ADVANCE SOCIAL SCIENCE ARCHIVE JOURNAL
Available Online: https://assajournal.com
Vol. 05 No. 02. April-June 2026.Page# 2650-2670
Print ISSN: 3006-2497 Online ISSN: 3006-2500
Platform & Workflow by: Open Journal Systems

Evaluating The Contemporarity of Ict Infrastructure on Resource Utilization in Unguja's Selected Advanced Secondary Schools. A Case of Urban District Schools Located

Dr. Salman Sarwar
Head of Business School, Salar International University, Sheikhupura, Pakistan
salmansarwar333@gmail.com
ORCID: 0000-0002-0043-6432
Dr. Priya Sukirthanandan
Dean, University of Cyberjaya, Malaysia
priya@cyberjaya.edu.my
ORCID: 0009-0002-6610-1157

Abstract
The study is entitled " The Impact of ICT Infrastructure and Resource Utilization in Unguja's Advanced Secondary Schools. The general objective was to assess the impact of ICT infrastructure and resource utilization in Unguja's Advanced Secondary schools. The study employed a mixed-methods approach, combining quantitative and qualitative research methods. This study employed both probability and non-probability sampling techniques, involving 240 samples, of which 201 were used in the survey questionnaire and 39 were used in the interviews and Focus group discussions. The study reveals that ICT infrastructure and resource utilization play a critical role in enhancing the academic performance of advanced secondary school students in Zanzibar. While notable progress has been made in providing ICT infrastructure and resource utilization, such as computers, projectors, and internet access, disparities in availability and usage persist across selected schools in this study. Similarly, teachers' and students' attitudes toward ICT are generally positive, reflecting recognition of its potential to improve teaching and learning processes. However, this positive outlook is often constrained by practical challenges, including unreliable internet connectivity, inadequate training, and insufficient leadership support for ICT initiatives. In recommendations, the Ministry of Education and its development partners should invest in upgrading ICT facilities, including modern computers, projectors, printers, and high-speed internet, as well as in continuous professional development programs for teachers to enhance their technical skills, confidence, and creativity in integrating ICT into lesson delivery. The study concludes that ICT infrastructure on resource use is crucial for improving the academic performance of advanced secondary school students in Zanzibar.

1.1 Introduction

The term "information and communication technology," often abbreviated as "ICT," has emerged as a valuable tool for enhancing educational standards worldwide. It has been used in educational settings to help students find the teaching and learning process more enjoyable (Jamali, 2023). With the creative use of information and communication technologies available

from anywhere at any time, it is possible to move away from traditional classroom-based teaching and learning. Along with contemporary trends, Sindh has also adopted ICT in recent years to improve educational opportunities (Jillani et al., 2024). Several international organizations, such as the United Nations (UN) and its agencies UNESCO and UNICEF, are now working on initiatives to integrate local Education systems into the broader global framework. Developed economies and Western-led organizations have historically shaped international Education policies. Nonetheless, many international organizations, including the United Nations (UN) and its agencies UNESCO and UNICEF, are now taking steps to incorporate local Education systems into the broader context of globalization (Ali et. al, 2023). The UNESCO Institute for Statistics (2018) reports that more than 1.5 billion students in more than 140 countries are gaining access to ICT-integrated Education programs, indicating that the global digital divide is closing. It has been demonstrated that digital tools such as tablets, interactive whiteboards, and e-learning platforms can enhance knowledge retention, promote active learning, and create customized learning environments. ICT adoption in Education is not without its difficulties, though (Anton et al., 2024). Additionally, Educational institutions have been increasingly using information and communication technology (ICT) devices in recent years. The use of ICT has been shown to improve teaching and learning outcomes, particularly in terms of student engagement, motivation, and achievement (Toma et al., 2023). Research indicates that integrating desktops, laptops, and smartphones with other information and communication technology (ICT) devices in classrooms promotes better student engagement and collaborative learning while providing direct access to a wide range of online and digital resources (Sun et al., 2024). Additionally, national funding for ICT integration is available to schools in both Denmark and Norway, supporting national policies aimed at achieving digital equality (Rohatgi et al., 2021). ICT integration in Education has long been a national priority in Denmark (Caeli et al., 2025). Peter Naur, the first Danish professor of computer science, pushed for the creation of a course in the 1960s that combined practical skills for developing computer systems with a critical understanding of the role computers play in society. The Nigerian government has responded by implementing various laws and programs to embed ICT across all levels of the country's educational system. The National Policy on ICT in Education, launched in 2019 to promote the incorporation of ICT in Education nationwide, is one such initiative. Furthermore, the 2022 National Information and Communication Technology Policy provides a robust framework for ICT integration across all educational tiers, emphasizing curriculum enhancement, teacher training, and infrastructure development. (National Information Technology Development Agency, 2022) According to Kamau et al. (2025), ICT is a priority area in East Africa, particularly in Kenya, for integrating ICTs into the teaching and learning process. This objective was made a national priority through the National ICT Policy, which also catalyzed the ministry's sector policy on ICT in Education. Acting swiftly, the ministry launched the National ICT Strategy for Education and Training in June 2006. Education was responsible for monitoring and evaluating the execution of the strategy. Evans, & Willis, (2024). A study found that integrating ICT into the secondary school curriculum is critical as it enhances the efficiency of school operations. To improve students' ICT literacy and overall academic performance, the Kenyan government has committed to supplying ICT resources to public secondary schools. Schools face challenges such as a shortage of qualified teachers with essential digital skills, poor internet connectivity, and limited access to reliable

electricity (Nancy & Prudence, 2024). In the past, the Tanzanian government sought to reintroduce ICT into the country's educational system. Training, capacity building, planning, procurement, and administration are emphasized in the 2007 ICT and Educational Policy. The use of ICTs across all administrative sectors, including Education, is already part of the Revolutionary Government of Zanzibar's (RGoZ) vision and policy. Therefore, according to Suleiman et al. (2020), the primary objective of ICT in Education is to reach students at pre-primary, primary, secondary, and tertiary levels. The 2006 Zanzibar Education Policy also outlines the country's vision for ICTs in Education (MoEVT, 2006). Furthermore, this is reiterated in the plan and documents of the Revolutionary Government of Zanzibar, which state that teachers, students, and other educational partners use ICT skills in teaching and learning to support the government's goals and plans. We need to examine how secondary school teachers' perspectives translate into classroom practices. Given its importance, this study aims to identify the issues affecting students' academic performance in advanced secondary schools with a focus on information and communication technology. Researchers in the urban district have not recently explored these topics. Therefore, this study aims to address this research gap. The findings will clarify the subject and bridge the knowledge gap between academics and decision-makers in Zanzibar, enabling them to implement necessary changes.

