero (Ramayah et al., 2018). Table 4 and Figure 2 presents the path analysis of this study. Four hypotheses *(H3b, H3c, H3d and H3f)* were statistically significant, while two hypotheses (*H3a and H3e*) were against our prior expectation and therefore were rejected. Findings show that information skills (*β=0.423, p<0.001*) significantly influence the sustainable digital economy. Findings show that information skills have a larger effect than other significant impacts. Similarly, critical thinking (*β=0.351, p<0.001*) significantly influences the sustainable digital economy. Furthermore, creativity skills (*β=0.423, p<0.01*) were also found to have a significant influence. Last, technical skills (*β=0.423, p<0.001*) were also found to have a significant influence with the least effect.

Table 4: t-statistics and β-values

Hypotheses	Path	β-values	*t*-statistics	*p*-values	Remarks
H3a	CC →SDE	0.209	0.630	0.529	Rejected
H3b	CR → SDE	0.324	2.731	0.004	Accepted
H3c	CT → SDE	0.351	3.350	0.001	Accepted
H3d	IF → SDE	0.423	6.592	0.000	Accepted
H3e	PS → SDE	0.070	0.955	0.339	Rejected
H3f	TC →SDE	0.220	2.404	0.016	Accepted

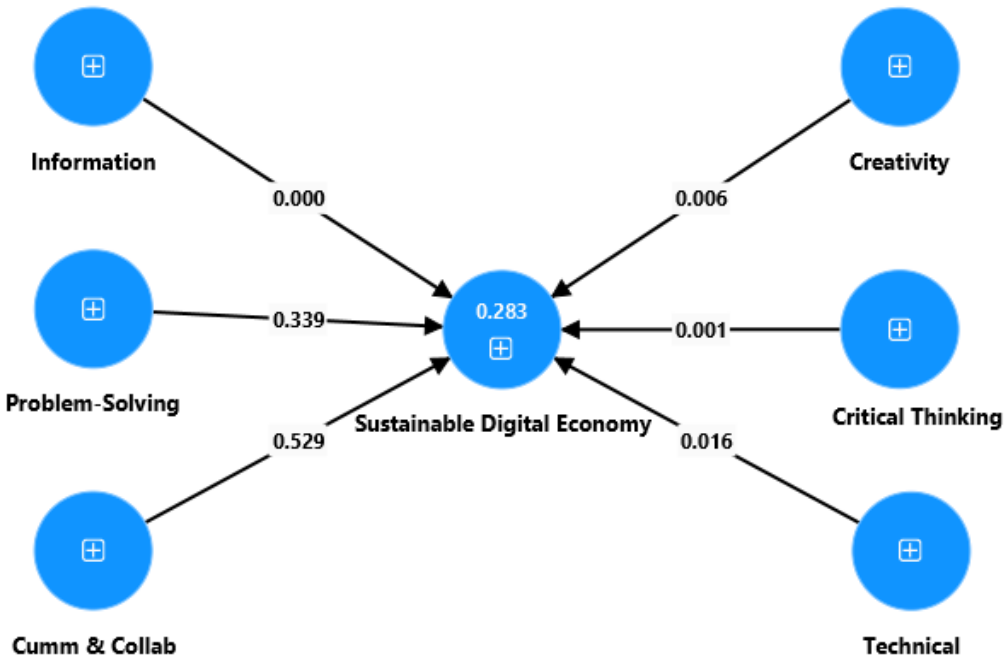

Figure 5: Structural Model Analysis

5.0 Discussion of Results

This study explored the influence of education levels and access to internet connectivity on developing digital literacy skills among public sector employees in Tanzania. Additionally, it examined how these digital literacy skills impact the sustainability of the digital economy. The findings provide valuable insights into the current digital capabilities of public employees and reveal key areas for improvement to facilitate a sustainable digital transformation. Among the many elements of digital literacy, employees' communication skills, creativity skills, critical thinking, problem-solving skills, and technical skills are particularly important in the sustainability of the digital economy. Their knowledge enables employees to investigate, create, and communicate digital information to participate effectively in daily dealings.

