

Adoption of mMoney and mHealth in a developing country: an assessment of the network and Security challenges in Botswana

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Abstract: Mobile Health (mHealth) and Mobile Money (mMoney) are leading-edge applications that can assist better people's lives and bridge the digital gap. They are contemporary examples of Advanced Networking being put to everyday use, and demand the same considerations in relation to confidentiality, integrity and availability that are at the heart of all other applications of advanced networking infrastructure. mHealth is a way to help ease pressure on the health systems around the world. mMoney also known as branchless banking is another way of making life easier for people in Botswana and around the world. Branchless banking assists customers by saving them the trouble of going to access money from an ATM machine or having to go to a bank. This research paper explores the security and networking challenges that affect the successful adoption of mMoney and mHealth. The research methods used in this paper consist of a wide review of existing literature review and primary data collected. The data was collected using surveys, namely questionnaires and interviews. Users of mHealth and mMoney were given questionnaires to answer and were interviewed. Experts in both fields were interviewed as well. The overall conclusion of this investigation concluded that for Botswana to successfully adopt the mHealth and mMoney technologies it is essential that they work on the countries' network infrastructure. People in Botswana should be educated on the security measure they can use to protect themselves from the security risks involved mMoney and mHealth.

Keywords: mHealth, mMoney, security, security and networking, network infrastructure

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I. Introduction

Botswana is a developing country with one of the fastest growing economies in the world. The people originating from Botswana are called Batswana. It is a sparsely-populated country divided into nine districts and has got six administration locations two of which are cities the rest being towns. Banks, Government, and mobile service providers are mainly found in these administration areas hence, people have to travel far to access services. Botswana's public health consists of health posts, clinics, primary hospitals, district hospitals, and referral hospitals. For every 100,000 people, it is approximated there are about 40 physicians and access to specialists is a major challenge especially for patients in the rural areas of Botswana. Botswana has been said to have the second highest prevalence of human immunodeficiency virus HIV/AIDS in the world. This has put a further burden on the health system which already had shortages of resources and manpower.

In the year 2007, Botswana outlined a National Information Technology Policy named Maitlamo. The Maitlamo policy outlined seven 'pillars' of IT that being e-governance, e-legislation, e-commerce, e-education, e-agriculture, e-tourism and e-health. This goes to show the commitment of the Botswana government to improve their ICT infrastructure. The government, however, faces a challenge in implementing this policy because the current data network was put in place twenty years back and needs upgrading. By the year 2016, the government of Botswana aims to have content delivered through mobile phones. They aim to include mobile payments and SMS notifications as mobile services they will render. (MTC, 2012)

In the USA, about 75 percent of households have a broadband connection and those connections have average download speeds of about 9.6 megabits per second and upload speeds of about two megabits per second whereas Botswana has an average download speed of 700 kilobits per second and upload speeds of about 250 kilobits per second. When mobile-health is implemented, it is important that all citizens of Botswana have access to it. But it is unfortunate that in Botswana not all parts of the country have set network infrastructures. Through Projects such as Nteletsa I and II the government has made an initiative to close the gap that exists between communities. The Nteletsa projects are rural development projects that the government of Botswana has come up with to ensure that rural communities in Botswana have access to telecommunication services. The projects have 197 villages in Botswana targeted. This will ensure that these communities have network availability (Nkwe, 2012).

1.1. Security Challenges in mHealth and money

The government of Botswana has a good strategic plan in place. But there still lies challenges in the path of successfully implementing mHealth and mobile money. Mobile devices have different operating systems from those that run in traditional workstations or laptops. The focus of hackers has over the years moved to be that of financial gain. Mobile banking is therefore at risk as hackers primarily target credit cards numbers and banking credentials. As users across the world grow to entrust their data into mobile phones the more they become targets to cyber criminals. This means that for a “techno phobic” nation like Botswana the risks of mobile banking is more likely to slow down the adoption of mobile commerce in general.

There are several reports in the media that indicate more and more Botswana are bound to be affected by Botswana’s trusting nature has been their greatest weakness. Botswana being a peaceful and tranquil country has made it citizens more laid back and trusting hence Botswana are likely to be susceptible to mobile banking threats. According to (Pitse,2009) new security measures recently introduced in the United Kingdom are believed to be pushing criminals abroad, with credit card fraud overseas doubling in the first half of last year and Botswana tour operators are having the worst of it. The Maitlamo Policy indicates that Botswana still has challenges with its data network being outdated and a lack of experts in the field of e-governance. Another factor that adds to the vulnerability of Botswana is that they are still new to the use of technology and still lack a proper awareness on how to mitigate security risks.