1.2 Problem Statement: This study examines the impact of ICT infrastructure on resource utilization in advanced secondary schools in Unguja. The researcher developed the study's concept in Zanzibar. The Zanzibar government aims to improve ICT across the country. The 2006 Zanzibar Education Policy also outlines the vision for ICT in Education (MoEVT, 2006). ICT infrastructure and resource utilisation have improved in the Unguja Urban district. The distribution of tablets to urban district advanced schools in January 2023 and the launch of national school networks in December 2024 are two initiatives that accelerate efforts to integrate ICT into advanced secondary Education (Haji, et.al., 2024). Despite these positive developments and initiatives, several persistent issues still hinder the desired educational outcomes. These include inadequate infrastructure and inefficient resource use. Likewise, as of December 2024, MoEVT has partnered with the World Bank, the Zanzibar Communications Infrastructure Agency (ZICTIA), and private sector partners such as Dolfen Co. to connect 100 schools via VSAT and fiber. Despite policy commitments, systemic barriers remain. The use of ICT in secondary schools continues to be limited by funding shortages, a lack of technical assistance, and high costs, despite Zanzibar's 2006 Education Policy and recent efforts to promote national ICT initiatives that recognize the importance of technology in Education (RGoZ, 2013). However, to date, no adequate empirical study has examined the effects of ICT integration on academic performance in advanced secondary schools in Unguja. By assessing the current level of ICT infrastructure and resource utilization in Unguja's advanced secondary schools, this study aims to address these gaps. This study will provide evidence-based insights to help educators, school administrators, and policymakers maximize the educational potential of ICT in Zanzibar, with a focus on the unique realities of Unguja.

1.3 General objective: The main objective of this study is to assess the impact of ICT infrastructure on resource utilization in Unguja's Advanced Secondary schools in Unguja, Zanzibar.

1.3.1 Specific objectives

To achieve the general objective, the researcher carries out the following specific objectives:

1) To assess the availability and utilization of ICT infrastructure resources in advanced secondary schools in Unguja

1.3.2 Research questions

1. To what extent are ICT infrastructure resources available and utilized in advanced secondary schools in Unguja**?**

2.1 Literature Review

This section provides a literature review relevant to the study's topic. In addition to defining key concepts, it examines the empirical and theoretical literature, as well as the theoretical and empirical review, within the conceptual framework. The chapter develops by presenting the research gap.

Advanced Secondary School: In Tanzania, "Advanced Secondary School" (also known as Form V and VI or A-Level) refers to the final two years of secondary Education, following the completion of Ordinary Level secondary Education. It prepares students for university or other higher Education by offering a more specialized and in-depth curriculum. (Institute of Education, Tanzania, 2024).

Academic Performance (AP): According to Steinmayr et al. (2016), Academic Performance (AP) is defined as a developmental trajectory that shapes life opportunities and influences the development of autonomy, relatedness, and competence. In this study, academic performance reflects educational outcomes that indicate the extent to which children have achieved their educational goals.

Information Communication Technology integration: According to IGI (2025), this refers to the use of technology to enhance, expand, and enrich student knowledge. It goes beyond teaching students how to use computers. It is a means of improving Education. ICTs can be utilized in schools to enhance students' information literacy by supporting their ability to access, use, and evaluate information from various sources, thereby improving learning, problem-solving, and the generation of new knowledge.

2.2 Theoretical Review:

2.2.1 Technology Acceptance Theory (TAM)

Davis used TAM in 1989 to explain how people used computers in service delivery organizations. To explain user behavior across a wide range of end-user computing technologies and user populations, Davis (1989) developed the Theory of Acceptance of Computers (TAM), which aims

to identify the general determinants of computer acceptance. Two particular beliefs, Perceived Usefulness (PU) and Perceived Ease of Use (PEU), were included in and tested by the basic TAM model. Perceived Ease of Use refers to the extent to which the potential user expects the target system to be easy to use. In contrast, Perceived Usefulness is the subjective likelihood that using a specific system (such as a single platform e-payment system) would improve the user's performance (Davis, 1989). According to Lee and Jun (2007), TAM should be able to examine variables other than convenience and usefulness perceptions that influence adoption intentions. While TAM had garnered significant support (Yang, 2005), its primary focus was on how perceptions of the technology's convenience and usefulness influenced adoption intentions (Lai & Zainal, 2015). This study's application of the theory examines the key principles, specifically perceived usefulness (PU) and perceived ease of use (PE). In relation to this study, the theory developed to explain the chosen organization's acceptance behavior was also assessed in terms of the organization's adoption of the technology, its value in providing public services, and its application in day-to-day work—specifically, the results of secondary school students' performance.

2.2.2 Change Management Model (CMM)

A systematic approach to moving people, groups, and organizations from one state to another is known as change management. The three common stages of change are unfreezing, effecting change, and refreezing, as outlined by Sacheva (2009) and Lewin's Change Model (1951). According to Požgaj and Vukšić (2011). Kotter's Eight-Step Model includes eight steps for change: increasing the urgency of the change, ensuring a strong change team leads the process, creating a vision, empowering employees, achieving short-term wins, consolidating gains, and embedding cultural change. According to this theory, change management is one of the elements that support the organization's growth in various ways, including top management support, the development of ICT automation, the enhancement of ICT staff skills, and the improvement of employees' attitudes towards management. Since the organization's top leaders have revised their perspectives on the implementation of ICT infrastructure and resource utilization, the research finds that the model has helped determine that ICT infrastructure and resource utilization in Zanzibar are well-developed.