This research has revealed some observations. The study found a strong relationship between education levels and digital literacy, with tertiary education employees demonstrating higher proficiency in advanced skills like critical thinking, creativity, and problem-solving. Those with lower education levels relied more on basic skills such as communication and collaboration. This highlights the need for targeted educational interventions to upskill public sector employees, especially those with lower educational backgrounds, to bridge the digital literacy gap to achieve a sustainable economy, as supported by previous research (Manana and Mawela, 2022). According to the findings, public employees who stated that their primary and secondary education was the sole way they acquired digital skills had the lowest scores across the board, whereas those who referenced further education had the greatest ratings. Because more Tanzanians end up working in non-formal sectors and not all attend tertiary education, this has some implications for the need for increased focus on establishing initiatives at all levels of education. In order to achieve a sustainable digital economy, digital education courses at various levels are, therefore, suitable options for boosting digital abilities (Vodă et al., 2022).

Importantly, access to internet connectivity significantly influences digital literacy, with employees who have regular access demonstrating higher proficiency in advanced skills like information management and problem-solving. In contrast, those without consistent access rely on basic skills like communication and collaboration. The findings show that some public institutions still have no internet access. These results align with GSMA (2023), which previously identified a lack of basic infrastructure, such as internet access and electricity to power digital devices. Joshkun et al. (2024) also pinpointed these aspects as the major obstacles to digital adoption. This highlights the importance of improving digital infrastructure in the public sector to bridge the digital divide and support full participation in the digital economy.

A detailed analysis of the results through Smart PLS yielded several discoveries. The findings of this study underscore the importance of digital literacy in promoting the sustainability of the digital economy. Advanced digital skills, particularly information management, critical thinking, creativity, and technical skills, significantly impact the digital economy's sustainability. These skills are essential for enabling employees to engage with digital technologies in a way that fosters innovation, efficiency, and resilience in the public sector to achieve a sustainable economy. This supports the broader view in the literature that a comprehensive approach to digital literacy is needed to navigate today's increasingly digital world. As Vodă et al. (2022) and Van Laar et al. (2019) noted, critically assessing digital content, solving complex problems, and creating innovative solutions are key competencies for the modern workforce. However, this study's lack of proficiency in problem-solving skills suggests that more effort is needed to cultivate these advanced competencies in Tanzania's public sector.

6.0 Conclusions and Directions for Further Research

This study found that the state of digital skills in the public sector is not yet where it should be, but it is improving and there are some promising initiatives within government entities. The findings of this study have important implications for policymakers and public sector leaders in Tanzania. The strong relationship between education and digital literacy underscores the need for investment in educational programs that enhance digital skills at all employment levels. Additionally, ensuring internet access at workplaces is essential to equipping employees with the tools to engage fully with digital technologies. Prioritizing the expansion of digital infrastructure and providing tailored training programs, particularly for employees with lower education levels, is critical for fostering advanced skills like critical thinking, creativity, and problem-solving. Closing the digital skills gap will improve public service effectiveness and support sustainable digital economic growth.

However, this study has certain limitations. The cross-sectional design limits the ability to observe changes in digital skills over time, and the self-reported data may introduce biases. Future research should employ longitudinal studies to track digital skill development and assess the long-term impact of educational interventions. Additionally, this study focused on Tanzania's public sector; future studies could explore digital literacy across different sectors and industries to offer comparative insights. Further research could also examine the role of digital infrastructure improvements and training programs in bridging the digital divide and fostering a more inclusive digital economy.

References

Al Khateeb, A. A. M. (2017). Measuring Digital Competence and ICT Literacy: An Exploratory Study of In-Service English Language Teachers in the Context of Saudi Arabia. *International Education Studies*, *10*(12), 38–51.

Baptista, J., Stein, M.-K., Klein, S., Watson-Manheim, M. B., & Lee, J. (2020). Digital work and organisational transformation: Emergent Digital/Human work configurations in modern organisations. *The Journal of Strategic Information Systems*, *29*(2), 101618.

Bawden, D. (2008). Origins and concepts of digital literacy. *Digital Literacies: Concepts, Policies and Practices*, *30*(2008), 17–32.

Bratianu, C., Neştian, A. Ş., Tiţă, S. M., Voda, A. I., & Guţă, A. L. (2020). The impact of knowledge risk on sustainability of firms. *Amfiteatru Economic*, *22*(55), 639–652.

Bruno, G., Diglio, A., Piccolo, C., & Pipicelli, E. (2023). A reduced Composite Indicator for Digital Divide measurement at the regional level: An application to the Digital Economy and Society Index (DESI). *Technological Forecasting and Social Change*, *190*, 122461.

Caglayan-Akay, E., & Oskonbaeva, Z. (2022). Analyzing the effect of economic and demographic factors on digital divide: the case of transition economies. *Economic Computation and Economic Cybernetics Studies and Research*, *56*(2).

Calvani, A., Cartelli, A., Fini, A., & Ranieri, M. (2008). Models and instruments for assessing digital competence at school. *Journal of E-Learning and Knowledge Society*, *4*(3), 183–193.

Cetindamar Kozanoglu, D., & Abedin, B. (2021). Understanding the role of employees in digital transformation: conceptualization of digital literacy of employees as a multi-dimensional organizational affordance. *Journal of Enterprise Information Management*, *34*(6), 1649–1672.

Chigona, W. (2024). *Implications of Information and Digital Technologies for Development: 18th IFIP WG 9.4 International Conference, ICT4D 2024, Cape Town, South Africa, May 20–22, 2024, Proceedings, Part I*. Springer Nature.

Dearborn, C., & Meister, S. (2017). Failure as process: Interrogating disaster, loss, and recovery in digital preservation. *Alexandria*, *27*(2), 83–93.

Eastwood, C., Ayre, M., Nettle, R., & Rue, B. Dela. (2019). Making sense in the cloud: Farm advisory services in a smart farming future. *NJAS-Wageningen Journal of Life Sciences*, *90*, 100298.

Eurostat. (2021). *Individuals' Level of Digital Skills. Available online*.

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39.

Gautam, R. S., Rastogi, S., Rawal, A., Bhimavarapu, V. M., Kanoujiya, J., & Rastogi, S. (2022). Financial technology and its impact on digital literacy in India: Using poverty as a moderating variable. *Journal of Risk and Financial Management*, *15*(7), 311.

Gefen, D., & Straub, D. (2005). A practical guide to factorial validity using PLS-Graph: Tutorial and annotated example. *Communications of the Association for Information Systems*, *16*(1), 5.

GSMA. (2023). *Tanzania's digitalisation journey: How to foster digital adoption? (Part 1)*.

GSMA. (2024). *Driving digital transformation of African economies, Evidence and methodology document*.

Hair, Joe F, Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152.

Hair, Joseph F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Hair Jr, Joe F, Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review*.

Hair Jr, Joseph F, Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.

Hanna, N. K. (2020). Assessing the digital economy: aims, frameworks, pilots, results, and lessons. *Journal of Innovation and Entrepreneurship*, *9*(1), 16.

Helsper, E. J., & Eynon, R. (2013). Pathways to digital literacy and engagement. *European Journal of Communication*, *28*(6), 696–713.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135.

Jaiswal, A. (2024). Google Form. In *Open Electronic Data Capture Tools for Medical and Biomedical Research and Medical Allied Professionals* (pp. 331–378). Elsevier.

Joshkun, S., Kurmanov, N., Kabdullina, G., Bakirbekova, A., Sabyrzhan, A., Rakhimbekova, A., Satbayeva, A., & Utegenova, Z. (2024). School or home: Exploring the impact of digital infrastructure on digital literacy of school-age young people in a developing economy. *Journal of Infrastructure, Policy and Development*, *8*(7), 4795.

Kitole, F. A., Mkuna, E., & Sesabo, J. K. (2024). Digitalization and agricultural transformation in developing countries: Empirical evidence from Tanzania agriculture sector. *Smart Agricultural Technology*, *7*, 100379.