Lack of Proper data protection laws

Though mHealth has been proved to be a growing phenomenon around the world, there is no federal agency that has the power to properly regulate the fast-growing world of mHealth applications and telehealth systems. Consumers need assurance of their confidentiality for them to accept and engage in mHealth. Botswana’s laws are still behind on information security and the lack of security experts in the area is another issue. This does not only put Botswana at the risk of hackers but also at the risk of exploitation of organizations they transact through. According to consumer watch dog Richard Harriman “Consumers have a big perception that large organization like banks are secure for online use; however interaction with many of them concerning their online security has showed that they are not.” (Mogende, 2013)

1.2. JUSTIFICATION FOR THE RESEARCH

mHealth and mMoney are two advanced networking technologies that are growing very fast in the world. As a matter of fact, they are taking the world by storm. Banks are saving money on building ATM machines and bank branches through the use of mobile banking also referred to as branchless banking. People are saving time and resources by using mMoney without having to own a bank account or even go to the bank. People around the world are able to get medical assistance in the comfort of their own homes through their mobile phones.

Botswana however is adapting to both these technologies at a slower base than most countries despite being one of the countries that have a majority of its citizens owning a mobile phone. mHealth could offload Botswana’s health system since Botswana is one of the countries faced with the scourge of HIV/AIDS. And considering that some villages in the country are far from cities and towns and there are no banks. Botswana would benefit greatly from mMoney. However, a lack of wide spread and reliable infrastructure coupled with a lack of security awareness is a serious challenge for the successful implementation of these technologies.

Several studies have been carried out on mobile banking but still a review of literature on m-banking particularly mMoney adoption remains missing especially in Botswana. Such a review represents an important milestone in the development of a research field. It provides an opportunity to step back and review the collective intelligence that has been amassed from an eclectic body of research that uses various samples, methods, and theories. (Hanafizadeh et al., 2014) also emphasizes that findings in mobile banking adoption contradict each other therefore the intention of this research paper is contribute to the knowledge of mMoney adoption in Botswana. The idea of the paper is to review the status of mobile banking particularly mMoney and mHealth and the adoption in both advanced networking technologies in developing and developed countries since these are two technologies that are growing around the world. As these technologies grow so do the risks and threats associated with them.

This research is futile in that Botswana is still in the process of implementing e-governance. There is very little knowledge base for e-governance in Botswana as it is because it is still in the implementation stage. mHealth came into picture in the year 2013 as a joint venture between the University of Pennsylvania, University of Botswana and Orange Botswana. For mHealth to be successfully implemented it is important that they are in possession of a mobile device. But with health workers bringing their own devices into the government health network a whole network of risks will be let into the network. One of the challenges that lie with mobile commerce in general is how to maintain the Confidentiality, Integrity and Authorization (CIA) triad. The mobile user’s confidentiality should be protected at all times and the data should reach its destination

withholding its integrity and there should also be a way for the user to prove they are who they say they are. This needs to be explored in Botswana. mHealth is an important advanced networking area to explore as it can be used to save lives and tremendously improve Botswana's healthcare system.

Introduction of mHealth will mean that health workers even outside of their work stations should be able to access the network. For this to be possible, there should be an implemented wireless network in good working order and also as devices from the outside are brought into the network a proper Bring Your Own Device (BYOD) device should be put in place. This research is relevant in that it will explore how advanced networking technologies, mHealth and mMoney can assist in Botswana and how it has been set up in other developing and developed countries. The technology landscape is undergoing rapid change with the increasing availability of mobile broadband through the deployment of commercial 3G, 4G/LTE, and Wi-Fi networks. Public safety is evolving to create an environment that will support hybrid solutions mixing private radio network, but also using other accessibility of both technologies.

1.3. Research Definition

Practical Problem/Issue

The issues that this study has addressed are ways in which mMoney and mHealth can be fully adopted in a developing country like Botswana. The research aim was to answer the following questions:

1. What have other developing countries like Kenya, South Africa and Tanzania done to ensure that mHealth and mMoney are successfully implemented in their countries though they are faced with issues in networking and security challenges?
2. How are first world countries like America and the UK using mHealth and mMoney and how can a similar way can be adopted in Botswana?
3. What advanced networking technologies are available to ensure that mHealth and mMoney can be successfully implemented in Botswana?
4. Is Botswana's network infrastructure advanced enough to handle the growing need to use mHealth services and mMoney?
5. Are mobile phone users aware of the risks involved in engaging into mMoney and mHealth and is enough information being passed on?