2.3 Empirical Review

The study by Wordu et al. (2022) examined the availability of ICT resources to improve teachers' instructional delivery in private secondary schools in the Port Harcourt Metropolis. The sample was chosen using a multistage sampling technique. Ten private secondary schools were selected from each of the two Port Harcourt Metropolis Local Government Areas to accomplish this. One hundred sixty teachers, comprising 80 men and 80 women, were randomly selected from each of the ten schools. The hypothesis was tested at the 0.05 level of significance using a z-test, and the data were analyzed using percentages, the mean, and the standard deviation. The results of this study demonstrate that among the ICT resources available to improve teachers' instructional delivery in private secondary schools were laptop computers, printers, Internet access, PowerPoint projectors, radio and television sets, and educational software. Second, the results

demonstrated that, among other devices, computer printers, radios, televisions, and smartphones are sufficient for teachers to deliver instruction in private secondary schools. The availability of ICT resources and teachers' proficiency with ICT in public secondary schools in Ngara, Tanzania, were the subjects of a 2021 study by Fidelis and Onyango. Both questionnaires and interviews were used as data sources in this mixed-methods study. Five hundred twenty-five stakeholders, including the DEO, WEO, school heads, ICT manager, and teachers, from 31 secondary schools made up the population. A sample of 84 respondents was selected from four randomly selected schools, using a combination of simple random sampling and purposive sampling. Quantitative data were analyzed descriptively, while qualitative data were analyzed thematically. Since teachers and students are primarily responsible for the significant changes in the Educational system over the past few decades, brought about by the revolution in ICT, Shehu's (2012) study aims to explore their attitudes toward the use of contemporary ICT resources.

2.4 **Research gap:** Based on the literature reviewed for this study, the researcher has identified gaps, as few to no studies have been conducted in Zanzibar. Various authors, including Kiwonde (2024), have examined the obstacles to the use of ICT in the teaching and learning process in Tanzanian secondary schools. Bendera (2024) reported low ICT adoption in Tanzania, with 94% citing infrastructural constraints as the primary reason. Haji et al. (2024) also pointed to training gaps and infrastructure challenges in ICT-enabled classrooms in Zanzibar. However, they did not investigate how the pedagogical use of ICT tools translates into academic results. Research often highlights deficiencies in teacher ICT self-confidence but fails to link teacher readiness to student performance outcomes. Hamoud & Nzilano (2024) observed that teachers' lack of skills and confidence hinders the effective integration of ICT.

2.4 Conceptual framework

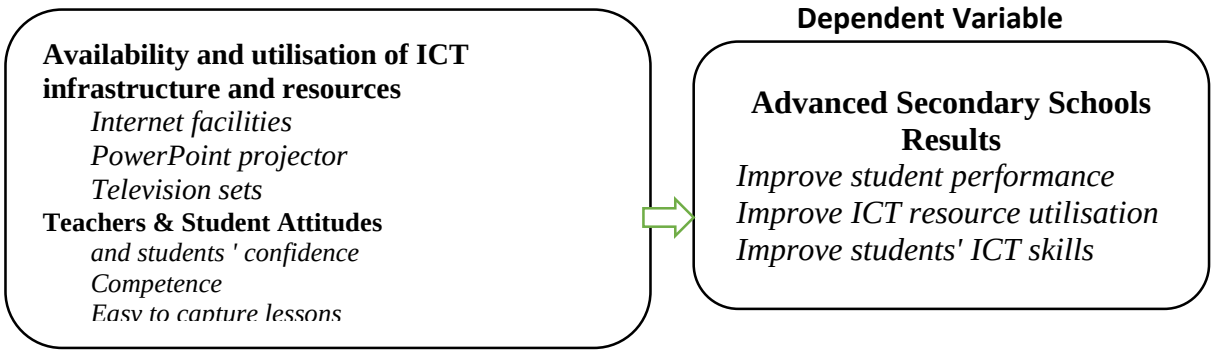

Figure 1. 1: Conceptual framework

Source: Developed by Author, 2025

Figure 2.1 illustrates the conceptual framework. It shows that when the researcher combines two key variables — independent and dependent — they can observe the study results and

develop practical recommendations for the audience. This framework consists of two main types of variables: dependent and independent. Independent variables include the availability of ICT resources, teachers' and students' attitudes, and challenges faced by teachers and students. A dependent variable is the students' academic performance. When considered together, these findings illustrate the influence of integrating information and communication technology on the academic performance of advanced secondary school students.

3.1 **RESEARCH METHODOLOGY**

This section presents research methodology. It is the process used to collect information and data to make decisions. The chapter presents the research design, Area of study, data sources and types, Data collection method, Questionnaire, Sampling Frame, Sampling procedures, and Data Validity and Reliability.

3.2 The study design: A cross-sectional design was used in this investigation. A cross-sectional design is an observational, non-experimental research design. It is typically employed to characterize, for instance, the traits of a population or subgroup of individuals at a specific moment in time. The study is conducted at a single moment in time. (Zangirolami et.al., (2018). Respondents' information was used to inform the design through questionnaires and in-person interviews. Financially and in terms of time, the design is cost-effective (Chiang-Hanisko et al., 2016). The conceptual framework that guides the research is known as the research design. Researchers can concentrate on one independent variable and one or more dependent variables by using cross-sectional studies (Zangirolami et al., 2018).

3.3 The research Approach: The researcher employed a mixed-methods approach in this study due to its nature. Researchers incorporate methods for collecting and analyzing data from both quantitative and qualitative research approaches within a single study (Tashakkori & Teddlie, 2015). That is why researchers collect or analyze not only numerical data, which is customary for quantitative research, but also narrative data, which is the norm for qualitative research, to address the research question(s) defined for a particular research study. The goal for researchers using the mixed-methods approach is to leverage the strengths and mitigate the weaknesses of both quantitative and qualitative research approaches.

3.4 Study area: The urban district is positively selected because it hosts a significant concentration of Form Five and Six (advanced-level) selected secondary schools compared to other districts in Zanzibar. This provides A larger and more diverse sample of students and teachers. More variation in ICT practices across schools. Similarly, the Urban District in Zanzibar, particularly on Unguja Island, has more advanced ICT infrastructure than rural or semi-urban districts. Most advanced secondary schools in the area are better equipped with ICT resources, including Computer labs, Internet access, Projectors and smartboards, and e-learning platforms (in some cases).

3.5 The Study Population: In this study, 600 people from the study area were included. The selected secondary schools are Benbella, Lumumba, Highview, and Tumekuja. They are the population of this study because the urban district is of great importance, and recent examination results have been highly successful. In turn, the target population corresponds to the complete set of individuals whose characteristics are of interest to the researcher, as specified in the study title. Most advanced secondary schools in the area are better equipped

with ICT resources, including Computer labs, Internet access, Projectors and smartboards, and e-learning platforms. MartínezMesa *et.al.,* (2016). The researcher draws results from the field from a representative sample selected from this population. The researcher will use this category of respondents due to the nature of the title and the type of information required, as well as experienced staff who understand the development trends of the selected organizations. The researcher employed various criteria to determine the sample size for this study. Firstly, the sample size would be credible in terms of reliability, validity, and generalizability if it were appropriately selected, which would lead to successful study results. Secondly, the aforesaid sample size minimized the sampling error. Thirdly, determine the confidence level in the study results (Pannell et al.,2023). For further illustration, the distribution of the respondents is shown

Table: 1. 1: Category of Study Population

S/N	Category of the study: Population	Representative number	Selection of Sample Size	Tool used to collect data
1	Head of the Department of Secondary Education, MoEVT	4	2	Interview
2	Head/Assistant Masters	31	4	Interview
3	Section leaders	53	6	Interview
4	Advanced Secondary teachers	189	27	Focus Group Discussions
5	Students	327	201	Surveyed Questionnaire
	Total	**600**	**240**	

Source: Field research data, 2025

3.5 Sample size

Kothari (2004) asserts that the ideal sample size is neither too small, which might not help achieve the goal, nor too large, which would result in significant expenses and resource waste. A small sample can then be used if the universe is homogeneous. Therefore, the sample size of respondents to be included in the study was determined using Yamane's formula (1967). One important consideration in calculating the sample size is the precision level, which is incorporated into the formula.

n = Sample size

N = Total population.

e = marginal error 0.05 (when the level of accuracy is 95%)

$n = 600/ [1+600(0.05)^2]$

n = 600/ (1+600(0.0025)

n = 600/ (1+1.5)

n = 600/2.5

Therefore, n = 240 respondents

Therefore, the study involved 240 respondents from four selected public sectors.

Therefore, based on the above statement and formula, the study population in the urban area is less than 600, and the sample size is also less than 600. Therefore, the study involved 240

respondents from four selected Secondary schools in Unguja, Zanzibar. The reasons for selecting the identified schools are that the most advanced secondary schools in the area are better equipped with ICT resources, including Computer labs, Internet access, Projectors and smartboards, and e-learning platforms (in some cases).

3.5.1 Sampling techniques and procedures

The study involved four advanced secondary schools in Unguja, which provided the sample size for this investigation. Both probability and non-probability sampling methods were employed in this investigation, involving participants in the survey. Probability sampling techniques were applied through simple random sampling. Simple random sampling is a type of probability sampling in which the researcher randomly selects a subset of participants from a population, and each member of the population has an equal chance of being selected. In this study, therefore, the researcher applied this technique to the data collection tools, using a survey questionnaire administered in the field, with 228 respondents. According to Singh & Masuku (2014), the Lottery Method of Sampling, a random sampling method, will be applied. The populations from Ben Bella Secondary School, High View Secondary School, Lumumba, and Tumekuja are assigned unique numbers. The numbers are then thoroughly mixed after the researcher puts them in a bowl and shakes it. Then, without looking, the researcher selects numbers. The population members or items that were assigned that number were then included in the sample. Different departments within the organisation were involved in identifying respondents who would provide the required information, based on the study's objectives. Whilst the nonprobability sampling technique was applied. It is a sampling technique in which the researcher relies on their judgment when choosing members of the population to participate in the study. Purposive sampling is a nonprobability sampling method, and it occurs when. The researcher chose the elements for the sample. This technique was used for some specific purposes. Headmasters/Assistant Headmasters, Heads of sections, and Units were involved in the study, as they possess valuable information necessary to obtain accurate results. Additionally, according to Black & Harrison (2010), researchers often believe they can obtain a representative sample by using sound judgment, thereby saving time and money. The selection of a group of people as informants in this study is based on their traits and provides the information the researcher wants to study (McKillup, 2005). Twelve respondents, heads of departments from the Ministry of Education and Vocational Training, two interviewees, and sections in Lumumba (five interviewees) and Tumekuja (five interviewees) were involved in the interviews. Researchers held that the range of opinions captured the possible reach to whatever level of detail the study sought; there is little reason to continue interviewing more people while researchers have reached “saturation” (Seidman, 2006). This justified that the 12 respondents had reached the details required in this study.

3.5.2 Data Collection: The study used primary sources of data to obtain information from respondents within the selected public organizations.

3.5.3 Primary Data: Data collected from firsthand experience is known as primary data. Primary data has not been published yet and is more reliable, authentic, and objective. Humans have not altered primary data; therefore, its validity is greater than that of secondary data (Sajjad, 2016).

In statistical surveys, it is necessary to get information from primary sources and work with primary data. Primary data was collected directly from selected public sector organizations.

3.5.4 Questionnaire: A questionnaire is a pre-formulated written set of questions to which respondents record their answers, usually within closely defined alternatives. Questionnaires are designed to collect large amounts of quantitative data. They were administered personally, distributed electronically, or mailed to the respondents. Questionnaires are less expensive and time-consuming than interviews and observation, but they also introduce a much larger chance of nonresponse and nonresponse error. In this study, 201 questionnaires were supplied to the selected respondents within the selected organisations. Each organization provided answers to the questions in the questionnaires given. This method was considered objectives two and three. The respondents for these questionnaires were long-term, experienced senior staff who are creative and can provide the best information. The study involved this type of respondent because the researcher wanted to capture the organizations' existing skills, competencies, and strategies. The selected group of informants in this study possesses traits and provides information that the researcher seeks to study, as noted by McKillup (2005).

3.5.6 Interview: An interview is a guided, purposeful conversation between two or more people. There are many diverse types of interviews. The reason for using this technique is that personal information was obtained easily. Additionally, more in-depth information was obtained. Twelve respondents from the selected schools and the Department of Secondary Education in MoEVT, Including Assistant directors/directors, and experienced staff, were involved to provide information for the study. The researcher used the style of semistructured interviews, which matches the participants 'experience, allowing them to express their views at length and under no pressure. In the field, this was applied by using Judgement sampling. The researcher selected respondents from the heads of sections/assistants who represent their departments to provide the required information. Twelve informants were involved from the urban district. The interview briefing was organized to inform the informants and prepare them to answer the questions, regardless of the study's purpose. This indicates that the 12 respondents interviewed provided the necessary details for the study. This method was considered objectives one and three.

3.5.7 Focus Group Discussion (FGDs): A focus group discussion is a qualitative research data-collection technique in which a selected group of people discusses a given topic or issue in depth, facilitated by a professional, external moderator. In this study, FGDs were conducted with selected respondents at both Lumumba and Tumekuja Secondary schools in urban districts. The reason for using FGDs is that it is easier to gather data from groups than from individual respondents who are busy with their daily life activities. The focus group method enables an in-depth examination of how group members perceive and feel about the subject. Researchers in the field used to organize five groups, each with 56 participants. They were asked to discuss the given guided discussion. The FDGs use 40 minutes for each group. This method considered objectives two and three.

3.8. Data Analysis: In this study, the quantitative data from the respondents were verified, compiled, coded, and summarised before being analyzed by using SPSS. Whereby qualitative data were analyzed using narrative analysis. This focuses on what the respondents explain during

the interview. It would be an instrumental style for getting a deep understanding of the respondent's perspective on the study title.

3.8.1 Data Validity: The researcher used credibility validity to measure validity. It is essential for validity. Credibility and validity were established through the use of various strategies, including a questionnaire and interview techniques, with pretesting conducted in the field prior to proceeding. This process was informed by the pilot, which contributed to refining the questionnaires to better align with the context and the required information—establishing the researcher's authority and ensuring structural coherence.

3.8.2 Reliability: The researcher used the test scores to measure reliability. Similarly, in the testing profession, "error of measurement" is the difference between a test taker's "true score" and the score the test taker got. It is referred to as the test taker's actual score, also known as the "observed score." If the test taker's observed score is higher than his or her "true score," the "error of measurement" is positive. If the test taker's observed score is lower than their "true score," the "error of measurement" is negative (Livingston, 2018). It is from these two systems that the profession of testing was used to measure reliability in this study. Finally, the test taker's observed score is lower than her "true score". This means that the error of measurement is negative.

4.1 Data Analysis, Presentation, and Discussion of the Findings

4.1 Profile of the respondents. During data collection, it is essential to gather respondents' background information to gain insight into their characteristics, including age, gender, and educational background.

4.2. Age Group: Analyzing the age distribution of the study's participants is crucial as it provides context for their cognitive development, educational level, and likely familiarity with digital technology. The age range of respondents helps to establish that the sample appropriately represents the target population of advanced-level secondary school students. Table 4.1 below depicts the scenario.

Table 2.1 Age Group of the Respondents

Age Group	Frequency	Valid Percent
Below 16	42	18.0%
17–18	103	42.%
18 -20	56	24.0%
21-30	15	6%
31-40	24	10%
Total	240	100%

Source: Field Research data, 2025

Table 2.1 highlights that over half (50.7%) of respondents fall within the 17–18 age range, which is the standard cohort for Form V and VI. This confirms that the sample is relevant for understanding ICT usage in the most active academic age group. This implies that adolescents in this age group are in the Piagetian "formal operational stage," capable of abstract thinking and thus well positioned to understand and benefit from ICT tools (Piaget, 1972; supported by Taber, 2016, in educational technology contexts).

4.3 Gender of Respondents: The gender distribution of the study's respondents is a vital demographic factor, as it can notably shape respondent patterns. Understanding the gender makeup of the sample is crucial for evaluating data representativeness and examining potential differences in how male and female students engage with and benefit from ICT resources in an educational setting. The following Table 4.2 demonstrates.

Table 3.1 Gender of the Respondents

Gender	Frequency	Valid Percent
Male	109	45%
Female	131	55%
Total	240	100%

Source: Field Research data, 2025

Table 3.1 indicates that slightly more females (54.2%) than males were surveyed, providing balanced gender representation. This result aligns with UNESCO's (2022) call for inclusive ICT access regardless of gender, especially in African regions where digital gender divides persist. A near-equal distribution enables fair conclusions regarding the impact of ICT on both genders.

4.4 Subject Stream: The academic specialization or subject stream of the student respondents is a key demographic factor, as it often determines the type and frequency of ICT resource use. Different streams typically have distinct curricular demands, which can impact how technology is integrated into teaching and learning. Table 4.3 below highlights the Subject Stream.

Table 4.1 Subject Stream

Subject Stream		
Subject	Frequency	Valid Percent
Arts	129	64.20%
Science	72	35.80%
Total	201	100%

Source: Field Research Data, 2025

Table 4.1 shows that the majority (64.2%) are arts students, which might influence ICT usage patterns, as science students often have more direct interaction with simulations, lab-based

software, etc. Science students may demonstrate greater utility in practical applications (Wang & Woo, 2020), while arts students may utilize ICT for research, presentations, and writing tools.

4.5 School Type: The classification of schools as public or private is a significant factor in this study, as institutional type is often closely linked to disparities in funding, resource allocation, and administrative flexibility, all of which can profoundly influence ICT infrastructure and its utilization. Table 4.4 below specifies the type of school.

Table 5.1 School Type

School Type

Type	Frequency	Valid Percent
Public	113	56.20%
Private	88	43.80%
Total	201	100%

Source: Field Research Data, 2025

Table 5.1 highlights A fair representation from both public and private schools, allowing for comparative insights. This is reflected in the study by Mtebe & Raisamo (2014), which shows that private schools in Tanzania often have better ICT infrastructure due to independent funding, unlike many public schools, which face resource constraints.

4.5.1 Class Level: The class level of respondents, distinguishing between Form V and Form VI, is a significant demographic factor, as it may reveal differences in ICT exposure, usage patterns, and academic priorities at different stages of the senior secondary Education cycle.

Table 6.1 below shows the Class Level.

Class Level

Level	Frequency	Valid Percent
Form V	129	64.20%
Form VI	72	36.00%
Total	201	100

Source: Field Research data, 2025

Table 6.1indicates that Form V students dominate the sample, which may reflect that many were new entrants and perhaps more recently exposed to school ICT resources.

4.5. The study findings:

4.5.1 To assess the extent to which ICT resources are available and utilised in advanced secondary schools in Unguja.

In this part of the study, the researcher was interested in assessing the extent to which ICT resources are available and utilised in advanced secondary schools in Unguja.

