An assessment of digital inclusion among vulnerable persons in developing economies

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Abbreviations

AGCC	: African Girls Can Code
CIPESA	: Collaboration on ICT policy in East and Southern Africa
COVID	: Corona Virus Disease
OECD	: Organisation for Economic Co-operation and Development
EFA	: Exploratory Factor Analysis
ICT	: Information and Communication Technology
IS	: Information Society
ITI	: Industrial Training Institute
M4D	: Mobile for Development
ITU	: International Telecommunication Union
PWD	: People With Disabilities
PWSN	: People With Special Needs
SMEs	: Small and Medium Enterprises
UN	: United Nations
UNHCR	: United Nations High Commission for Refugees
UNCDF	: United Nations Capital Development Fund
UCC	: Uganda Communications Commission
WHO	: World Health Organization

1. Executive Summary

The present period is plagued with rapid transformation caused by the rapidly evolving digital technologies. Despite this development, not everyone is digitally connected, most especially in the developing economies, and thus, this creates socio-economic challenges. Digital access should not be seen as a luxury during this era, but a necessity for everyone to participate in the global digital society.

This study is aimed at discovering the determinants that influence digital inclusion among the vulnerable persons in Uganda and South Africa. In this study, a comprehensive literature review was conducted that integrated academic research, policy research and intergovernmental research.

The study adopted a mixed research approach to assess the factors influencing digital inclusion in Uganda and South Africa. Surveys using questionnaires were carried out in Uganda and South Africa. Interviews were also conducted in Uganda to gain participants' thoughts about improving digital inclusion in Uganda and South Africa. A conceptual framework was developed, and six variables were empirically tested. Four determinants were found to influence digital inclusion in developing economies and may be applicable to other developing economies. These are Internet access, digital literacy, socio-economic status, and Information and Communication Technology (ICT) infrastructure. The research report will be useful to practitioners, policy makers and academia to understand the determinants of digital inclusion, and also to assist them to develop strategies of digital inclusion.

As a result of the study, the proposed recommendations to improve digital inclusion include:

a) Leverage ICT infrastructure for both urban and rural settings to enable equal access to technological services;
b) Provide assistive technologies to meet the customised ICT requirements and promote effective ICT use for people with special needs (PWSN);
c) Carry out digital awareness and trainings to promote digital literacy for everyone;
d) Governments to consider subsidisation to make mobile technology affordable for those with low-income. This will also enable vulnerable people to gain access to technological devices and services using mobile technology such as smartphones;
e) There is need for governments and private entities to invest in most appropriate ICT infrastructure to widen network access for all people in various locations;
f) Humanitarian organizations to spearhead the promotion of digital rights for all people; and
g) Design systems that are most appropriate for ageing populations to enable them to use technology effectively.

Implementing the proposed recommendations, to some extent, will help in minimizing the digital inclusion gap and more especially among the vulnerable people. Policy makers and government agencies have a leading role to promote digital inclusion. Once digital inclusion gaps are minimized, all people including the vulnerable will benefit from inclusiveness. The benefits of digital inclusion include: greater opportunities for employment, increased productivity, increased participation in the digital economy, opportunities to access financial services, e-government services, and recreation services, building stronger social connections, and improvement of research skills and learning.

2. Introduction

The adoption of ICTs and Internet technologies have created the “placeless connectivity” with the “anywhere, anytime” approach (Webster, 2013). However, despite this high level of adoption, some individuals still do not have Internet access, thus causing some doubts about how this gap might affect them in the future. These gaps have led to the isolation and marginalization of individuals and communities over the years caused by the uneven Internet and ICTs access (Elena-Bucea et al., 2021). These ICT disparities have caused “digital divide” and the need to take on digital inclusion.

Digital inclusion is referred to as the different strategies ensuring all people have equal access, skills, and opportunities so as to benefit from digital technologies and ICTs (ITU, 2019). Inequality discussions have been focused on digital systems u around the ‘digital divide’ (Carni and Yates, 2020). Digital divide has been regarded as the gap between those who have and those who do not have access to the Internet, and the term was first used in the USA during the Clinton administration (Olphert and Damodaran, 2013). Digital divide is related to connectivity, capability and content, especially where there is a lack of access to equipment for connectivity purposes, required skills and capabilities, and suitable functionality and content to attract users. The Organization for Economic Co-operation and Development (OECD) defines digital divide as “the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities” (OECD, 2001).

The COVID-19 pandemic has created a new profound sense of accelerating the digital inclusion agenda (World Economic Forum, 2020). Whilst the importance of digital connectivity in daily life has been heightened, the COVID-19 pandemic has revealed the gaps in access and increased the digital divide in both the developed and developing countries, affecting many vulnerable people. Low- and middle-income countries lack fixed network coverage, penetration, and high speed connection. In response to the COVID-19 crisis, connectivity and technological players have provided short term response actions, which is contained in the Digital Development Joint Action Plan and Call for Action published by the World Bank, International Telecommunications Union (ITU), GSMA and World Economic Forum.

According to a survey carried out by Miniwatts Marketing Group (2021), 90% of the adults in developed countries are using the Internet, while only 57% of the people in developing countries do so. 93% of the world’s unconnected population live in low- and middle-income countries (GSMA, 2021). The percentage of the population in Europe that lives within the reach of mobile cellular signal is close to 100% (ITU, 2021). In America, the Internet penetration stands at 92% of the total population (Datareportal, 2022). In the USA, digital divide has led to inequality amongst the ethnic groups (Chakravorti, 2021). Almost half of the Americans who do not have Internet at home were in Black and Hispanic households. In 2018, a third of all the white workers were working in jobs that they could be performed at home, while less than 20% of Black workers and only 16% of Hispanic workers were in jobs that can be done remotely. Consequently, a majority of Black and Hispanic workers could be locked out of 86% of jobs by 2045 if additional interventions were not carried out to close the digital divide.

Some communities could not adopt Internet technologies due to digital illiteracy. Only 32% of the population in lower income countries have basic digital skills, while 62% have basic digital skills in higher-income countries. The digital divide also affects Small and Medium Enterprises

(SMEs) which comprises 90% of businesses worldwide, and not just individuals and households (World Economic Forum, 2020). In Africa, the digital divide exists, most especially with respect to Internet and broadband adoption (Mutsvairo and Ragnedda, 2019; Oyelaran-Oyeyinka and Lal, 2005), so that not all people can benefit from new digital technologies. Therefore, it is important to understand the drivers (or factors) of digital inclusion in these economies to inform policymakers on potential measures to reduce the divide gap (Myovella et al., 2021).

2.1 Research Background

This research project is one of the successful projects in the Connect2Recover research competition organized by ITU's Connect2Recover initiative. The focus of the research competition is to improve research on digital resiliency and digital inclusion for COVID-19 pandemic recovery, to develop a global research community of researchers around digital inclusion, and finally, to promote knowledge sharing of practices that can build back better with broadband. ITU's strategic plan 2020-2023 echoes inclusiveness among other goals with a focus to bridge the digital divide and to enable everyone to benefit from telecommunications/ICTS.

According to Stefanita and Ivan (2018), much of the digital divide research was centered on the gap between those who have or do not have access to the Internet and on the factors which lead to inequality in access. The digital divide phenomenon has been researched by how the term 'access' is perceived. The types of 'access' mentioned in the literature include material access, psychological access, skills access, and usage access. Material access means not having computers or Internet connection. Psychological access refers to not possessing digital experience due to fear or a lack of interest in ICTs. Skills access is not having digital skills due to lack of emphasis in educational system or support. Usage access implies the deprivation of significant usage opportunities. Not having access can lead to negative effects that are related to political information and participation, health and well-being, social capital, and social inclusion (Friemel, 2016).

Digital exclusion causes inequality and marginalization of the part of society in which it exists (Deaton, 2013). Thus, the digital access gap needs efforts to be bridged since it can lead to inequality in resource distribution, life opportunities and societal inclusion (Stefanita and Ivan, 2018). Consequently, the focus of our research falls on identifying the factors and their interdependencies that influence digital inclusion among the vulnerable groups living in Uganda and South Africa. By analysing the determinants of disparities of Internet access in these two countries, the knowledge derived will assist in the development of strategies to bridge the digital divide. Drawing on the findings, the project team developed a suitable digital inclusion framework for developing economies that can provide in-depth insights into the drivers of digital inclusion as well as recommendations on how to bridge the digital divide. The framework can be used policymakers to reduce digital divide among their citizens.

2.1.1 Global Digital Inclusion Trends

According to the ITU (2021), 4.9 billion of the world's population (63%) have Internet access. Nevertheless, 2.9 billion remain offline and 96% of them live in developing countries. The situation is not balanced in developing countries as compared to developed nations where

Internet connectivity has reached its saturation point (Myovella et al., 2021). For example, in Africa, only about 33% of the population use the Internet as compared to 87% in Europe (ITU, 2021). UNCTAD (2021) states that 20% of the people in developing countries use the Internet as compared to 90% in developed countries (ITU, 2021). Consequently, knowledge about digital inclusion is important to allow developing countries to take measures and mitigate or even overcome the digital divide as proposed by the UN Summit for the Adoption of the Post 2015 Development Agenda (ITU, 2018).

2.1.2 Digital Inclusion Trends in Uganda

Uganda experiences an amazing digital gap among various sections of people. Kakaire (2020) alludes that though there were 16.9 million Internet subscribers in Uganda in 2019 and mobile subscriptions stood at 26.7 million, however, most of the population remained unconnected. Due to the limited digital skills and high costs of data, the digital gap in the country is wider among the vulnerable persons, women inclusive. While Uganda seems to have good digital inclusion policies and a stronger regulatory environment, nevertheless, skills, innovation, infrastructure, and inclusiveness are insufficient (UNCDF, 2020). It is clear from the Uganda Digital Vision 2040 that Information and Communication Technology (ICT) empowers people.

Billwald, Mothobi, Ndiwalana and Tusubira (2019), in their report on the status of ICT in Uganda, reveal that Uganda has a big urban-rural gap in Internet use, where only 9% of Ugandans living in rural areas have access to the Internet whereas about 30% of urban dwellers use it. This gap among the vulnerable persons is likely to be even wider. The divide resulting from gender and ICT use in the country does not vary much from urban-rural ICT setting. A survey carried out by the Communications Commission (CC) in 2015 on access and usage of ICT reveals that only 15% of women had used a computer or Internet in the last three months as compared to 21% of the men. There are some efforts to integrate policies such as Vision 2040, National Youth Policy, gender issues, Persons with Disabilities (PWD) concerns in National ICT programs, nevertheless, the digital inclusion concerns continue to escalate. Above getting access to the digital devices, their most appropriate use demands right skills, an enabling environment, expertise, knowledge and suitable technological tools. CIPESA (2022) reveals that the introduction of new taxes for data bundles is a huge hindrance to inclusive access and use of Internet and more especially, among the vulnerable people. The media tax negatively affect the use of social media applications such as Facebook, WhatsApp, YouTube, Instagram, TikTok, Twitter, Snapchat that were used by the vulnerable people. Therefore, though the use of ICT in the country seems to have improved in various areas such as education, health, finance, public service, some sections of Uganda are still digitally excluded, and the gap may continue to widen in the absence of the most appropriate solutions.

2.1.3 Digital Inclusion Trends in South Africa

Despite its high level of technology and strong economic development, documentation of digital inclusion trends has gained little attention. Like many other African countries, amidst its high level of technological advancement, South Africa still experiences inequality of access,

use and utilization of ICT, which is contrary to ITU's mission to ensure that everyone to use and benefit digital information, products, and services equally and equitably (ITU, 2019). According to ITU (2019), people and communities who are connected possess digital skills and are empowered to access information, online health services and life-saving disaster warnings. Individuals in this category can pay for goods and services via mobile phones, stay in touch with the loved ones and increase their productivity. Consequently, there is no country in Africa that seems to have fully attained complete digital inclusion.

The 1996 South Africa Constitution stipulates that everyone, whether male or female, has equal right to access knowledge and information (South Africa, 1996). Despite the existence of such constitutional rights and laws, South Africa still experiences some traces of digital exclusion and more especially among the vulnerable persons. Billwald et al. (2019) note that South Africa has a lower urban-rural digital inclusion gap than Uganda. Nevertheless, this lower gap does not make South Africa free from digital inclusion challenges. According to the Statistics of South Africa (2018), Western Cape and Mpumalanga provinces are less connected as compared to Gauteng province.

The story of digital inclusion in South Africa is not much different. Venter et al. (2019) note that despite South Africa being the leader of digital usage in Africa with 83% Internet penetration, digital inclusion challenges continue to be predominant. In South Africa, digital access does not always reach the less affluent, disenfranchised, and vulnerable groups, thus causes digital divide in such communities. The more affluent the group is, the easier it is for them to access digital services for socio-economic development, and the reverse is true for the vulnerable people. Thus, there is the need for provision of equal opportunities in terms of ICT infrastructure, access, ICT skills and friendly devices to all people. Matli and Ngoepe (2020) state that deficiency in digital skills creates discrimination among people in society.

The need to narrow the digital inclusion gap among the various vulnerable categories of persons in developing countries is very important in order to reduce the digital divide among the vulnerable group. UN (2020) advocates for the provision of effective and affordable ICT infrastructure, affordable Internet, promotion of digital skills, and increasing the awareness of the benefits of digital skills.