II. Literature Review

In the year 2012, Botswana was considered out of 152 countries both developing and developed as a country with the highest growing cell phone densities. According to a report released in 2012 by the World Bank, in 2011 there were 144 mobile phone subscribers per 100 people in Botswana. Botswana's mobile phone population density was higher than that of Germany, United Kingdom and even that of Japan. According to (Masunga, 2011) the mobile market in Botswana is growing much faster than the PC market with a growth of 150% compared to the PC market of 20%. This means that in Botswana more and more Botswana own mobile phones. Statistics show that mobile population coverage is now sitting at 90%. (Chang et al 2012). These statistics show that a majority of the people in Botswana should be able to access any service rendered through their mobile phone.

Botswana however still faces challenges in its network infrastructure and the mHealth and mMoney services may still fail to assist those in rural areas. In a speech given by the Assistant Minister of Local Government and Rural Development, Olebile Gaborone, Botswana has developed a National Broadband Strategy to improve the poor and unreliable network infrastructure. The National Broadband Strategy is a five year plan that is to address the shortage of the fixed and mobile broadband networks for all the ICT networks.

The government of Botswana is indeed putting in effort to ensure that everyone in Botswana is able to access the network. But however there are still some challenges in the Kgalagadi and Ngamiland which are wide spread districts with very rural areas. The country is already struggling to implement some of e-governance services. Kenya and Botswana are both developing countries connected to the WACS and EASSy cables. This has increased the number of internet users in both countries especially mobile phone internet users. Speed has increased since both countries invested this connection. The difference between the two countries is that in Kenya, this reduced the internet prices whilst in Botswana the prices still remain high.

mMoney

GSMA (2010) defines mMoney as "A service in which the mobile phone is used to access financial services." A customer needs to have a mobile wallet in order to access mMoney. According to ITU(2015), mMoney refers to financial transactions and services that can be carried out using a mobile device such as a mobile phone or tablet. These services may or may not be linked directly to a bank account. mMoney is sometimes referred to as branchless banking as it gives financial institutions a way in which to operate even in remote areas without the need for offices or ATM machines.

mMoney services mostly operate through human agents. The agent meets the customer and messages are sent to and from servers of financial institutions through mobile phones and physical cash are transferred between the agent and the customer. It is empirical that these transactions that occur between the mobile phone and the financial service server are secured. The greatest challenge for mMoney is that security is provided at the network layer only leaving the application layer vulnerable as no cryptography is implemented Panjwani (2011). Mobile phone operators in Botswana all offer these services. Orange has a service called Orange money whilst Mascom has a service called MyZaka. BeMobile also has its own mMoney service called Smega. First National Bank Botswana (FNB) also has a mMoney facility called FNB Ewallet. The FNB Ewallet contains the best of all worlds as it can connect to a bank account or just a mobile phone.

According to Mburu (2012), one in three Botswana is unbanked and hence needs a way to transact their money without a bank account. MMoney has been used all over the world, Kenya being the world leaders of mMoney through MPesa. Mburu (2012) highlights, that Kenya like Botswana is a developing country but the adoption rate of mobile banking in Botswana is slower than that of Kenya. Mburu (2012) further explains that population can also be a contributing factor to the adoption of mMoney as the economy of scale is impossible and thus the implementation passed on to the consumer becomes more expensive.

Google also has a mobile service known as Google Wallet. Google has disclosed that Google wallet security has been breached. Kerner(2012) states that the security vulnerabilities would allow a thief to gain access to the funds available in Google Wallet provided the thief is in physical possession of a phone that has not been protected with a screen lock. This clearly indicates that challenges are grave when it comes to mMoney services. It is essential to explore the security measures put in place in Botswana as compare to countries like Kenya. According to Panjwani (2011) M-Pesa uses a custom SIM Tool Kit (STK) to secure messages between a client's phone and the server. There isn't much information about the security algorithms that mMoney service providers use but the recent attacks on M-Pesa showed that it does not guarantee end to end user security. Other mMoney services rely on the GSM security suite but it known to be quite weak and its weakness are what can be used to attack mMoney services. There is however little literature on the application layer security of mMoney and in Botswana it is not quite clear what security the mobile service providers are using Panjwani (2011).

mHealth

The World Health Organization (WHO) defines mHealth as "a medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices." MHealth uses the SMS, GPRS, 3G/4G, GPS and Bluetooth functionalities of a mobile phone. According to the World Health Report (WHO) (2011) higher income countries have more mHealth activities than lower income projects. The report further states that European countries are the most active when compared to African countries. mHealth is often implemented through the use of voice communications which is why most countries only use it for call centers. Other essential services of mHealth such as using mHealth for surveillance and decision making are not being implemented primarily because they require infrastructure which can be expensive to implement. One of the factors that limit mHealth adoption is data security. There lies an issue with the message transmission security and data storage security. (World Health Report (WHO) (2011)).