Schools' ICT Equipment and Materials (ICTEM)

ICT equipment and materials are important resources that support the effective teaching and learning process at advanced and other educational levels. In the field, the researcher asked respondents to rate various items from their perspectives. The following is the summary in Table 7.1

Table 7.1: Schools' ICT Equipment and Materials

Category of answer	Frequency	Valid Percent
Strongly Disagree	12	6.00%
Disagree	25	12.40%
Neutral	79	39.30%
Agree	80	39.80%
Strongly Agree	5	2.50%
Total	201	100%

Source: Field research data (2025)

Table:7.1 indicates that Agree and Strongly Agree = 42.3% of respondents believe their school provides adequate ICT equipment and materials. Whereby Neutral = 39.3% a high portion, possibly due to inconsistent access or lack of awareness of the full range of ICT resources. Whereas, disagree and strongly disagree = 18.4% indicating a significant number of students feel their schools are poorly equipped. While over 42% of students acknowledge the presence of ICT facilities, nearly 4 in 10 remain undecided, and almost 1 in 5 deny availability. This result suggests That Equipment may exist but is limited in quantity, not functional, or inaccessible to all students. Students in public schools or from non-science streams may lack regular exposure to the available ICT resources. Some schools may prioritize specific levels (e.g., Form VI) or subjects when allocating ICT tools. During the focus group discussion sessions, the researcher organised different groups based on the schools. Focus group discussion from school 'A'. The question asked was: What kind of ICT tools are available at your school (e.g., computers, projectors, smartboards)?

> *…some schools received tablets under the Ministry of Education project, but most are no longer functioning due to a lack of updates or mishandling……*

Similarly, an explanation was obtained from the second FGD school 'A' that

> *…. teachers identified that their schools have desktop computers in their ICT lab, but most of them are outdated and not all of them work properly*."

The current study results comply with the study by Mtebe & Raisamo (2014). According to their study across Tanzanian secondary schools, limited access to ICT resources is a significant barrier to effective integration of technology into teaching. They found that even when computers are available, the student-computer ratio is often too high to ensure meaningful learning experiences. Similarly, Tella et al. (2021) highlight that the lack of ICT materials, particularly in rural and semi-urban schools, is a root cause of underutilization of technology in East African Education systems. In Zanzibar, the ZICTIA ICT Policy Framework (2020) also acknowledged these infrastructure disparities, noting that most government-funded schools rely on donor programs for ICT resources, making provision unstable and unsustainable. This implies that the data strengthens the current impact of ICT infrastructure, which is insufficiently distributed or utilized. It supports calls for government investment and donor partnerships to provide consistent ICT facilities across all secondary schools. Training and awareness might also be necessary if students remain “neutral” because they do not know what ICT equipment, they are supposed to have access to.

Reliability of ICT Access

In the field, researchers sought to determine the reliability of ICT access. The respondents were given the items to select as they felt were best suited for their school's learning environment. This indicator measures how consistently and dependably students can access ICT tools and infrastructure (e.g., internet availability, stable electricity, functional devices). Table 4.3 illustrates the field situation.

Table 8.1 Reliability of ICT Access

Category of answer	Frequency	Valid Percent
Strongly Disagree	16	8.00%
Disagree	3	1.50%
Neutral	79	39.30%
Agree	86	42.80%
Strongly Agree	17	8.50%
Total	201	100%

Source: Field research data, (2025)

Tables: 8.1postulates the field result. In brief, the results highlight that 51.3% of respondents scored Agree or Strongly Agree, while 39.3% scored Neutral, indicating a significant number of mixed or uncertain experiences. While 9.5% of the respondents scored 'disagree' and 'strongly

disagree', a small but relevant group expressed dissatisfaction. The general result implies that the majority believe they have reliable access to ICT services, a promising sign. However, the large neutral segment suggests inconsistent access or unequal distribution between schools or even within schools (e.g., only science students or Form VI have full access). The low percentage of disagreement (9.5%) suggests limited outright dissatisfaction, although reliability may vary by school type (public vs. private) or region.

During the focus group discussion with teachers from School A, the researcher identified a problem with power cuts that threatens the reliability of the ICT infrastructure and resource utilization. The following sentences vividly explain the situation.

> "…*power cuts are a big problem. Sometimes we come to the lab, and there is no electricity at all." "When we have double sessions and power goes out, the ICT session is cancelled or turned into a theory class." [FGDs School A. Aug. 4, 2025]*

This conversation, to some extent, supports the notion that there is ineffective ICT and resource utilization at the Advanced Secondary school in the study area. However, improvements to the services are in progress. Similarly, during FGDs with School 'B', participants also highlighted the issue of electricity for effective ICT and resource utilization. In brief, please see the following narration from the school.

> *".....some schools have solar panels, but they do not fully support the ICT lab. We need backup generators." "Electricity availability varies; urban schools tend to have more stable power compared to rural outskirts. [FGDs School B, 5 Aug. 2025]*

This result corresponds with findings by Unwin (2019) and Oluoch et al. (2022), who argue that in East Africa, ICT access is improving but remains unreliable in public schools, often due to Unstable electricity, Poor internet connectivity, non-maintained ICT labs, and Selective access based on academic streams. Furthermore, Roshanaei and Duan (2021). emphasized that reliability, not just availability, is key to achieving educational outcomes through ICT. If students experience frequent outages or broken equipment, the infrastructure becomes functionally useless. In the Zanzibar context, Ali (2023) notes a significant variation in ICT access reliability between urban and peri-urban schools, often reflecting the difference between donor-supported and government-funded programs.

Teachers' Role in Using ICT

In the field, researchers are interested in understanding the role of teachers in using ICT. This measures the extent to which teachers utilize ICT tools (such as smartboards, projectors, online platforms, and educational software) in classroom instruction and learning facilitation. The following Table 4.4 depicts.

Table 9.1 Teachers' Role in Using ICT

Category of answer	Frequency	Valid Percent
Strongly Disagree	1	0.50%
Disagree	62	30.80%
Neutral	52	25.90%
Agree	65	32.30%
Strongly Agree	21	10.40%
Total	201	100%

Source: Field research data, (2025)

Table 9.1 indicates the results obtained in the field. The results show that 'Agree' and 'Strongly Agree' account for 42.7%, suggesting that teachers are using ICT tools to some extent in the classroom. Neutral = 25.9% possibly reflects inconsistent or occasional use. Disagree and Strongly Disagree = 31.3% a significant portion of students do not observe active ICT use by teachers. The fact that nearly a third of respondents disagree suggests a gap in teacher readiness or motivation to integrate ICT in classroom practices. With only 10.4% strongly agreeing, it appears that very few teachers are making intensive or innovative use of ICT. The high neutral rate (25.9%) could imply that ICT use by teachers is passive or limited to occasional presentations, not active facilitation or student engagement.

In this aspect, researchers interviewed teachers in the FGDs from School C about their role in ICT infrastructure and resource utilization. The participants highlighted the following role.