2.2 Research Scope

The scope of this research focuses on the tendency of various groups of people to digital inclusion including the vulnerable people in Uganda and South Africa. Hence, the data was collected from respondents in these two countries. It is believed that generalizations can be made from the findings of the research based on the collected data. The respondents who participated and responded to the questionnaire and interviews were from the districts of Kampala, Mukono, Luuka, Jinja, Iganga, Wakiso, Masaka, Mpigi, Nebbi in Uganda and the provinces of Gauteng and Limpompo in South Africa. The study was conducted from the Month of January up to June 2022.

2.3 Problem Statement

Governments around the world have included digital inclusion on their agenda in order to give their citizens what they need to function effectively as digital society members (Thomas et al., 2018; Digital Inclusion Research Group, 2017). ICTs are important infrastructures that enable organizations, individuals, communities, and countries to contribute and benefit from the digital economy (Kumar et al., 2021). They assist people to stay connected and enhance different types of exchanges such as financial, natural, health and social resources.

Digital inclusion is vital in the promotion of economic prosperity and social equality; however, gaps persist between organizations, individuals and communities when accessing and using various digital technologies (Kumar et al., 2021). While the Internet penetration is increasing globally, the digital divide continues and the capability of accessing and using ICT effectively remains unequal (Callahan and Siefer, 2019; Newman et al., 2017). Recently, such inequalities have been exacerbated globally by the COVID-19 pandemic (Broom, 2020), thus, this increases the urgency to investigate these inequalities. Therefore, it is important to understand and develop strategies for the promotion and enhancement of digital inclusion in developing economies so that disadvantaged groups and communities can have better and improved access to the use of ICTs.

Several studies have investigated the antecedents and drivers of digital inclusion at the country and individual levels (Holgersson et al., 2019; Rashid, 2016; Salemink et al., 2017), however, most of these studies were carried out in developed economies. Moreover, the underlying procedures shaping digital inclusion are unclear at the global level (Adam and Alhassan, 2020). Also, to date, there has been little or no quantitative research on digital inclusion in African economies and recent studies on the Internet and development outcomes relationships (Hjort and Tian, 2021; Zhuravskaya et al., 2020) have been on Internet access exclusively and have not investigated other aspects of digital inclusion. This study aims to fill these gaps. Based on this, we examined the factors contributing to digital inclusion among in developing economies. This research on digital inclusion aims to discover a better understanding of this important, yet under researched theme in the Information Society (IS) field.

2.4 Research Goals, Objectives, and Aim

The aim of this study is to discover the factors that influence digital inclusion among vulnerable persons in the developing economies of Uganda and South Africa.

Main objective: To make an assessment of digital inclusion considering the case studies of Uganda and South Africa and to recommend ways to reduce digital divide in these two countries.

Specific Objectives:

(a) To identify factors influencing digital inclusion in developing economies.
(b) To identify the requirements for digital inclusion in developing economies.
(c) To develop and validate suitable digital inclusion framework for developing economies.

(d) To provide recommendations on how digital divide reduction can be achieved in developing countries such as Uganda and South Africa.

2.5 Research Questions

The research questions for the study are as follows:

(a) What are the factors and their interdependencies that influence digital inclusion among the vulnerable people in developing economies?
(b) What are the requirements for digital inclusion in developing economies?
(c) How can the identified factors be used to develop a suitable digital inclusion framework/model for developing economies?
(d) What are the recommendations on how digital divide reduction can be achieved in developing countries such as Uganda and South Africa?

3. Literature Review

3.1 The Concept of Digital Inclusion

Digital inclusion has emerged as a key technological concern dominating the agenda of governments' policy debates and resolutions among humanitarian and development partners. The approach to its minimization may differ between developed and developing economies. Similarly, the meaning attached to the digital inclusion may change based on the source.

Alamelu (2013) explains digital inclusion as a process of creating an informed society by including the digitally excluded persons. Digital inclusion of recent has been associated with socio-economic development because access to information technology yields various benefits including skills, improved service delivery, job opportunities, recreation, innovation, improved production and manufacturing, learning and many more. The challenge associated with access and the ability to effectively use information and communications technologies (ICTs) to address the needs of people disadvantaged due to skills, age, gender, and disabilities is a global concern. Industrial Training Institute (ITI) (2019) describes digital inclusion as the different strategies designed to ensure that all people have equal access, opportunities and skills to benefit from digital technologies. It is important therefore that all parties excluded from access and effective use of technological devices and associated benefits are empowered to acquire total digital inclusion status at all levels. Seale et al. (2010) view digital inclusion as a phenomenon whereby the marginalized people are availed of equal opportunities to access and meaningfully participate in the use of digital technologies. The emerging of the fourth industrial revolution (4IR) has greatly transformed the lifestyle of humans, be it in developed or developing economies. Most of the activities, be it in education, manufacturing, health, finance, agriculture, recreation, and mining are facilitated by modern technology, hence exclusion of persons from access and use of technologies has great drawbacks to people's service delivery and production.

Digital inclusion as per this study is a process that allows vulnerable people to access and meaningfully use digital technologies and enjoy the associated benefits including access to

information and job opportunities, being able to participate in digital the economy and network with others.

Several stakeholders play varying roles in narrowing the digital inclusion gap. Maplecroft (2009) provides that the stakeholders in the digital inclusion ecosystem includes: government that has a leading role in developing comprehensive policies and enabling the digital inclusion environment; the private sector plays a role in the development and diffusion of the technologies for infrastructure, content and application; civil society engages the citizens in implementing technological-related activities for digital inclusion; and finally, international and regional institutions provide the resources that facilitate digital inclusion.

3.2 Digital Inclusion Factors

3.2.1 Internet Access

To narrow the digital inclusion gaps, the available Internet must be made accessible to the various users with ease. Internet that is available but not easily accessible is as good as none-existent. Hence the Internet should be accessible and affordable by all people. The Internet is a key technological tool that can enhance digital inclusion. There are, however, barriers to accessibility which exist in developing countries that include lack of access to electricity, high costs of technology, power outages and poor ICT infrastructure (Waswa et, al. 2021). The absence of sufficient electrical power supply makes it challenging for telecommunication companies to set up mobile networks consequently, and it limits people from buying mobile technological devices. Van Deursen and van Dijk (2018) cited in Triwibowo (2020) consider physical and material access as the domains of access. Physical access entails availability of infrastructure to connect to the Internet including different types of connections required, quality of connectivity and access location. Material access is viewed in terms of existing measures to device opportunity, device diversity, peripheral diversity and maintenance. Consequently, individuals who have opportunities to get access to technology are more likely to accelerate and reap greater digital benefits. It is obvious that vulnerable persons who in most cases are disadvantageous acquire fewer opportunities in gaining access to the Internet.

Access to the Internet yields positive and a significant impact on the use of technology, and hence, in terms of digital inclusion (Alderete, 2017; Makinde et al, 2019). It is not surprising that it has become a human need and right. The UN General Assembly in 2016 passed a non-binding resolution that declared Internet access as a human right. The use of technology and access to the Internet results in various opportunities and benefits. It provides global communication, access to information, ability to share experiences, and gain access to entertainment (Andeson, Steen and Stavpoulos, 2017; Brynjolfsson and McAfee, 2014). It is however, unfortunate that many people cannot use the Internet. The mobile phones that would have facilitated access to mobile Internet are very expensive in developing countries. A4AI (2020) disclose that smartphone prices in low developing countries remain high, hence, it hampers Internet take-up. According to the A4A1 survey, smartphone prices in 70 African countries were least affordable, at 63% of average monthly income as compared with 12% of average monthly income in America.

3.2.2 Digital Literacy

Several African countries have acknowledged the importance of technology but also note that, the ability to effectively use the technology is dependent on the level of digital literacy. Digital literacy is a key enabler of adoption to changing technology, and hence, is a contributing attribute to digital inclusion. World Economic Forum (2020) alludes that digital illiteracy is a barrier to digital inclusion. The Forum reveals that in developing economies, only 32% of the population has acquired basic digital literacy whereas in developed economies it ranges between forty four percent to sixty two percent (44% -62%). The adoption and use of technology increase more when digital literacy is present. People who used mobile technology for emailing and social networking were those with digital literacy (Deen-Swarray 2016). Yet digital technologies are regarded as a fundamental tool for achieving digital inclusion (Chetty et al, 2017). Even where digital technology is available, low uptake still poses a significant challenge where its users are not digitally literate. Digital illiteracy is a major barrier to digital technology use (Waswa et al, 2021). Digital literacy is not only important in attaining digital inclusion. Digital skills are also necessary in order to gain access to the labour market, higher education, to take part in society or benefit from various services (Carretero Gomez et al., 2017).

3.2.3 Socio-Economic Status

Some of the causes of vulnerability emerge from socio-economic imbalances in society and consequential exclusion of some persons from the information society. It is obvious that to acquire relevant technology for digital inclusion, it requires financial resources. Based on that background, poor people in most circumstances are digitally excluded from the Information Society. For example, (Gong 2020) discloses that an increase in Internet accessibility is positively associated with improvements in socio-economic outcomes such as job opportunities, education attainment, health literacy and political engagement.

Unlike face-to-face interaction, online interactions support people with disabilities—who feel inferior due to their socio-economic background—underscore their qualities as ‘normal’ people until they decide to disclose it on their own accord (Panayiota Tsatsou, 2020). In such way, disability can be detached the activity of human interaction, and the disabled persons are empowered to confidently and positively recreate their identity.

3.2.4 Mobile Technology

In developing countries where Internet access infrastructure is insufficient, the role of mobile technology and mobile devices have assisted them to leapfrog and gain access to technologies and the Internet. The Internet plays significant roles in reducing the digital gap inclusion (Triwibowo 2020). Mobile phones are the primary tool used by people in developing countries to access the Internet and attain its associated benefits. This mobile technology revolution was already unfolding rapidly and generated global excitement to improve social and economic status. This is because they are used for virtual social interactions and also for

accessing mobile money services. Surman et al. (2014) reveal that efforts under the Mobile for Development (M4D) have been made to bolster mobile content in developing economies.

3.2.5 ICT Infrastructure

Achieving complete digital inclusion requires the availability and the most appropriate ICT infrastructure with updated technologies. The Internet, which is central to digital inclusion, can only be effective if the underlying ICT infrastructure is resilient and made available to the users. The ICT infrastructure promotes the Internet speed, quality of service, and hence, provides great opportunities for information access. Meach (2019) asserts that insufficient ICT infrastructure results in diminishing socio-economic participation of the people in their societies. Variation in ICT infrastructure in a community is a key concern because technology has had a great impact in most areas including manufacturing, commerce, education, transport, marketing, and agriculture. To leverage digital inclusion, government and private sector should invest in ICT infrastructure (Bello and Jug, 2015 cited in Taylor 2017; Information Society, 2016). Resilient ICT infrastructure in a community promotes mobile network access, hence enabling digital inclusion and especially in developing countries among the vulnerable people. Provision of adequate ICT is necessary in the development of an economy because they are essential in bridging the digital divide gap and enabling equal access to information (Dutta et al., 2015). Therefore, ICT infrastructure is essential and provides strong foundation for digital inclusion.

3.2.6 Inclusive Technology

The mere provision of digital technologies to the people cannot narrow digital inclusion gap. In order for the people to achieve the benefits of engagement with digital technologies, it is important to avail them with the *most appropriate technology* to meet their requirements. Ashley et al., (2003) assert that even when equipment and services are provided free of charge, people will not effectively use them. Therefore, to achieve meaning digital inclusion, the technology must be relevant to the needs of the user, expand on their existing knowledge and skills, and it must be affordable and sustainable (Pitula and Radhakrishnan 2007). Based on that background, inclusive technology empower the people to achieve greater participation in the Information Society and improves access and use technology of e-services.

Pitula and Radhakrishnan (2007) maintain that inclusive technology should measure the extent that a given community is able to use a specific technology to attain its goals. In this regard, is it feasible within the community environment? In terms of measuring its practicability to satisfy and adapt technology's requirements in terms of tools, resources and skills-for instance, is it affordable to the community? It can also be considered to measure the cost/benefit of the technology with respect to the community, such as whether is it usable by the community? With regard to measuring usability and accessibility with respect to the community, for example, is it relevant to the community goals? Other measures include – measuring its appropriateness to the community needs; measuring whether the community relies on the tools and trusts the resources, in this case, does it improve the community?

Finally, it is also worthwhile to measure the extent the technology contributes to positive outcome to the community's goals.

3.3 Digital Inclusion issues for vulnerable people

The COVID-19 pandemic has not only caused a worldwide health crisis, but it has also excavated existing inequalities, and "has exacerbated the vulnerability of the least protected in society" (United Nations, 2020). The vulnerable people as regards this study include: the ageing population, women, youths, people with special needs, and refugees.

3.3.1 Digital Inclusion issues for Ageing populations

According to World Health Organization (WHO) persons who are 65 years and above are ageing. WHO (2018) states that the global population is ageing more quickly than ever before, and the number of people over 60 years will increase from 12% to 22% by 2050. This 22% of the global population is a significant number of people that, if not digitally included, may affect negatively upon people's lives and lifestyle. This is because digital technologies are becoming increasingly unescapable in the Information Society (IS). Access to and use of digital technologies is associated with countless benefits that include information, good and services, recreation, learning and social networking (Olphert, Damodaran and May 2013). It is evident that people who are digitally included in the IS obtain socio-economic benefits and an improved quality of life. Digital inclusion has become a global concern (Tomczyk et al., 2019). Both developed and developing countries experience varying levels of digital inclusion. Watson (2018) argues that though digital inclusion and marginalization of the elderly is a long-lasting and prevalent fact in society, the use of technology makes them feel less excluded by connecting them socially through communication technologies. The reasons for digital exclusion of the elderly in the Information Society are several. For example, Friemel (2016) maintains that ageing populations are likely to have poor digital skills for accessing relevant resources and use of technology.

Weil et al., (2021) disclose that the elderly's inclusion in the digital sphere offers access to a comprehensive set of activities, from day-to-day online shopping and banking to use of social media and video chat to maintain social connections. Technology offers the potential to the elderly people to improve their quality of life. In addition, timely access to information, learning opportunities, e-business, communication services, and government services not only help them improve their quality of life, but also to participate in their digital economy.

Ofori-Asenso et al., (2018) maintain that the ageing populations need to remain reliant on digital technology and the Internet for basic services and social connections. It is unfortunate that globally, the elderly are still consistently falling behind, with poor digital abilities and literacies persisting (Anderson and Perrin, 2017). The elderly gains a sense of empowerment when they can successfully migrate these in-person experiences to the digital sphere (Lind et al., 2020).

3.3.2 Digital Inclusion issues for Women

Women and girls form another category of vulnerable people considered by this study who are disadvantaged and not fully enjoying benefits of the 21st technological revolution because of their digital exclusion. The 21st technological revolution and diffusion of new information and communication technology (ICT) innovation such as mobile technology and the Internet offers great opportunities for the well-being of people in developing countries. These technologies play a role and allow people to search for information, communicate, find employment opportunities, access health services, and in matters relating and governance. Developing countries have experienced growth in access and use of these technologies such as computers and the Internet. For example, the number of Internet users in Africa and Asia-Pacific region increased by 23% and 24% respectively between 2019 and 2020 (ITU, 2021). However, whether, there is equity for access and use of the technology between women and men remains a question.

One needs to understand whether the great opportunities offered by the 21st technological revolution are equitably shared between men and women. In developing countries, women's access to use of digital technologies are limited because of economic, social and cultural obstacles. Despite progress towards gender equality and growing women's empowerment in the 21st century, it is evident that women's access to, use of and benefits from digital technologies remain a myth. ITU (2021) disclose that, globally, in 2020, 62 per cent of all men were using the Internet, compared with 57 per cent of all women. The divide remains wide in the developing countries, where only 19 per cent of women are using the Internet (12 percentage points lower than men) and in Africa, 27% of women and 38% of men use the Internet (ITU, 2021). Factors of digital inclusion among women include digital literacy, privacy and security, social networking, time, and professional use (Thompson and Anindita 2020). Sey and Hafkin, (2019) note that there were 250 million less women online than men globally.

The need to narrow the digital inclusion gap among women cannot be over emphasized anymore. Technology offers related benefits to both men and women. There are a few studies carried out with focus on digital inclusion based on gender. Pawluczuk et al. (2020) recommended programs for girls and women, which aim to empower them to use, gain access or learn about digital technologies through workshops and coding clubs. Similarly, ITU (2018) presents initiatives with equivalent purpose such as African Girls Can Code (AGCC) that aims to bridge technology and empowers women through access to education and employment.

3.3.3 Digital Inclusion issues for the Youths

The youths form a part of the marginalized and vulnerable community that are at risk to digital exclusion from the Information Society. Youths' lives are inundated by digital technologies at school and the community where they live, therefore, addressing concerns of the youths' access to digital technology in today's Information Society cannot afford to be overlooked (Livingstone and Helsper 2007). The youths should fully understand modern technology not as mere consumers but as active participants in the information society (Irani et al., 2010). It is unfortunate that barriers to youths' access and use of technology in Africa are massive. Pinet et al. (2021) disclose barriers driving the youth digital divide in Africa as multifaceted. Youths are subject to two disadvantages: inadequate infrastructure and lack of affordability.

Both disadvantages restrict the youths' access to the Internet and the required devices and data. On the African continent, though 80% of the youth consider wifi as a fundamental human right (Ichikowitz Family Foundation, 2020), over 70% of Africa's youth is offline (AU, 2020).

3.3.4 Digital Inclusion issues for People with Special Needs

About 15% of the global population is composed of People with Special Needs (PWSN), approximately 1 billion people. There are an estimated 93–150 million children with disabilities globally, of which nearly 80% live in the Global South (Global Initiative for Inclusive Information and Communication Technologies (G3ICT, 2014). Digital technologies are important for people with special needs because digital technology help them overcome their social isolation, and marginalization, and avail them with opportunities to participate in various digital activities in the society. It is unfortunate, however, that though nearly two-thirds of world Internet users are from developing countries (ITU, 2015), only 5-15% PWDSN and children from the Global South countries have basic access to assistive technologies (WHO, 2010).

Recent literature discloses that, whereas there is an increased level of digital inclusion among people with special needs as compared to previous decades, the proportion of PWSN that have access to and use the Internet is lower (Panayiota Tsatsou, 2020). The significance of technological devices to people with special needs cannot underestimated anymore. Technological tools and devices help people with special needs to productively overcome inequalities in their everyday lives (Chib and Jiang 2014). Absence of access to technology by PWSN is a "denial of opportunities or inability to control one's environment (Easton 2014). Recent technology is progressively becoming integral to today's living for an improved quality of live. Therefore, it imperative that people with special needs learn how to adopt computer technologies in order to be part of the Information Society (Freedman et al., 2011).

Varying factors lead to digital inclusion gap between the people with special needs and able-bodied individuals and these include socio-economic barriers such as income, cost, assistive technology and digital skills. GSMA (2020) points out accessibility as one of the concerns of digital inclusion for people with special needs. In addition, people with disabilities globally tend to have much lower levels of mobile and smartphone ownership and are less aware of mobile Internet or perceive it as less beneficial compared with non-disabled persons. Limited access to technology minimizes opportunities for people with special needs to enjoy the benefits associated with technological advance. ITU's Study Group 1 on Question 7 (2021) maintain that lack of ICT accessibility is barrier to accessing content, media, public services and even the job market for persons with disabilities.

3.3.5 Digital Inclusion issues for refugees

UNHCR (2019) defines "a refugee as someone who has been forced to flee his or her country because of persecution, war, or violence. According to this study, the refugees belong to the vulnerable people and probably more negatively affected by the digital inequality than any other group of vulnerable people. This is because, due to their circumstances, refugees are forced to migrate to a foreign country in which they may not get equal rights, priority and

attention as compared to the national citizen. It is obvious that refugees equally require access and use of Internet and technology for navigation and communication among themselves and with their relatives and friends.

Technology can be successfully used to alleviate human suffering, improve refugees' chances for integration, and improve the acceptance of refugees among the hosting population. Mobile technology, specifically smartphone-enabled mobile applications and social networks play a crucial role in saving refugees' lives during their travels to countries to settle, as well as in their integration thereafter (Safa'a, 2018; AbuJarour and Krasnova, 2017; Felton 2015). Technology plays a key role in promoting social inclusion because it allows refugees to participate in society and regain control over their lives (Diaz Andrade and Doolin, 2016). Technological tools like Google Translate can be of great assistance to the refugees in communicating with the host country in their local language and minimizing the language barrier during settlement. The role of ICT in aiding refugees to cope with forced migration, and relocation in a foreign country, has increasingly been acknowledged. Berg (2022) discloses that Somalian refugees in France utilized social media platforms, including Facebook and YouTube, as well as voice over Internet protocol (VoIP) services, such as Skype and MSN Messenger, to aid in navigation during their migratory trajectories and settlements. Studies conducted by Kutscher and Kreß (2016, 2018) on unaccompanied minor refugees in Germany disclose that Internet access is as vital as "food," as it provides young refugees with a way of staying connected with their family and friends, as well as in promoting language acquisition. Unfortunately, like other vulnerable people, refugees experience digital exclusion, and hence, do not fully enjoy the benefits associated with ICT.

In summary, the digital inclusion concerns include digital literacy, mobile technology, ICT infrastructure, Internet access, socio-economic status, and inclusive technology.

3.4 The Conceptual Framework

Several studies have investigated the underlying factors contributing to digital divide both theoretically and empirically, (Myovella et al., 2021) however, academic literature for assessing the effectiveness of digital inclusion initiatives remains scarce (Wagg, 2021). Key studies that have developed frameworks to identify crucial factors and components to implement digital inclusion initiatives include studies by Madon et al. (2009), Smith (2015) and Bach et al. (2013).

Based on the discussion in the previous sections, this study proposed six hypotheses that were used to investigate the drivers (factors) influencing the digital inclusion in these developing economies (see figure 1). The independent variables are Internet access, Digital literacy, Socio-economic status, Mobile technology, ICT Infrastructure, and Inclusive technology. The dependent variable is Digital inclusion of developing technologies.

3.4.1 Internet Access

The most important dimension of digital inclusion is Internet access/use (Sharp, 2022). Most studies in the literature used Internet access as a dependent factor (DiMaggio et al., 2001; Rigins and Dewan, 2005). The results of their investigations revealed that the potential inequality in Internet access limits people's opportunities like finding jobs, getting education, accessing governmental information, and building relationships. According to Rigins and Dewan (2005), the inequality in Internet access influences how businesses compete globally.

Access to Internet and technology has had an influence on the digital inclusion (Waswa et, al., 2021; Makinde et al., 2019; van Deursen and van Dijk 2018; Alderete, 2017; Anderson et al., 2017; Brynjolfsson and McAfee, 2014); users' need to shape the required technology to drive digital inclusion (Pitula and Radhakrishnan, 2007); mobile technology provides gateways for provision of Internet and hence also influence digital inclusion (Triwibowo, 2020; Surman et al. 2014). Sparks (2013) identifies Internet access to be one of the factors of digital inclusion.

Thus, we postulate the following hypothesis:
H_1: Internet access positively influences the digital inclusion of developing economies' citizens.

3.4.2 Digital Literacy

Digital literacy is fundamental for meaningful digital inclusion (Chetty et al., 2017; Waswa et al., 2021). Van Dijk and Hacker (2003) state the importance of acquiring a proficient level of digital literacy when digital inclusion is considered. Digital inclusion encompasses not only Internet access but also training for the digital literacy skills required for effective usage of ICTs (IMLS, 2011). Consequently, policymakers and private firms have proposed several projects to enhance digital inclusion that provides digital literacy training (Ragneda and Mutsvairo, 2018). Due to this development, some authors have started to analyze and investigate digital divide in relation to the digital literacy and skills of citizens with different socio-economic background (Hargittai, 2010; van Dijk and van Deursen, 2014).

According to Sanders (2020), digital literacy must be looked at as part of inclusion since users of the Internet can still be digitally excluded because they do not have sufficient skills to be able to navigate the digital world. Moreover, for effective use and utilization of digital technologies, relevant and updated, digital skills are an influential factor in narrowing the digital inclusion gap (Van Deursen and van Dijk, 2014; Helsper and Eynon, 2013).

Thus, it is postulated that:
H_2: Digital literacy positively influences the digital inclusion of developing economies' citizens.

3.4.3 Socio-Economic Status

Rogers (2003) has explained how differences in income level may influence Internet use. For example, financial status helps to adopt innovation quickly and can influence physical and material access (Van Dijk, 2012). In this sense, Chinn and Fairlie (2006) conclude that the digital divide between different countries is mainly explained by income differentials. Fuchs (2008) also emphasizes that income inequality is a factor that influences the level of the digital

divide. Zhang (2013) contends that the Internet consumption theory can be used to explain the differences in Internet diffusion, where the level of income plays an important role when considering consumers that maximize their utilities within the constraints of the income budget.

In line with the above literature, the following hypothesis is proposed:
H_3: Socio-economic status positively influences the digital inclusion of developing economies' citizens.

3.4.4 Mobile Technology

The smartphone has become an important port of entry to the digital world because the Internet is going mobile (Correa et al., 2018). Moreover, policy agendas have enhanced mobile connectivity as a fast and relatively cheap solution to offer physical Internet access, thus, reducing the digital divide (Donner, 2015). In that regard, the process of digital inclusion can be studied via smartphones and compared with computers due to an increase in policy considerations of mobile connectivity (Subtel, 2017). Smartphones allow an increase in Internet access in terms of digital inclusion (Stork et al., 2013), however, research has found out that smartphones are a hindrance for the digital inclusion process. This is because the Internet allows more diverse usage like work activities, information seeking and content creation (Pearce and Rice, 2013). Consequently, mobile Internet users have become a category of citizens in the online world (Napoli and Obar, 2014).

In line with the above literature, the following hypothesis is proposed:
H_4: Mobile technology positively influences the digital inclusion of developing economies' citizens.

3.4.5 ICT Infrastructure

Achieving complete digital inclusion requires available and resilient ICT infrastructure using updated technologies. It provides foundation for digital inclusion (Meach 2019; Bello and Jug, 2015; Dutta et al., 2015). To leverage digital inclusion, government and private sector should invest in ICT infrastructure (Bello and Jug, 2015; Information Society, 2016). Mobile networks support Internet access, hence enable digital inclusion especially in developing countries. Provision of adequate ICT is necessary in the development of an economy because they are essential in bridging digital divide and enabling equal access to information (Dutta et al., 2015).

ICTs especially the Internet and the web has transformed every facet of human life (Alhassan and Adam, 2021). Citizens of countries believe that they are digitally excluded when there is a discrepancy in the access to ICTs. Digital inclusion is regarded as citizen's inclusion in the information society at various levels through technology either directly or indirectly (Kaplan, 2005). Therefore, an investigation into the dual effects of digital inclusion and ICT access is important. According to the literature, it is pragmatic for governments and appropriate agencies to ensure the necessary ICT infrastructures are put in place in order to allow easy usage of the ICTs by individuals to achieve national accessibility (Alderele, 2017; Makinde et al., 2019). The failure of a country to embrace and use ICTs will cause them to become digitally

excluded since they will not have access to information resources (Alam and Imran, 2015; Pavez, 2016).

Relying on this motivation, it is hypothesized that:
H_5: ICT Infrastructure positively influences the digital inclusion of developing economies' citizens.

3.4.6 Inclusive Technology

In order to achieve digital inclusion, the technology must be relevant to the needs of the user, expand their existing knowledge and skills and it must be affordable and sustainable (Pitula and Radhakrishnan 2007). Pitula and Radhakrishnan (2007) maintain that inclusive technology should measure the extent that a given community is able to use a specific technology to attain its goals. Information technology and communication technology are major topics of this age, and it is also essential for people with disability (Goggin and Newell, 2007). There is a close link between technology and disability which presents itself in adopted technologies used by disabled people in innovative ways, often not seen by the promoters and designers of such technologies.

Thus, it is hypothesized that:
H_6: Inclusive technology positively influences the digital inclusion of developing economies' citizens.

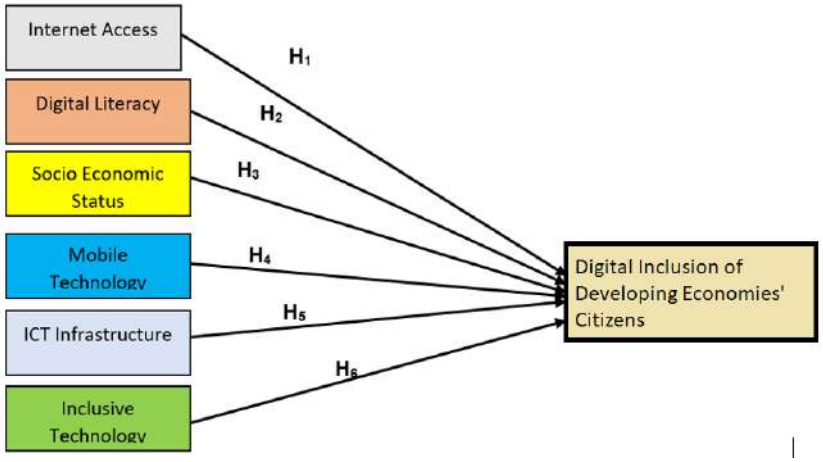

Figure 1: The Conceptual Framework (Source: Authors)

4.0 Methodology

The mixed method approach was used to carry out the investigation in this research. The quantitative part was carried out first while the qualitative part was carried out later. This approach was used to explore the factors that influence digital inclusion among the vulnerable people in the developing economies of Uganda and South Africa. Questionnaires (see Appendix A1 and Appendix A2) were designed and developed, and they were distributed to

those who belong to the vulnerable group and those who do not in Uganda and South Africa. The measuring instrument was based on a five-point Likert scale – ranging from 1: “Strongly agree” 2: “Disagree” 3: “Neutral” 4: “Agree” 5: “Strongly disagree”. The questionnaire comprised of eight sections, with the first section centered on the biographical data. The remaining sections were based on the independent and dependent variables: Internet access, Digital literacy, Socio-economic status, Mobile technology, ICT infrastructure, Inclusive technology, Digital technology and Digital Inclusion of developing economies’ citizens. Some interviews were held in Uganda to understand digital inclusion in developing economies.

4.1 Sample and Data Description

The sample population of the respondents consisted of a total of six hundred twenty (620) respondents, three hundred and twenty (320) from Uganda and three hundred (300) from South Africa. The respondents were from varying geographical setting. Respondents from South Africa were from the provinces of Limpompo and Gauteng, while those from Uganda were from the districts of Kampala, Wakiso, Luuka, Masaka, Mpigi, Wakiso and Nebi. The respondents included two hundred and fifty-seven (257) males and three hundred sixty-three female (363) participants.

The vulnerable sample population were mainly people with special needs (106), the elderly people (236), the youths (229) and refugees (49). Asiamah et al. (2017) maintain that proper specification of the population in any study is important because it establishes the credibility of the research. Therefore, selecting the research participants was given special attention and time was taken to properly identify suitable study participants.

Given the nature of the study, various sampling techniques were applied. The study sites were intentionally selected because the study targeted specific participants (vulnerable people) in order to gain an in-depth understanding of the study phenomenon. The youths and refugees were randomly selected from the identified study sites, whereas for the elderly and people with special needs, the snowball technique was used because this category of people cannot be easily identified and found. Therefore, the selection of the study participants was based on study objectives, scope of the study, available time, and information richness that the participants could bring to the study in order to enrich the data collected.

4.2 Data Collection

The data was collected using the survey method and interviews in Uganda and South Africa. A pilot study was carried out to ensure the reliability of the constructs used in the questionnaire. Additionally, the pilot study assisted the research team to test the data instruments, verify research protocols, and identify the risks involved in the study. Data was collected using questionnaires and informative interviews. The interviews are best known for providing rich data about a study and helping the researcher to better understand the study phenomenon. Interviews are considered good for collecting data on complex issues. The study of digital inclusion among the vulnerable people was a complex study because it was dealing with people that are disadvantaged and marginalized in the society. The marginalized and

disadvantaged are those who do not have access to the Internet and they are poor, elderly, live in rural areas and particularly women in developing countries (Sharp, 2022).

The researchers traveled to study locations and that helped them to understand the environmental perspectives of the study participants.

Twenty-eight (28) interviews were carried out each lasted for about 45 minutes. The investigator carried out the interviews with 28 participants until each participant had no new further idea to contribute. Some authors have indicated that the data saturation process indicates when further interviews should be stopped and warned that there should be no further data collection after the saturation level is reached in order to avoid data redundancy and data analysis challenges (Gentles et al., 2016; Fusch and Ness, 2015). The interview participants included the elderly, youths, PWD, women and refugees who formed the target population for the study. The interview participants voluntarily consented to participate in the interviews, choose the most appropriate time and venue for the interviews and their identities were not reflected in this report to ensure privacy and confidentiality. Codes have been adopted to represent the interview participants in the study, for example EMIRE01, represents Elderly Male Interview Correspondent No One (01); YFIR03 – Youth Female Interview Respondent Three (03); RFIR04 – Refugee Female Interview Correspondent No Four (04). The number of interview's questions for the study were based on the level of data saturation during the interviews.

The study used a questionnaire as the main data collection instrument for gathering data from a total of six hundred and twenty (620) respondents from Uganda and South Africa. The research team found it necessary to administer the questionnaire by physically distributing them. This is because oftentimes, questionnaires sometimes cannot be completed by the respondents as they do not understand the questions and hence, leave them incomplete. Additionally, digital inclusion to the vulnerable people was technical subject, therefore, it required the research team to physically explain and interact with the study population about the subject area. Consequently, online questionnaire could not be used to distribute questionnaires in such situations and set up. The respondents filled the questionnaires without disclosing their identities in line with the research ethical concerns to maintain the participants' confidentiality.

4.2.1 Selection of Interview Participants

The interview participants were selected by using the purposive sampling technique. The principal researcher selected the members of the community that he felt have knowledge and experience and can provide the best information in the phenomenon of interest. Purposive sampling is the identification and selection of individuals that have knowledge and experience of the phenomenon of interest (Cresswell and Plano Clark, 2011). The selected participants must also be available and willing to participate, communicate their experiences and opinions in an expressive, articulate and reflective manner (Bernard, 2002).

4.2.2 Questionnaire Guide Design

The design of the questionnaire involved planning the questionnaire, writing items and revising the items, and administering the questionnaire. A five-point Likert scale was used to develop the questionnaire by using four items per construct. The items were direct, clear and specific to the construct. Complex words were not used in the items so that different people will not give different meanings. The researcher's beliefs, feelings and bias were avoided and only one question per item was asked.

4.3 Model and Analysis Technique

Statistical analysis was carried out on the quantitative data of the study by using the SPSS version 25. The statistical analysis involved summaries of data in graphs as well as inference statistics to analyze the data. The statistical data analysis allowed the research team to quantify, categorize and describe the basic characteristics of the data set for the study. The statistical data analysis was also used in finding the relationships between the dependent and independent variables of the study. Qualitative data was analyzed thematically, allowing the research team flexibility, giving richness and interpretation of the study findings. The qualitative data analysis followed Clarke and Braun's (2013) steps for data analysis, and it involved the following: interview transcription, reading, coding, identifying themes, review themes, define and name themes, and writing the themes.

The digital inclusion model for this study used the linkage between the hypothesis, concepts discussed in the literature and data analysis.

4.4 Validity and Reliability of the Study.

The research team ensured that reliability of the constructs for the study was carried out by using the Cronbach's alpha and item analysis. Construct validity, discriminant validity, and scale reliability were performed using exploratory factor analysis (EFA) (Wang et al., 2010). Validity of a research instrument assesses the extent to which the instrument measures what it is designed to measure (Robson, 2011; Thatcher, 2010). Construct validity, discriminant validity, and scale reliability were adopted using exploratory factor analysis. Multiple regression analysis was used to perform the data analysis and to test the hypotheses. Reliability measures consistency, precision, repeatability, and trustworthiness of a research (Chakrabartty, 2013). Cronbach's alpha (σ) ensured the reliability of the constructs for quantitative data of the study.

Validity for qualitative data differs from quantitative validity. Mohamad et al., (2015) relate qualitative validity to appropriateness of the research value, tools, techniques, and processes. In this study, qualitative validity was achieved by triangulation of the data sources, instruments and research team members. Secondly, data validation exercise was conducted with the study participants to verify the validity of the findings with the respondents' feedback. Reliability for qualitative data was achieved using the collection of rich data from in-depth interviews.

4.5 Ethical Considerations for the Study

This study assessed the factors that influenced digital inclusion among vulnerable persons in Uganda and South Africa. Dealing with vulnerable persons is a complex matter because the vulnerable people are disadvantaged and marginalized. Therefore, the research team paid special attention to ethical issues and research ethical rules were adhered to throughout the study. The following were the ethical concerns considered:

4.5.1 Study Design

The study design followed in this research is descriptive (empirical) using cross-sectional surveys to collect data. Hypotheses were developed and tested thus, revealing the causal relationships between the variables (Ranganathan and Aggarwal, 2018). Moreover, interviews were used to collect qualitative data that enriched the findings of the study. In addition, detailed plans for the collection and analysis were discussed and agreed upon before the data collection exercise commenced.

4.5.2 Data Collection Instruments

The instruments that were used in the collection of quantitative data from the research participants were tested for reliability using item analysis, and validity using composite reliability, construct reliability and discriminant validity. Therefore, the data for the study was reliable and relevant. The research team comprises of one principal researcher, one researcher and one research assistant for collection of data in Uganda, while for collection of data in South Africa, the research team consist of one principal researcher and two research assistants.

4.5.3 Accessing Research Sites

Permission was obtained from the respective institutions and communities that participated in the study and the researchers were granted access without any persuasion. See the permission letter sent to institutions in the appendices.

4.5.4 Discrimination

The participants were recruited without any bias or discrimination based on race, age, religion or sex.

4.5.5 Informed Consent

Before participants became involved in the study, the research team clearly and comprehensively explained the purpose of the study, their role in the study and the methods of data collection the research proposed to use.

4.5.6 Voluntary Participation

All participants willingly consented to participate in the study, and they were informed that they were free to withdraw from the study, at any time, if they so wished.

4.5.7 Privacy and Confidentiality

The identity and privacy of the research participants were given special attention in this study. Interviews were carried out at places and times convenient for the research participants. The research team avoided discussions that were beyond the study requirements (that were ‘off topic’). Given the nature of the study, the identities of the research participants and their research sites were not reflected anywhere in the data collection, analysis or reporting of the findings.

4.5.8 Data Use

The research team explained to the study participants the purpose of the study. This gave them confidence to provide accurate and detailed information knowing that the information provided would not be misused.

4.5.9 Use of Secondary Data

No secondary data was used in this study.

4.5.10 Validation of the Research Findings

The validation of the research findings was carried out by ensuring the reliability and validity of the constructs. Moreover, the exploratory factor analysis (EFA) was used to carry out the research findings.

4.5.11 Honesty and Truth

The research team ensured that their work is underpinned with truth and honesty throughout the study from the research design to the reporting of the findings. The information contained in this report is a true record of the investigation carried out without any intentional personal bias. The study focused on understanding the factors influencing digital inclusion among the vulnerable persons in Uganda and South Africa.

5. Findings of the Study

5.1 Uganda

5.1.1 Measuring Instrument and Data Collection (Uganda)

The research was conducted through empirical investigation. Questionnaires (see Appendix A1 and Appendix A2) were developed using a five-point Likert scale and were distributed to Ugandan citizens living in urban and rural areas. The questionnaire comprises of eight (8) sections with the first section centered on the respondent's biographical data. The remaining sections were based on the independent variables (Sections B to G) and the dependent variable (section H). The dependent variable is: Digital inclusion of developing economies citizens. The independent variables are: Internet access, Digital literacy, Socio economic status, Mobile technology, ICT infrastructure and Inclusive technology. All the variables were measured using four items in the questionnaire. For example, digital inclusion was measured by government services, job opportunities, e-health and e-economy.

A total of three hundred and twenty (320) respondents completed the questionnaire out of five hundred (500) questionnaires that were distributed to Ugandan citizens using random sampling technique. Thus, the response rate was sixty-four percent (64%).