In Botswana the e-governance infrastructure is still being set up and not much research has been carried out on the e-governance hence there is not a lot of research on mobile governance in Botswana. Some mobile government services have however been put in place. For example students in Botswana are able to get their school results via their cell phones. Some of the limitations that lie with e- Government are lack of trust and limited education levels of a greater portion of the population. Considering that more Botswana own a cell phone as compared to a personal computer, one of the e-government services that will be highly used will be mobile government (Bwalya et al, 2009).

The Maitlamo policy outlined seven pillars that being e-governance, e-legislation, e-commerce, e-education, e-agriculture, e-tourism and e-health. All these pillars can be implemented to mobile government. For the purpose of this research the focus will be on mHealth and mMoney. According to the Braw (2014) developing countries like Botswana, with their less extensive healthcare infrastructure, would benefit greatly from mHealth but they're only predicted to account for a small share of the market, in Africa's case 5% by 2017. The smart phone penetration in developing countries is expected to climb from today's average of 8% but since they are still not a massive market for smart phone they may get left behind. Another challenge that developing countries face is the undependable signal strength. Braw (2014)

According to Tebogo (2014) M-health will provide convenient interactions between patients and practitioners as well as the ability to monitor patients continually in a non-intrusive way. mHealth is a tool that can be used to get quality and accurate health data. Data collection is a problem for developing and undeveloped countries such as Botswana. Accurate health data is essential in that it is a way in which health care can be evaluated. In most developing countries collecting data is currently a big problem and the data collected often tends to be inaccurate as this data is collected through face to face interviews and pen to paper methods. These do not prove to only be inaccurate but may also be costly. (Velthoven et al, 2013)

According to WHO other countries in Africa have successfully implemented mHealth projects. Zimbabwe a developing country like Botswana has successfully implemented an appointment reminder for HIV/AIDS, TB, cholera, and influenza homecare patients in rural areas. Using mHealth to remind clients of their appointments could help reduce the number of missed appointments. A study conducted in Brazil showed 7890 SMS reminders sent to patients through a clinic web software system and the study indicated that the number of patients who did not turn up was quite low.

In Botswana's health system setting up of appointments at public health centers is still an upcoming development. Currently appointments are being made for Pre-natal cases, post-natal cases and HIV/AIDS patients. But a study was conducted to send SMS reminders to patients to remind them to take their anti-retroviral medication. A mHealth system that would remind patients of appointments will come in very handy in improving the service at health care centers where people often have to queue for hours while waiting for their turn. According to WHO for appointment reminder to work the mobile penetration should be good as well as the network (WHO, 2011).

According to (Keetile et al, 2013) the Ministry of Health shows that over the past 18 years there has been an increase in the number of patients suffering from Hypertension. Now the government of Botswana's health system is already burdened with the scourge of HIV/AIDS hence a burden of hypertension ought to be removed. In the United States of America 1/3 of the adult population own a blood pressure monitor hence people don't often have to go to the doctor unless there is a need. This culture in the USA has grown so much that even adults who were never diagnosed with Hypertension own a blood pressure monitor to ensure that any future risks of hypertension are discovered in time (Depra, 2014).

Currently in Botswana hypertension monitoring is mainly done from clinics which at times are too far for patients to reach it. At times patients have to have to wait for a sometime before their High blood pressure is monitored after walking a couple of kilometers to reach the clinic. This brings a question to the accuracy of the measuring as not all patients are willing to wait. In developed countries wearable bands such as "H2" will monitor the patient's blood pressure and send the results to their smart phone and it will be sent to a server and in case the patient requires intervention from a medical practitioner the patient will be given an appointment. In developing countries like Botswana such a service is a necessity as patients would not be force to travel long distances to just check their blood pressure. Cameroon has a telemedicine programme that monitors hypertension. It is reported that telemedicine requires advanced high speed technologies such as 3G/4G and GPRS. This is a challenge developing countries like Botswana.

Ghana has implemented a telemedicine programme as well called MDNet which allows doctors to communicate to each other free of charge. MDNet's main aim was to reduce the number of referral hence one health worker can communicate with a specialist via text, email or voice to have them diagnoses a patient. The major success contributing factor has been the cooperation between the service providers in Kenya and its advanced network infrastructure.

According to the (Cargo, 2013) South Africa is one country that is taking full advantage of mHealth. (Cargo, 2013) also denotes that mHealth services can be used to cater for the following services: Client education and behavior change communication, Sensors and point-of-care diagnostics, Registries and vital events tracking, Data collection and reporting, Electronic health records, Human resource management, Supply chain management, Financial transactions and incentives, