EXTENT OF USE OF MOBILE PHONE APPLICATIONS FOR RURAL DEVELOPMENT IN SOME RURAL COMMUNITIES OF VHEMBE DISTRICT

By

Zvikomborero Callista Mache

(Student Number: 18007602)

A dissertation for Masters in Rural Development Degree (MRDV) submitted through the Institute for Rural Development to the Faculty of Science, Engineering and Agriculture

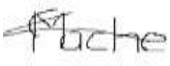
Supervisor : Dr B. Dube (late)

Co-Supervisors : Prof J. Francis and Prof M. Masehela

July 2023

DECLARATION

I, Zvikomborero Callista Mache, declare that this dissertation for the Masters in Rural Development Degree (MRDV) submitted to the Institute for Rural Development, Faculty of Science, Engineering and Agriculture at the University of Venda has not been submitted previously for any degree at this or another university. It is original in design and in execution, and all reference material contained therein has been duly acknowledged.

Signature  **Date** 13/08/2023

Z. C. Mache

AKNOWLEDGEMENTS

I am grateful to my supervisors, the late Dr B. Dube (May her soul rest in eternal peace), Prof J. Francis and Prof M. Masehela for the guidance and support during my studies. Thank you my father, Mr B. Mache, for funding my studies. To the Institute for Rural Development family, I will never be able to thank you enough for the warm induction and friendship throughout my stay as a Masters student. It became a home away from home with the support and assistance from you. Many people contributed to the success of this study, including Miss Awelani Nemathithi as my Research Assistant and the Njhakanjhaka Traditional Authority community members. Librarians at the University of Venda were always supportive. All said and done, greatest honour to our Lord Jesus Christ for provision, divine health, protection and wisdom in successfully completing this research.

ABSTRACT

The study was designed to determine the extent of use of mobile phone applications for development in the villages funder the jurisdiction of the Njhakanjhaka Traditional Authority in Limpopo Province of South Africa. Specific objectives that guided the study were to: 1) identify the major mobile applications that youth and adults use; 2) determine what youth and adults use mobile applications for; and 3) assess the extent to which each mobile application is used. The Knowledge Gap and Digital Divide theories guided the study. A convergent parallel mixed methods research design was adopted. Purposive and convenience sampling were used to select respondents. For purposive sampling, respondents were supposed to own at least one mobile phone. Such persons were expected to be members of any community development initiatives implemented in the Njhakanjhaka Traditional Authority area. Convenience sampling was used to select persons who responded to a questionnaire requiring responses on a Likert-type scale of 1 (Strongly disagree) to 5 (Strongly Agree). There were seven (7) respondents per separate focus group, comprising youth and adults. The total number of respondents was 30, composed of 7 youth and 23 adults. Qualitative data was analysed using Atlas.ti ver 8.4 software. The IBM Statistical Package for Social Sciences (SPSS) version 26.0 software was used to analyse quantitative data. Statistical significance was determined at the 95 % confidence level. Mann Whitney U and Kruskal Wallis tests were conducted where appropriate to test for statistical significance of difference. *WhatsApp* was the most reliable application whilst Snapchat was ranked the least. Mobile applications regarded as key to rural development were ranked high. Youth used mobile applications more than adults. Adults used mobile applications to obtain information on weather, meeting invitations and job vacancies. In contrast, youth revealed that they used the mobile applications for community news updates, jobs and socialisation. Respondents complained that poor network service, expensive data and unreliable electricity supply limited use of mobile phone applications. There was no significant association ($P > 0.05$) between gender and all the perceptions relating to the extent of use of mobile applications. However, statistically significant associations ($P < 0.05$) were observed between age of respondent and the following perceptions: “I would recommend Instagram to other communities” and “Mobile phones are key to rural development.” The results of this study highlight that mobile phone applications play a pivotal role in community development in the Njhakanjhaka Traditional Authority. This justifies the need for establishing Wi-Fi hot spots to enhance connectivity and access to information.

Table of Contents

List of Tables

List of Figures

List of Appendices

CHAPTER 1 INTRODUCTION

1.1 Background

Adapting to newer forms of communication technologies to enable improvement of livelihoods of residents of rural communities is a key imperative of the 21st Century (Andone et al., 2016). Rapid changes in communication technologies such as smart televisions, tablets and mobile phones demand that dynamic approaches to community development be adopted. These include use of mobile phone applications. Mobile applications refer to software developed to take advantage of the mobile technology, enabling the collection and transmission of data for economic and social activities, whether commercial, administrative or for entertainment purposes (McNamara, 2009; Chinedu *et al*, 2019). Jobs (1983) predicted that the digital distribution system would evolve six months towards the launching of the first Macintosh, 24 years from the first iPhone and 27 years before the first iPad in Aspen. He stated that "it would be a little like a record store, where software would be downloaded over phone lines" (Strain, 2015). Applications are believed to have emerged from the early Personal Digital Assistants (PDAs) through the addictively simple game named "Snake" on the Nokia 6110 phone, which led to the first 500 Apps in the Apple App Store, when it was introduced in July 2008 (Strain, 2015, Silverstein, 2022).

Currently, the mobile phone is the most popular communication technology, given the global world's penetration estimated at 67 % among a population of five billion (Global System for Mobile Communication: GSMA, 2020). In Africa, approximately 557 million mobile users were recorded at the end of 2015, with an approximate penetration level of 46 % (GSMA, 2016). In sub-Saharan Africa, mobile phone subscribers were estimated to be 495 million under mobile subscribers, which is equivalent to 46 % penetration, (GSMA, 2021). South Africa, one of the fastest growing economies in sub-Saharan Africa (StatsSA, 2022), was rated the second largest mobile phone market in Africa after Nigeria (GSMA, 2021). South Africa had 89 million unique mobile subscribers compared to 163 million in Nigeria (GSMA, 2021) However, the fact that many people have more than one Subscriber Identity Module (SIM) card across various networks explains this (GSMA Intelligence, 2016). It is clear from the statistics provided above that mobile phones are popular.

Andone et al. (2016) found that age could be a factor for determining popularity of mobile phone applications. Similarly, Levdikova (2019) makes specific reference to the American market. Andone *et al.* (2016) reveals that teenagers use mobile applications more than adults, especially

the communication and social applications such as *WhatsApp*, *Facebook*, *Messenger*, *Snapchat* and *Instagram*. Furthermore, Andone *et al.* (2016) contend that females spend an average 8 % more time on mobile phones on social applications than their male counterparts. Shava & Chinyamurindi (2018) point out that in South Africa, youth in rural areas significantly use *Facebook* for knowledge sharing and exposure to modern cultures. Adults utilise their mobile phones mainly for calling and sending messages (Andone *et al.,* 2016). However, Levdikova (2019) argues that many elderly people rely on their smartphones for checking emails and connecting with friends and relatives. They send messages via applications such as *WhatsApp*, *Facebook* and *Messenger*, in addition to playing games and reading books.

Statistics South Africa (2016) reports that accessibility to mobile phones in South Africa is considerably high. The same StatsSA (2016: 5) report indicates that "only 3.5 % of households did not have access to either landline or mobile phones in the year 2016. A comparison of 87 % of households had access to at least one mobile phone, while 9.4 % of households had access to both a landline and a mobile phone and only 0.1 % had only a landline." This shows that there is a positive progression towards accessibility of mobile phone technologies within South Africa. However, access to mobile phones differs by province. In the mainly rural provinces of Mpumalanga and Limpopo, mobile penetration is estimated to be about 95 % and 94 %, respectively (StatsSA, 2016). Based on these facts, rural populations can be said to have become more reliant on mobile telephones than on landlines (StatsSA, 2016). Access to the internet using mobile phones is still low with 57 % in rural areas compared to 72 % in towns and cities (StatsSA, 2020).

The high level of mobile phone penetration in South Africa justifies research to assess the extent to which this newer technology is utilised for development purposes. Gupta (2016) points out that the introduction of mobile phones is a major source of development in India. Indian farmers are said to be using social media to sell their produce through online platforms (Bansal, 2015; Kesherwani *et al.*, 2022). The successful use of social media for development in some parts of India led the country's Minister for Rural Development to fully participate on social media platforms to highlight initiatives for rural India. Thus, social media usage in the rural communities has flourished and become a fundamental part of rural community development (Gupta, 2016). The latter scholar adds that the mobile phone has been central in powering social media networks among rural populations and this has changed their lives considerably. Mobile phones have given rural farmers in India many opportunities to sell their crops easily through online programmes which have resulted in the removal of middlemen (Gupta, 2016; Dewi & Abdullah 2020. This

illustrates the effectiveness of mobile phones and how rural communities in India have embraced them to enhance local development.

In Kenya, mobile phone usage in rural areas was said to be growing rapidly (Eriksson, 2008; Krell, *et al.*, 2020). The demand for mobile phones in rural Kenya has exceeded expectations and as the urban market has become flooded, rural customers have become the new target group (Eriksson, 2008). Fahamu (2007) argues that mobile phones, at a social level, are changing and creating relationships and networks, as well as strengthening the already existing relationships. Quandt *et al.* (2020) concurs with the above adding that mobile phones enabled networking among farmers as well as increase on profits. Rural communities in Kenya use mobile phone application (Apps) such as the "Kazi 560" to get job alerts (Fahamu, 2007). "Kazi'' means 'job' in Swahili. Anyone seeking employment can get information via SMS alerts (Eriksson, 2008). This confirms that mobile phone technologies are being used successfully in parts of Kenya for rural community development initiatives.

In Ghana, Duncombe (2012) points out that successful innovations in rural areas tend to be market-driven. Tuitjer & Kupper (2020) coincide with the above according to their rural north Germany study. For example, Esoko (formerly Tradenet) provides an electronic means to get data that focus on market prices, buyers, sellers, inventory and transport. This information is distributed via mobile phones to thousands of small-holder farmers who participate in various produce markets. Use of mobile phones has enabled rural producers to interact directly with end-user markets, traders, suppliers, extension services and with each other (Duncombe, 2012; Asongu & Boateng, 2018). This shows how rural communities in Ghana are familiar with mobile phone applications, which are being utilized for rural community development through the agricultural sector. Mobile phone technologies enable farmers in Ghana to gain an awareness of new markets for agricultural produce and to communicate with various stakeholders.

In South Africa, there is no clear evidence of studies conducted to determine whether mobile phone applications have had an impact on rural development. Given the high penetration levels of mobile phones in South Africa, it is imperative to investigate the extent to which they contribute to rural development, as well as to establish whether age is a factor in their usage for development endeavours. The current case study was carried out in Njhakanjhaka rural community of Makhado Municipality, South Africa.

1.2 Problem Statement

Mobile phone technologies have proven to be reliable, quick and efficient communication tools throughout the world. Evidence from the international community demonstrates that mobile phones can make communication in formerly isolated rural communities easy while enhancing development initiatives (Bhavnani *et al.,* 2008; Barbosa *et al.*, 2020). Mobile phone technologies are reliable, quick and efficient communication tools throughout the world. However, in the Njhakanjhaka Traditional Authority in Limpopo Province of South Africa, despite considerable evidence of high levels of mobile phone penetration, there is limited research that indicates the extent to which grassroots community members utilise them to enhance achievement of rural development outcomes.

1.3 Aim and objectives

The aim of the current study was to assess the extent to which mobile phone applications were used to disseminate information needed for development in the Njhakanjhaka Traditional Authority of Makhado Local Municipality in Limpopo Province. The following specific objectives guided the study:

a. To identify the major mobile phone applications that youth and adults use;
b. To determine how the youth and adults use mobile phone applications; and
c. To establish the most popular mobile phone applications youth and adults use for rural development.

1.4 Questions

a. What type of mobile phone applications do youth and adults in Njhakanjhaka Traditional Authority use for rural community development?
b. How are youth and adults in the Njhakanjhaka Traditional Authority utilizing mobile phone applications as tools for rural community development?
c. What are the most common mobile application youth and adults use for rural community development?

1.5 Theoretical Framework

Knowledge gap and digital divide theories were adopted to guide this study. The knowledge gap theory (Tichenor *et al*., 1970) explains the infusion of mass media information into a social system and argues that people of high socioeconomic status access information at a faster rate than the poor. Their argument was that the urban population accessed information faster than the rural population, which has continued to increase the gap mainly due to lower economic status of the rural population and difficulty of obtaining newer technologies. This implies that the poorer rural population does not have reliable access to current information as compared to the residents of urban areas. Tichenor *et al*. (1970) contend that the effect of the newer forms of technology at the global level shows an increase in technology and expense of obtaining it. Poor people cannot afford them. The same scholars further contend that the knowledge gap gets widened as the people of a higher economic class benefit more as this gap increases over the years. The other argument has been that people of high socioeconomic status have better skills in communication, reading, comprehending and remembering information as they are better educated (Tichenor *et al.,* 1970).

The knowledge gap theory helped in assessing how mobile phones limited the information gap for rural population. Mobile phones provide internet access, which enables access to news and information from around the world. This theory was relevant to this study because it refers to global technological advancement in developing countries. Therefore, the theory assisted to assess if the existence of mobile phones in the Njhakanjhaka Traditional Authority enabled the acquisition of knowledge. Central to the argument underpinning this theory is that he knowledge gap would increase between those of high and low socioeconomic status due to latter's lack of education.

The "digital divide" refers to the gap between those who have and have no access to newer forms of information technology (Srinuan & Bohlin, 2011). Hoffman & Novak (2001) reveal that Lloyd Morrisett, a president of the Markle Foundation, who perceived a divide between the information-haves and have-nots first coined this concept. The theory postulates that there is an economic and social gap between the population of a nation and their access to information technologies (Van Dijk, 1999). It continues that the rise in income leads to accessibility and usage of technology (Bus *et al*., 2012). Mwantimwa (2018) states that the digital divide theory reviews inequalities through demographics of individuals thereby separating those who have access to computers, internet and different levels of computer literacy. This theory was appropriate in exploring to what

extent mobile phone applications had bridged the gap between the haves and the have-nots, particularly, within the rural community of Njhakanjhaka given the high levels of mobile phone penetration in the Limpopo Province.

There are some limitations of the digital divide theory, which should be considered. According to Van Dijk (2006), the theory suffers from sound conceptualisation, lack of interdisciplinary research, lack of quality relevant research; it is rather static and insufficient attention is paid to consequences of the digital divide. The theory, despite these limitations, was key in identifying whether mobile applications are essential in bridging the gap in information dissemination.

1.6 Operational Definition of Key Terms and Concepts

Techopedia (2020) states that *mobile phone* refers to a wireless, handheld device that allows users to make and receive calls and text messages, among other features. The initial mobile phones could only allow one to make and receive calls, however, they were later improved to enable text messaging. Modern day mobile phones are packed with many additional features, such as web browsers, games, cameras, video players and even navigational systems (Techopedia, 2019).

Mobile application is most commonly referred to as an “app”. It is a type of application software designed to run on a mobile device, such as a smartphone or tablet computer (Techopedia, 2020). Rivero *et al.* (2006) define mobile application as one that can be used on the move; it may or may not be wireless and is tailored to the characteristics of the device that it runs on (Rivero *et al.,* 2006). Gloag (2019) defines the term as a software program that is designed to run on a specific hardware, namely, mobile handheld computing devices, such as tablets and mobile phones. They are programs that are activated when individuals press an icon on their mobile devices which in turn activate different features for navigation. For instance, applications such as WhatsApp, Gmail, Facebook, Messenger, Snapchat and Instagram among others are available on mobile phones (Gloag, 2019).

The United Nations (UN, 2017) defines *youth* as those persons 15 - 24 years old. South Africa National Youth Policy (2015), however, classifies as youth those from ages 15-35 years. In this study the United Nations definition is the one that was used.

International Association for Community Development (IACD, 2017) explains *community development* as - both a practice-based profession and an academic discipline that promotes participative democracy, sustainable development, rights, economic opportunity, equality and social justice, - and through these, education and empowerment of people within their communities, whether these be of locality, identity or interest, in urban and rural settings, can be undertaken. In 1948 United Nations defined community development “as a process designed to create conditions of economic and social progress for the whole community with its active participation and fullest possible reliance upon the community initiative” (Canadian Global Response, 2018).

The above scholarly remarks helped to identify the rural community of Njhakanjhaka’s (both adults and youth) perceptions of community development. This did assist in reviewing the areas that both youth and adults agree and disagree on regarding community development, as well as what they believe best defines community development, as this refers to a broad phenomenon

Lutz & Linder (2004) define *traditional authority* as the leaders of traditional communities; this refers to historic roots of leadership, the legitimate executioners of power. In Africa, Asia and Latin America, traditional authorities are mostly referred to as, chiefs and elders (Lutz & Linder, 2004).

1.7 Outline of the Dissertation

Five chapters constitute this dissertation. In Chapter 1, the introduction and background to the study are presented. International and South African statistics on mobile phone penetration are provided together with highlights of how mobile phones have been successfully used as tools for rural community development in many parts of the world. Other components of the chapter are the problem statement, and aim and objectives. The two theories chosen provide the framework for the study. Soon after Chapter 1 is the review of literature on mobile applications for rural development. This is contained in Chapter 2. Details on the research design, study area, population, sampling procedures as well as data collection and analysis are articulated in Chapter 3. The results of the qualitative and quantitative studies are contained in Chapter 4. Chapter 5 is the last and devoted to discussion, conclusions and recommendations of the study. Immediately after Chapter 5, a list of references is presented.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The mobile phone is a major innovation that has changed the way people communicate and use information to make decisions. As technology advanced, software designers started enhancing the functionality of mobile phones to support various applications (Okonkwo & Huisman, 2019). The applications support and provide a wide range of activities, including entertainment, education and transport. To date, mobile application development has grown to include development-oriented applications for agriculture, community engagement and service delivery Marwa et al. (2020). Given the gradual penetration of mobile applications into community development work, this chapter critically reviews literature on the relationship between mobile applications and community development, types of mobile applications used for community development, uses of mobile applications, as well as whether age is a factor in the use of mobile applications in rural development.

2.2 Types of Mobile Applications Used for Community Development

Mobile applications are helping Africans and the international community to improve their livelihoods and economies. Mobile applications have been developed to facilitate the functionalities of various mobile technology devices for data gathering and information dissemination (Okonkwo & Huisman, 2019). The different types of mobile applications that exist used in commerce (Abdelkarin & Nasereddin, 2010), teaching and learning (Hwang & Chang, 2011), promoting governance (Poblet, 2011), agriculture (Murugesan, 2013) and provision of health services (Kumar *et al*., 2013). These mobile applications (apps) have been widely adopted and applied in various contexts and activities across the world. As such, it is critical to know and understand mobile applications that are being used for development (Wang *et al*., 2013).

In developed countries such as Sweden farmers utilize, for example, the green encyclopaedia to calculate the attack risk by insects, identifying the most common pests in field crops and weed monitoring (Costopoulou *et al*., 2016). In Australia, F-Track Live is a farm management application that lets multiple users, record and access all farm information, timeously. Utilizing these applications requires technical knowledge which some farmers lack, hence, limiting their adoption of these devices. Okoroji *et al*., (2021) using their Technology Adoption Model (TAM) they

discovered the same problem of farmers not being familiar with usage of applications hence less if not none adoption to usage of applications. In addition, the cost of installing these applications and data to continuously access information are major drawbacks.

Mobile banking is one area where mobile applications are becoming increasingly important in both urban and rural areas. The popular M-Pesa money-transfer application from Kenya has revolutionized banking for millions in rural areas who do not have access to traditional banks; it is the dominant form of mobile money in east Africa. The application allows users to send money to people, regardless of whether the recipient has banking account. It has become the most developed mobile-payment system in Africa, accounting for 80% of global mobile transactions (Murugesan, 2013) however, studies on mobile phones' use among rural communities in South Africa are limited. Kene-Okafor (2020) attests that Vodacom launched M-Pesa in 2010, the first in Southern Africa, however, the adoption was moderate and never reached the heights recorded in Eastern African markets, like Kenya and Tanzania. This ultimately led to the shutdown of the M-Pesa product in 2016.

Mbiti & Weil (2011) in their quantitative research concluded that there is little evidence of M-Pesa economic and social impact. One of the strengths of this study is that it compared both urban and rural use of M-Pesa and it also considered gender. The consideration of gender is similar to this current study, however, this study failed to differentiate adults and youth usage of M-Pesa, unlike the previous study. The other factor the current study does not incorporate is whether illiteracy is a key issue for failure to use M-Pesa. Munga (2010) identified social strain on families being caused by the use of M-Pesa's instant sending and receiving of money, as some husbands and relatives hardly visit their families as a result of this.

The iCow is a Kenyan SMS and voice mobile app which provides information under a subscription service to increase farms' productivity through access to knowledge and experts (Costopoulou *et al*., 2016). Marwa *et al*. (2020) state that application of knowledge on livestock practices as advised via iCow services improved milk yield resulting in more for sale by farmers. This is similar to John & Barclay; Meydami (2017a, b) who concur with the positive impact from embracing mobile apps in improving agriculture production. Bateki *et al*. (2021) also agree stating that mobile applications do help in combating challenges faced in the biophysical and socio-economic constraints fostering milk yield gaps. However, other Kenyan farmers failed to use iCow due to poor network connectivity and also some owned mobile phones that cannot access the internet (Chilimo & Ngulube, 2011; Marwa *et al.,* 2020).

Another application being used in Kenya, WeFarm enables small-scale to ask questions via SMS and receive answers from o0ther registered users in Kenya (Omulo & Mensah (2020). WeFarm application enabled farmers to get information, for example, on types of farming inputs available and better pricing. WeFarm uses smart technology to identify one farmer out of 1,000,000 with a question and match him or her with the one farmer out of 1,000, 000 who has an answer. Small scale farmers who received daily weather updates via SMS made a better choice of crops to grow and also increased their scale of production (Camacho & Conover, 2019). The challenges facing innovation designed for agriculture are quite high and adoption gradual; Yigezu *et al.* (2018) contend that some farmers regard innovations as potential risks rather than opportunities worthy of harnessing.

In India, the MKisan application enables farmers and all other stakeholders to obtain advice and information from experts and government officials at different levels, however, farmers using this application complain that sometimes solutions offered through this platform is too general and vague (Kharel, 2018). Mittal *et al.* (2010) argues that the use of WhatsApp should help since queries can be posted as pictures and in audio-visual format, hence this would help diagnoses so as to relevantly advise farmers. In addition, this approach would help peer discussions and learning which are impossible through mobile advisory services (Thakur, 2016). WhatsApp was discovered to be one of the most used application by farmers in India for dairy farming (Jadhav *et al*., 2021). The usage of WhatsApp has been proven as assisting farmers in a more efficient way; they can even keep important information starred or archived on the same application.

The Modisar application assists farmers in Botswana to manage livestock by tracking their farm records, cattle herds, farm costs and sales (Devanand & Kamala, 2019). The app name ‘Modisa’ is a Tswana word meaning “Herd boy”. This application can be utilised even without internet connection as a farmer can capture farm information on the application and would synchronise the data whenever they get internet connection (Muraga, 2015). Omalayo (2015) further stated that Modisar application provided farmers advice on areas, such as animal vaccinations, feed, nutrition and finance.

The Laurey (2016) review of m-Agriculture applications revealed that some applications are not sustainable over long term, since some gave exaggerated expectations which led to farmers’ frustration and eventually abandonment of applications, when these are not fulfilled. Demenongu *et al.* (2018) note that some farmers faced a challenge of poor infrastructure within their

communities, thus, no proper network coverage and poor electricity supply, however, none of these studies on applications provided a comprehensive account of the education and age levels of the users of these applications. The current study, thus, also highlights the challenges of these mobile applications factoring in the age factor.

In the developing world, smallholder farmers are increasingly relying on mobile phones to access agricultural information and advisory services. A wide variety of mobile agricultural initiatives have been established in the developing world over the last few years. These initiatives offer the potential of providing agriculture-related information and services to many smallholder farmers at a low cost (Caine *et al*., 2018). The content and the design of the mobile agricultural tools take full cognizance of the educational attainment, gender, age and the informational and technological skills of the farmers as well as the local circumstances in which these phones are being used (Kameswari *et al*., 2011). One issue with these technologies is that they are designed on the perceived needs of farmers by outsiders rather than developing a deep understanding of the farmers at local levels (Glendenning & Ficarelli, 2012). The lack of bottom-up approaches to understand farmer needs before developing applications in agriculture has been one of the drawbacks associated with mobile applications.

Information provided in mobile applications must be relevant and timely for farmers. For instance, Agri-Fin Mobile, Reuters Mobile Light and IKSL, coordinated the dissemination of information around the crop cycle, with different information being provided around the relevant timings for each crop. Farmers seem to like these applications as they provide information about farming practices in a timely manner, however, Caine *et al*. (2018) argue that the provision of accurate, credible and reliable localized content remains a challenge for mobile agriculture applications. Partnerships with local organizations and farmers who possess high-quality content have improved this challenge. The provision of localized content and the maintenance of its quality control, however, is expensive, and this partly explains the scarcity of sustainable mobile agricultural applications.

In India, farmers are connecting with their customers through WhatsApp groups in the virtual market. WhatsApp groups for farming solution is a recent extension approach with the aid of internet and smart phones. This enables information sharing in multiple forms, ranging from text-based messages to audios, visuals, audio-visual and even web links making it an information-enriched platform. Additionally, information sharing is possible at any place and at any time

without worrying about background disturbances, thus, it has become popular among farmers in many parts of the world (Devanand & Kamala, 2019). WhatsApp is also enabling farmers to access information on farm operations, markets and plant-health issues, thus, the application has increased social media literacy among farmers and at the same time facilitating fast and cheap transfer of information among them (Naruka *et al*., 2017). On the level of daily interactions, the WhatsApp groups are successful at providing a sounding board of assistance and in motivating farmers.

Given the above information, different mobile applications are increasingly playing a significant role in combating rural and urban poverty as well as fostering sustainable development through creating information-rich societies and supporting livelihoods. Kharel (2018) advises on the need for appropriately deploying the different needs of urban and rural people; this will make mobile applications powerful relevant tools of economic, social and political empowerment.

There is high levels of penetration of mobile applications into developing countries, however, most of the applications are for entertainment and lifestyle purposes. These consumer-oriented mobile applications are typically offered on a mass-volume and low-cost basis. In contrast, it is far more complex and time-consuming to develop applications targeted at a specific development challenges in a sector. In addition, mobile applications for development purposes, rarely, generate sufficient revenues to be financially sustainable at a small scale or without significant revenue from bundling, advertising, cross-subsidies and other sources (Qiang *et al*., 2012). As such, despite the potential, developing mobile applications for development purposes is still challenging and slow, therefore, it is critical to investigate mobile applications in use at a local level.

Marketing decision makers are burdened to choice if they would take part in the new online communications available. On the other side having to request and justify the cost of using traditional advertising mediums such as TV or radio (Fisher, 2009). Goode (2009) also views social media as a very significant tool for the marketing environment. In his research 60% of planners utilized a minimum of 16 online leads every year through social media. He discovered that most financial planners used Facebook. The LinkedIn platform which is created for business professionals, also provide relevant information and prospects for decision makers. Moreover, Fisher (2009) also highlighted that firms are defining different uses of social networking sites. For instance, LinkedIn is usually made use of selecting proper candidate to specific jobs by human resources department in some organisations.

Mobile phone technologies have enabled even the poorest countries to extend telecommunication network coverage to the mass of their populations including the rural poor. The International Telecommunications Union (2012) notes that recent reviews of practice have revealed widespread application of mobile phones in support of livelihoods in rural and less developed regions of developing countries. In sub-Saharan Africa (Donner, 2009) identify mobile phones as a key innovative technology in support of livelihoods, with evidence of growing integration into agricultural extension, information provision and marketing systems. Mobile phones are also being used extensively for advocacy and campaigning on livelihood-centred development issues (Hellstrom, 2010). Thus, the practical application of mobile phones in support of livelihoods is growing rapidly, but conceptualisation of the interrelationship between them is lagging. For this reason, Heeks (2007) raise concerns about the rapid implementation of new information and communication technologies based on little understanding of their development impact.

The role of mobile phones can be expressed in terms of livelihood asserts. Mobile phones can facilitate direct substitution of assets. For instance, there is widespread evidence of substitution between expenditure on mobile phone airtime and transportation costs. Better communication via mobile networks leads to a reduction in the frequency of journeys and the time and expense of travel, with an additional key benefit of enhancing the ability of poor communities to respond more quickly to emergencies (Muto and Yamano, 2009). Mobile phones and applications also save time hence allowing reallocation of the saved time to other activities. For instance, no one is required to go around surrounding villages to inform people of about an upcoming meeting due to the use a phone. However, re-allocation of resources and the diverting of expenditure within limited household budgets also give rise to opportunity costs and negative impacts (May, 2010). This may result in limited use of mobile applications in a bid to save especially in low income societies.

Studies carried out in Africa prove that users of mobile phones can enhance people's pre-existing social and economic networks (Sife *et al*. (2010). Similalry, Donner (2006) suggests that the poor get their most valued information by word of mouth, and the diffusion of mobile phones is playing a key role in extending these organic informal networks. This way passive diffusion is increasing the efficiency of underlying information processes and thus increasing potential for productivity in societies.

Based on the above information, mobile applications can facilitate the initiation of development strategies by communities, enabling them to access local, regional, national, and global networks. Thus, applications can be a tool to break down the traditional structures of power that work against the very poor. Despite the potential, mobile phone applications are relatively a new tool in

community development for many developing countries. it is perhaps a recent development that grassroots NGOs are exploring the potential for mobile phones to aid them in their work at village level. The success of mobile applications is based on the functionality of the economy, the willingness of communities to embrace it and the affordability of both smart phones and applications (Fuller & Thomas, 2008).

Mobile phones and associated applications assist in reducing barriers to the access of rural population to education and training services. Mobile applications provide an e-learning platform that supports the teacher's work such as organize and upload pedagogical material, create an on-line library of the courses. They also support student's work like on-line access to the library, on-line clarifications and cooperation, the group work such as access to remote laboratories for experimental work. Moreover, they intensify familiarization of young people and development of skills in ICTs. At the community level, everyone has the possibility to use on-line learning services offered by various providers' institutions. This enhances the absorption of new skills and competencies that lead to personal empowerment and increase of skills and knowledge of employees in rural regions (Stratigea, 2011).

2.3 How Mobile Applications Are Used in Community Development

Mobile phone applications can be useful tools for rural development if harnessed well by the community and the policymakers. Applications, such as social media, - Facebook and Twitter - can be appropriate platforms were rural communities can adapt to modern ways of advancing their communities. In India, according to Rai & Shahila (2013), for example, Facebook came to the assistance of many farmers when they were faced with the crisis of an oversupply of turmeric which had led to the price dropping excessively, however, a boycott of 2500 farmers led to price being doubled. In another incident, small tea farmers in West Bengal India launched a website in 2012 which they linked with their Facebook and Twitter to connect farmers directly with international markets (USAID, 2013), however, evaluative research into them did not highlight the profile of these farmers - their age, literacy level and even the infrastructure of their villages; Rai & Shahila (2013), concluded with a general statement that the majority of villages in India lack access to electricity and internet.

There has been considerable excitement about the possibilities of mobile phone applications in development. Mobile applications and phones have had significant impact in some economic development arena especially for the marginalised and poor communities. These apps cover a spectrum of activities from information sharing, bringing people together as well as easy and fast communication. Mobile applications offer various kinds of services in agriculture, such as, weather forecasting for farmers, agricultural business news, information for agricultural machinery and equipment, agricultural product market prices, management of agricultural product and dairy farming, management of irrigation systems and management of crop sensors (Gichamba & Lukandu, 2012; Lomotey & Deters, 2014).

In Ivory Coast, which is also known as Côte d'Ivoire, agriculture mobile applications are increasingly improving the lives of rural community farmers. In agriculture, mobile applications are used to track information on local and international markets, market prices and technical advice, which was previously difficult to access (Goggin & Clark, 2009). This has enabled the producers to have direct communication with the buyers and to avoid the costs associated with intermediaries. Mark-Antony *et al*. (2021) mobile applications are being used by extension agents and farmers too and it is beneficial to them.

A case similar to what is referred to in the preceding paragraph is that of Indian fisher-folk using mobile phones to decide where best to land with their catch. Another interesting scenario is the emergence of the *'shu shu shu'* or 'market spy' in Tanzania. Here farmers are employing so-called, market spies, in nearby cities to relay the latest product prices and availabilities to them by mobile phone (International Fund for Agricultural Development: IFAD, 2007). Such timely information enables improved market access, improved profits, and ensure awareness of changing market trends and new opportunities. However, effectiveness of mobile applications depends on factors such as access to accurate and timely information, management of the information, and capacity to respond to community enquiries (Asaba *et al*., 2006). Therefore, the providers of the several information needed by farmers should be highly alert of current changes and be able to update farmers on time. Their accuracy on giving relevant information will continue proving successful results as more and more farmers would opt to rely on them.

Facebook has advanced into one of the major development platforms in rural areas of both developed and developing countries. In South Africa, it has become a valuable communication outlet for civic and non-profit organizations to reach their stakeholders and provide information

(Frye, 2014; Kanter & Fine, 2010). Stakeholders and community members can exchange messages, join awareness campaigns, voice their concerns and lobby for support through Facebook platforms (Chiulli, 2014). This shows that communities have a many ways of using mobile applications such as Facebook for rural development as they bring their voice out through this platform. This would indeed help in making key players in policies make drastic changes that will help solve different issues the rural based dwellers have publicly published.

Furthermore, Facebook is an affordable means to more efficiently meet organizational goals and missions (Frye *et al*., 2014). Chiulli (2014) adds that Facebook is widely used by organizations to efficiently communicate with their community members in Africa. For instance, Bosch (2009) reports wide use of Facebook in schools and communities of South Africa; Peters *et al*. (2015) studied the use of Facebook among Americans, Namibians and expatriate Namibians and discovered a growing trend in the application use.

In education, mobile application use in the schools fosters critical, integrative and contextual teaching and learning as well as developing information literacy, therefore, it improves the overall efficiency of the delivery of education in schools and in educational management institutions, at all levels. Kharel (2018) reported the use of WhatsApp in many higher education institutions in South Africa and Zimbabwe. For instance, WhatsApp groups are used for assignment discussions, announcements, clarification of queries and many other student-lecturer interactions. The effectiveness and efficiency of WhatsApp as an education tool has not yet been established in rural South Africa. Fortunately, in Turkey a study discovered that an education environment using WhatsApp proved more successful, compared to the traditional environment, according to Cetinkaya (2017).

Mobile assessment is a type of educational assessment where the delivery of assessment is done via mobile (Zheng, 2015). This mobile assessment (m-assessment) is usually used to assess leaners via mobile phone devices. For instance, mobile functions such as texting, calling and mobile applications are used (Hunt & Pellergrino, 2002). Kreutzer (2008) reviewed that students in grade 11 used their mobile phones mainly for music and calls. However, the other assessment reviewed some also using their mobile phones for sms, games, internet, pictures and for sending please call me. Fritz-Palao (2014) stated that mobile devices allow real-time formative assessment in schools. Teachers can assess the performance of their students and this enables them to adjust their teaching based on the feedback (Fritz-Palao, 2014).

Furthermore, Fritz-Palao (2014) listed the four most popular ways to use for assessment which are as follows: First, texting for understanding Not Distraction this is whereby students who are shy will text their teacher with their questions. Secondly, practice for upcoming Common Core assessments this involves a mobile phone application which allows teachers to employ different types of questions which students will be expected to answer via their mobile phones (Fritz-Palao, 2014). Third, increasing engagement will make mobile phone easy to incorporate fun, dynamic quizzes, polls and contests in lessons which will encourage student participation, debate and discussions (Fritz-Palao, 2014). Fourth, testing out of the box this is the ability to flip formative assessment, whereby teachers flip the usual classroom model by conducting quizzes via mobile devices as part of homework. Then the results will be used to plan the following day or week instructions (Fritz-Palao, 2014).

Mobile assessment is also being used on some medical or clinical assessments for example cognitive assessment. According to Hultsch *et al*. 2008 mobile cognitive assessment it is the assessment of the brain after an injury, illness or response to treatment. Cognitive test is sometimes done traditionally whereby patiently can interact with the real-world environment. However, several studies have developed and tested repeatable cognitive tests on a computer or mobile platform that are delivered in a fixed environment (Moore *et al.,* 2016). Moreover, another health assessment being done using mobile phone is that of consumers using mobile phones to allow individuals to participate in personalized body weight management (Farina *et al.,* 2016). Simple measurements such as weight, height, waist and hip circumferences are desirable as they are contributing factors of metabolic and chronic diseases (Leiter *et al.,* 2015). Thus, this shows that mobile phones can be used for rural community development in terms of the community health.

In a nutshell, mobile assessment proves to be a reliable and worthy technological aspect of the mobile phone. Thus, if used for rural community development depending in which sector it might enable realising gaps that would assist in working on a solution towards the limitations found be it in education, health sector or even agricultural.

Mobile applications are also commonly used in governance in East Africa. Mobile governance is an umbrella term that covers several initiatives involving the use of mobile technologies in the domains of citizens' participation, public awareness, management of emergencies and crises, as well as provision of public services (Poblet, 2010). In East Africa, mobile applications have been used in elections and have been used in various ways during the campaigning. For instance, text messages were used in campaigns, in the run-up to the Ugandan elections 2006 and Kenyan

elections in 2007 (Limo 2007). Technology has also been used for post-election monitoring like in Kenya 2007/2008. Also in Kenya, media houses provided election results via SMS at a premium rate as breaking news (Limo 2007). Nairobi People's Settlement Network used mobile phones to get organized against evictions in Kibera, Nairobi (Hellström, 2011).

In Zimbabwe, mobile applications are widely used to bank and transfer money in both urban and rural areas. A study by Chinakidzwa *et al*. (2015) revealed that ecocash was the commonly-used mobile money application in rural areas of the Mudzi District; the application is used for sending and receiving local currency and to bank money for future use. This mobile money platform was easy to use for the public, thus, its popularity; however, the cost associated with using this mobile money channel was a major concern for the rural dwellers.

The MKisan application enables farmers and all other stakeholders to obtain advice and information sent by experts and government officials at different levels in India. The iCow is a Kenyan SMS and voice mobile app that provides an assortment of information under a subscription service to increase farms' productivity, through access to knowledge and experts. In Botswana, the Modisar application assist farmers to manage livestock by tracking their farm records, cattle herds, farm costs and sales. WeFarm aims at small-scale farmers enabling them to ask questions via SMS and receive answers from other registered users in Kenya, Uganda, Tanzania and the Ivory Coast. In Sweden, the green encyclopedia, helps, for instance, to calculate the attack risk by insects, the identification of the most common pests in field crops and weed monitoring (Costopoulou *et al*., 2016). All these applications help to enhance agriculture productivity and growth.

In the South African agricultural system, mobile applications and Information Communication Technology are envisaged as increasing agricultural production, providing better access to regional and global product markets, improving knowledge-sharing and information-exchange among farmers, producer associations, agribusinesses and the agricultural and rural communities in general (Maumbe & Okello 2013). In addition, Davis *et al.* (2010) notes that ICTs will enhance farmers' abilities to respond to emergencies, such as pest outbreaks and wild fire damage, assist with on-farm disease diagnosis, improve record keeping and analysis that is critical for generating decision-making information (intelligence) needed to keep the farm business healthy.

Mobile applications are also widely used in health systems (Mulgan, 2006). The African communications 'revolution' is believed to have generated confidence of the mobile phone possibility to break barrier of healthcare providers in isolated rural areas (Hampshire *et al.,* 2015). Hampshire *et al.* (2015) further states that even though m-health programmes remain limited in popularity youth are using their mobile phones creatively and strategically to acquire current healthcare information. Nuwamanya *et al.* (2018) added that numerous profitable programs are being applied around the world that make use of mobile technology to bring about awareness of Sexual and Reproductive Health (SRH) among youth.

Hampshire *et al.* (2015) during their survey in Ghana, Malawi and South Africa on usage of mobile phones they discovered that youth used mobile phone more than the adults. The uptake of mobile phones was also being influenced by the sharing of mobile phones within some households. Hence, according to their review usage exceeded ownership of mobile phones. Mobile phone usage and ownership was highest in South Africa followed by Ghana and then Malawi, this was believed to have been due to availability of network in those countries (Porter *et al*., 2012). Hampshire *et al.* (2015) further stated that mobile phones can enable communication with people in the incident of sickness or any health crisis. Nuwamanya *et al.* (2018) noted that mobile phone applications are a feasible and effective way to increase access to SRH services and tools in both low- and middle-income countries. Even though the ownership of mobile phones in Ghana and Malawi was high among males than females which was a contrast with South Africa (Porter *et al.,* 2012). It is of importance to acknowledge that as highlighted earlier access to mobile phones was increased by sharing mobile phones within households.

The mobile phone is now increasingly becoming a vital tool for the effective delivery of healthcare in developing countries. This is most notable in remote areas with little infrastructure. For instance, the Consol Homes Orphan Care, which is a community-based healthcare model in Malawi was established, to enable locally-mobilised community members to support children and adults infected with HIV and/or affected by AIDS. The community carers each supports hundreds of households with a sick family member, offering help with basic care, cleaning, counselling, nutrition, and referrals to hospitals and clinics. The mobile phone enables the healthcare workers to maximise the use of their time in helping those living with HIV, rather than spending large parts of their day on the road (Goggin & Clark, 2009).

According to Goggin & Clark (2009) mobile applications are also utilised to promote HIV awareness and education across the world. For instance, the Heroes Project in India and the Mexican Zumbido support network which enables patients with HIV-related illness to send texts to the network about their daily concerns and challenges. The social franchise Mobile for Good (M4G) project in Kenya uses the mobile phone to provide health information, employment opportunities to marginalised communities.

Mobile phones and applications, such as WhatsApp, also allow for communication between people in diaspora and their native communities (Karim, 2003). These are diverse in their nature, settings, cultural and communicative characteristics and architectures, yet, there is a significant literature on the similar roles of mobile applications, such as Mukuru which allows for the sending of money to more than five countries in Africa. This helps to foster rural development in the receiving communities.

Mobile applications have also become critical in activism and social organisation. One example is a mobile application which is a community of people and organizations using mobile phones to enhance social impact. The application increases the effectiveness of NGOs around the world who recognize that mobile phones provide unprecedented opportunities for organizing, communication, service and information delivery (Mobile Active, 2008). Mobile Active produces strategy guides available in several languages, including English, Spanish, and Arabic, that cover, for instance, the use of mobile phones for election monitoring, electoral and voter campaigns, as well as for advocacy and fundraising.

In terms of understanding the intersection between mobile phones and community development, the role of local understanding and ownership of needs once again emerges as critical. There is a long-standing problem of technology deployment and design in development, whereby technology is given to, or imposed upon people without due regard to their needs and cultures. This has long been critiqued, with the general recognition in community development that unless the initiative comes from the community, it is unlikely to be sustainable. From the standpoint of science and technological studies, there has come the recognition of the role of users, and social, cultural, and political factors in 'shaping' technology (Haddon *et al*., 2005).

Based on the above information, mobile applications can facilitate the initiation of development strategies by communities, enabling them to access local, regional, national, and global networks, thus, applications can be tools to break down the traditional structures of power that work against

the very poor. The potential of mobile phones is very obvious, however, the applications are relatively a new tool in community development for many developing countries. It is a recent development that grassroots NGOs are exploring the potential for mobile phones to aid them in their work at village level. The success of mobile applications is based on the functionality of the economy, the willingness of communities to embrace it and the affordability of both smart phones and applications (Chinedu *et al.,*2019). In this regard, it is imperative for this study to ascertain how mobile applications are being used for rural development activities, in a local context, such as the location of this study.

Mobile phones and associated applications also assist in reducing barriers to access, to education and training services, by rural population. Mobile applications provide an e-learning platform that supports the teacher's work, in such ways like, organizing and uploading pedagogical material as well as creating an on-line library of the courses. They also support student's work like on-line access to the library, on-line clarifications and cooperation, group work and access to remote laboratories for experimental work. In addition, mobile phones intensify familiarization of young people and development of skills in ICTs. At the community level, everyone has the possibility to use on-line learning services offered by various providers and institutions. The usage enhances the absorption of new skills and competencies that lead to personal empowerment and increase of skills and knowledge of employees in rural regions (Stratigea, 2011).

Market-driven mobile payment services are also providing potential for poor communities to benefit from faster and more secure financial transactions (Duncombe & Boateng, 2009). Infrastructure and service platforms are sufficiently scaled through platforms such as Mukuru in South Africa, and Safaricom's M-pesa in Kenya. These applications and services enable communities to receive remittances or to make payments with the potential for the non-banking individuals in poor communities to access formal banking services; this is suitable for low-income users. New mobile innovations for providing micro-insurance and facilitating social cash transfers have also been developed across Africa.

Donner & Escobari (2009) suggest that mobile phones have become key tools for communication, linking buyers and sellers within supply chains as well as supporting access to markets. Through passive diffusion, mobile phones are now entrenched in informal micro-enterprise networks, such as for the self-employed including street hawkers, domestic and casual labourers (Rangaswamy,2009). Mobile phone applications are also leading to the creation of new

entrepreneurial activity or new forms of livelihood, thus, supporting diversification strategies. This was evidenced by the Grameen telephone ladies of Bangladesh (Rashid and Khaled, 2020). Due to the distinctions in mobile application uses in communities, the current study sought to explore the uses of mobile applications in rural development, at a local level.

It is important to note that social media has, and continue to shape the global landscape. The rural of Tanzania communities constitute a significant percentage of the population whose members are predominantly agro-pastoralists these communities largely depend on crop farming and livestock keeping for their livelihoods (Uzuegba, 2016). In developing countries, these rural communities experience poverty associated with poor and low agricultural production poor market access and social services (Kazi *et al.,* 2017).

Mobile phones can help address the challenges of information access and application in socioeconomic services to alleviate poverty. There is evidence that aspects of poverty cannot be addressed without mobile phone technologies in the current age (Greenberg, 2005). For example, mobile phone technologies have served as effective tools in providing security information, (Rao, 2010). In addition, the delivery of after-sale services and support can directly lower the cost (Gurstein, 2000). With appropriate communication, the seller can learn about market prices and demand a higher wholesale price. Fisherman, for instance, can use mobile phones to determine the port at which to sell their catch. Thus, this review that mobile phones are being utilized to influence ways to curb poverty as farmers and fisherman get exposed to better market options.

Moreover, the use of mobile phones does provide access to markets in nearby villages and towns, thereby increasing income for smallholder farmers and producers (Srinivasan & Burvell, 2015). The other factor being mobile phones enable both farmers and nonfarmers to access information on products they want to purchase. Therefore, form the above, it can be noted that a mobile phone is a technological tool that has so many functions that are being utilised by the rural community for development in Tanzania. It is so as farmers save money as they sell their products to nearby markets. Which in turn also builds new networking within their close by villages thus promoting sharing of ideas hence develop their rural communities.

In Uganda according to, Masuki *et al.* (2010): mobile phones were distributed in rural communities of Kibuya, Karujanga, Rwanyena, and Mugandu. These proved useful as they allowed farmers in these communities to communicate with various stakeholders such as stockists, technocrats, and traders throughout the harvest season (Masuki *et al*., 2010). Farmers would inquire of availability of seeds and other inputs thus early season. Mid-season they would inquire about pesticides for

pest and disease management. At the end of the season would inquire on prevailing market prices for agricultural commodities. Therefore, the use of mobile phone among rural adults is clearly reviewed which vividly promotes community development. This is so as farmers were able to be informed of latest and improved pesticides as well as seeds.

Dannenberg & Lakes (2013) highlighted that the flow of information through mobile phones was characterised by a limited volume of data exchange. Mwantimwa (2018) further explained that the data and information exchanged via mobile phone technologies does not fulfill the information needs of rural communities in Kenya. Thus, referring to the information shared on mobile phones not being of relevance towards rural community development. The information might have been just basic social life information. Moreover, Krone *et al.* (2015) stated that lake of knowledge, skills and low level of education are impediments to effective use of mobile phones. Furthermore, Krone *et al.* (2015) contend that the use of mobile phones limited access to complex knowledge and sophisticated markets. In the same argument, low literate rates and poor skills were impediments of utilisation of text messaging among the rural communities in Kenya, (Wyche & Steinfield, 2016). In addition, Mwantimwa (2018) stated that many rural Kenyan dwellers in the Bangamoyo and Monduli rural districts faced difficulties in reading the content of the message received from the source. Thus, one can deduce that low literacy and lack of knowledge are impediments towards mobile phones being effective tools for rural community development.

Mobile phone technologies networks and charging costs remained beyond the reach of rural community dwellers in remote areas of Northern Kenya (Kazi *et al.*, 2017). Another factor highlighted by Uzuegbu (2016) is that rural communities constitute a significant percentage of the population whose members are predominantly agro-pastoralists. These communities largely depend on crop farming and livestock-keeping for their livelihoods. Hence, they use mobile phones to access new markets and get information on prices for pesticides and vaccinations (Uzuegbu, 2016). Mobile phone technologies also enhance the conveniences and confidence for traveling it provides relevant information in real time (Sarwar & Soomro, 2013). Thus, the above, review determinants towards rural community development. Given that mobile phone, technologies enable farmers to communicate with new buyers and get information on products they need in the comfort of their own homes. There is also the issue of saving money as they avoid traveling to urban centers as they access information instantly on their phones. In a nutshell, can note that mobile phone-based technologies are being utilised by the rural adults for rural community development despite some of the highlighted shortcomings that are faced by some rural dwellers.

Mobile communications technology has become the world's most common way of transmitting voice, data and services. Mobile applications are vital for developing countries because that is where it is growing fastest, and in the next few years nearly all new mobile customers will come from developing countries because penetration has reached saturation levels in developed countries. To date almost every community uses mobile handsets and thus the penetration of mobile applications has become inevitable (Daniel, 2010). The development of applications for them offers uses that extend well beyond voice and text communications. Mobile applications for rural development could provide the most economic, practical, and accessible routes to information, markets and governance for millions of people (Qiang et al., 2012). (McNamara 2009) define mobile applications as software designed to take advantage of mobile technology, enabling the collection and transmission of data for economic and social activities and development purposes.

Nielsen *et al*. (2018) assessed that mHealth interventions are particularly suitable for youth regarding sexual health promotions as this would be discrete way to a group which is tech savvy at-risk population. MHealth is an increasingly popular way to disseminate promotional information to many people at a low cost and it helps in case of ongoing health activities (Nielsen *et al*., 2018). Furthermore, Nielsen *et al*. (2018), stated that creative mHealth interventions such as games, videos, and challenges such as quizzes, puzzles and riddles could engage youth in sexual health awareness and behavioural change. Larsson *et al*. (2006) supports the above notion stating that educational interventions did show positive results in terms of increased knowledge on STI and condom usage also attitude change among the youth. However, Malbon & Romo (2013) contest their resolutions stating that increase in knowledge on STIs did not promote behaviour change on increase of condom use and reduction of sexual partners. Therefore, form the above one can agree that mobile phone application impact on behaviour change it is still a contested terrain.

Nielsen *et al.* (2018) the youth in Stockholm County population ownership of mobile phones is the highest in the Sweden population and majority of these are smart phones. mHealth apps popularity is evidenced by the estimated 102 billion downloads of health-related apps worldwide (Gibbs *et al.,* 2017). Nielsen *et al*. (2018) argues that even though they were evidence of impact of mHealth increasing information dissemination and knowledge on STIs even the testing for STI. There is need to develop better ways to influence behaviour change for example usage of the

condom (Nielsen *et al*.,2018). Nielsen *et al*. (2018) further stated that given the stigma around STIs and youth the mobile applications are effective tools to disseminate information about STIs, testing and treatment. Gibbs *et al.* (2017) also argued that from a review on mobile apps for STIs showed that a few mHealth apps did not meet the needs of people looking for accurate sexual health information and there was a demanding need for high- quality. Given the above facts, mobile phones do have a positive impact on information dissemination even though they were need for better user friendly m-health applications that suit the need of the people.

Mobile phone based-technologies are believed to be useful by the youth all around the globe. Social media is believed to be more popular among the youth (Swist *et al.,* 2015). According to Vacaru *et al.* (2014) in New Zealand a research was conducted on how and what the youth aged 14 to 18 use the mobile phone for in their daily schedules. The youth stated that mobile phones are practically convenient as they have everything in one portable device. That are communication tools, entertainment, note writing, reading, and going online. According to Vacaru *et al.* (2014), mobile phone did reduce or even cut the use of the laptop, books, and notepads. Furthermore, Vacaru *et al*. (2014) stated that mobile phone was used as a tool for security reasons given that one can call or text for help in case of an emergency. In another light, parents could check on their children whereabouts using the mobile phone. This show an example on the youth uptake of the mobile phone at a global level and the zeal and capability of utilising this technological communication device.

Porter *et al.* (2016): Sub-Saharan Africa the youth access to mobile phone applications have expanded dramatically over the last decade in both rural and urban. In the case of education, access to the internet through mobile phone is recognised, worldwide to have a vast potential to expand youths learning opportunities (Porter *et al*., 2016). The mobile phone is not only used for easy access to information for their curriculum but rather allows the youth to have their own voice and discover their place in the world (Hughes *et al.*, 2017). Porter *et al*. (2016) in Sub Saharan Africa the dramatical proliferation of the mobile phone has changed the information communication technology access for African youths. This is possible given the ability the mobile-based technologies of accessing internet hence, African youth get exposed to new ideologies and new forms of lifestyles.

In Sub Saharan Africa, three countries namely, South Africa, Ghana and Malawi a survey was done on youth access to mobile phone and usage specifically focusing on educational use (Porter *et al*., 2016). The statistical findings were as follows: Ghana male youth mobile phone ownership was 18.8% and female youth mobile phone ownership was 12.9%, Malawi male youth ownership

was 45. 0% and female youth mobile phone ownership was 37.2% and in South Africa, male youth mobile phone ownership was 50.9% and female youth mobile phone ownership was 50.8% (Porter *et al*., 2016). Therefore, the above statistics review that indeed youths in Africa do have access to the mobile phone and they do utilise them. However, this empirical findings do not prove if mobile applkications are used for any rural development by these youth.

Porter *et al*. (2016) The youths highlighted that they use the mobile phone to google their homework and discuss with their schoolmates. Other youths reviewed their access to Facebook using the mobile phone and they accessed academic sites such as physical science sites. UNESCO, (2012) stated that a substantial portion of mobile learning initiatives in Sub Saharan Africa has taken place in South Africa. Thus, given the above statistical evidence, one can deduce the South African youths do have access to mobile phone technologies. The youth are using the mobile phone as a tool for rural development in the case of enriching their education.

In developed countries, mobile applications are considered software that operates on smartphones like iPhones, BlackBerries, and Android devices as opposed to standard second generation (2G) mobile phones. Nevertheless, in developing countries mobile applications have been developed even on 2G networks to suit the needs of the customers (Qiang *et al*., 2012). Initially, mobile apps were developed for undertaking basic tasks of computer programs, such as email, web browsing, calendar, contacts, weather forecast etc. Today, the growing demand for new mobile products and services puts pressure on both businesses and organizations to develop mobile apps for commerce, banking, health, and rural development related purposes to meet specific needs of various sectors (Serrano, *et al.*, 2013). The current study focuses only on mobile applications for rural development. Several mobile applications for rural development in different countries are illustrated in Table 2.1 below.

Table 2.1 Selected mobile applications for development (Qiang *et al*., 2012)

Mobile application	Application use	Target users	Country
Nokia Life Tools	Nokia Life Tools is a software suite embedded in certain Nokia phones to provide agricultural, educational and entertainment services to developing country markets	General public & Farmers	China, India & Indonesia
DatAgro	The application is taking advantage of the high penetration rate of cell phones in Latin America to allow rural farming cooperatives to define the types of information most critical to their lives and livelihoods and receive it via text messages.	Farming cooperatives	Chile & Latin America
Weather Application (Grameen)	The application allows anyone with a mobile phone to send and receive text messages to find out the local weather forecast by city or district.	General population	Uganda
Esoko	The platform provides automatic and personalized price alerts, buy and sell offers, bulk SMS messaging, stock counts and SMS polling. Markets, commodities, languages and currencies are easily configured. Esoko also offers strategy, support and trainings to projects rolling out MIS.	Agri-business, NGOs, government, farmers, traders	Nigeria, Mali, Rwanda, Tanzania, Zambia, Kenya, Mozambique, Uganda, Malawi, Mozambique, Madagascar
Manobi	Manobi allows farmers, traders, hoteliers, and housewives can now receive free daily text messages containing information on the product of their choice on any selected market.	Farmers, traders, Hoteliers	Senegal, South Africa
GL-CRSP Livestock Information Network and Knowledge System (LINKS)	LINKS is a Livestock Information Network and Knowledge System which provides regular livestock prices and volume information on most of the major livestock markets in Ethiopia, Kenya and Tanzania along with information on forage conditions, disease outbreak, conflict and water supply to support decision making at multiple scales.	Farmers, traders	Ethiopia, Kenya, Tanzania
WaterReporter	The solution uses open source software, Web-based GIS and relatively simple software on mobile phones, allowing water quality test data from field kits to be sent in and centrally monitored and analyzed.	Field workers, labs, rural people in areas lacking potable water	South Africa
Mobenzi	Mobenzi is a software service designed to create work in impoverished communities in South Africa. Mobenzi allows people to perform simple tasks, via SMS on their phones.	Job seekers	South Africa
BridgeIT and Text2Teach	BridgeIT is a program that uses mobile phones to bring educational videos to rural classrooms in Tanzania. Text2Teach is an educational program which aims to enable teachers and students to access over 900 multimedia educational materials like video, pictures, text or audio files via Short Message Service (SMS) and was initiated by BridgeIT.	Teachers, Students	Philippines, Tanzania
M4Girls	The M4girls project is a partnership between Nokia, Mindset Network, and the Department of Education (North West Province/South Africa) to test the provision of educational content on a mobile phone platform to girl learners.	Teachers, Students	South Africa
Jokko Initiative	The Jokko Initiative provide a new generation of girls with access to the valuable tools of communication technology, and training in its applications for community engagement and positive social change.	Rural youth, rural women	Senegal
Whatsapp	Used for group and individual chats at affordable cost to enhance text, call and video communication in communities	All community members	Global

Despite the penetration of mobile applications in developing countries, most of the applications are for entertainment and lifestyle purposes. These consumer-oriented mobile applications are typically offered on a mass-volume and low-cost basis. In contrast, it is far more complex and time-consuming to develop applications targeted at a specific development challenge in a sector. More so mobile applications for development purposes rarely generate sufficient revenues to be financially sustainable at a small scale or without significant revenue from bundling, advertising, cross-subsidies and other sources (Qiang *et al*., 2012). As such, despite the potential, developing mobile applications for development purposes is still challenging and slow.

Across the globe, social network applications such as Facebook, Skype, Live Messenger and Twitter are mostly used by the young, connected and urban and continue to be out of reach for a significant portion of the region's old population. However, the fact that these networks have opened to mobile access through mobile data and that new phones come with features and popular applications integrated with the phone have rapidly increased the penetration of applications in the older age groups and thus providing an opportunity for enhancing community development through mobile applications. However, as highlighted here, the types of applications used in different communities vary due to their usefulness, affordability and compatibility with mobile phones among other thigs. It is therefore important to identify area specific applications to inform development practitioners who may be interested in using the applications in those areas (Qiang et al., 2012).

The notion of mobile communication and applications as a tool to alleviate poverty is becoming increasingly mainstreamed. Even though long-term impact studies are scarce, the potential and perceived benefits regarding innovative mobile phone usage for social and economic development are enormous. The basic mobile phone is a tool that supports bottom-up economic development. It is also seen as a way of empowering individuals by encouraging entrepreneurship and innovation as well as giving the poor a voice. Through mobile phones, farmers get access to market prices, young urban citizens can transfer money back to their home villages, health workers can give diagnoses and collect data, news can be spread and read in crisis situations, citizens can build opinion and mobilise (Hellstrom, 2010).

Mobile phones are believed to have enhanced knowledge through their multi-functions and their access to the internet (Sarwar & Soomro, 2013). According to Food and Agriculture Organisation (FAO, 2014), information plays a key role in improving the livelihood of farm households and

small-scale rural entrepreneurs and accelerating rural development. Thus, rural communities are bound to gain a lot of information as they are exposed to a global market through mobile phones technologies (FAO, 2014). Thus, below there are several ways the rural adults have utilised the mobile phone-based technologies in their everyday, lives. This would be ranging from the European rural communities down to African rural communities.

In Bangladesh, mobile phone technologies have enhanced knowledge as patients of diabetics get alerts on when to take their medication, get tips on healthy diets and even get alerts on their next doctor appointments. Thus, this is believed to have improved the livelihood of the rural community which has seen rural development, (Fottrell *et al.,* 2016). Fottrell *et al.* (2016) further stated that there is evidence that mHealth techniques can increase adherence to medication in those already diagnosed with a chronic disease. The other factor being of evidence on mHealth influencing behaviour change. This reflects that the mobile phone is playing a pivotal role in the acquisition of knowledge which in turn is leading to behaviour change in the rural community among adults.

According to Fottrell *et al*. (2016), authors of a review of 14 intervention studies in the United States, Europe, Australia and South Korea) specifically on phone messages used to decrease obesity found that 11 of the studies using short message service (SMS) messages had a statistically significant effort on weight loss, diet or exercise, though the interventions did differ substantially, and questions remain about long-term impact. Thus, this review that mobile phone technologies are being embraced for the acquisition of knowledge for rural community development issues at a global level. However, sustainability towards behaviour change is not clear due to no statistics on the long-term adaptation to diet and exercises.

Through community mobilisation, there is good evidence for lifestyle interventions preventing and delaying the onset of T2DM, and peer support is a cost-effective means of promoting lifestyle changes. Community-based peer support as a method of T2DM control interventions is starting to be tested in low-income countries and inspiring proof is evolving. This shows that mobile phone technologies do play a role and are being used for rural community development initiatives. As mobile phones are being used to mobilise the community for such good health activities on raising awareness on other ways to fight T2DM. Thus, this, in turn, boosts the acquisition of knowledge as the rural community is able to interact and share experiences on how the information shared on mobile phones is changing their livelihood for the better.

In addition, on mHealth, the lack of adherence to treatment and side effects resulting from anti-viral (ARV) therapy is a major obstacle to prolonging and enhancing the quality of lives of those infected by HIV (Shackleton, 2007). Mobile phones are believed to have proven to be a vital tool in overcoming this obstacle by providing ways patients are alerted and reminded, at the appropriate time, to take their medication. The other factor raised by Shackleton (2007) is that of mobile phone text messages also proving to be effective in the dissemination of information on sexual health, HIV prevention and related issues to young people in a direct and discrete way. Therefore, due to mobile phones being quick and being a private gadget such awareness private messages would indeed help the rural community prevent the first-time infection or further complicating their immune systems.

Shackleton (2007) further, stated that texts are easy, cheap and popular, and people can have access to information anonymously and discrete given that in the rural stigma is still an obstacle to disclosure and openness. One can note that mobile technologies are being used for rural community development as an awareness tool successfully. Thus, a clear acquisition of knowledge through mobile phone on HIV prevention and how to live a healthy lifestyle as an HIV positive individual is freely distributed within the rural community.

Shackleton (2007) highlighted that in South Africa there was the Dokoza project which focused on providing patient information to a health professional, enabling them to access patient data, such as results of blood test, with a mobile phone. Costa *et al.* (2015) stated that drug adherence was provided by SIMpill which provided patients with reminder and provided the patients adherence to health care provider. In short one can deduce that, given that some rural individuals are ignorant to information that is important towards their medications. Thus mobile technology show an efficient and quick way to alert patients which shows a good and cost-effective way of information dissemination in the community.

2.4 Age as a Factor of Usage of Mobile Applications in Community Development

Extensive use of smart mobile devices and applications provides new opportunities for companies and communities. Modern consumer is referred as social, local, and mobile (Marsden & Chaney, 2013). The convergence of users' locality, mobility, and sociability aspects require a deeper understanding of consumer behaviour. Swanton (2017) illustrates that as mobile devices continue

to multiply, companies need to develop applications complying with the needs of mobile consumers in their ever-changing contexts and environments. Considering this, companies, their marketers, designers and business developers, are obliged to carefully rethink opportunities for application development and strategies (Hoehle & Venkatesh, 2015). To enhance application use, a host of factors, therefore, must be considered.

Mobile phone applications can be useful tools for rural development if harnessed well by the community and the policymakers. Mobile phone applications such as social media the likes of Facebook and Twitter can be good positive platforms were rural community can adapt to modern ways of advancing their communities. Scott & Carrington (2012) defined social media as communication sites or service that allows people to connect with each other to inform others about events and activities and to share news, photos, videos, and items of interest. Ahlqvist *et al*. (2008) stated that social media as a technologically web-based system used for interaction among people where they create and exchange information, ideas and opinions in a virtual community. In other words, according to Kaplan & Haenlein (2010), social media is defined as "a group of Internet-based applications that are built on the ideological and technological foundations of Web 2.0", and that allows the construction and sharing of user-created content. It includes all social media platforms such as; blogs, wikis, and podcasts to Facebook, Twitter, YouTube, and Google. These platforms also enable people to post their pictures, videos, and even audios. The sites even allow real-time updates were one can have a live video with the visual community.

Wang *et al.* (2013) suggest that age plays a key role in the use of mobile applications. For instance, in America, young people's use of mobile applications is determined by perceived behavioural control, usefulness and internet availability are predictors. Kim & Yoon (2013) adds that perceived information usefulness, perceived entertaining usefulness and perceived ease of use, significantly, influence the attitude toward application usage across age groups, however, cost-effectiveness had no influence on app usage in that study.

Facebook still mainly appeals to the young-age groups rather than the elderly (Heinz *et at.,* 2013). In this regard, information communicated through mobile applications may not reach the elderly who are still sceptical about using that channel Czaja *et al.* 2006). The need for technical knowledge required to operate mobile applications, limits its usage. The other key factor being lack of financial capacity for purchasing data to operate the application affect the use of the

application in low-income communities (Vaportzis *et al.,* 2017). Given these challenges, it is crucial to establish the common applications used for rural development.

Many young consumers use mobile applications without any specific purpose (intention to use), in contrast to older people who use apps for specific tasks (Mehra *et al*., 2020). Lee *et al*. (2013) suggest that compatibility of applications influence adoption by different age groups. Compatibility is associated with how new technology fits in with peoples' prior experiences. Users generally adopt mobile apps for their design compatible to their usage, thus, applications may be compatible for use, for different age groups.

The complexity of mobile applications also influences how different age groups adopt them. Shih (2007) notes that complexity directly affects the intention to purchase and the intended use, causing Lee (2007), to suggest that mobile applications should be simple for easy adoption by older users. Older consumers are generally attracted to less complicated and more straightforward solutions as compared to their younger counterparts.

Lee (2007) states that both trial ability and intention to use the system are associated with each other and affect the use of applications. If a product has a high trial ability, it merely means that the product is more useful for the public and system (Yang *et al.*, 2008). Most people and especially young consumers are comfortable with trying any application before adopting it, however older users are more sceptical and prefer tried and trusted applications. Free applications, therefore, can induce trial ability amongst young people.

Observability of mobile applications is also key to use. Huang *et al.,* (2009) hints that if an application or system is more observable and describes the changes in perception towards that, the system will increase its ease of use, as observability changes customers' attitude and perception. Young consumers normally start using an application through observing others, especially their peer groups, using an application and adopting it immediately and vice versa. This is because youngsters are fascinated more often with the idea of showing or demonstrating innovations like the latest apps to their peer group and friends.

Shen (2015) reports factors such as source, perceived usefulness, application type, attitude, mood, regulatory focus framing and perceived risk as key determinants of use. In this study age had no influence on the use of applications. Taylor *et al*. (2011) state that application adoption

and usage increase with use based consumers' strongest relatives' usage, however, there was only marginal support for adoption and usage being influenced more by friends than by family members.

Nysveen *et al.* (2005) highlight that a person is more likely to use an application if there is an intrinsic reward and fun in using it. Trendy, being attractive in design and appealing in usage through animation, images, colour, humour are more likely to increase usage. Application users, especially the younger population, perceive enjoyment or playfulness derived from the application as useful.

Modern applications are changing the lifestyles of the younger generations but they have much less impact on older people. Senior citizens generally resist sophisticated features on their mobile phones and the ability to install third-party software is not relevant for this target market. The next generation of senior citizens may be affluent mobile phone users who are familiar with devices such as IPhone. In contrast to the approach of cutting features and making special devices, the current approach of developing mobile applications on popular Smartphone platforms by providing a well-designed user-interface and utilising all the features that mobile technology provides, is more beneficial and cost-effective to meet a range of senior citizens' requirements in the long-term (Gao & Koronios, 2010).

According to Boyd & Ellison (2007) Social network sites allow people to create profiles of themselves indicating their personal stuff such as age, sex, marital status, location, and interests. Reddy *et al.* (2016) stated that "social networks have undergone a dramatic growth in recent years. Such networks provide an extremely suitable space to instantly share multimedia information between individuals and their neighbours in the social graph. Social networks provide a powerful reflection of the structure and dynamics of the society of the 21st century and the interaction of the Internet generation with both technology and other people." A social network is a site or application that enables virtual communities for people to share their daily activities with family and friends and even at a global level (Ukomadu, 2018).

In Nigeria for instance according to Ukomadu (2018), some diasporas opted to start a social media group as a tool of mobilising people to re-start the community development of the Ogwaland. This community infrastructure and services had deteriorated due to poor communication mode to mobilise people for community development. The other reason being the majority of, the active age group had migrated into the urban centres and other had left for the international greener

pastures. The decision was made after a meeting in 2016 of starting a WhatsApp group which would comprise of youths, the educated elite who were now outside of the community. The community Whatsapp group was titled Ogwa Unity Forum. This was deemed the best way to mobilise them for this good cause of community development (Ukomadu, 2018). Therefore, from the above, it can be noticed that modern day age social networks are also playing a pivotal role in community development, in this case as a tool for mobilising people due to their several advantages.

Some of the advantages of the WhatsApp social network as asserted by Abbas (2018) are as follows: availability on any smartphone, sending instant, unlimited messages across the world, send also audio and video messages, send document files, send location and group chats of 256 members among other advantages not mentioned here. The above mentioned, advantages of WhatsApp made it a good and effective social network to use for mobilising the community. However, WhatsApp does have its shortcoming which is data usage is needed to utilize its services, the group limit of 256 participants, videos and audios might exhaust phone storage and the failure to retrieve old chats when one changes phone device. Overall the social media site is a good tool for mobilising for rural community development. It breaks the traditional way of doing things were the community would have been expected to come and meet for a meeting at a one given physical area. Whereas in this instance, the former village dwellers and the diaspora meet on one virtual group and bring up collective ideas on way forward on fixing their rural community.

Facilitation of usage is only one aspect of the problem which needs attention. To bridge the widening digital divide that has emerged between the technical experts and the increasingly older generation is necessary (Kang, 2014). The use of technological applications requires a certain level of procedural knowledge. Certain knowledge procedures, stored in the long-term memory permit the required human-computer interaction in a certain situation. For instance, since cognitive performance slows down with age, lowering the complexity of applications or the user-application interaction for elderly users is a key factor for design and development of mobile applications (Ziefle & Bay, 2005). Some studies show that the elderly are reluctant to use modern technologies. It is generally acknowledged that older people are less apt to accept new and unknown technology, than their younger counterparts (Hertzog & Bleckley, 2001). There is evidence to suggest that older adults are motivated to use mobile applications especially when they are sufficiently informed as to the resulting benefits (Melenhorst *et al*., 2006). The reduced usage rates by the elderly might be the result of poor understanding of the benefits that mobile

applications could have for them, as well as their reluctance to learn skills which they feel requires a highly specialized form of expertise or special knowledge that they lack**.**

The ability to understand and benefit from technology, although, it is far less dependent on age, however, it does require flexibility and effort, which many elderly people are unwilling to invest unless the benefits offered clearly outweigh the effort. Studies also show that older adults tend to lose concentration easily and become disinterested with a subject. This may be based on a form of anxiety that is based on the mistaken distrust in one's own capabilities (Sundaram *et al*., 2007). Developers, thus, must understand the attitudes of the elderly towards technology, so as to increase their adoption of mobile application, particularly, for development in rural areas where the elderly people form the majority.

Although the ability to understand and benefit from technology is far less dependent on age, it does require flexibility and effort, which many elderly people are unwilling to invest unless the benefits offered clearly outweigh the disadvantages. Research also show that older adults tend to lose concentration easily and become uninterested with the subject. This may be based on a form of anxiety that is based on the mistaken distrust in one's own capabilities (Lines et al., 2004). Thus, developers must understand the attitudes of the elderly towards technology to increase the adoption of mobile application particularly for development in rural areas where the elderly people forms the majority.

There are several common illnesses which can be classified as age-related which interfere with the use of mobile phones and associated applications. For instance, rheumatoid arthritis, while not being exclusively age-related, has been shown to cause isolation and depression in the elderly and sometimes hinders the use of technological innovations, such as mobile telephones and the internet (Holzinger *et al*., 2008). In most cases the effects of aging, however, are less drastic. They include, slower response times, coordination reduction and loss of flexibility. Age-related muscular degeneration can be the cause of restricted eyesight, while deafness may be preceded by years of gradual loss of hearing (Holzinger *et al*., 2008). But this combination of partial loss of vision, hearing, memory and mobility contribute to loss of capacity to operate some mobile applications.

Language is also another variable that determine the use of mobile applications. Language comprehension of the elderly people is different from the youth and thus influences their

preferences for mobile applications (Gordon-Salant, 2005). Understanding this is necessary in the designing of textual and auditory content of mobile applications. When designing text-based materials the limitations of the working memory of the elderly must be taken into consideration.

2.5 Summary of Literature Review

Available literature reveals that mobile technology has the potential to strengthen rural development. To date, various mobile applications have been development to assist in rural development projects and programs, however, major findings from this review were that most of the applications preferred in rural communities are still in finance, entertainment and agriculture. It is also apparent that applications that comprehend local rural development context are limited in South Africa as mostly only generic applications for certain aspects exist. Researches have also shown that age determines preference and use of mobile applications with variations apparent among the youth and the elderly. Some of the gaps identified in this review were the lack of comparison between youth and adults in some studies; some studies failed to indicate if illiteracy played a role in lack of usage and if not owning a smart phone also contributed to low usage. There is, therefore, a need for conducting an empirical study to understand the types of mobile applications that are in use for rural development. This would help to inform development practitioners on the opportunities available to utilise mobile applications as well as the identifying the common types of mobile applications that are already in use in the local communities.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the methods of data gathering, analysis, sampling methods and data presentation are outlined. In addition, the following details are provided - study area, research design, population, sampling techniques, data collection methods, data analysis, reliability validity analysis and the ethical considerations applied.

3.2 Description of the Study Area

The study was conducted in Njhakanjhaka Traditional Authority (Figure 3.1). It is located in Makhado Local Municipality of Vhembe District. This District is one of the five in Limpopo Province of South Africa. Hosi Njhakanjhaka III is the current leader. Areas that constitute the Traditional Authority and respective coordinates are the following: Elim town (-34.582555,19.750000); Mabobo (-23,156433,30.047454); Magangeni (-23.184761,30.073037); Magulule (-23.164798,30.044450); Njhakanjhaka (-23.217137,30.246925); Shikuhele and Vari (-23.183379.29411276); Shirley (-23.171344,30.082477) and Waterval residential township (-23.171267,30.068656).Njhakanjhaka Tradtional Authority was selected and was fit for this study because within the Institute of Rural development it is one of the rural communities that they work with on key rural development activities. This led researcher in having an interest in carrying out this research with this specific cural community. The importance of Njahakanjhaka Traditional Authority within the South African context is that this community upholds and preserves heritage and culture.

3.3 Research Design

The convergent parallel mixed methods research design was used to conduct this study. This entailed merging quantitative and qualitative data to provide a comprehensive analysis of the research problem (Creswell, 2014). Mixed methods design is beneficial as the research benefits from the strength of both qualitative and quantitative approaches (Tashakkori & Teddlie, 2010). Creswell, (2014) adds that in convergent design the investigator typically collects both forms of data, at roughly the same time and then integrates the information in the interpretation of the overall results. Contradictions or incongruent findings are explained or further probed in this design.

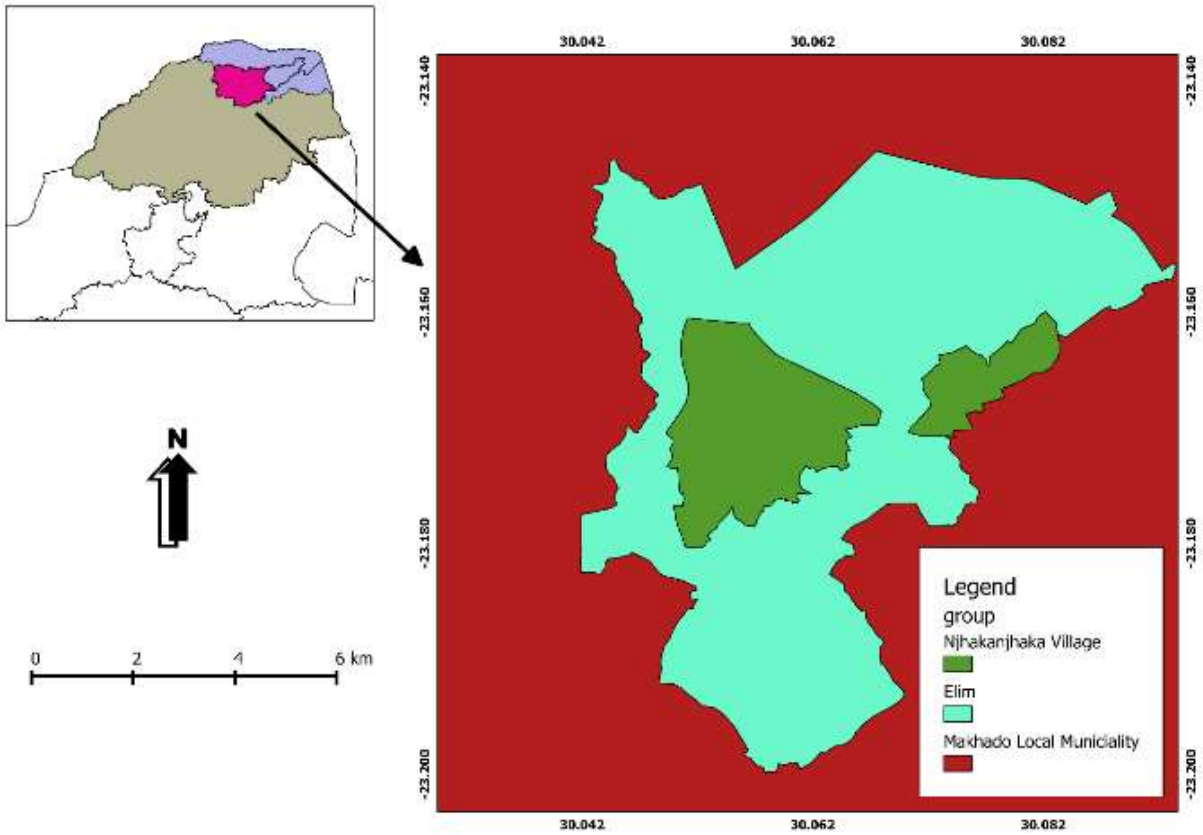


Figure 3. 1 Map of the Njhakanjhaka Traditional Authority in Makhado Municipality

3.4 Population and Sampling Procedures

Research population is the target group with similar characteristics from which the sample would be drawn for the research. Creswell (2014) defines population, simply as all the members of the group that would be used in conducting the research, thus, in this case the research population was the Njhakanjhaka community. There were 9 000 people in the Njhakanjhaka Traditional authority when the study was conducted (Statistics South Africa, 2015). It is from this population that participants to the study were sampled, purposively. Purposive sampling does not claim representativeness and therefore does not require large numbers of respondents or statistical calculators (Campbell *et al*., 2017).

For the first phase of data collection, which was qualitative, purposive sampling was used to select participants for focus-group discussions. Purposive sampling was used to select a specific group of people who would help provide relevant data to realise the aims and objectives of the research (Campbell *et al*., 2017). Levy & Lemeshow (2013) add that purposive sampling involves identifying and selecting individuals or groups of individuals who are especially knowledgeable about or experienced about the phenomenon of interest. Strengths of purposive sampling include the fact that it provides more control over who is selected to be included in the sample, being more appropriate for research focused on segments of a target population and less selection bias likely (Daniel, 2012). Its limitations include, it requires greater resources (for instance, time and money); it requires more recent and up-to-date information and knowledge about the population and requires greater effort (Daniel, 2012).

Purposive sampling was used in identifying key persons involved in rural development amongst youth and adults interested in participating. Local change agents, such Community Development Workers facilitated the mobilisation of respondents. Youth and adults who used mobile phone applications were invited to participate. Respondents who expressed interest were placed in focus groups in which they deliberated on the research questions referred to above.

Initially only four focus group discussions each involving youth and adults were planned. However, on the day for data collection five focus groups were created one being of female youth, one of male adults and 3 of female adults. Unfortunately, there were none youth male particpnts. According to Liamputtong (2011), focus-group discussions must have about 30-50 participants involved. The decision to have more focus groups depends on the point at which data saturation is reached. Data saturation is the point in data collection when no new or relevant information emerges with respect to the research (Saumure & Given, 2012). Each focus group was made up

of seven people. The total numbers of participants were 7 youth and 23 adults. Seven participants per focus group are recommended because of the difficulty of managing large numbers (Smithson, 2008).

During the second phase, convenience sampling was used to select participants. Lewis-Beck *et al.* (2004) explain convenience sampling as that which involves selecting readily available respondents. Waterfield (2018) defines it as a method where the selection of participants is based upon their availability. This availability is usually in terms of geographical proximity but may also involve other types of accessibility, for instance, in terms of contacts (Waterfield, 2018). Ellison *et al.* (2009) state that the advantage of convenience sampling is that it is very cheap and the simplest form of sampling, Salkind (2010) adds that, although, convenience samples may yield intriguing findings, they suffer from the inability to generalise beyond the samples. In the case of only using convenience sampling, researchers would not know whether their sample is typical or atypical of other groups, however, this shortfall is common to all non-probability samples (Ellison *et al.*, 2009). The researcher failed to obtain the target number of youth and adults in the community, however, through convenient sampling, 30 respondents were selected.

3.5 Data Collection

Data collection refers to how researchers get their information. Data was collected on the same day, both for the qualitative and quantitative approaches; the data was collected in phases. The first phase was for the qualitative methods and the second phase was quantitative. To collect qualitative data, focus-group discussions were conducted using an interview guide with open-ended questions. Focus-group discussions assist in understanding, in-depth, the main research issue (Stewart & Shamdasani, 2015). Moreover, focus-group discussions provide data from a group of people quickly and often at less cost than would be the case of individual interviews (Stewart & Shamdasani, 2015). The aim was to find out the type of mobile phones that the interviewees' used, how and whether they used them for rural development. The other information required was the kind of mobile phone applications they use and how they use them for the same initiative.

Focus-group discussions of the youth and adults were separate, however, they were conducted in the same venue. This decision was made based on the fact that focus group discussions are supposed to have demographic similarities, such as age, gender, occupation, education, ethnicity, religion and even social class (Liamputtong, 2011). This was achieved due to community entry through first seeking permission to conduct the research from the relevant traditional authority.

The subjects were categorized as mentioned earlier which helped in getting unique feedback from the different age groups with different needs and different views on what is deemed rural community development. The second phase used a self-administered questionnaire with a Likert-type scale. The questions were derived from the literature review on rural development in communities that use mobile phone applications. Interpretation of questions to the participants was done by the help of research assistant during the activity. The objectives were to find the extent of usage of mobile phones for rural development and to confirm whether data collected in the first phase was relevant; in other words, whether the responses of the focus group discussions represent the views of the population of Njhakanjhaka. The purpose of using a Likert-type scale in the questionnaire was to enable the researcher to obtain more data than nominal-dichotomous items (Mitchell & Jolley, 2013). The other reason was to get confirmation of the applicability of the previous data to the wider population of the Njhakanjhaka village. At the second phase of data collection, objectives number two and three were addressed.

3.6 Data Analysis

Data analysis was carried out using Atlas ti ver 8.4 and IBM Statistical Package for Social Sciences (SPSS) version 26.0 for qualitative and quantitative data, respectively. In line with the Coghlan & Brydon-Miller (2014) explanation, this was neant to be a process that helped to develop meaning and understanding from the various data sets collected. Data collected from the focus group discussions was captured using Microsoft Excel, while data from the questionnaire was imported to Atlas ti for coding and analysis of content. After coding, network diagrams were formulated and a descriptive analysis of the results was obtained; coding in Atlas.ti ver 8.4 of 2019 involved labelling sections or passages of text. This can also be defined as identifying interesting features in the data that relate to the research questions or objectives. In coding, different color highlighters were used. The following are the stages taken when coding using Atlas ti ver 8.4.

First, a researcher must import captured relevant text or data, then next pick a segment and right click to select *coding*. This leads to various options which are '*code in vivo'* this means the code was named according to what was highlighted. The other option was labeled '*enter code names'* which mean creating a new code name. Then there is another option *'select code from a list'* meaning that there were set of codes already created which were already on the list. The last option is '*last used codes'* which refers to codes that where once used before. However, in this research the *enter code names* option was used. The stages were of selecting *enter code names*

then writing desired code name and clicked create. The new code appears on right margin alongside the highlighted segment. This was done for every question answered from the data gathered from the focus-group discussions tools.

To analyze the quantitative data, the IBM Statistical Package for Social Sciences (SPSS) version 26.0 was used - Kaiser Meyer Olkin, Bartlett's test, Mann Whitney U test and the Kruskal Wallis test. Means and standard deviations of scores of each descriptor/variable using the scores for rating extent of use of mobile applications were obtained. The Mann Whitney U test was conducted to establish whether there was any association between gender and each variable of interest. Furthermore, because there were categories of age considered, the Kruskal Wallis test was carried out. In instances where significant difference was observed, the Mann Whitney U test was used to isolate results of interest.

The validity of the measuring instrument was measured by using Factor analysis and principal components analysis (PCA). Kaiser Meyer Olkin (KMO) was used to measure the adequacy of the sample before using factor analysis and Bartlett's test of Sphericity. According to Business Analytic (2012), to continue with factor analysis, the KMO should have a value of at least .6. In this study, the KMO was observed to be .687, thereby showing that the sample used in this study was appropriate to continue with factor analysis. Furthermore, the Bartlett's Test of Sphericity was 0.000, which is acceptable (Business Analytic, 2012; Andy, 2013).

Smith (1995) stated that Ishikawa diagram was introduced by Kaoru Ishikawa. Kaoru Ishikawa was a Japanese chemist who graduated from Tokyo University in 1939 and studied statistical methods in 1948. Through Ishikawa work Japanese economy recovered. Ishikawa has long been considered one of the world's foremost authorities on quality control (Smith, 1995). Ishikawa stressed on the importance of training, the usage of cause-effect diagrams for problem solving, and quality circles to achieve continuous improvement (Ishikawa 1985 cited by Tari, 2005).

Fishbone diagram according to Coghlan & Brydon-Miller (2014) Dr Kaoru Ishikawa formulated a visual analysis tool for considering the causes of a specific problem or event. It is believed it was originally used in the Quality Circle in the 1960s. Ishikawa diagram offers a systematic way to visualize cause and effect relationships and is considered one of the seven basic tools of quality control. The diagrams may be called Ishikawa diagrams, cause-and -effect diagrams or fault

trees, but because the diagram itself looks like the skeleton of a fish, it is commonly referred to as a fishbone diagram (Coghlan & Brydon-Miller, 2014).

Coghlan & Brydon-Miller (2014) further states that, the head in a fishbone diagram reflects the problem, issue, event or objective. Then the spine of the fish skeleton are vertical ribs that summarize the potential causes whatever has been identified in the head. More information or examples may be added under the horizontal lines coming out of the rib. Quality control has typically identified relevant cause categories such as machines, methods, human, materials and environment the categories can be modified to suit the analysis needs. It is important to know that when using a fishbone diagram, the problem solvers must work backwards (Coghlan & Brydon-Miller, 2014). Thus, in this case the literature review information helped pick up some of the causes on why some rural communities fail to utilize mobile phone for rural community development. Figure 5.1 of the fishbone diagram showing challenges leading to poor mobile phone application usage shall be presented in chapter 5.

Chi-square *goodness of fit test* was used to analyze the data collected using a questionnaire requiring responses on Likert-type scale. The questionnaire for this study focused only on 5 mobile phone applications, thus WhatsApp, Facebook, Instagram, Snapchat and Twitter. The reason being the popularity of these applications. This test is usually run when you are trying to run data that has nominal variable data; nominal data has no rank or order. In brief, the stages were - first all the data on the Linkert type scale questionnaire were captured using SPSS version 26.0. It is key to know that this test is done for every questionnaire data captured. This is an example on stages to run a Chi-Square Test. With the SPSS when the option to analyze was selected, the researcher clicked on *crosstabs*, clicked *reset* and clicked *gender* and *mobile app user* and *non-mobile app users*. After that, the researcher clicked on *cells,* clicked on *statistics,* clicked on *Chi-Square* option. Chi-Square test is a test for association; it gives information only on whether the association has any significance, however, it does not tell how strong. Then after, the researcher clicked on continue and then tables were formed with the statistical information. The Chi-Square test assumption was that of having a percentage less than 5 (SPSS Tutorial 2019).

Depending on the outcome, the possibility of gender having a significant association with the usage of some mobile applications would be shown in the Tables; a clear informative review of the data would then be done. This would also highlight the differences and similarities in the usage of mobile phones between the adults and youth, as well as determine if age is a factor in how

mobile phone applications are utilized for community development. Above all, the analysis helped to reveal the extent to which the communities use mobile phones for development. After the whole analysis procedure, the information was consolidated and presented in the form of statistical charts; interpretations were also given.

3.7 Ethical Considerations

The first stage was that the University of Venda's Higher Degrees Committee and Research Ethics Committee approved the studies. Next, permission was granted by the traditional leaders and the community of Njhakanjhaka to conduct the research. Respondents got an explanation on what the study entails and they went on to sign consent papers to indicate their willingness to participate. These ethical clearance stages were done as they assist in avoiding being denied permission to carry out the research, thus, written consent proved there was a legit agreement between both parties. The other advantage is that it proved that the researcher was a current student of University of Venda. The signed consent also permits publishing, in whatever format, papers and even the final dissertation. This protected the participants, for instance, in the case of them opting to pull out; in such a situation, the participants' decision would be respected.

CHAPTER 4 PRESENTATION OF RESULTS AND ANALYSIS

4.1 Introduction

The results of a study on the extent to which mobile applications were being utilised in the Njhakanjhaka community to facilitate rural development are presented in this chapter. Their fears, challenges and relate possible solutions were covered. Njhakanjhaka community usage and adaptation to mobile applications regardless of age shows their positive attitude towards wanting to develop their community. Mobile phones have a potential for economic growth and social empowerment. The usage of mobile phone applications opens up opportunities, as well as, inclusion of rural community in other processes of governance. This in turn contribute to good governance and development of the community which would be guided by the voice of the people through usage of mobile applications.

4.2 Respondents' Demographics

More than three quarters (77%) of the respondents were adults with the remainder being youth. The same proportions were observed for females and males, respectively. Almost half of the respondents (47%) were aged 41 to 50, followed by those who were 16 to 35 (23%), those who were 36 to 40 (23%), those who were 51 to 60 (4%) and those who did not know (3%). Most of the respondents came from Nhjakanjhaka (47%); from Waterval (30%); Shikuhele had (13%) and Elim and Sherly were (10%). The number of rural development activities respondents stated to have participated in were as follows - 1 to 15 (93%), 16 to 30 were (3%) and 31 to 45 were (4%). The educational backgrounds of the respondents were as follows - high school (40%), followed by matric certificate (23%), gone to some college were (17%), postgraduate degree were (10%), completed grade school were (7%) and completed college were (3%).

4.3 Mobile phone types and applications used by community

Both youth and adults expressed the view that smart phones were most common amongst the youth. They further gave the model of smart phones showing that among the youth, Huawei and iPhone were common. Adults had similar view with youth that Huawei was common, as well as, android and other smart phones. Looking at mobile applications commonly used by the

community, the youth gave WhatsApp as the mobile application used and it was used to communicate through community group. Adults agreed with youth on WhatsApp being common and they added Facebook as the other application they were using for accessing regular posts. These views are clearly illustrated in Table 4.1 below. The results regarding the most used application by both youth and adults in their community Facebook application was ranked most used with (57%) *strongly agreeing,* 17% *Agree,* 17% *Neutral*, 3% *Disagree* and 6% *Strongly Disagree.* This was followed by WhatsApp and three other apps - Twitter, Instagram and Snapchat, ranked the least. Below Table 4.1 shows how respondents ranked applications using scale of 1(*Strongly Disagree)* to 5 (*Strongly Agree*).

4.3.2 Factors influencing preferred application for community development

The youth and adults agreed on operation cost being one of the factors they consider when choosing an application. The former stated that they would also consider the cost of downloading an application, whist adults said they would also look at application accessibility. In support of the above views, below is one comment from the adult group regarding operation cost.

"Firstly, we do a research on how many people are going to afford to use that application."

(Adult group responds)

The other comments are clearly shown in Figure 4.2 below which are highlighting factors why communities prefer certain applications. The issues around number of people who can access and afford a mobile application seem to be major in determining this factor.

4.3.3 Challenges and solutions associated with use of mobile applications

Respondents gave their views on challenges they face on utilizing mobile phone applications. Adults stated the following: conservatism of the elderly people and lack of data for internet connection. The two challenges raised by the youth were also raised by adults - inability of elderly people to operate applications and limited network signal. Possible solutions to challenges were given - adults suggested mobile application education for the elderly, provision of free Wi-Fi, reduction of data rates and resolving electric power cut challenges, while, the youth gave the following as solutions - use of free Facebook application, use of reliable network providers, installation of more network boosters and the introduction of user-friendly cellphones for the elderly.

4.3.4 Extent of community benefiting from mobile applications

The respondents, both adults and youth, agreed mobile applications are good tools for communication. The youth stated that mobile applications allowed them to get more information faster than ordinary phone call. Adults agreed with youth that mobile applications are fast; adults went on to state that the communities benefit because they get the news while sitting in their homes and it gave them easy access to current news in and around the community.

Table 4. 1 Ranking extent of use of applications for community development

Applications	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Facebook	57	17	17	3	6
WhatsApp	47	30	19	3	1
Twitter	3	27	27	13	30
Instagram	3	7	30	27	33
Snapchat	3	13	17	47	20

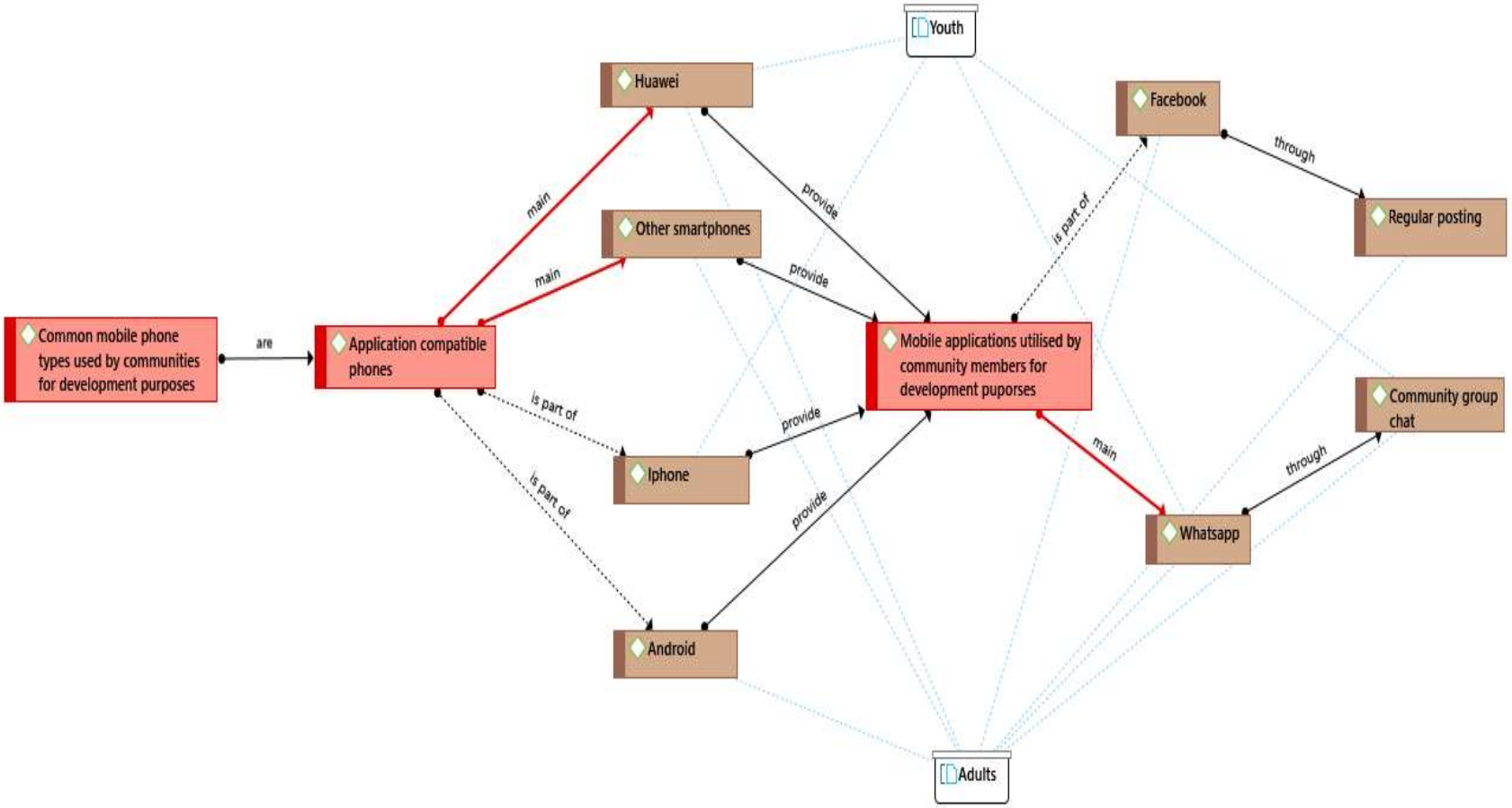


Figure 4. 1 Types of mobile phones used by community

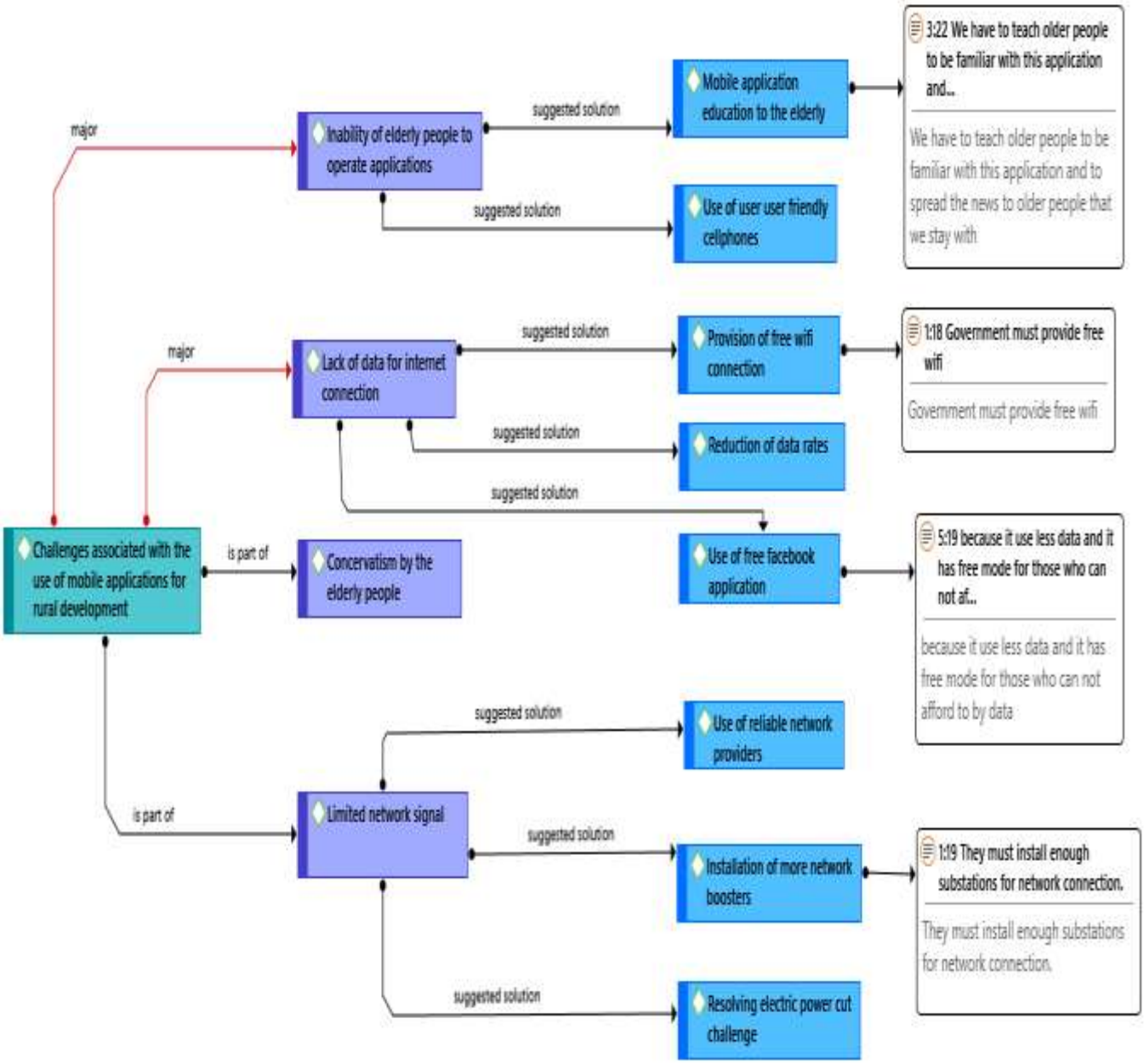


Figure 4.2 Challenges associated with the use of mobile applications for rural development

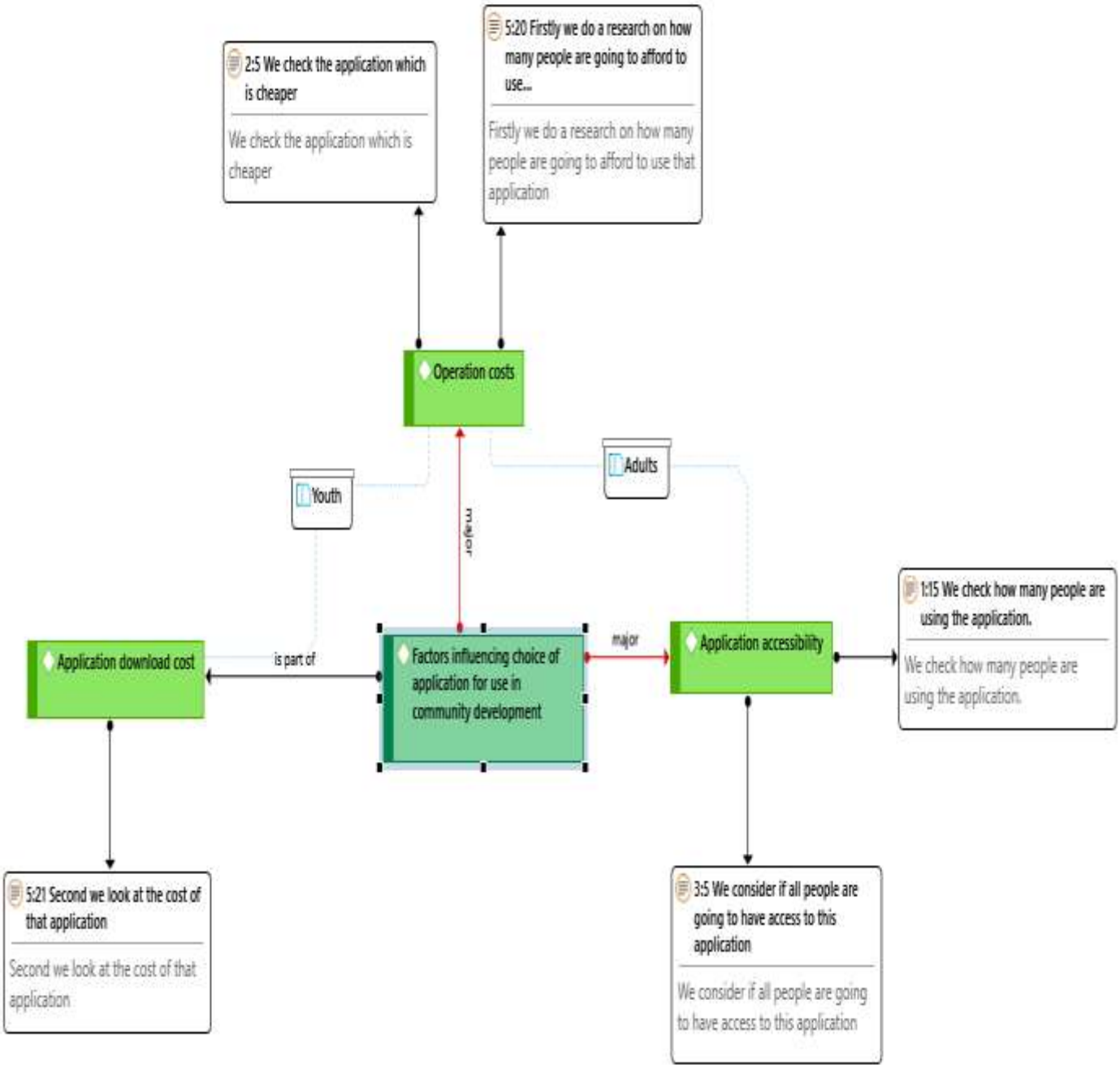


Figure 4.3 Aspects of mobile application requiring changes

4.3 Aspects of mobile application requiring changes

Youth mentioned that the application they were going to change was WhatsApp for it to be free. They further added that their decision was because many people in their community could not afford data. Adults stated that they were to change Facebook through enforcing age restrictions. The adults clearly stated that they were not happy with some of the content on Facebook. Other adults added they would opt to strengthen Facebook privacy terms. Figure 4.3 above clearly shows their feedback.

4.3.6 Extent of information shared, changing community perceptions to technology

Participants stated that their community had gained an increased understanding of mobile technology functions. The other factors being there was increased dependence on technology and more acceptance of technology. These aspects were clearly stated by the adults as they responded that the communities now value technology since it helps them with spreading information and made their lives easy. The youth supported the same previous point, adding that their communities do appreciate how technology was making lives simpler and faster than how they used to do things before. The youth further gave an example of being able to apply for jobs online, rather than spending a lot of money printing out CVs and travelling to submit their CVs.

4.3.7 Type of information asked for and received over mobile applications

Participants gave reasons for using mobile applications. They stated that they use mobile applications to find weather forecast, news, job vacancies, community news updates and get meeting invitations. In support of the respondents, Figure 4.4 shows a network diagram with some quotations.

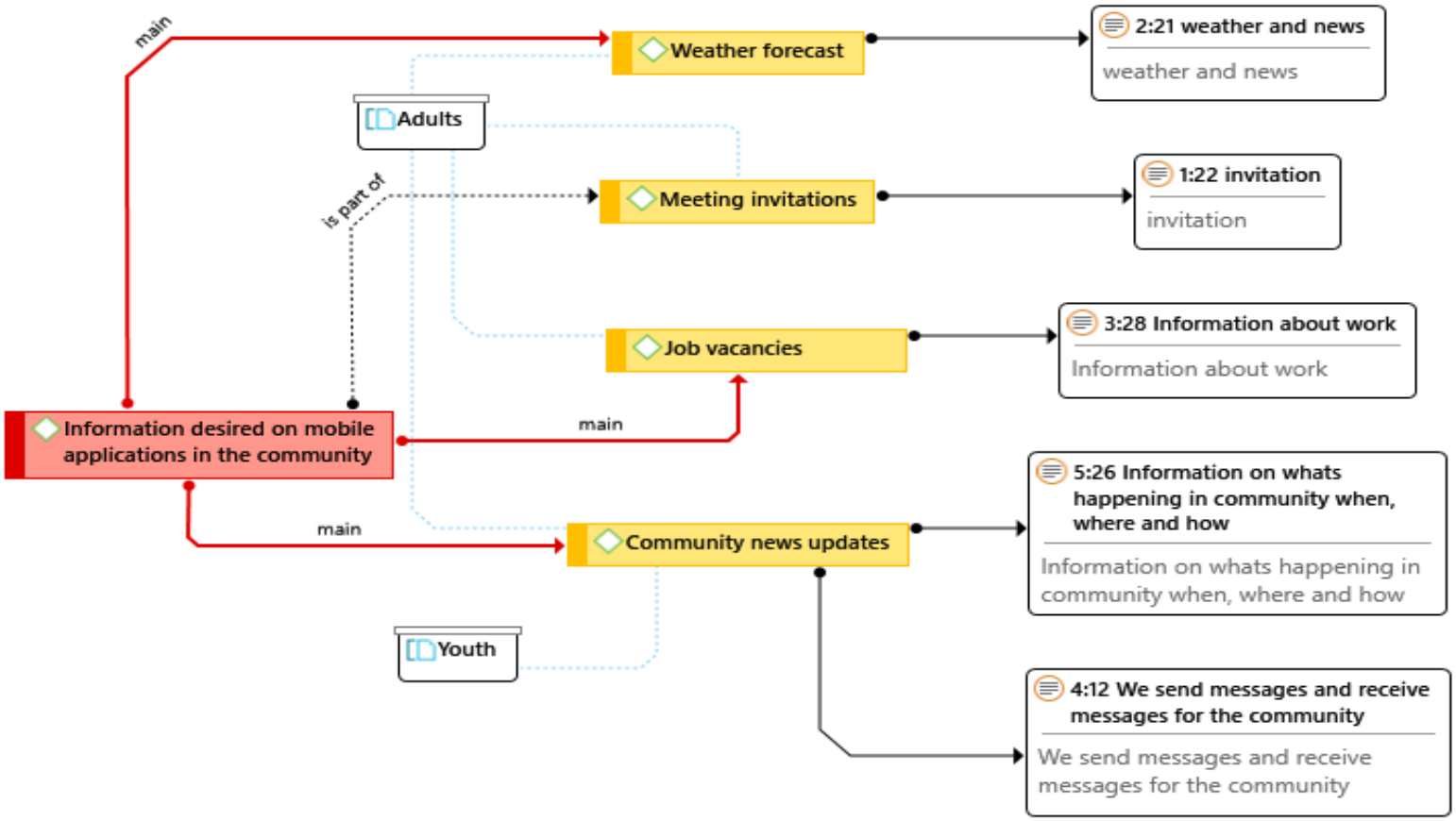


Figure 4. 4 Information asked for on mobile applications

4.4 Summary mobile application ranking results

This section ranks the responses regarding an application's reliability in the dissemination of rural development information. WhatsApp ranked the most reliable application with (60%) *strongly agreeing*, while Snapchat was ranked by participants the least reliable with (53%) of *strongly disagree*. Regarding which application the community would recommend other communities WhatsApp came out again as the application with the highest ranking of *strongly agree* (63%), followed by Facebook (30%). The *strongly disagree* ranking was accorded Instagram with (37%).

Application ranking on whether mobile applications had made it easy to share information about rural development, the majority of respondents ranked *strongly agree* (67%) whilst (3%) ranked *strongly disagree*. Mobile application being key to rural development, (53%) ranked just *agree.* The issue on mobile applications being a good tool to enhance rural development (57%) respondents *strongly agree* whilst the least number of respondents *strongly disagreed* (7%). The question of mobile applications being user-friendly, the majority of participants *disagree* (43%) whilst the *strongly agree* rate was (7%). With the youth using mobile applications more than adult respondents (47%) *strongly agree* and (47%) *agreed* whilst (6%) *disagree*.

The issue on adults being afraid to adapt to change (40%) *agree* while (26%) were *neutral,* (17%) of the respondents *strongly agree* and of the same percentage *disagree*. Mobile applications being cheaper than land lines, (47%) *agree* (33%) of the respondents *strongly agree* and (20%) were *neutral*. The ranking on whether adults face challenges when using mobile applications (53%) of the respondents *agree,* (23%) were *neutral* (maybe), (24%) of the respondents *strongly agree*. Urban and rural being united by mobile applications, (57%) *agree* and (43%) of the respondents *strongly agree*. Information being spread faster by use of mobile applications (44%) *strongly agree,* (50%) *agree,* and (3%) of the respondents were either *neutral* or *strongly disagree.*

4.5 Results of Mann Whitney U test and Kruskal Wallias test

Descriptive statistics were computed in this regard the means and standard deviations of each descriptor/variable using the scores for rating extent of use of mobile applicarions. Therefore, Mann Whitney U test were conducted to establish whether there was any association between

gender and each variable of interest. Furthermore, because there were categories of age considered, the Kruskal Wallias test was carried out. In instances where significant difference were observed, the Mann Whitney U test was used to isolate results of interest.

There was no statistically significant association ($P>0.05$) between gender and all the perceptions relating to extent of use of mobile phone applications. However, statistically significant associations ($P<0.05$) were observed between age of respondent and the following: “I would recommend Instagram to other communities” and “Mobile phones are key to rural development.”

4.7 Summary

In this chapter, the results of data analysis are present. The perspective of both youth and adults are covered. In Chapter 4, the results are discussion, conclusions drawn and recommendations made.

CHAPTER 5 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The purpose of the current study was to assess the extent to which mobile phone applications were used to disseminate information needed for community development in the areas under the Njhakanjhaka Traditional Authority. Types of mobile phones that youth and adults used for rural development were revealed, including how they were utilised to improve livelihoods. In this chapter, the results of the study which are presented in Chapter 4 are discussed highlighting how they confirm or differ with the existing body of knowledge on the subject. Conclusions and recommendations are then drawn.

5.2 Discussion of Results

5.2.1 Mobile phone types and applications used by community

Both youth and adults of the Njhakanjhaka community expressed the view that smart phones were most common amongst the youth. They further gave the model of smart phones showing that among the youth, Huawei and iPhone were common. Adults had similar view with youth that Huawei was common, as well as, android and other smart phones. Fielke *et al.* (2020) agree that rural communities utilize smart phones to send and collect information. Though their research was more based on small holder farmers and extension agents. Tsan *et al.* (2019) also added that mobile phone- based extension services targeting farmers are usually send via smart phones. McCampbell *et al.* (2021) sated that farmers owning a smart phone are at a great chance of adopting to digital extension services.

The fact that young adults use mobile applications more than adults according to a lot of the literature is been proven right by this study too. Andone *et al*. (2016) agrees with the same point, asserting that globally teenagers use mobile applications more than adults and that the most used applications by the youth were WhatsApp, Facebook, Messenger, Snapchat and Instagram. Hampshire *et al.* (2015) during their survey in Ghana, Malawi and South Africa on usage of mobile phones, discovered that the youth used mobile phone more than the adults.

The uptake of mobile phones in Njhakanjhaka was also influenced by the sharing of mobile phones within some households. Most research only focused on ownership of mobile phones and did not ascertain whether, these were smartphones or ordinary mobile phones which were used. This point was, however, explored in this study as participants stated that they used smartphones such as, Huawei, iPhone and other android mobile phones.

Increasingly, youth interact online rather than in person, and smartphones can interfere even with face-to-face interactions via what has been termed ‘phubbing’: attending to one’s phone when in the presence of others (Chotpitayasunondh & Douglas, 2016). The youth are believed to have increased rapidly on their use of social media. According to Rideout & Robb (2018) young people from 13-17 years who use smartphones have reached 89%. In a research done in Australia youth did spend 5 or more hours a day on social media which lead to an increase from 11% in 2013, to 16 % in 2015 to 20 % in 2017 (Boak *et al.,* 2018).

The usage of mobile phones applications by youth is also vividly evidenced as they use them for m-health. However, this factor is not bought out in this study. In other researches this is another factor that increase the youth usage of mobile applications. Nielsen *et al*. (2018) further stated that given the stigma around STIs and youth the mobile applications are effective tools to disseminate information about STIs, testing and treatment. Therefore, there is need to develop better ways to influence behaviour change for example usage of the condom (Nielsen *et al*.,2018). Hampshire *et al.* (2015) argues that, even though m-health programmes remain limited in popularity youth are using their mobile phones creatively and strategically to acquire current healthcare information. Hampshire *et al.* (2015) further stated that mobile phone applications can enable communication with people in the incident of sickness or any health crisis within the community. Thus, from the above one can deduce, that mobile applications can surely develop a community if utilised well.

Mobile applications are also used successfully for education which increases the usage of mobile phones among the youth. According to Vacaru *et al.* (2014) in New Zealand a research was conducted on how and what the youth aged 14 to 18 use the mobile phone for in their daily schedules. The youth stated that mobile phones are practically convenient as they have everything in one portable device. That are communication tools, entertainment, note writing, reading, and going online. According to Vacaru *et al.* (2014), mobile phone did reduce or even cut the use of the laptop, books, and notepads. Furthermore, Vacaru *et al*. (2014) stated that mobile phone was used as a tool for security reasons given that one can call or text for help in case of an emergency. In another light, parents could check on their children whereabouts using the mobile phone. This show an example on the youth uptake of the mobile phone at a global level and the zeal and capability of utilising this technological communication device.

5.2.2 Factors influencing preferred application and adaption to change

The youth and adults agreed on operation cost being one of the factors they consider when choosing an application. The former stated that they would also consider the cost of downloading an application, whist adults said they would also look at application accessibility. In support of the above views, below is one comment from the adult group regarding operation

cost. *"Firstly, we do a research on how many people are going to afford to use that application," Adult group responds.* According to Guo (2022) preference on usage of an application has a positive impact on the user's activity. They further added that it is more psychological for one to trust to use a specific application. This also would determine their activity on the preferred application.

The issue of adults being afraid to adapt to change proved to be a contested terrain as the results did show different views of the participants. There was also a comment that was added in one adult group that suggested that the adults were even pioneers in the using of mobile applications - "*The community is exposed to technology and we are even teaching the young ones."* This was similar to Levdikova's study (2019) which states that many elderly people were savvy smartphone users as they utilised them to access their emails, connect with family and friends using messaging apps such as WhatsApp and Facebook Messenger. These results oppose the knowledge gap theory argument of Tichenor *et al*. (1970) that illiteracy is a barrier in using new forms of technology. This shows that the Njhakanjhaka communities have high levels of educated adults, which was seen in their demographic results; this shows that illiteracy does not affect use of mobile applications.

The communities assert that they are benefiting from the use of mobile applications. This was supported by their comments, such as*, "Mobile applications allow us to get information fast than being called"* and *"News spread fast in the community and we get information of what is happening in community while sitting in our homes."* Gupta (2016) agrees with the above assertion stating that rural populations' livelihood is changing considerably as they benefit from the use of mobile applications. Rai & Shahila (2013) research in India proved that Facebook served many farmers when they were faced with the crisis of an oversupply of the turmeric which had led to the price dropping excessively. Nuwamanya *et al.* (2018) disclosed that communities were benefiting as they received instant information on many issues, such as sexual reproductive health. One can, thus, deduce that many communities are benefiting from using mobile applications, however, in different ways.

Facebook has advanced into one of the major development platforms in rural areas of both developed and developing countries. In South Africa, it has become a valuable communication outlet for civic and non-profit organizations to reach their stakeholders and provide information (Frye, 2014; Kanter & Fine, 2010). Stakeholders and community members can exchange messages, join awareness campaigns, voice their concerns and lobby for support through Facebook platforms (Chiulli, 2014). This shows that communities have a many ways of using mobile applications such as Facebook for rural development as they bring their voice out through this platform. This would indeed help in making key players in policies make drastic

changes that will help solve different issues the rural based dwellers have posted or shared as their grievances.

Information searched for or required on mobile applications differ according to - age group, gender and profession. In this study the participants gave the following reasons – to access weather forecast, news, job vacancies, community news updates and for invitation to meetings. On the issue of job seeking using applications, this is similar to the application “Kazi 560” in Kenya to get job alerts (Ericksson, 2008). In Ghana farmers utilise mobile application to obtain information on market prices, buyers, inventories and transport (Duncombe, 2012).

5.2.3 Challenges and solutions associated with use of mobile applications

Mobile applications have been embraced by the rural community, despite challenges that are associated with using them. Results of this study showed that the communities faced challenges, such as lack of data for internet connection, limited network signal, conservatism from the elderly, and the inability of some elderly people to use applications. The issue of illiteracy being a challenge was not widely accepted as some adult respondents argued that this does not apply to their communities. This is opposite of what Tichenor *et al*. (1970) knowledge gap theory argued, that illiteracy in rural population is a factor hindering adapting to new technologies. Similar challenges were also discovered in a study done in the rural communities in Kwara State in Nigeria. Afoloyana *et al.* (2015) identify challenges such as, in ability to read and write, lack of money to purchase recharge cards, and poor network quality. The other challenges which were raised by other researchers, even though not by this study were - high cost of owning a mobile phone, lack of electricity, lack of interest to own a mobile phone and the high risk of mobile theft (Afoloyana *et al.,* 2015). This shows that communities experience similar challenges when it comes to utilising mobile phone applications.

Asif *et al.,* 2017) also stated in their study that high charges on air time was an obstacle for mobile phone use. Poor network connections due to remoteness of some rural communities is also identified in some researches (Warthi & Bhanotra, 2017; Navinkumar *et al.,* 2018 & Folitse *et al.,* 2019). Therefore, the government and relevant stakeholders should work together in providing affordable packages of air time and data. If not better they could better provide Wi-Fi hot spots in public areas such as local hall, local clinic, local library and even at their offices. The other challenge that lead to limited usage of mobile applications which is similar to other researches is the lack of electric power (Asif *et al.,* 2017; Mukadasi, 2018). The other challenges identified though not associated with this study are lack of mobile

servicing centres, language barrier, lack of knowledge and complex technology (Falola & Adewumi 2012; Navinkumar *et al.,* 2018).

Thus from all the evidences above on challenges that are faced by communities in wanting to use the various mobile phone applications. The conclusion that can be drone from the researches is that mobile applications are well accepted globally. However, the constrains that are associated with poverty, poor infrastructure, poor network coverage, expensive air time or data, illiteracy among other challenges as highlighted earlier. These slow down the usage and adoption of mobile phone applications. For sustainability the government need to find a way for more free internet access especially in poor rural communities. This in turn would help boast rural development as the rural dwellers would have access to the rest of the world. The community would be able to learn what other communities are doing to develop their communities and even share ideas.

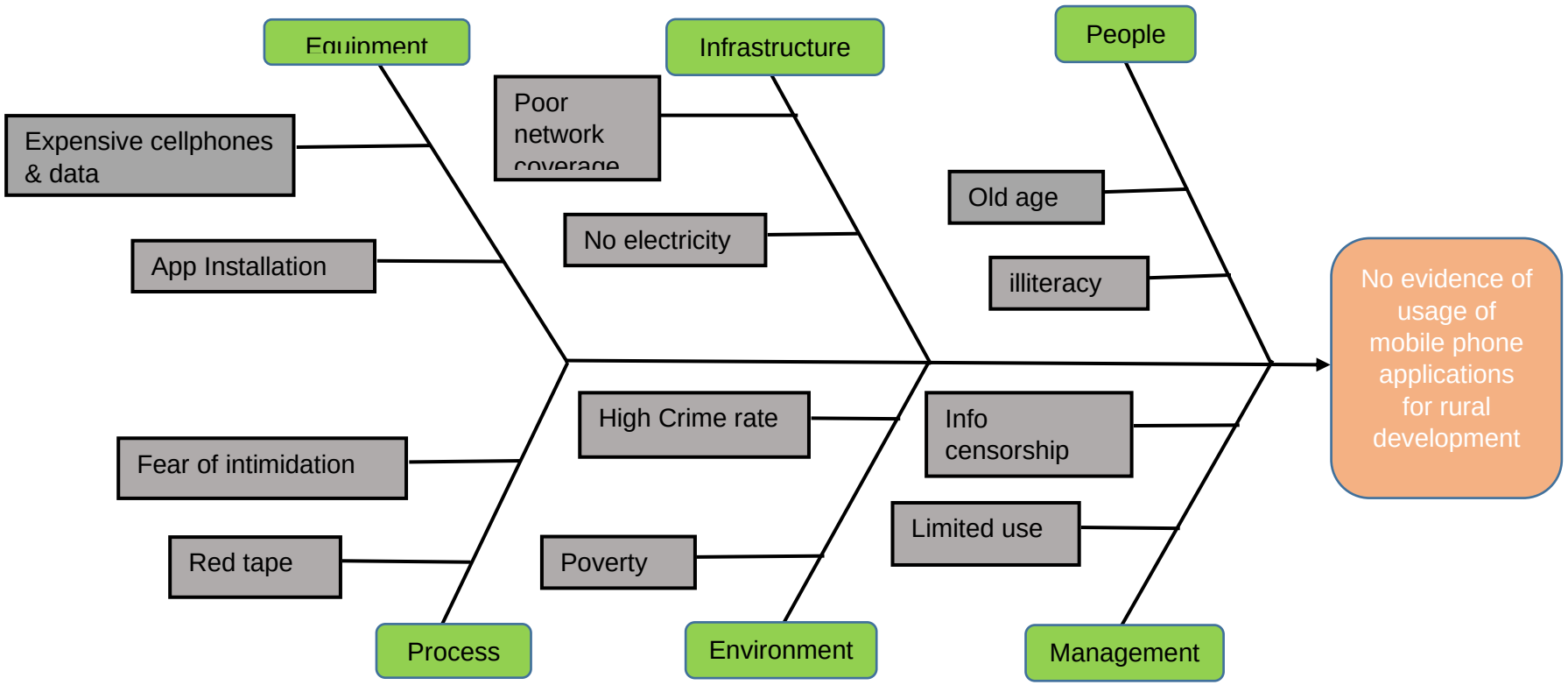


Fig 5.1 Fishbone diagram showing challenges of poor mobile phone usage

The other crucial issues that came out of this study results are that mobile applications are able to eliminate the gap in information dissemination through access to modern technology; this was illustrated as the communities affirmed that they connect to the world, through the internet, with their mobile applications. This contradicts Tichenor *et al*. (1970) knowledge gap theory that newer forms of technology at the global level did not show a rise in technology only, but it also showed the expense of obtaining such technologies too, and that the poor would not be able to afford.

If the poor communities can afford smart phones which gives them access to local and international information through the use of the internet, it shows the gap is becoming reduced and soon might no longer exist. This is similar to the digital divide theory argument which is supposed to have been created by economic and social gap within the populations of the nations and which prevents their access to information technologies (Van Dijk (1999). This is therefore, not also contested by this study as the Njhakanjhaka population acknowledged that they have access to smart phones such as iPhone, Huawei and other Android mobile phones.

The National Development Plan (2016) in their National Integrated ICT Policy White Paper, states that regarding digital divide, newer technologies will emerge to ensure increase of internet coverage in rural, remote and underserviced areas, thus, the Njhakanjhaka community suggested that there will be an increase in internet coverage in South African. This will be in line with vision 2030 as ICTs would be upgraded for the benefit of all communities. Regarding the issue of digital literacy, according to NDP (2016) funding should be made available for projects that would focus on the training and skill development for broadband users in rural and low-income communities. This in the long run would mitigate lack of digital literacy becoming a barrier to communities' uptake and use of newer technologies.

5.3 Conclusion

Results of this study illustrated that the type of mobile phone used in the community are smartphones and that mobile applications are being utilized by both youth and adults to the same extent. Preference of mobile application to be used for rural development is mainly determined by the number of individuals who can access and afford an application. The other key issue is that the Njhakanjhaka communities use WhatsApp and Facebook more than the other applications, in conducting their rural development activities and despite challenges being faced in using mobile applications, the communities' livelihood is believed to have become better.

5.4 Recommendations

a) The use of mobile applications for rural development is active and seems to be key towards improving the community, thus, the relevant authorities, such as Traditional Authority along with network providers should work on providing free Wi-Fi hotspots for rural community. Influential individuals within the communities should boost interest in the use of mobile applications, especially, to get the latest relevant community updates and invitation to functions or meetings.
b) Network providers to moderate prices for data bearing in mind of rural communities.
c) Network providers, government and relevant Non-Governmental Organizations should launch projects that raise awareness of the importance of using mobile applications for rural development. Other projects can focus on teaching members of communities how to use mobile applications in enhancing their livelihood.
d) The government, as well as, the Traditional authority of Njhakanjhaka should encourage the use of mobile applications in the education, health and other sectors since this has proven to be helping other rural communities.
e) Within the Traditional Authority, those literate on issues to do with mobile applications uses, especially for socio-economic purposes, should educate others since this has been proven to develop rural communities.
f) Njhakanjhaka Traditional Authority to utilize mobile applications in showcasing their events that are open to public in the form of pictures, videos or even live coverage if possible. This would help in making their community recognizable not only at a local level but even international. In turn this could help attract potential investors in projects within the community.

g) There is need to encourage rural health providers to use mobile applications in spreading important health information within the rural community. A good example could be WhatsApp, a creation of a group on the platform that would be used to share important health issues. The WhatsApp groups could be two separate groups so that the youth will be comfortable to ask any questions they want under health.

h) The usage of mobile applications for education in the rural community need to be improved. The rural schools should get educated and encouraged to use mobile applications within education set up. Thus, a teacher could share important educational material through a WhatsApp group too. This has proven to be working in other rural communities.

i) Student can create a WhatsApp group for discussions regarding a topic. This would allow the students to identify key problematic issues they would like their teachers to elaborate or explain again in a next normal lesson if not a revision lesson.

j) Farmers within the community of Njhakanjhaka to also use mobile applications to seek relevant information for prices of products and services. The same mobile applications can be used to communicate with farming experts or even among themselves as farmers.

k) Formal and informal businesses to use mobile applications to boast sales by advertising on mobile applications such as Facebook. On Facebook there is now a user friendly Facebook market were people can advertise their products and get to communicate with potential buyers.

5.5 Recommendation for further study

a) This study only took place in Njhakanjhaka village in Vhembe District. A suggestion is that a District research could be done or a comparison of two or three villages within the same District or in another area. This would enable finding out if the same results will be obtained from other villages, discover which other mobile phone applications are popular and the challenges faced in those other communities, in connection with these applications.

b) There is need to carry out research which would include the traditional council and other key traditional leadership individuals on the similar issue of mobile application use for rural development. This is motivated by the fact that we are now in the fourth industrial revolution, hence, leaders play critical role in influencing change within their communities. It would, therefore, be of interest to ascertain their views and how they are shaping and preparing their communities for such a global change.

c) There could be need to carry out research on certain service providers that have an active and running mobile application being used by the communities. This would assist in raising their providers' willingness to participate and bring awareness on the benefits of using mobile applications, for rural development.

d) A study on youth usage of mobile applications for rural development can be done. This could be a comparison of the rural youth and urban youth. How they are being the voice of the voiceless for the communities in promoting awareness on key issues that affect youth today.

e) A study can be done on how they can eradicate poverty or to create wealth or employment. This can be done through usage of mobile applications focusing on agriculture, or innovations that could develop a communities' production of crops for rural development.

f) There is also need for a study on comparing how the already active on social media rural community traditional authorities post their day to day activities. The study would try to find out to what extent their participation on social platforms have increased their popularity. Which in turn have bought investors or fresh ideas on how best they can cub challenges faced by their community.

REFERENCES

Abbas, M. 2018. What are the advantages and disadvantages of WhatsApp.Internet. Quora: New York, USA.

Abdelkarim, A.A & Nasereddin, H.H.O. 2010. *Mobile Commerce*, Journal of Mathematics and Technology,**1**(4):51-55.

Ahlqvist, T. Back, A. Halonen, M. & Heinoen, S., 2008. *Social Media Roadmaps: Exploring the futures triggered by Social Media,* VTT Tiedotteita, Helsinki, Finland.

Andone , I.,Blaszkiewicz, K., Eibes, M & Trendafilov, B. 2016. *How Age and Gender Affect Smartphone Usage,* Heidelberg: Research Gate.

Asongu, S & Boateng, A. 2018.*Introduction to Special Issue: Mobile technologies and inclusive development in Africa*. Journal of African Business, **19**(3):297-301.

Bansal, E. 2015*. Impact of Social Media on Rural India*. International Journal of Mangaement Research and Business Strategy*,* (3):1-9.

Barbosa, J.Z., Prior, S.A., Pedreira, G.Q., Motta, A.C.V., Poggere, G.C & Goularte, G.D. 2020. *Global trends in apps for agriculture*. Multi-Science Journal,3(1):16-20.

Bateki, C.A., Daum, T., Salvatierra-Rojas, A., Muller, J., Birner., R & Dickhoefer, U., 2021. *Of milk and mobiles: Assessing the potential of cell phone applications to reduce cattle milk yield gaps in Africa using a case study*. Computers and Electronics in Agriculture, 191:1-10.

Bhavnani, A., Won-Wai Chiu, R., Janakiram, S. & Silarszky, P. 2008. *The Role of Mobile Phone in Sustainable Rural Poverty Reduction*. ICT Policy Division ,1-25.

Boyd, D. & Ellison, N., 2007. *Social Network sites: Definition, History and Scholarship*. Journal of Compute Mediated Communication*.*

Bus, J., Crompton, M., Hildebrandt, M. & Metakides, G., 2012. *Digital Enlightenment.* Amsterdam: IOS Press.

Caine, V, Steeves, P & Clandinin, DJ. 2018. *Social justice practice: A narrative inquiry perspective. Education,* Citizenship and Social Justice,**13**(2):33–143.

Camacho, A & Conover, E. 2019 *The Impact of receiving sms price and weather information on small scale farmers in Colombia*, World Development, Elsevier, **123**:1.

Campbell, A., Taylor, B. J. & McGlade, A. 2017. *Research Design in Social work Qualitative and Quantitative Methods.* London: Sage Publications.

Canadian Global Response, 2019. *Community Development.* [Online]
Available at: https://canadianglobalresponse.ca/portfolio/community-development/
[Accessed 28 March 2019].

Cetinkaya, L. 2017 *The impact of WhatsApp Use on success in education Process*. International Review of Research in Open and Distributed Learning, **18**(7)

Chilimo, W. & Ngulube P. 2011. *Role of Information and Communication Technologies in Sustainable Livelihoods in Selected Rural Areas of Tanzania*. African Journal of Library, Archives and Information Science, **21**(2):153-166.

Chinedu, O., Huisman, M.& Taylor, E. 2019*. Socio-Economic contributions of Mobile Applications in Africa: Impact of Local Mobile Applications at International Multidisciplinary Information Technology and Engineering Conference*. DOI:10.1109/imitec45504.2019.9015912

Coghlan, D. & Brydon-Miller, M., 2014. *Data Analysis: The Sage Encyclopidia of Action Research,*Thousand Oaks, Sage Publication. Inc.

Costopoulou, C., Ntaliani, M & Karetsos, S. 2016. Studying mobile apps for agriculture. Journal of Mobile Computing and Application, **3**(6):44-49.

Creswell, J. W., 2014. *Research Design: Qualitative, Quantitative and Mixed Methods Approaches.* 4th ed. Los Angeles: Sage Publications.

Creswell, J. W. & Creswell, J. D., 2017. *Research Design: Qualitative, Quanititative and Mixed Methods Approaches.* 5th ed. Los Angles : Sage Publications.

Czaja,S.J., Charness, N., Fisk, A.D., Hertzog, C., Nair., S.N. & Rogers, W. 2006. *Factors predicting the use of technology:findings from the Center for Research and Educaion on aging and Technology Enhancement* . Psychological Aging , **21**:333-352.

Daniel, J. 2012 Samplying Essentials: Practical Guidelines for Making Smpling Choices . Sage Publication, Inc. Thousand Oak, Califonia.

Dannenberg, P. & Lakes, T., 2013. *Use of Mobile Phones by Kenyan Export-Oriented small-scale Farmers Insights from Fruit and Vegetable Farming in the Mt Kenya Region*. Economia Agro-Alimentare*,* **3**: 55-76.

Davis,K.,Swanson, B., Amudavi, D., Mekonnen, D.A.,Flohrs, A., Riese, J.,Lamb, C & Zerfu, E. 2010. *In-Depth Assessment of the Public Agricultural Extension System of Ethiopia and Recommendations for Improvement*. International Food Policy Research Institute, 01041.1-77.

Demenongu, T.S; Yahaya,M & Jiriko,R. 2018. *Assessment for Farm Inputs Distribution under the E-Wallet Scheme in Benue State, Nigeria*. International Journal Agriculture Food Resources **6**(2).

Devanand, I.I & Kamala, I.M. 2019. *Innovative Extension Approach for Sustainable Agricultural Development: WhatsApp Groups for Farming Solution*. Current Journal of Applied Science and Technology, **37**(3): 1-8.

Dewi, D.A & Abdullah, Z.H. 2020. *A Review on Agricultural Mobile Apps for Sustainable Agribusiness: before and during Covid-19 Pandemic*. International Journal of Innovation Engineering and Science Research, **1**(1): 1-5.

Donner, J. & Escobari, M. 2009. *A Review of the research on mobile use by micro and small enterprises (MSEs)*, paper presented at the International Conference on information and Communication Technologies and Development. Doha. Qatar.17-19 April 2009. http://jonathandonner.com/donner_escobari_ICTD2009_mse-review_prepub.pdf [Accessed 10 July 2020]

Duncombe, R.A.& Boateng, R. 2009. *Mobile phones and financial services in developing countries: a review of concepts, methods, issues, evidence and future research directions*, Third World Quarterly. **30**(7):1237-1258.

Duncombe, R. 2012. *Mobile phones for Agricultural and Rural Development: A Litersture Review and Suggestions for Future Research Directions*. Development Informatics,1-38.

Ellison, S.L.R., Farrant, T.J & Barwick, V. 2009. Practical Statistics for the analytical scientist: Abench guide, PAGES. Cambridge, Royal Society of Chemistry.

Eriksson, E. 2008. *A Case Study About Cell Phone Use by People in Rural Kenya,* Vaxjo: MSI Vaxjo University .

Fahamu, 2007. *Mobile phones,human rights and social justice in Africa,* Nairobi: Fahamu. [Online]
Available at: http://www.kiwanja.net/database/document/report_fahamu_mobile_activism.pdf

Gichamba, A. & Lukandu, I.A. 2012. *A Model for designing M-Agriculture Applications for Dairy Farming*. The African Journal of Information System, **4**(4):120-136.

Glendenning, C.J. & Ficarell, P.P. 2012. The relevance of content in ICT initiatives in Indian agriculture. IFPRI Discussion Paper 1180. Washington, D.C, IFPRI.

Gloag, D. 2019. *Mobile Application Definition.* [Online]
Available at: https://study.com/academy/lesson/mobile-app-definition-development-management.html
[Accessed 28 March 2019].

Global System for Movile Communication. 2017. *The Mobile Economy Sub-Saharan Africa,* London: GSMA Intelligence .

Gordon-Salant, S. 2005. *Hearing loss and aging: new research findings and clinical implications*. The Journal of Rehabilitation Research and Development,**42**(4):9-74.

GSMA Intelligence, 2020. *The Mobile Economy,* London: GSM Association.

GSMA Intelligence, 2021. *The Mobile Economy Sub-Saharan Africa ,* London: GSMA.

Gupta, S. 2016. *A study on:Impact of Social Media in Rural Development*. International Journal of Engineering Research and Technology Special Issue, 66-67.

Haddon, A., Goodman, H, Park, J. & Crick, R.D. 2005. *Evaluating Emotional literacy in Schools: The Development of the School Emotional Environment for Learning Survey*. Pastoral Care in Education, **2**(4):5-16.

Heinz, M., Martin, P., Margrett, J. A., Yearns, M., Franke, W., Yang, H.-I., Wong, J. & Chang, C.K. 2013. Perceptions of technology among older adults. J. Gerontol Nurs. **39**(1):42-51.

Hellstrom, J. 2011. *Mobile governance: Applications, Challenges and scaling-up. Mobile Technologies for Conflict Management*. Springer, 159-179.

Hertzog, C.& Bleckley, M.K. 2001. *Age Difference in the Structure of Intelligence: Influences of Information Processing Speed*. Intelligence, **29**(3):191-217.

Hoehle, H.& Venkatesh, V. 2015. *Mobile Application Usability: Conceptualisation and Instrument Development*. MIS Quarterly,**39**(2):435-472.

Holzinger, A., Kickmeier-Rust, M.D.& Albert, D.2008.*Dynamic media in computer science education; content complexity and learning performance: is less more?* Educational Technology and Society,**11**(1):279-290.

Huang, Y.M., Jeng, Y.C.& Huang, T.C. 2009 *An educational mobile blogging system for supporting collaborative learning*. Educational Technology and Society, **12**(2):163-175.

Hwang, G.J & Chang, H.F. 2011 *A Formative Assessment based Mobile Learning Approach to Improving the Learning Attitudes and Achievements of Students*. Computers and Education, **56**(4):1023-1031.

International Association for Community Development. 2017. *Community Development.* [Online] Available at: http://www.iacdglobal.org/about/
[Accessed 12 August 2018].

Jadhav, K., Kolhe, S., Nande, M., Khanvilkar, A & Doiphode A., 2021. *Utilization of Mobile Based ICT Tools by the Dairy Farmers of Satara and Pune Districts of Maharashtra.* Asian Journal of Agricultural Extension, Economics & Sociology, **39**(6):35-43.

John, A. & Barclay, F. 2017. *Usage and effects among Rural Communities*. Journal of Media and Communication, **1**(1):100-136.

Kameswari, V.L.V., Kishore, D. & Gupta, V. 2011. *ICTs for Agriculture Extension: A Study in the Indian Himalayan Region*. Electronic Journal of Information Systems in Developing Countries. **48**(1):1-12.

Kang, S. 2014. *Factors influencing intention of mobile application use*. International Journal of Mobile Communications,**12**(4):360-379.

Kaplan, A. M. & Haenlein, M., 2010. *Users of the World Unite! The Challenges and opportunities of Social Media*. Business Horizons, **53**(1): 59-68.

Kene-Okafor, T. 2020. *After its failed stint with M-Pesa Vodacom is planning to Launch another fintech service in South Africa*.[Online] Available at: http://techpoint.africa/2020/7/23/vodacom
[Accessed 15/08/2020]

Kesherwani, D., Rout, S., Padhy, D & Ravichandran, S. 2022.*Social Media Help Farmers: For Improving Agriculture Practices*. International Journal of Biology, Pharmacy and Allied Sciences,**11**(1):410-418.

Kharel, S. 2018*. Information and communication technology for the rural development in Nepal*. Tribhuvan University Journal, **32** (2):177-190.

Kim, S., Wang, R, G., Matthouse, E. 2015. *The Effects of Adopting and Using a Brand's Mobile Application on Customers' Subsequent Purchase Behavior*. Journal of Interactive Marketing, **31**:28-41.

Kumar, S., Nilsen, W. J., Abernethy, A., Quinn, C., Shusterman, V. & Swendeman, D. 2013. Mobile Health Technology Evaluation: the mHealth evidence workshop. American Journal of Preventive medicine **45**(2):228-236.

Lee, S., Lee, S.& Kim, Y.2007. *Factors Influencing the adoption behaviour of mobile banking: a South Korean perspective*. Journal of Internet Banking and Commerce,**12**(2):1-9.

Lee, J.H.& Song, C.H. 2013. *Effects of trust and perceived risk on user acceptance of a new technology service, Social Behavior and Personality*. An International Journal, **41**(4):587-597.

Levdikova, T. 2019. *Desinging Apps for Elderly Smartphone Users.* [Online]
Available at: https://clutch.co/app-development/resources/designing-apps-for-elderly-smartphone-users
[Accessed 4 April 2019].

Levy, P.S. & Lemeshow, S. 2013. Sampling of Populations: Methods and Applications, 616, John Wiley & Sons.Inc

Lewis-Beck, M.S., Bryman, A. & Liao, T.F. 2004. Convenience Sample. In (Ed). *The SAGE Encyclopedia of Social Science Research Methods*, Sage Publication.

Liamputtong, P. 2011. *Focus Group Methodology:Priniciple and Practice.* Sage Publication Ltd, London, UK.

Lomotey, R. K. & Deter, R. 2012. *Using a Cloud-Centric Middleware to Enable Mobile Hosting of Web Services*. Personal and Ubiquitous Computing. **10**:634-641.

Lutz, G & Linder, W. 2004. *Traditional Structures in Local Governance for Local Development*. Berne, Feb 2004, University of Berne Institute of Political Science: Berne, Switzerland.

Marsden, P. & Chaney, P. 2013. *The Social Commerce Handbook 20 Secrets for Turning Social Media into Social Sales*, Pages, McGraw Hill, New York, USA.

Marwa, M.E., Mburu, J. Oburu, R. E. J. Mwai, O. & Kahumbu, S. 2020. *Impact of ICT based extension services on dairy production and household welfare. The case of iCow service in Kenya*. Journal of Agricultural Science, **12**(3):141-152.

Mark-Anthony, A. C., Chukwuemeka, A.A. & Martins, A.O. 2020. *Social Media Used by Arable Crop Farmers for Communicating Climate Change Adaptation Strategies in Imo State, Nigeria*. Journal of Agricultural Extension, **25**(1):1-10.

Maumbe, B.M. & Okello, J.J. 2013. *Uses of information and communication technology (ICT) in agriculture and rural development in sub-Saharan Africa: Experiences from South Africa and Kenya*. International Journal of ICT Reaerch and Development in Africa, **1**(1):113-134.

Maumbe, B.M. 2012. *The rise of South Africa's quick service restaurant industry*. Journal of Agribusiness in Developing and Emerging Economies, **2**(2)

Mehra, A., Paul, J. & Kairav, R.P.S.2020. *Determinants of mobile apps adoption among young adults: Theoretical extension and analysis.* Journal of Marketing Communications, 1-29.

Melenhorst, A., Rogers, W.A. & Bouwhuis, D.G. 2006. *Older Adults Motivated Choice for Technological Innovation: Evidence for Benefit- Driven Selectivity*. Psychology and aging. **21**(1):190-195.

Meydami, E. 2017. Role of Information and Communication Technologies in Government Effectiveness, 494-503, Proceedings of the 10th International Conference on theory and Practice of Electronic Governance, 7-9 March 2017, New Delhi, India.

Mittal, S., Gandhi, S. & Tripathi, G. 2010. *Socio-economic impact of Mobile Phone on Indian Agriculture*. ICRIER Working Paper 246. International Council for Research on International Economic Relations, New Delhi, India.

Mbiti, I. & Weil, D.N. 2011. *Mobile Banking: The Impact of M-Pesa in Kenya*. National Bureau of Economic Research, (17129):1-57.

McNamara, K. S., 2009. *Mobile Applications in Agriculture and Rural development:Framing the topic and learning the Experience.* Washigton DC, American University, World Bank.

Mitchel, M. L. & Jolley, J. M., 2010. *Research Design Explained.* Califonia: Wardsworth.

Munga, G.N.2007. *The Impact of Mobile Banking: A Case Study of Mpesa in the Kenyan Society*, School of Business, University of Nairobi, Nairobi, Kenya.

Muraga, D. 2015. *Modisar: A unique farm management app in Botswana*. [Online] Available at: http://www.idgconnect.com [Accessed 20 August 2020]

Murugesan, S. 2013. *Mobile Apps in Africa*. IT Professional, **15**(5):8-11.

Murungi, K. M. 2018 *Influence of Social Media to community development: Lessons from Kenya*. International Journal of Social Science and technology, **3**(6): 51- 68.

Mwantimwa, K., 2018. *Use of Mobile Phones in Boosting Socioeconomic Information Access and Utilisation among Tanzania Rural Communities*. African Journal of Library *,* **28**(1):107-122.

Naruka, P.S., Verma, S., Sarangdevot, S.S., Pachauri, C.P., Kerketta, S. & Singh, J.P. 2017. *A Study on Role of WhatsApp in Agriculture Value Chains*. Asian Journal of Agricultural Extension, Economics & Sociology, **20**(1):1-11.

National Youth Policy. 2015-2020. *We are generation 2020 we don't want a hand-out; we want a hand up!* Pretoria, National Youth Development Agency. [Online] Available at: http://www.gov.za/gcis_document [Accessed 12 September 2017].

Nuwamanya, E., Nuwasiima, A., Babigumira, J.U & Asiimwe, F.T. 2018 *Study protocol: Using a Mobile phone-based application to increase awareness and uptake of sexual and reproductive health services among the youth in Uganda*. A randomised controlled trial. Reproductive Health, **15**(1):216.

Nysveen, H. 2005. *Mobilising the Brand: The Effect of Mobile Services on Brand Relationships and Main Channel Use*. Journal of Service Research, **7**(3):1-62.

Okonkwo, C.W. & Huisman, M., 2019. *The Predicting Success Factors of Mobile Applications Development: Organisational Perspectives*. In: International Association for Development of the Information Society. International Conference Information Systems. The Netherlands, 11-13 April 2019, North –West University, Potchefstroom, South Africa.

Okoroji, V., Lees, N.J & Lucock X. 2021 *Factors affecting the adoption of mobile applications by farmers: An empirical investigation.* African Journal of Agricultural Research, **17**(1):19-29.

Omolayo, O. 2015. These 10 Apps will Boost Agriculture in Africa. [Online] Available at: http://venturesafrica.com/these-10-apps-will-boost-agriculturein-africa/ [Accessed 10 July 2020].

Omulo, G. & Mensah, K.E. 2020. *Farmer- to -Farmer digital network as a strategy to strengthen agricultural performance in Kenya: A research note on 'Wefarm' platform*. Technological Forecasting and Social Change, Elsevier, 158.

Poblet, M. 2011 *Rule of Law on the Go: New Developments of Mobile Governance.* Journal, **17**(3):498-512.

Qiang, C.Z., Kuek, S.C., Dymond, A. & Esselaar, S. 2012. *Mobile Applications for Agriculture and Rural Development*. ICT Sector Unit World Bank, Washington. D.C, United States of America.

Quandt, A., Salerno, J.D., Neff, J.C., Baird, T.D., Herrick, J.E., McCabe, J.T., Xu, E & Hartter, J. 2020. *Mobile phone use is associated with higher smallholder agricultural productivity in Tanzania*, East Africa. PLoS ONE. **15**(8):1-16.

Rai, G.A. & Shahila, Z. 2013. *Rural India: The Next Frontier for Social Media Networks*. Building Services Engineering Research and Technology, **2**(1):1-6.

Rangaswamy. N. 2009. *ICT for Mesh-Economy: Case-Study of an Urban Slum*. Paper presented at IFIP 2009. 26 May. Dubai http://research.microsoft.com/en-us/people/nimmir/ifip2009.doc

Rhashid, A.T.& Khaled, A. 2020. *Rural ICT Business in Bangladesh: A credible Development Agent?* South Asia Research **40**(1):58-74.

Rivero, L. C., Doorn, J. H. & Ferraggine, V. E., 2006. *Encyclopedia of Database Technologies and Applications.* London: Idea Group Reference.

Salkind, N.J.2010. Convenience Sampling, 254-255, In Salkind, N.J. (Ed), *Encyclopedia of research design*, Sage Publication, Inc. Thousand Oaks, United States of America.

Saumure, K. & Given, L.M. 2012. Data Saturation.196, In Given, L.M.(Ed), *The Sage Encyclopedia of Qualitative Research Methods*, Sage Publication, Inc. Thousand Oaks, California.

Scott, J. & Carrington, P. J. 2012. *The Sage Handbook of Social Network Analysis,* 640p, Sage Publication Ltd London, UK.

Shava, H. & Chinyamurindi, W. T., 2018. *Determinants of Social Media Usage Among a Sample of Rural South Africa youths*. South African Journal of Information Management*,* **20**(1):1-8.

Shen, G.2015. *User's adoption of mobile applications: Product type and message framing's moderating effect*. Journal of Business Research, **68**(11):2317-2321.

Shih, C. 2009. *How tests change teaching: A model for reference English Teaching*. Practice and Critique. **8**(2):188-206.

Silverstein, B. 2022. *How the PDA Paved the way for Smartphones: The Personal Digital Assistant was a visionary fad*. [Online]

Available at: https://historyofyesterday.com/how-the-pda-paved-the-way-for-smartphones-ba1eeacacf4
[Accessed 29 August 2022].

Smithson, J. 2008. Focus Groups, 357-430, In Alasuutari, P., Bickman, L. & Brannen, J. (Ed) Handbook fo Social Research Methods, Sage Publication, Inc, Thousand Oaks, Califonia.

Srinuan, C. & Bohlin, E., 2011. *Understanding the digital divide: A literature survey and way forward*. Chalmers University of Technology, 1-38.

Statistics South Africa, 2015. *Statistics Release: Mid year population estimates,* Pretoria: Statistics South Africa.

Statistics South Africa, 2016. *General House Hold Survey,* Pretoria: Statistics South Africa.

Statistics South Africa, 2020.General House Hold Survey, Pretoria: Statistics South Africa.

Stewart, D. W. & Shamdasani, P. N., 2015. *Focus Group Theory and Practice.* Pages. London: Sage Publication.

Strain, M., 2015. *History Mobile Apps Future Interactive timeline.* [Online]
Available at: https://www.theguardian.com/media-network/2015/feb/13/history-mobile-apps-future-interactive-timeline
[Accessed 15 December 2018].

Stratigea, A. 2011. *ICTs for Rural Development: Potential Application and Barriers involved*. Netcom, **25**(3-4):179-204.

Sundaram, S., Schwarz, A., Jones, E.& Chin, W.W. 2007. *Technology use on the front line: How Information Technology enhances individual performance*. Journal of the Academy of Marketing Science. **35**(1):101-112.

Swanton, B. 2017. *Engage the Business by Developing an Application Strategy Together*. [Online] Available at: http://www.gartner.com [Accessed 17 August 2020]/56

Tashakkori , A. & Teddlie, C., 2010. *Sage Handbook of Mixed Methods in Social and Behavioral Research.* 2nd ed. California: Sage Publications ,Inc.

Taylor, D.G, Voelker, T.A.& Pentina, I. 2011. *Mobile application adoption by Young adults: A social network perspective*. International Journal of Mobile Marketing, **6**(2):60-70.

Techopedia, 2020. *Mobile Phones.* [Online]
Available at: https://www.techopedia.com/definition/2953/mobile-phone
[Accessed 14 June 2022].

Tichenor, P., Donohue, G. & Olien, C.1970. *Mass Media folw and differential growth in knowledge.* [Online] Available at:
http://journals.sagepub.com/doi/abs/10.1177.009365027500200101
[Accessed 21 September 2017].

Thakur, R. 2018. *Customer engagement and online reviews*. Journal of Retailing and Consumer Services, **41**:48-59.

Tuitjer, G & Kupper, P.2020. *How Knowledge-based Local and Global Networks Foster Innovations in Rural Areas*. Journal of Innovation Economics & Management, 33:9-29.

Ukomadu, C. 2018. The Role of Socila media in community development Nigeria:The Owe Unity Forum (Oaf) Model. *Journal of Humanities and Social Sciences,* **23**(5):34-43.

United Nations. 2017. *Definition of Youth*. [Online] Available at: http://undesadspd.org/Youth.aspx [Accessed 18 September 2017]

USAID. 2013. *Using ICT to Enhance Marketing for Small Agricultural Producers*. USAID. Washington. DC, United States of America.

Vaportzis, E., Clausen, M.G. & Gow, A.J. 2017. *Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers*: A Focus Group Study. Frontiers in Psychology, **8:**1687.

Van Dijk, J.1999. *The Network Society Social Aspects of New Media.* London: Sage Publication.

Van Dijk, J.A.G.M., 2006 Digital Divide Research, Achievements and Shortcomings. Poetics, **34**(4-5):221-225.

Wang, H.Y, Liao, C & Yang, L. 2013 *What affects Mobile Application Use? The roles of consumption values*. International Journal of Marketing Studies, **5**(2)11.

Waterfield, J. 2018. Convenience Sampling, 403, In Frey, B.B. (Ed), *The Sage Encyclopaedia of Educational Research, Measurement and Evaluation*, Sage Publications. Inc., Thousand Oaks, California.

Yang, S.J.H., Zhang, T.& Huang, A.F.M. 2008. *Applying web page adaptation techniques to the augmentation of mobile learning*. Research and Practice in Technology Enhanced Learning, **3**(3):253-273.

Yigezu, A.Y., Tizale, C.Y., Kassie, G.T. & Aw-Hassan, A. 2018. *Modelling land-use decisions in production systems involving multiple crops and varieties*. Journal of Agricultural and Resource Economics, **13**(3):240-250.

Ziefle, M.& Bay, S.2005*. How Older Adults Meet Complexity: Aging Effects on the Usability of Different Mobile Phones*. Behavior & Information Technology, **24**(5):375-389.

Appendix 1 Letter of informed consent

My name is **Zvikomborero Callista Mache**. I am a master's student at the University of Venda registered for a Master's in Rural Development (MRDV). My research topic is **Extent of use of mobile applications for rural development in some communities of Vhembe District**. I hereby, kindly ask you to participate in this study. Please note that information gathered during focus group discussions and individual questionnaire will only be used for this study. You shall not be paid for your participation. You can discontinue participation at any time.

Signature of the researcher _____ Date _____

I have read, understood, had my questions answered regarding terms to participate in this study. I voluntarily agree to participate in this study.

Participant Signature _____ Date _____

Legal Guardian Signature (If applicable)

Signature _____ Date _____

Appendix 2 Focus group interview guide

University of Venda

QUESTIONS FOR FOCUS GROUP DISCUSSION

TOPIC: Extent of use of mobile phone applications for rural development in some communities of Vhembe District

Section A. Demographic

1.Group name: ……..

2. Age: ……

3. Gender: (Please tick appropriate) Male ☐ Female ☐

2. Village: ……

3. Number of rural development activities you have participated in: ……

4. What is your professional background? (Please tick appropriate below)

No formal education	
Some primary school	
Completed grade school	
Some high school	
Matric	
Some college	
Completed college	
Postgraduate degree	

Thank you for taking your time to answer this min personal questionnaire

Section B: Focus Group Discussion Guide

Facilitator welcome, introduction and instruction to participants

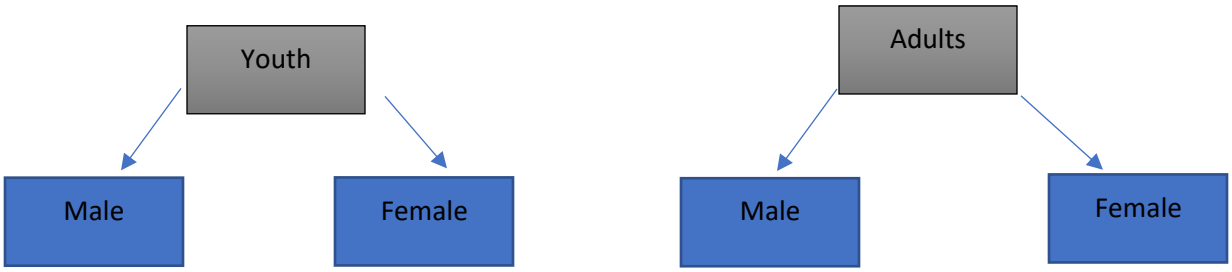
Welcome and Introduction: Welcome and thank you so much for volunteering to take time in being part of this focus group. I really do appreciate your time. This guide intends to assess the perception of the community regarding mobile phone applications as a tool for rural development**.** The focus group discussion is estimated to take 45 minutes.

Anonymity: May I reassure you again that despite being recorded the discussion will be anonymous. The recordings shall be kept safe until they are transcribed and translated word by word, then they will be deleted. Please feel free to ask questions, comment as accurately and as truthful as you can. No answer is wrong so please speak freely.

Basic Ground rules:

- One person should be allowed to speak at a time. Thus, may I urge you to be patient with one another.
- All answers are valued, there is no right or wrong answer.
- You can speak through the group facilitator hence everyone within group can get a chance to participate and give their view.
- Do you have any questions? (Answers)
- Now we move on to group formation (group of youth male and youth female separated into groups of 6-8 participants; male adults and adults female separated to 6-8 participants).

  Group Formation layout



Discussions Commence: Please within your groups first selection of group facilitator and a scriber within the different groups.

Conclusion: To all participants and facilitation team thank you so much for your time and input. Your information is valuable to the study. I hope you found the exercise interesting. As you leave, I hope you have handed in your personal detail questionnaire. Thank you again.

Guiding questions

1. What type of mobile phones do you use? Are these types common in the community?
2. Which type of mobile phone applications do you use in executing community development in the community? How?
3. What applications do you prefer and why?
4. When you select an application to use what do you consider?
5. What challenges do you face when using mobile applications for rural development and why?
6. How can these challenges of using mobile phone applications be solved?
7. Are mobile applications good tools for enhancing rural development?
8. To what extent is the community benefiting from using mobile phone applications for rural development?
9. Suppose that you were in charge and could change one thing on the application of your choice. What would you change? Why?
10. To what extent is information received by the community through mobile applications changing the society's perception to technology?
11. What kind of information do you ask for and/or receive over the mobile phone applications?
12. Of all the things we have discussed what is the most important thing about mobile phone applications? Why?

Appendix 3 Ranking mobile phone application for rural development

SECTION A: Ranking mobile phone applications

Please rank the mobile phone applications dissemination of rural development information. Use the following scale when answering, 1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree, 5 Strongly Agree.

Questions: Which application is most used by youth and adults?	**Rank**
1.Facebook	
2.WhatsApp	
3.Twitter	
4. Instagram	
5.Snapchat	
Question: Which mobile application is reliable for dissemination of rural development information?	**Rank**
1.Facebook	
2.WhatsApp	
3.Twitter	
4. Instagram	
5.Snapchat	
Question: Which mobile application would your community recommend other communities?	**Rank**
1.Facebook	
2.WhatsApp	
3.Twitter	
4. Instagram	
5.Snapchat	

SECTION B: Ranking the statements below

Use the following scale when answering, 1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree, 5 Strongly Agree.	**Rank**
1.Mobile applications are good tools for enhancing rural development	
2.Sharing information about rural development is made easy by mobile applications	
3. Mobile applications are key to rural development	
4.Mobile applications are user friendly for all ages	
5.Youth use mobile applications more than the adults	
6. Adults are afraid to adapt to change	
7.Mobile applications are cheaper to use than calling	
8. Adults face challenges to use mobile applications	
9. Mobile applications have united the urban and rural	
10. Mobile applications are fast in spreading information to many people	

Appendix 4 Ethical Clearance Certificate

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Ms ZC Mache

Student No:
18007602

PROJECT TITLE: **Extent of use of mobile phone applications for rural development in some communities of Vhembe District.**

PROJECT NO: **SARDF/19/IRD/10/0410**

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr B Dube	University of Venda	Supervisor
Prof J Francis	University of Venda	Co - Supervisor
Dr M Masehela	University of Venda	Co - Supervisor
Ms ZC Mache	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: October 2019
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: .....
Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse

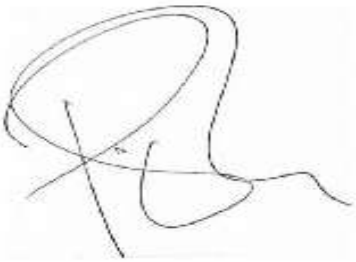
UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2019 -10- 07
P/BAG X5050
THOHOYANDOU
0950

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950, LIMPOPO PROVINCE, SOUTH AFRICA
TELEPHONE (015) 962 8504/8313 FAX (015) 962 9060
"A quality driven financially sustainable, rural-based Comprehensive University"

Appendix 5 Proof of Editing

10 June, 2023

This is to certify that I, Dr P Kaburise, of the English Department, University of Venda, have proofread the research report, titled - **EXTENT OF USE OF MOBILE PHONE APPLICATIONS FOR RURAL DEVELOPMENT IN SOME RURAL COMMUNITIES OF VHEMBE DISTRICT** - by Zvikomborero Callista Mache (student number: 18007602). I have indicated some amendments which the student has undertaken to effect, before the final report is submitted.



Dr P Kaburise (0794927451; email: phyllis.kaburise@gmail.com)

Dr P Kaburise: BA (Hons) University of Ghana (Legon, Ghana); MEd University of East Anglia (Cambridge/East Anglia, United Kingdom); Cert. Teaching English as a Foreign Language (Cambridge University, United Kingdom); Cert. English Second Language Teaching, (Wellington, New Zealand); PhD University of Pretoria (South Africa)