> *…. guiding students in digital search, especially for science and project-based subjects. Demonstrating the use of software tools, simulations, and interactive learning platforms to enrich classroom content [FGDs 6 Aug. 2025]*

This suggests that the ICT infrastructure and resource utilization have an impact on students' performance, as confirmed by the teachers. Apart from that, the Head teacher from School C (HTC) explained that

> *…Many secondary school teachers, particularly in my school, lack frequent ICT-related training, which requires not only infrastructure but also pedagogical ICT competence. It is better to improve this aspect. [HTC Interview: Aug. 6, 2025]*

. The current study results align with those of Kafyulilo et al. (2015) and Mwalongo (2011) in Tanzanian contexts: many secondary school teachers lack adequate ICT training. Teachers often rely on traditional teaching methods, even when technology is available. The integration of ICT into pedagogy requires not only infrastructure but also pedagogical competence in ICT. Similarly, Tondeur et al. (2012) explain that teachers' beliefs, support systems, and digital literacy levels all influence their ICT practices in the classroom. Without institutional support or ongoing training, usage remains superficial. This implies that, despite the availability of ICT resources in some schools, teachers may not be maximizing their use, thereby limiting the impact of ICT on students' learning. The results suggest that teacher capacity-building programs and professional development in ICT integration are urgently needed. This is a critical finding: even when

infrastructure exists (as previous variables have shown), its impact depends heavily on how teachers utilise it.

Students' Use and Familiarity with ICT Tools

In the field, the researcher tested the variable to evaluate the extent to which students themselves use ICT tools for learning activities, including computers, internet research, online learning platforms, and educational software. Table 4.4.5 presents the situation in brief. Feedback). This data suggests that Unguja schools are still in the first-order stages.

4.6 Conclusion, And Recommendations

Conclusion: The following is the conclusion of the study titled The Impact of ICT Infrastructure and Resource Utilization in Unguja's Advanced Secondary Schools. The study demonstrates that ICT infrastructure plays a crucial role in enhancing the academic performance of advanced secondary school students in Zanzibar by improving resource utilization. While significant progress has been made in providing ICT facilities such as computers, projectors, and internet access, disparities in their availability and use remain across the schools examined. In some schools, resources are underused due to limited technical skills, poor maintenance, or a lack of integration into the curriculum. Similarly, teachers' and students' attitudes towards ICT are generally positive, indicating recognition of its potential to enhance teaching and learning. However, this positive outlook is often limited by practical issues, including unreliable internet connections, a shortage of proper training, and a lack of strong leadership support for ICT initiatives.

Recommendations: The following are the general recommendations for the effective implementation of ICT infrastructure and resource utilization in the performance of advanced secondary school students. First, the government, through the Ministry of Education, and development partners should invest in upgrading ICT facilities, including modern computers, projectors, printers, and high-speed internet, to ensure all advanced secondary schools have sufficient and reliable access. They should also ensure the equitable distribution of ICT resources to prevent disparities between schools in urban and less-privileged areas. Second, the responsible ministry should integrate ICT-based activities and digital content into the national curriculum to encourage regular use of technology in teaching and learning. Promote blended learning approaches that combine traditional teaching methods with ICT-enhanced strategies for enhanced engagement and understanding. Third, the government, along with other stakeholders, should allocate dedicated budgets for ICT maintenance, upgrades, and technical support to keep resources operational and up-to-date. Collaborating with telecommunication providers can help lower internet costs and enhance connectivity in schools. Additionally, offering regular technical support is crucial for promptly resolving hardware or software issues.

References

(National Information Technology Development Agency, 2022)

ALI, H. (2023). *Assessment on the Role of Artificial Intelligence in Accelerating Justice Delivery* (Doctoral dissertation, IAA).

Ali, Z., Ahmad, N., Rehman, H. U., Ullah, N., & Zahra, T. (2023). Investigating teacher educators' perceptions on technology integration in teacher preparation programs. *Journal of Social Sciences Review*, *3*(2), 341–355.

Anton, J. D., Sengottuvel, N. A., & Kumar, S. (2024). Perception of Students Toward Traditional Teaching and Online Teaching Methods During the 2nd Year MBBS. *Journal of Indian Academy of Forensic Medicine*, *46*(3), 391–396.

Black, P., & Harrison, C. (2010). Formative assessment in science. *Good practice in science teaching: What research has to say*, 183–210.

Caeli, E. N., Caviglia, F., & Bundsgaard, J. (2025). ICT Use, Self-efficacy, and the Future of Eighth-Grade Students: A Qualitative Study of Gender Differences. *TechTrends*, *69*(1), 233–243.

Chai, Y., Pannell, D. J., & Pardey, P. G. (2023). Nudging farmers to reduce water pollution from nitrogen fertilizer. *Food Policy*, *120*, 102525.

Chiang-Hanisko, L., Newman, D., Dyess, S., Piyakong, D., & Liehr, P. (2016). Guidance for using mixed methods design in nursing practice research. *Applied Nursing Research*, *31*, 1–5.

Davis (1989). *Perceived usefulness, perceived ease of use, and user acceptance of information technology*. MIS Quarterly, 13(3), 319–340.

Evans, S., & Willis, C. (2024). The use of digital technologies in sport and physical Education lessons: fostering need-supportive behaviors in physical Education teachers.

Haji, O. N., Alochere, B. J., Mokua, T. K., & Asiimwe, S. Teacher Competencies and Digital Effectiveness: A Flipped Classroom in Zanzibar Lower-Secondary Schools.

IGI: Global Scientific Publishing, (2025) Information Communication Technology Infrastructure Integration: Derived from: www.igi-global.com October 23, 2025

Institute of Education, Tanzania, 2024): Derived from https://www.tie.go.tz/, October 23rd, 2025.

Jamali, A. A., Ur Rehman Khoumbhati, K., Shah, A. A., Bhutto, A., & Jamali, A. M. (2024). Exploring ICT-based learning adoption in higher Education: An extended perspective of the technology acceptance model. *Mehran University Research Journal Of Engineering & Technology*, *43*(3), 89–101.

Jilani, S. A. A. S., Bukhari, S. S. H., Lashari, A. A., Rasool, A., Khoso, T. A., & Shah, S. A. A. (2024). The Role of Heads' Leadership Styles In Public Sector Secondary School Teachers' Commitment in Sindh. Migration Letters, 21(S2), 16291642.