Table 1: Descriptive Statistics - Uganda Survey Respondents Demographics (Source: Authors)

Age group	Frequency	Percent
11-17	2	0.5
18-25	96	24
26-35	45	11.3
36-45	50	12.5
46-55	52	13
56-65	32	8
>=66	43	10.8
Gender		
Male	143	35.8
Female	177	44.3
Other	0	0
Educational level		
No formal education	31	7.8
Primary level	56	14
Ordinarily level	86	21.5
Advanced level	51	12.8
Diploma	43	10.8
Degree	34	8.5
Postgraduate	19	4.8
Group		
Elderly	121	30.3
Youth	90	22.5
Person with special needs	76	19
Refugee	33	8.3
Race		
Black	309	77.3
Asian	1	0.3
Colored	10	2.5
Foreign	0	0
Citizens having access to Internet		
Daily basis	69	17.3
Weekly basis	17	4.3
Monthly basis	41	10.3
Twice a month	44	11
No access to Internet at all	149	37.3
Purpose of using Internet		
E-business	51	21.8
Entertainment	60	15
Government services	32	8
Communication such as emails	89	22.3
Information search	62	15.5

Job search	6	1.5
Online learning	20	5.0
Office work	0	0
Technologies used to access Internet		
Personal Phone	128	32
Personal computer at home	39	9.8
Office computer at place of work	11	2.8
Computer at my school/university	31	7.8
Assistance from friends	95	23.8
Private or Internet cafe	16	4.0
How citizens feel about their Government digitally including them		
Yes	117	29.3
No	177	44.3
Not sure	26	6.5
Is Government working towards digital inclusion of her citizens?		
Yes	108	27
No	174	43.5
Not sure	38	9.5

5.1.2 Profile of the Respondents (Uganda)

A total of 320 respondents completed the questionnaire, as illustrated in Table 1. 24% of the respondents (n=96) were within the age range 18 – 25 years. 44.3% of the respondents (n=177) were females. In terms of educational levels, 21.5% of the respondents (n=86) were ordinary level citizens. In terms of usage, 37.3% (n=149) of the respondents did not have access to the Internet, whilst 22.3% (n=89) of them were using the Internet such as emails to communicate, and, 32% of them (n=128) used their telephones to access the Internet. Further, 44.3% of the respondents (n=177) felt that their government is not digitally including them. Additionally, 43.5% of the respondents (n= 174) felt that their government is not working towards digital inclusion to accommodate its citizens.

5.1.3 Construct Reliability (Uganda)

The Cronbach's alpha (σ) of each construct was estimated to assess that the constructs are reliable and consistent, as shown in Table 2. According to Hair Jr. et al., (2010), the lowest acceptable value of Cronbach's alpha for a construct is 0.6. Consequently, all the constructs are reliable since their Cronbach's alpha values are more than 0.6. Digital inclusion is the most reliable construct with Cronbach's value of 0.782 while the lowest reliable construct is Socio-economic status with Cronbach's alpha value of 0.727.

Table 2: Reliability of the Constructs (Uganda) (Source: Authors)

	Construct	**Cronbach's Alpha**
TransB	Internet access	.759
TransC	Digital literacy	.735
TransD	Socio economic status	.727
TransE	Mobile technology	.730
TransF	ICT infrastructure	.739
TransG	Inclusive technology	.739
TransH	Digital inclusion	.782

(**NOTE**: Cronbach's alpha > 0.7 indicates reliability)

5.1.4 Correlation of the Constructs (Uganda)

Table 3 shows the correlation matrix of the constructs. According to Tabachnik and Fidel (2007), correlation coefficients over 0.30 should be used when inspecting the correlation matrix (often termed the factorability of R). Most of the correlations between the constructs in this study are above 0.30, therefore, factor analysis can be used to perform statistical analysis of this study. The highest correlation (0.585) is between Mobile Technology and ICT Infrastructure, while the lowest correlation (0.164) is between Internet Access and Digital Inclusion.

Table 3: Correlation Matrix (Uganda) (Source: Authors)

Constructs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Internet access	1						
2. Digital literacy	0.356	1					
3. Socio-economic status	0.393	0.432	1				
4. Mobile Technology	0.198	0.368	0.428	1			
5. ICT Infrastructure	0.197	0.338	0.351	0.585	1		
6. Inclusive Technology	0.425	0.380	0.483	0.362	0.307	1	
7. Digital Inclusion	0.164	0.282	0.210	0.274	0.290	0.167	1

5.2 South Africa

5.2.1 Measuring Instrument and Data Collection (South Africa)

A total of three hundred (300) respondents completed the questionnaire out of five hundred (500) questionnaires that were distributed to South African citizens using random sampling technique. Thus, the response rate was sixty percent (60%).

Table 4: Descriptive Statistics – South Africa Survey Respondents Demographics (Source: Authors)

Age group	**Frequency**	**Percent**
11-17	26	6.5
18-25	41	10.3
26-35	94	23.5
36-45	44	11.0
46-55	59	14.8
56-65	24	6.0
>=66	12	3.0
Gender		
Male	112	28.0
Female	186	46.5
Other	2	0.6
Educational level		
No formal education	26	6.5
Primary level	50	12.5
Ordinarily level	131	32.8
Advanced level	24	6.0
Diploma	43	10.8
Degree	19	4.8
Postgraduate	7	1.8
Group		
Elderly	115	28.7
Youth	139	34.8
Person with special needs	30	7.5
Refugee	16	4.0
Race		
Black	286	71.5
Asian	10	2.5
Colored	4	1.0
Foreign	0	0
Citizens having access to Internet		
Daily basis	61	15.3
Weekly basis	35	8.8
Monthly basis	47	11.8
Twice a month	19	4.8

No access to Internet at all	138	34.5
Purpose of using Internet		
E-business	12	3.0
Entertainment	60	15.0
Government services	65	16.3
Communication such as emails	64	16.0
Information search	54	13.5
Job search	28	7.0
Online learning	12	3.0
Office work	5	1.3
Technologies used to access Internet		
Personal Phone	190	47.5
Personal computer at home	28	7.0
Office computer at place of work	13	3.3
Computer at my school/university	18	4.5
Assistance from friends	29	7.2
Private or Internet cafe	22	5.6
How citizens feel about their government digitally including them		
Yes	79	19.8
No	177	44.3
Not sure	44	11.2
Is Government working towards digital inclusion of her citizens?		
Yes	79	19.8
No	176	44.0
Not sure	45	11.3

5.2.2 Profile of the Respondents (South Africa)

A total of 300 respondents completed the questionnaire, as illustrated in Table 4. 23.5% of the respondents (n=94) were within the age range 26 – 35 years. Also, 46.5% of the respondents were females (n=186). In terms of educational levels, 32.8% of the respondents (n=131) were ordinary level citizens. In terms of usage, 34.5% of the respondents (n=138) interviewed did not have access to the Internet, whilst 16.3% of them (n=65) were using the Internet to conduct Government services, and 47.5% of them (n=190) used their telephones to access the Internet. Further, 44.3% of the respondents (n=177) felt that their government is not digitally including them. Additionally, 44.0% of the respondents (n= 176) felt that their government is not working towards digital inclusion to accommodate its citizens.

5.2.3 Construct Reliability (South Africa)

The Cronbach's alpha (σ) of each construct was estimated to assess that the constructs are reliable and consistent, as shown in Table 5. According to Hair Jr. et al., (2010), the lowest acceptable value of Cronbach's alpha for a construct is 0.6. Consequently, all the constructs are reliable since their Cronbach's alpha values are more than 0.6. ICT Infrastructure is the most reliable construct with Cronbach's value of 0.809 while the lowest reliable construct is Digital Literacy with Cronbach's alpha value of 0.742.

Table 5: Reliability of the Constructs (South Africa) (Source: Authors)

	Construct	**Cronbach's Alpha**
TransB	Internet access	0.763
TransC	Digital literacy	0.742
TransD	Socio economic status	0.761
TransE	Mobile technology	0.800
TransF	ICT infrastructure	0.809
TransG	Inclusive technology	0.806
TransH	Digital inclusion	0.747

(**NOTE**: Cronbach's alpha > 0.7 indicates reliability)

5.2.4 Correlation of the Constructs (South Africa)

Table 6 shows the correlation matrix of the constructs. According to Tabachnik and Fidel (2007), correlation coefficients over 0.30 should be used when inspecting the correlation matrix (often termed the factorability of R). Most of the correlations between the constructs in this study are above 0.30, therefore, factor analysis can be used to perform statistical analysis of this study. The highest correlation (0.736) is between Digital Literacy and Internet Access, while the lowest correlation (0.138) is between ICT Infrastructure and Digital Literacy.

Table 6: Correlation Matrix (South Africa) (Source: Authors)

Constructs	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Internet access	1						
2. Digital literacy	0.736	1					
3. Socio economic status	0.521	0.614	1				
4. Mobile Technology	0.169	0.231	0.280	1			
5. ICT Infrastructure	0.146	0.138	0.192	0.477	1		
6. Inclusive Technology	0.142	0.192	0.261	0.419	0.396	1	
7. Digital Inclusion	0.595	0.732	0.732	0.201	0.179	0.286	1

5.3 Comparison of Uganda and South Africa Findings

5.3. 1 Comparison of the Profile of Respondents in Uganda vs South Africa

The results obtained from the two countries indicate similar outcomes. In both countries, most of the people within the age range of 18 – 35 years participated in the research. Additionally, more females participated in the research than males in both countries (44.3% for Uganda

and 46.5% in South Africa). Most people have an ordinary educational level in both countries (21.5% for Uganda and 32.8% for South Africa). Most people from both countries indicated that they do not have access to the Internet (37.3% for Uganda and 34.5% for South Africa), that is most people are digitally excluded. More citizens from Uganda are digitally excluded than South African citizens who participated in the research. Most people access the Internet by using their personal phones in both countries (32% for Uganda and 47.5% for South Africa). Most people in Uganda access the Internet to communicate e.g., via emails while most people in South Africa use the Internet to access Government services.

In both countries, citizens felt that they are digitally excluded by their governments (44.3% for Uganda and 44.3% for South Africa). These results are illustrated in the two figures (Figure 2 and
Figure 3 below.

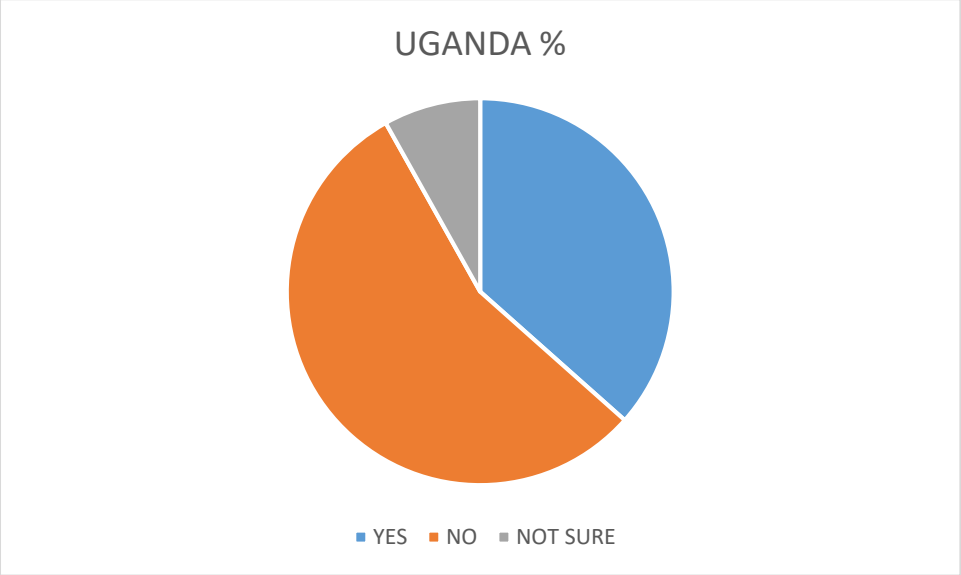

Figure 2: Pie Chart Illustrating Government Digital Exclusion in Uganda (Source: Authors)

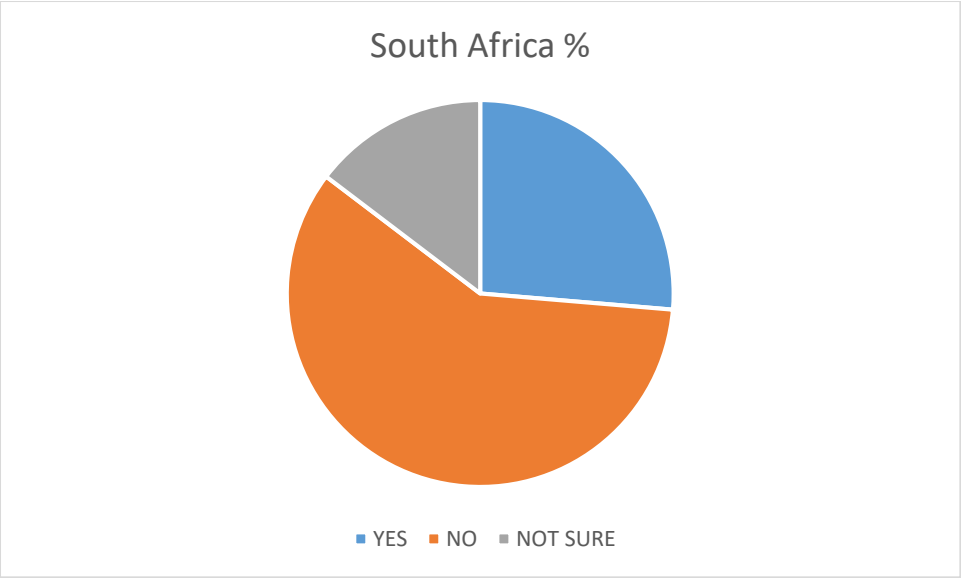

Figure 3: Pie Chart Illustrating Government Digital Exclusion in South Africa (Source: Authors)

Moreover, citizens of both countries felt that their governments are not doing enough in the areas of digital inclusion (43.5% for Uganda and 44.0% for South Africa). These results are illustrated in the two figures (Figure 4 and Figure 5) below.