Kuhlemeier, H., & Hemker, B. (2007). The impact of computer use at home on students' Internet skills. *Computers & Education*, *49*(2), 460–480.

Lopes, A. S., Sargento, A., & Farto, J. (2023). Training in Digital Skills—The Perspective of Workers in Public Sector. *Sustainability*, *15*(13), 10577.

Manana, T., & Mawela, T. (2022). Digital skills of public sector employees for digital transformation. *2022 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT)*, 144–150.

Martin, A. (2008). Digital literacy and the "digital society". *Digital Literacies: Concepts, Policies and Practices*, *30*(151), 1029–1055.

Nachtigall, C., Kroehne, U., Funke, F., & Steyer, R. (2003). Pros and cons of structural equation modeling. *Methods Psychological Research Online*, *8*(2), 1–22.

NBS. (2024). *Tanzania Formal Sector Employment and earnings Survey*.

Nooorrizki, R. D., Abadi, D., Siwi, N. S. W., Sa'id, M., Mantara, A. Y., & Ramadhani, F. (2022). Factors affecting digital literacy in young adults. *KnE Social Sciences*, 308–315.

Parker, C., Scott, S., & Geddes, A. (2019). Snowball sampling. *SAGE Research Methods Foundations*.

Phuapan, P., Viriyavejakul, C., & Pimdee, P. (2016). An analysis of digital literacy skills among Thai university seniors. *International Journal of Emerging Technologies in Learning (Online)*, *11*(3), 24.

Qin, R. (2023). Overcoming the digital transformation paradoxes: a digital affordance perspective. *Management Decision*.

Ramayah, T., Cheah, J., Chuah, F., Ting, H., & Memon, M. A. (2018). Partial least squares structural equation modeling (PLS-SEM) using smartPLS 3.0. *An Updated Guide and Practical Guide to Statistical Analysis*.

Rodríguez-de-Dios, I., Igartua, J.-J., & González-Vázquez, A. (2016). Development and validation of a digital literacy scale for teenagers. *Proceedings of the Fourth International Conference on Technological Ecosystems for Enhancing Multiculturality*, 1067–1072.

Stordy, P. (2015). Taxonomy of literacies. *Journal of Documentation*, *71*(3), 456–476.

Tanzania Digest. (2023). *Digital Dreams in Tanzania: Nurturing a Thriving Online Job Market*.

Union, A. (2020). *The Digital Transformation Strategy for Africa (2020-30)*.

Van Deursen, A. J., & Van Dijk, J. A. G. M. (2015). Toward a multifaceted model of internet access for understanding digital divides: An empirical investigation. *The Information Society*, *31*(5), 379–391.

Van Laar, E., Van Deursen, A. J. A. M., Van Dijk, J. A. G. M., & De Haan, J. (2019). The sequential and conditional nature of 21st-century digital skills. *International Journal of Communication*, *13*, 26.

Vodă, A. I., Cautisanu, C., Grădinaru, C., Tănăsescu, C., & de Moraes, G. H. S. M. (2022). Exploring digital literacy skills in social sciences and humanities students. *Sustainability*, *14*(5), 2483.

Vuorikari, R., Punie, Y., Gomez, S. C., & Van Den Brande, G. (2016). *DigComp 2.0: The digital competence framework for citizens. Update phase 1: The conceptual reference model*. Joint Research Centre.

Vyas, V., & Jain, P. (2021). Role of digital economy and technology adoption for financial inclusion in India. *Indian Growth and Development Review*, *14*(3), 302–324.

Xianbin, T., & Qiong, W. (2021). Sustainable digital economy through good governance: Mediating roles of social reforms and economic policies. *Frontiers in Psychology*, *12*, 773022.

Yamane, T. (1973). *Statistics: An introductory analysis*.

Zhang, J. (2023). EFL teachers' digital literacy: the role of contextual factors in their literacy development. *Frontiers in Psychology*, *14*, 1153339.