Kafyulilo, A., Fisser, P., Pieters, J., & Voogt, J. (2015). ICT Use in Science and Mathematics Teacher Education in Tanzania: Developing Technological Pedagogical Content Knowledge. *Australasian Journal of Educational Technology*, *31*(4).

Kamau, G., Ogogo, C., & Kirimi, J. (2025). Information and Communication Technology (ICT) Acceptance in Educational Management at the Administration Police Training College in Embakasi, Kenya. *International Journal of Multidisciplinary Research*, *5*(6).

Kiwonde, F. M. (2024). The Use of ICT in Tanzanian Secondary Schools: Experiencing Obstacles in the Teaching and Learning Processes. *Journal of Issues and Practice in Education*, *16*(1), 59–75.

Lai, P. C., & Zainal, A. A. (2015). Consumers' intention to use a single platform e-payment system: A study among Malaysian internet and mobile banking users. *Journal of Internet Banking and Commerce*, *20*(1), 1–13.

Lee, J., Cerreto, F. A., & Lee, J. (2010). Theory of planned behavior and teachers' decisions regarding use of educational technology. *Journal of Educational Technology & Society*, *13*(1), 152–164.

Livingston, S. A., Carlson, J., & Bridgeman, B. (2018). Test reliability: basic concepts. *Research Memorandum No. RM-18-01). Princeton, NJ: Educational Testing Service*, *8*, 1–38.

Martínez-Mesa, J., González-Chica, D. A., Duquia, R. P., Bonamigo, R. R., & Bastos, J. L. (2016). Sampling: How to select participants in my research study?. *Anais Brasileiros de Dermatologia*, *91*(3), 326–330.

McKillup, S. C., & McKillup, R. V. (2005). Fire does not stimulate flowering of the grass tree Xanthorrhoea latifolia subsp. latifolia in central Queensland. *Australian Journal of Botany*, *61*(7), 558–565.

Ministry of Education and Vocational Training (MoEVT, 2006), Education Policy

Mtebe, J. S., & Raisamo, R. (2014). Investigating perceived barriers to the use of open educational resources in higher Education in Tanzania. *International Review of Research in Open and Distributed Learning*, *15*(2), 43–66.

Mwalongo, A. (2011). Teachers' Perceptions of ICTs for Teaching, Professional Development, Administration, and Personal Use. *International Journal of Education and Development using ICT*, *7*(3), 36-49.

Oluoch, C. O. (2022). *Effects of Information Technology on Internal Auditing in Commercial Banks in Kenya* (Doctoral dissertation, University of Nairobi).

Piaget, J. (1972). Development and learning. *Reading in child behavior and development*, 38–46.

Požgaj, Ž., & Vukšić, V. B. (2011). Personal knowledge management: The implications of Web 2.0 services on the learning process. In *2011 Proceedings of the 34th International Convention MIPRO* (pp. 1213-1217). IEEE.

Revolutionary Government of Zanzibar (RGoZ, 2013). Recent efforts have been made to promote national ICT initiatives that recognize the importance of technology in Education.

Rohatgi, A., Bundsgaard, J., & Hatlevik, O. E. (2021). Collaboration, Attitudes, ICT Use, and Students' ICT Literacy. *Equity, Equality and Diversity in the Nordic Model of Education*, 139.

Roshanaei, M., & Duan, Q. (2021). International Telecommunication Union Standardization for Trust Provisioning in Information, Communication, and Technology Infrastructure toward Achieving the United Nations' Sustainable Development Goals. *Journal of Computer and Communications*, *9*(10), 44–59.

Sachdeva, S., Iliev, R., & Medin, D. L. (2009). Sinning saints and saintly sinners: The paradox of moral self-regulation. *Psychological Science*, *20*(4), 523–528.

Seidman, I. (2006). *Interviewing as qualitative research: A guide for researchers in Education and the social sciences*. Teachers College Press.

Singh, A. S., & Masuku, M. B. (2014). Sampling techniques & determination of sample size in applied statistics research: An overview. *International Journal of economics, commerce and management*, *2*(11), 1–22.

Suleiman, M. M., Yahya, A. T., & Tukur, M. (2020). Effective utilization of ICT tools in higher Education. *development*, *2*(5), 7-20.

Sun, W., & Shi, H. (2024). Fostering success in online English Education: Exploring the effects of ICT literacy, online learning self-efficacy, and motivation on deep learning. *Education and Information Technologies*, *29*(18), 24899–24920.

Taber, K. S. (2016). The role of new educational technology in teaching and learning: A constructivist perspective on digital learning. In *Handbook on digital learning for K-12 schools* (pp. 397–412). Cham: Springer International Publishing.

Teddlie, C., & Tashakkori, A. (2012). Common "core" characteristics of mixed methods research: A review of critical issues and call for greater convergence. *American behavioral scientist*, *56*(6), 774–788.

Tella, A., & Onyebinama, C. (2022). Advanced Technology And New Approaches To Teaching Information Literacy At the Universities In A Developing Country Context: Challenges And The Way Forward. *The Dlis 2022*, 2.

Toma, F., Ardelean, A., Grădinaru, C., Nedelea, A., & Diaconu, D. C. (2023). Effects of ICT Integration in Teaching through Learning Activities. *Sustainability*, *15*(8), 6885.

Tondeur, J., Aesaert, K., Prestridge, S., & Consuegra, E. (2018). A multilevel analysis of what matters in the training of pre-service teachers' ICT competencies. *Computers & Education*, *122*, 32–42.

United Nations Educational, Scientific and Cultural Organization (UNESCO, 20218) Institute for Statistics Report

Unwin, G. (2019). *Industrial Organization in the Sixteenth and Seventeenth Centuries*. Routledge.

Wang, Y., & James Woo, D. (2020). Investigating Digital Literacy Skills in Examination-Oriented Education System for the Post-Pandemic Era. In *Proceedings of the 2021 4th International Conference on Education Technology Management* (pp. 169–175).

Wordu, J. A. (2022). Quality, Relevance and Impact (QRI): Evaluating the contribution of higher Education to sustainable development in Nigeria.

Yamane, Y. (1967). Mathematical Formulae for Sample Size Determination.

Zangirolami et al. (2018). *Research methodology topics: Cross-sectional studies* Article in Revista Brasileira de Crescimento Desenvolvimento Humano · November 2018.

Zanzibar Information Communication Technology Infrastructure Agency (ZICTIA, 2020) ICT Policy Framework