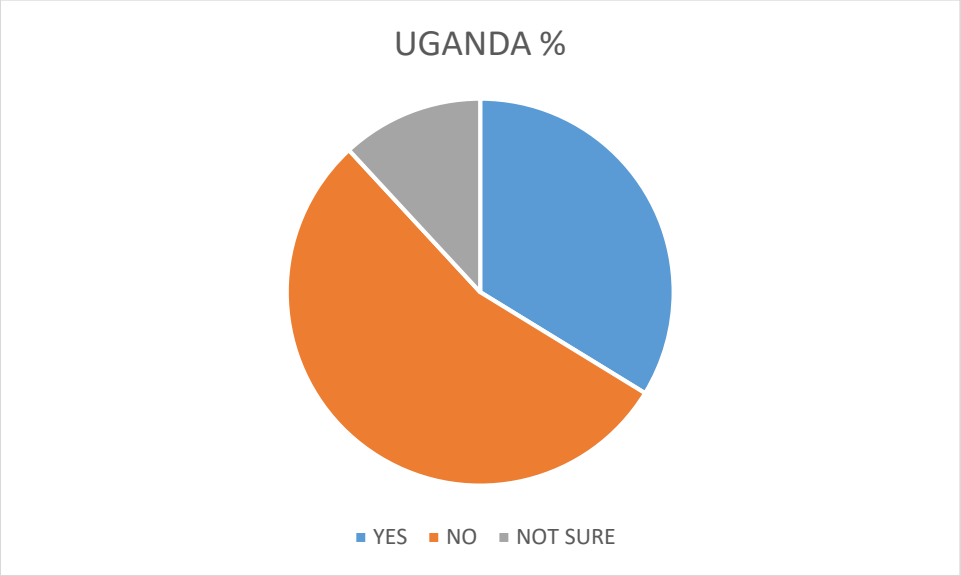

Figure 4: Pie Chart Illustrating How Citizens felt about their Government Digital Exclusion in Uganda (Source: Authors)

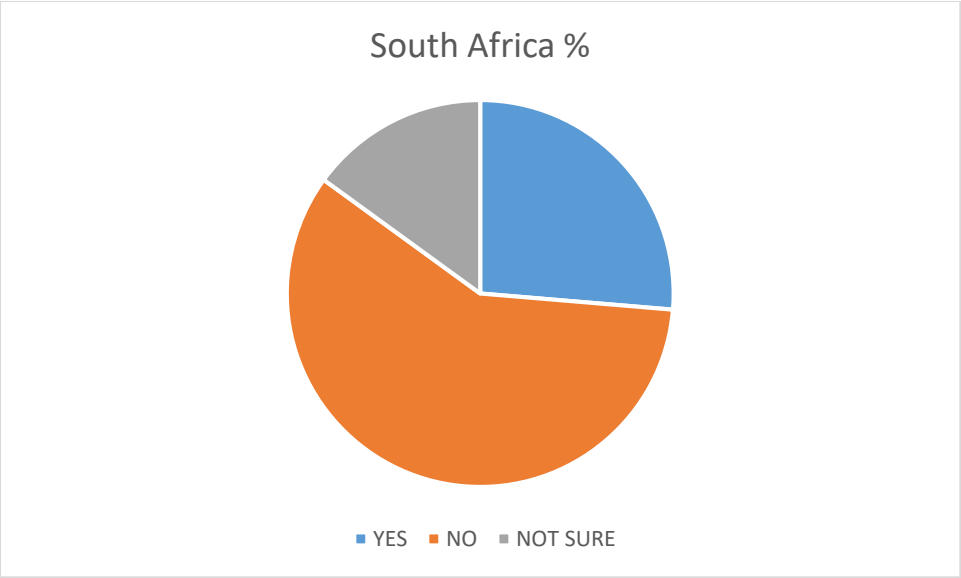

Figure 5: Pie Chart Illustrating How Citizens felt about their Government Digital Exclusion in South Africa (Source: Authors)

5.3.2 Comparison of the Construct Reliability in Uganda vs South Africa

For both countries, all the constructs are reliable since their Cronbach's alpha values are more than 0.6. For Uganda, Digital inclusion is the most reliable construct with Cronbach's value of 0.782 while the lowest reliable construct is Socio-economic status with Cronbach's alpha value of 0.727. For South Africa, ICT Infrastructure is the most reliable construct with Cronbach's value of 0.809 while the lowest reliable construct is Digital Literacy with Cronbach's alpha value of 0.742. It can be inferred that the constructs of South Africa data are more reliable than that of Uganda since South Africa has higher Cronbach's Alpha values than Uganda.

5.3.3 Comparison of the Correlations of Constructs in Uganda vs South Africa

Refer to correlation coefficients of Table 3 (Uganda) and Table 6 (South Africa) above for the comparisons.

5.4 Qualitative Findings

Detailed qualitative data collection process and procedures were explained in sub-section 4.2. The following were the main themes that emerged out of the interviews conducted:

Internet Access
The research participants were asked about whether they have access to Internet and the purpose for which Internet is used. Several study participants revealed that due to availability of mobile phones Internet access is no longer a big challenge as it was before. Access to Internet was cited by several participants as key to digital inclusion because of unlimited benefits. According to the study participants, Internet is used mainly for communication, entertainment, and e-business.

> "Yes, I have access to Internet on a weekly basis, and of late, we have found it very useful. We use it to communicate with friends, when bored we use to listen to music or watch video. Also due to COVID-19 we learnt to use Internet to buy goods online. Due to the high rent and taxes some businessmen have decided to market and sell their products online." YMIR23.

> "Though we have a challenges with high priced data bundles, it is not easy to avoid Internet access on daily basis regardless the period used. We now use WhatApps for most communication including death announcements, married meetings, adverts for businesses, you name it. Internet in our community is the billboard." EMIR04

Digital literacy

The study investigated about some of the basic requirements for access and use of Internet and digital devices. The answers from the study's participants disclosed that digital literacy is a very important factor for effective use of Internet and technological devices. Participants revealed before using Internet or technological device it is important to know how it works and this requires technological training.

> "According to me digital literacy is a basic need in today's world. I have friends who have money and can afford to access Internet almost every day, because they do not know how to use it, they miss a lot. To tell you the fact, they do not even know what they are missing." YFIR02

Mobile Technology

Mobile technology emerged as one of the themes that played a role in digital inclusion. Investigation to improve digital inclusion among various categories of people resulted in the mobile technology theme. The study's participants revealed the emergence of mobile phones has helped many people including those in the rural and remote areas to get access to the Internet. The reason is because mobile phones are relatively affordable by many people, unlike tablets and laptops. Hence most of them are use mobile phones to access the Internet because they cannot afford a computer. Mobile phones are used as a multi-purpose technological tool to communicate, conduct business, entertainment and as a learning tool by many people, according to the study participants.

> "My dear, I am grateful to the person who brought mobile phones for us. As a migrant in this country, I use it get key information that helps to know what is happening in my mother country and also communicate to my relatives". RFIR11

> "I tell you, the emergency of COVID-19 made me to appreciate more the mobile phone. During lockdown, I remained in touch

> with my clients and the sells never declined because of my phone. Clients could pay me by mobile money and we send them goods using motor bike. No doubt mobile phone is important for us to get digitally included." EMIR15

Inclusive Technology

The study investigation among people with special needs led to the emergence of inclusive technology as one of the themes, among other findings. Students with special needs were asked about the challenges they faced in digital inclusion. Respondents revealed that some of them have access to the technological devices but cannot use them because they are not most appropriate to them. Some learners had no physical hands to use the technology but can hear and talk, whereas others who have physical hands can neither hear nor talk. It appears that the participants are not able to access the technology and Internet and meeting their needs with the most appropriate technology is key for their digital inclusion.

> "Here at our school, most of us have missed the opportunity to use the computer because their computers cannot help us. We need special computers for the blind for example, special software for voice recognition to help us all enjoy the digital age. We have only one such a computer and we are many." SNIR10

> "How I wish we have computers made specifically for us. We have special needs in technology as special needs learners. We need special computers with special mouse and keyboard and screen." SNIR05

Socio-Economic Status

Socio-economic status is one of the themes that emerged out of the study's investigation about digital inclusion for vulnerable people. The study's respondents pointed out clearly that one must have money to buy and maintain technology to be in position to use it. As most people are poor, they cannot afford to use technological and hence are automatically excluded. They cited high prices for phones, Internet, and data bundles which were considered luxury to items them, while basic needs are more important.

> "Given my income level, I cannot afford to spend on Internet and data bundles because they are very expensive in my country. I know I miss a lot but for now I focus on my family basic needs". WFIR20

> "You are right, but my dear, Internet is beyond my capacity. To tell you the truth, if a friend helps to get access to the Internet, I can use, but currently it is not my priority due to the costs involved". EFIR14

ICT Infrastructure

The investigation about some of the digital inclusion concerns among the vulnerable people for this study resulted in ICT infrastructure. The study's participants, and more especially those in the rural area, cited ICT infrastructure as key for digital inclusion, however, ICT infrastructure is poorly distributed in their country. Most of the National ICT infrastructure is housed in urban centers, yet their villages' need IT services even more than those living in urban area. People living in urban areas are close to sources of services as compared to those living in rural areas.

> "Uneven allocation of National ICT infrastructure explains well why here in the rural area we cannot easily get ICT services. The telecommunications are insufficient and yet we also lack electric power. What do you expect?" EMIR24

6. Developing a Model for Digital Inclusion in Developing Economies

6.1 Combining Data from Both Countries (Uganda and South Africa)

The data from the two countries were combined in order to develop a model for digital inclusion in developing economies (see Table 7). In total, there are six hundred and twenty (620) respondents that completed the questionnaire in both countries. More females, or 58.5% of the respondents (n=363) participated in the research. 35.0% of the respondents (n=217) have an ordinary educational level, while most of them are black, or 96.0% of the respondents (n=595). 46.2% of the respondents (n=287) do not have access to the Internet, while 24.7% of them (n=153) use Internet (via emails) to communicate. Personal phones are the technology mostly used by 51.3% of the respondents (n=318) to access the Internet. 57.1% of them (n=354) felt that they digitally excluded, while 56.5% of them (n=350) felt that their government are not doing enough to digitally include their citizens.

Table 7: Descriptive Statistics - Uganda and South Africa Survey Respondents Demographics (Source: Authors)

Age group	**Frequency**	**Percent**
11-17	28	4.5
18-25	137	22.1
26-35	139	22.4
36-45	94	15.2
46-55	111	17.9
56-65	56	9.0
>=66	55	8.9
Gender		
Male	255	41.1
Female	363	58.5
Other		
Educational level		
No formal education	57	9.2
Primary level	106	17.1

Ordinarily level	217	35.0
Advanced level	75	12.1
Diploma	86	13.9
Degree	53	8.5
Postgraduate	26	4.2
Group		
Elderly	236	38.1
Youth	229	36.9
Person with special needs	106	17.1
Refugee	49	7.9
Race		
Black	595	96.0
Asian	11	1.8
Colored	14	2.3
Foreign	0	0
Citizens having access to Internet		
Daily basis	130	21.0
Weekly basis	52	8.4
Monthly basis	88	14.2
Twice a month	63	10.2
No access to Internet at all	287	46.2
Purpose of using Internet		
E-business	63	10.2
Entertainment	120	19.4
Government services	97	15.6
Communication such as emails	153	24.7
Information search	116	18.7
Job search	34	5.5
Online learning	32	5.2
Office work	5	0.8
Technologies used to access Internet		
Personal Phone	318	51.3
Personal computer at home	67	10.8
Office computer at place of work	24	3.9
Computer at my school/university	49	7.9
Assistance from friends	124	20.0
Private or Internet cafe	38	6.1
How citizens feel about their Government digitally including them		
Yes	196	31.6
No	354	57.1
Not sure	70	11.4
Is Government working towards digital inclusion of her citizens?		

Yes	187	30.2
No	350	56.5
Not sure	83	13.4

6.2 Validity and Reliability

Construct validity, discriminant validity, and scale reliability were performed using exploratory factor analysis (EFA) (Wang et al., 2010). Multiple regression analysis was used to perform the data analysis to test the hypotheses. Cronbach's alpha (σ) ensured the reliability of the constructs.

6.2.1 Computation of Loading Factors (LF), Average Variance Entreated (AVE), Composite Reliability (CR), and Maximum Shared Variance (MSV)

In order to assess the validity and reliability of the constructs, the loading factors (LF) of all the items, the average variance entreated (AVE), the composite reliability (CR), and the maximum shared variance (MSV) of each construct were all estimated, and the results are shown in Table 2.

The lowest permissible value of LF is 0.707 (Borroso et al., 2010). The lowest permissible value of each construct's composite reliability (CR) is 0.5 (Hair et al., 2011). The lowest permissible value of AVE is 0.7 (Urbach and Ahlemann, 2011). The value of each MSV should be less than its corresponding value of AVE. Considering the estimated values in Table 8, almost all of the estimated values are within the acceptable range. Therefore, this confirms that the items are reliable, and the constructs are valid and reliable. The Maximum Shared Variance (MSV) is the square of the highest correlation coefficient between latent constructs. For example, if the correlation between latent constructs A and B is 0.40, A and C is 0.50, A and D is 0.30, then the highest correlation is 0.50, therefore, MSV for the latent construct A is $0.5^2 = 0.25$.

Table 8: Estimation of LF, AVE, CR, and MSV (Source: Authors)

Constructs / Items	LF	AVE	CR	MSV
Internet Access (B)		0.387	0.716	0.250
B1	.647			
B2	.632			
B3	.604			
B4	.603			
Digital Literacy (C)		0.336	0.668	0.354
C1	.517			
C2	.614			
C3	.616			
C4	.567			
Socio-Economic Status (D)		0.279	0.607	0.237
D1	.571			
D2	.512			
D3	.468			
D4	.557			
Mobile Technology (E)		0.430	0.750	0.397
E1	.633			
E2	.681			
E3	.692			
E4	.612			
ICT Infrastructure (F)		0.278	0.606	0.224
F1	.511			
F2	.502			
F3	.579			
F4	.514			
Inclusive Technology (G)		0.200	0.492	0.178
G1	.347			
G2	.546			
G3	.393			
G4	.476			
Digital Inclusion (H)		0.490	0.791	0.514
H1	.554			
H2	.716			
H3	.746			
H4	.762			

(**NOTE**: Composite reliability (CR) > 0.7 indicates internal Consistency. Average Variance Extracted (AVE) > 0.5 indicates Convergent Reliability)

6.2.2 Construct Reliability, Multicollinearity and Discriminant Validity Test

Table 3 illustrates the estimation of the Cronbach's Alpha (σ), variance inflation factor (VIF), and AV. The Cronbach's Alpha of each construct was estimated to confirm that the constructs are reliable and consistent, as shown in Table 3. The lowest acceptable value of Cronbach's Alpha for a construct is 0.6 (Hair Jr. et al., 2010). The Cronbach Alpha values of Internet Access (TransB), Digital Literacy (TransC), Socio-Economic Status (TransD), Mobile Technology (TransE), ICT Infrastructure (TransF), and Inclusive Technology (TransG) are above 0.6 and therefore are reliable and consistent.

Multicollinearity defect results when the inner meanings of the constructs become very close to each other. Because of this, the variance inflation factor (VIF) of each construct needs to be estimated (James et al., 2013; Chatterjee and Simonoff, 2013; O'Brien, 2007). The maximum acceptable value of VIF is 5 (Ringle et al., 2015), although Hair et al. (1995) put the maximum acceptable value of VIF to be 10.

Discriminant validity is said to be established when each item is found to be strongly related with its own construct and weakly related with other constructs. To test for discriminant validity, the average variance (AV) of each construct must be computed. The AV is computed by calculating the square root of the corresponding AVE. Then, the discriminant validity is established if the AV of each construct is more than the correlation coefficients of that construct with other constructs (Gefen and Straub, 2005). From Table 9, the value of almost all the AVs of the constructs in the ninth column is greater than the corresponding correlation coefficients shown in off-diagonal places. Therefore, discriminant validity is confirmed for all the constructs (Fornell and Larcker, 1981). The values of VIF for all constructs lie between 1.567 to 1.704, thus confirming that the data is free from multicollinearity defects.

Table 9: Estimation of Cronbach's Alpha, VIF, and AV (Discriminant Validity Test) (Source: Authors)

	TransB	**Trans C**	**Trans D**	**Trans E**	**Trans F**	**AV**	**σ**	**VIF**	**No. of Items**
TransB	**0.566**					0.622	0.755	1.567	4
TransC	0.450	**0.513**				0.580	0.736	1.704	4
TransD	0.162	0.277	**0.361**			0.656	0.736	1.592	4
TransE	0.140	0.201	0.268	**0.575**		0.527	0.754	1.679	4
TransF	0.229	0.222	0.346	0.420	**0.423**	0.447	0.763	1.589	4

(**NOTE**:
AV > Correlations of construct indicates discriminant validity. VIF <= 10 indicates no multicollinearity defects.)

Table 10: Correlation Matrix (Source: Authors)

Variables		**1**	**2**	**3**	**4**	**5**	**6**
1. Internet Access	TransB	1.000					
2. Digital Literacy	TransC	0.566	1.000				
3. Socio Economic	TransD	0.450	0.513	1.000			

Status							
4. Mobile Technology	TransE	0.162	0.277	0.361	1.000		
5. ICT Infrastructure	TransF	0.140	0.201	0.268	0.575	1.000	
6. Inclusive Technology	TransG	0.229	0.222	0.346	0.420	0.423	1.000

6.3 Factor Analysis

Factor analysis presents construct validity evidence of self-reporting scales (Nunnally, 1978). The sample size is a deciding factor in checking if factor analysis can be applied in a study (Williams et al., 2012). According to Comrey (1973), the guide to sample size are as follows: 100 – poor, 200 – fair, 300 – good, 500 – very good, and 1000 or more – excellent. In this study, our sample size was 450, indicating that the sample size is good for factor analysis. Additionally, the correlation matrix's factorability can be used to determine if factor analysis can be used in a study (Williams et al., 2012). Tabachnik and Fidel (2007) indicate that correlation coefficients over 0.30 should be used when inspecting the correlation matrix (often termed the factorability of R). Hair et al (1995) classify these loadings using another procedure as ± 0.30 = minimal, ± 0.40 = important and ± 0.50 = practically significant. For correlations above 0.30, the researcher can use factor analysis as the appropriate statistical method for the study. As indicated in Table 10, most of the correlations between the variables were above 0.30 in our study. Therefore, factor analysis can be used to perform the statistical analysis of this study.

In order to assess the suitability of the respondent data for factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were conducted. The KMO index is recommended when the cases to variable ratio are less than 1:5 (Williams et al., 2012). The KMO index ranges from 0 to 1, with 0.5 considered suitable for factor analysis (Hair et al., 1995; Tabachnick and Fidell, 2007). Also, Bartlett's Test of Sphericity should be significant ($p < 0.05$) for factor analysis to be suitable (Hair et al., 1995; Tabachnick and Fidell, 2007). Table 11 illustrates the KMO and Bartlett's test of sphericity values for our study variables.

From Table 10, the KMO was 0.859 (i.e., KMO > 0.50), thus indicating that the data was suitable for factor analysis. Also, the Bartlett's Test of Sphericity $\chi 2\ (276) = 5260.885$, $\rho < 0.05$ [$\rho = 0.000$] showed that there were patterned relationships between the items.

Principal component analysis (PCA) was performed to simplify the factor structure of the group items, that is, high item loading on one factor and smaller item loadings on the remaining factor solutions (Costello and Osborne, 2005). In order to obtain scale unidirectionality and simplify the factor solutions, the Kaiser's criteria (eigenvalue > 1 rule) and the cumulative percent of the variance extracted were employed (Kaiser, 1960; Cattell, 1966; Horn, 1965).

Table 12 illustrates the main component analysis result and shows that five components have their eigenvalues greater than 1.000; thus, only the five components contribute to a cumulative variance of 55.795%.

Table 11: KMO and Bartlett's Test of Sphericity (Source: Authors)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**.859**
Bartlett's Test of Sphericity	Approx. Chi-Square	**5260.885**
	df	**276**
	Sig.	.000

(**NOTE**: **p < 0.05** indicates factor analysis to be suitable for data analysis)

Table 12: Principal Component Analysis (Source: Authors)

Component	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	6.166	25.691	25.691	6.166	25.691	25.691
2	3.301	13.756	39.447	3.301	13.756	39.447
3	1.609	6.704	46.150	1.609	6.704	46.150
4	1.206	5.026	51.177	1.206	5.026	51.177
5	1.109	4.619	55.795	1.109	4.619	55.795
6	.998	4.158	59.954			
7	.938	3.910	63.864			
8	.815	3.394	67.258			

6.4 Multiple Linear Regression

The summary of the regression model is indicated in Table 13. The R square value of the regression model in this study is 0.290. The adjusted R square value is 0.283, which implies that the following variables: Internet Access, Digital Literacy, Socio-Economic Status and ICT Infrastructure collectively predict 28.3% of Digital Inclusion.

Table 13: Summary of the Regression Model (Source: Authors)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.539[a]	.290	.283	.88255	.290	41.650	6	611	.000

a. **Predictors**: (Constant), Internet Access, Digital Literacy, Socio-Economic Status, Mobile Technology, ICT Infrastructure, Inclusive Technology
b. **Dependent Variable**: Digital Inclusion

Table 14: Contribution of Individual Constructs in the Regression Model (Source: Authors)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.091	.147		.619	.536
	Internet Access	.150	.054	.119	2.786	.006
	Digital Literacy	.353	.045	.347	7.807	.000
	Socio Economic Status	.127	.052	.105	2.433	.015
	Mobile Technology	.030	.055	.024	.538	.591
	ICT Infrastructure	.128	.055	.100	2.332	.020
	Inclusive Technology	.016	.045	.014	.354	.723

The contribution of individual constructs in the regression table is indicated in Table 14. According to Anaesth (2016), the *P*-value (or the calculated probability) is the probability of the event occurring by chance if the null hypothesis is true. The *P*-value is numerical, and it is between 0 and 1. The *P*-value is used by researchers to decide whether to accept or reject the null hypothesis. The *P*-value is a way to indicate the incompatibility between a particular set of data and a proposed model for the data (Wassertein and Lazar, 2016). In the regression table (Table 14), the variables having their P-values to be less than 0.05 are as follows: Internet Access (0.006), Digital Literacy (0.000), Socio-Economic Status (0.015), and ICT Infrastructure (0.020).

These results indicate that all of the four variables meaningfully contribute to the prediction of digital inclusion in developing economies. From the standardized coefficients of the individual constructs, the beta value of digital literacy is 34.7%, which contributes to the highest prediction of digital inclusion in developing economies. Thus, the variable with the highest contribution towards the prediction of digital inclusion in developing economies is digital literacy. The *P*-values of mobile technology and inclusive technology are 0.591 and 0.723 respectively, and *P*-value > 0.05, therefore these variables do not contribute to digital inclusion in developing economies.

6.5 Hypothesis Evaluation

The hypothesis testing outline from the regression table is indicated in Table 15. According to Anaesth (2016), if *P* value < 0.01, then the result is highly significant, and the null hypothesis should be rejected. If *P* value ≥ 0.01 but *P* value < 0.05, then the result is significant, and the null hypothesis should be rejected. If *P* value ≥ 0.05, then the result is not significant, and the null hypothesis should not be rejected. In Table 15, based on Anaesth's (2016) interpretation of the *P* value, four out of the seven hypotheses (namely: H1, H2, H3, and H5) are supported.

Table 15: Hypothesis Testing Outline (Source: Authors)

Hypothesis Symbols	**Hypothesis**	**Beta(β)**	***P* - Values**	**Is *P* < 0.05?**	**Remarks**
H_1	IA → DI	.119	.006	Yes	Supported
H_2	DL → DI	.347	.000	Yes	Supported
H_3	SES → DI	.105	.015	Yes	Supported
H_4	MT → DI	.024	.591	N0	Not Supported
H_5	II → DI	.100	.020	Yes	Supported
H_6	IT → DI	.014	.723	No	Not Supported

IA – Internet Access; **DL** – Digital Literacy; **SES** – Socio Economic Status; **MT** – Mobile Technology; **II** – ICT Infrastructure; **IT** - Inclusive Technology; **DI** – Digital Inclusion. (**NOTE**: *P* < 0.05 indicates that the hypothesis is supported)

6.6 The Resulting Model

The resulting model is shown in Figure 16, and it is based on the four hypotheses (H1, H2, H3, and H5).

H_1: Internet access positively influences the digital inclusion of developing economies citizens.

H_2: Digital literacy positively influences the digital inclusion of developing economies citizens.

H_3: Socio-economic status positively influences the digital inclusion of developing economies citizens.

H_5: ICT Infrastructure positively influences the digital inclusion of developing economies citizens.

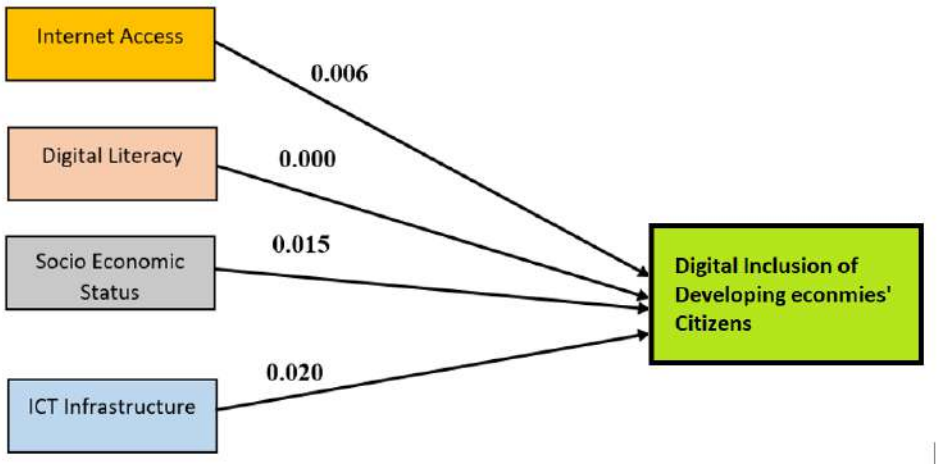

Figure 6: The Resulting Model (Source: Authors)

7. Conclusion

A model that can be used to understand and develop digital inclusion in developing economies was developed in this study. Digital inclusion refers to the different strategies used to ensure that all people to have equal access, skills, and opportunities so as to benefit from digital technologies and ICTs (ITU, 2019). A measuring instrument was developed and distributed to participants in Uganda and South Africa. Construct and discriminant validity of the constructs were established, and the result confirmed the adequacy of the model. The results confirmed that Internet access, digital literacy, socio-economic status, and ICT infrastructure are the determinants of digital inclusion in developing economies.

The study adopted a mixed research approach to assess the factors influencing digital inclusion in the developing economies of Uganda and South Africa. Surveys using questionnaires were carried out in Uganda and South Africa. Interviews were also conducted in Uganda to gain the participants' thoughts about improving digital inclusion in the developing economies. A conceptual framework was developed, and six variables were empirically tested. Four determinants were found to influence digital inclusion in the developing economies. These are Internet access, digital literacy, socio-economic status, and ICT infrastructure. The research report will be useful to practitioners, policy makers and academia to understand the determinants of digital inclusion, and also to assist them to develop strategies for digital inclusion.

Digital inclusion is still a big challenge among the vulnerable persons in developing economies of Uganda and South Africa. It is evidence from the results that inequalities exist in the use and associated benefits of digital technologies among the stakeholders in the digital inclusion ecosystem. A mere provision and access to technologies is no longer a critical issue in narrowing the digital inclusion gap between vulnerable people and non-vulnerable persons. The relevance, appropriateness of the technologies and acquisition of digital literacy are key to minimizing the digital inclusion gap.

By empowering the vulnerable people to access the most appropriate technologies that meet their needs, this would facilitate them to acquire digital literacy and knowledge, and improve their socio-economic capacities. When they are able to leverage the ICT infrastructure, there is an opportunity to gradually narrow the digital inclusion gap for the vulnerable group.

The research will be useful for practitioners, policy makers and academia. The study provides the impetus to building appropriate strategies and designing a complete roadmap for successful digital inclusion implementation in developing economies.

Based on the proposed framework, policymakers can develop more targeted approaches to foster digital inclusion among the vulnerable people. With the many positive impacts of digital inclusion, this could go a long way in helping these groups find better opportunities for gainful employment, increase their productivity, enhance their wellbeing, have the ability to access to e-health services, have instant access to reliable information and financial credit, facilitate their participation in the digital economy, remain competitive, and be networked with their families and friends. Some of the recommendations that may be considered in minimizing digital inclusion gap are presented in section (8.0).

8. Recommendation

Basing on the study findings, the following recommendations are proposed:

1) Leverage the ICT infrastructure for both urban and rural settings to enable equal access to technologies and e-services.
2) Provide assistive technologies to meet the customised ICT requirements and promote effective ICT use for people with special needs (PWSN).
3) Conduct digital awareness campaigns and trainings to promote digital literacy for everyone.
4) Governments to consider subsidisation to make mobile technology affordable for those with low-income. This will also enable vulnerable people to gain access to technological devices and services using mobile technology such as smartphones.
5) Governments and private entities to invest in the most appropriate ICT to widen network access for all people in various locations.
6) Humanitarian agencies to spearhead promotion of digital rights for all people.
7) Design systems that are most appropriate for ageing populations to enable them to use the technology effectively.
8) Regularly, review ICT policies, legislations, standards and regulations that promote ICT accessibility for all people and ensure that they are adhered to.

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Appendix A1: Questionnaire

Digital Inclusion Framework for Various Groups of persons in Developing Economies

Instructions:
Mark your choice with an X or Tick (√) in the relevant field and select only one option unless indicated.

The questionnaire consists of eight sections:

Section A : Biographical data
Section B : Internet Access - individuals have access to Internet or digital services
Section C : Digital literacy – persons have the skills and knowledge to use digital services
Section D : Socio-Economic Status – individuals can afford digital services

Section E : Mobile Technology – how easy to get access to digital services
Section F : ICT Infrastructure – existence of ICT platforms to provide digital services
Section G : Inclusive Technology – The appropriateness of the technology to its end users
Section H : Digital Inclusion - ICT policies and laws – policies, laws and promoting digital inclusion

Section A: Biographical Data

1. Age group

1	11-17		
2	18-25		
3	26-35		
4	36-45		
5	46-55		
6	56-65		
7	>=66		

2. Gender

1	Male		
2	Female		
3	Other		

3. Education Level

1	No formal education		
2	Primary level		
3	Ordinarily level		
4	Advanced level		

5	Diploma		
6	Degree		
7	Postgraduate		

4. Group

1	Elderly		
2	Youth		
3	Person with special needs		
4	Refugee		

5. Race

1	Black	
2	Asian	
3	Colored	
4	Foreign	

6. Access to Internet

1	Daily basis	
2	Weekly basis	
3	Monthly basis	
4	Twice a month	
5	I do not have access to Internet at all	

7. Purpose of Internet Use

1	E-business	
2	Entertainment	
3	Government services	
4	Communication such as emails	
5	Information search	
6	Job search	
7	Online learning	
8	Office work	

8. Technologies used to access Internet

1	Personal Phone	

2	Personal computer at home	
3	Office computer at place of work	
4	Computer at my school/university	
5	Assistance from friends	
6	Private or Internet cafe	

9. Do you believe that you are digitally included by your government in your country?

1	Yes	
2	No	
3	Not sure	

10. Is your government trying her best to include all people with digital inclusion?

1	Yes	
2	No	
3	Not sure	

Section B: Internet Access

Indicate your level of agreement with each of the following statements by ticking the appropriate box. 1: Strongly agree 2: Disagree 3: Neutral 4: Agree 5: Strongly disagree

Questions	1	2	3	4	5	**Tick**
1. Getting Internet access for all people can promote digital inclusion in my country						
2. Internet access should be available to all people						
3. No digital inclusion can be achieved without Internet access						
4. I believe Internet access should be provided free by government						

Section C: Digital Literacy

Indicate your level of agreement with each of the following statements by ticking the appropriate box. 1: Strongly agree 2: Disagree 3: Neutral 4: Agree 5: Strongly disagree

Questions	1	2	3	4	5	**Tick**

1. Having operating information technology equipment such as computer, laptop, tablet, smartphones facilitate digital literacy.						
2. Accessing online or digital services promotes digital literacy						
3. Using social media platforms and information sharing improve digital literacy						
4. Searching and navigating information in online databases promotes digital literacy						

Section D: Socio-Economic Status

Indicate your level of agreement with each of the following statements by ticking the appropriate box. 1: Strongly agree 2: Disagree 3: Neutral 4:Agree 5: Strongly disagree

Questions	1	2	3	4	5	**Tick**
1. Low level of income or poverty negatively has impact on digital inclusion						
2. I can afford on regular basis to pay for my digital services such as Internet bandwidth or subscriptions						
3. Governments must assist citizens to improve their socio-economic statuses in order to improve digital inclusion.						
4. Socio-economic status has a direct impact on digital inclusion						

Section E: Mobile Technology

Indicate your level of agreement with each of the following statements by ticking the appropriate box. 1: Strongly agree 2: Disagree 3: Neutral 4: Agree 5: Strongly disagree

Questions	1	2	3	4	5	**Tick**
1. Mobile technology highly promotes digital inclusion irrespective of the ones' location.						
2. I can easily get access to my digital device any time anywhere with ease						
3. I can access and use my digital device any time and from anywhere with ease						
4. I need to move somewhere else such as to office, school, university or Internet café to get access to digital device						

Section F: ICT Infrastructure

Indicate your level of agreement with each of the following statements by ticking the appropriate box. 1: Strongly agree 2: Disagree 3: Neutral 4: Agree 5: Strongly disagree

Questions	1	2	3	4	5	**Tick**
1. Good ICT Infrastructure promotes digital inclusion						

2. My country has good ICT infrastructure to support digital inclusion						
3. The ICT infrastructure in my country is affordable and supported by government policies and laws						
4. Improvement in the National infrastructure will greatly minimize the digital inclusion gap						
Section G: Inclusive Technology						
Indicate your level of agreement with each of the following statements by ticking the appropriate box. 1: Strongly agree 2: Disagree 3: Neutral 4: Agree 5: Strongly disagree						
Questions	1	2	3	4	5	**Tick**
1. The design and development of technology that is tailored to various categories of persons and that meets customized user needs promotes digital inclusion						
2. I have access to inclusive technology that is most appropriate for user needs						
3. Inclusive technology assists disabled persons to have access to digital inclusion						
4. It is important for governments to include inclusive technology in promoting digital inclusion						
Section H: Digital Inclusion						
Indicate your level of agreement with each of the following statements by ticking the appropriate box. 1: Strongly agree 2: Disagree 3: Neutral 4: Agree 5: Strongly disagree						
Questions	1	2	3	4	5	**Tick**
1. Digital inclusion increases access to government services						
2. Digital inclusion increases job opportunities						
3. Digital inclusion improves health services using e-health						
4. Digital inclusion improved e-economy						

Appendix A2: Questionnaire with Authors

Factors/Authors	Question Identifiers	Questions
Internet Access (DiMaggio et al., 2001; Rigins and Dewan, 2005; Waswa et, al. 2021; Makinde et al, 2019; Brynjolfsson and McAfee, 2014)	**B1**	Getting Internet access for all people can promote digital inclusion in my country
	B2	Internet access should be available to all people
	B3	No digital inclusion can be achieved without Internet access
	B4	I believe Internet access should be provided free by government
Digital Literacy (Chetty et al, 2017; Waswa et al, 2021; Hargittai, 2010; van Dijk and van Deursen, 2014; Van Deursen and van Dijk, 2014; Helsper and Eynon, 2013)	**C1**	Having operating information technology equipment such as computer, laptop, tablet, smartphones facilitates digital literacy.
	C2	Accessing online or digital services promotes digital literacy
	C3	Using social media platforms and information sharing improve digital literacy
	C4	Searching and navigating information in online databases promotes digital literacy
Socio-economic Status (Rogers, 2003; Van Dijk, 2012; Chinn and Fairlie, 2006; Fuchs, 2008; Zhang, 2013)	**D1**	Low level of income or poverty negatively has impact on digital inclusion
	D2	I can afford on regular basis to pay for my digital services such as Internet bandwidth or subscriptions
	D3	Governments must assist citizens to improve their socio-economic statuses in order to improve digital inclusion.
	D4	Socio-economic status has a direct impact on digital inclusion
Mobile Technology (Correa et al., 2018; Donner, 2015; Subtel, 2017; Stork et	**E1**	Mobile technology highly promotes digital inclusion irrespective of the ones' location.
	E2	I can easily get access to my digital device any time anywhere with ease
	E3	I can access and use my digital device any time and from anywhere with ease

al., 2013)	**E4**	I need to move somewhere else such as to office, school, university or Internet café to get access to digital device
ICT Infrastructure (Meach 2019; Bello and Jug, 2015; Dutta et al., 2015; Alderele, 2017; Makinde et al., 2019)	**F1**	Good ICT Infrastructure promotes digital inclusion
	F2	My country has good ICT infrastructure to support digital inclusion
	F3	The ICT infrastructure in my country is affordable and supported by government policies and laws
	F4	Improvement in the National infrastructure will greatly minimize the digital inclusion gap
Inclusive Technology (Pitula and Radhakrishnan 2007; Goggin and Newell, 2007)	**G1**	The design and development of technology that is tailored to various categories of persons and that meets customized user needs promotes digital inclusion
	G2	I have access to inclusive technology that is most appropriate for user needs
	G3	Inclusive technology assists disabled persons to have access to digital inclusion
	G4	It is important for governments to include inclusive technology in promoting digital inclusion
Digital Inclusion (Callahan & Siefer, 2019; Newman et al., 2017; Walsham et al., 2007; Alamelu, 2013)	**H1**	Digital inclusion increases access to government services
	H2	Digital inclusion increases job opportunities
	H3	Digital inclusion improves health services using e-health
	H4	Digital inclusion improved e-economy

Appendix B: Interview guide

This study aims to identify the factors and their interdependencies that influence digital inclusion among the various groups living in Uganda. The identified factors can be leveraged on by government agencies, learning institutions, policy makers and international donor community to minimize the digital inclusion gap in developing economies. This tool is to elicit data from learning institutions, women, men, elderly persons, girls, people with special needs and refugees. Neither respondents nor institutions shall be identified by name in this study. Objectivity, honesty, integrity and confidentiality shall be strictly observed. The data provided will be used for purposes of this study only. You have been selected to participate in this study because you belong the target for the study and your sincere answers will help in identifying factors necessary to narrow the digital inclusion gap in your country.

1. In your own opinion, what do you understand by term digital inclusion?
2. Explain in detail some of the reasons and purpose for accessing digital technologies such as the Internet.
1. Explain in your own experience the most common technological tools used to access the Internet.
2. In your own assessment, describe some of the categories of people in your country that you think are digitally excluded and why do you think so?
3. In your own understanding, explain possible successful factors for digital inclusion in your country.
4. Explain the challenges faced to attain complete digital inclusion in your country.
5. Elaborate some strategies that you think can be used to narrow digital inclusion in your country.
6. Explain some of the benefits you have attained ever since you started accessing and using digital technologies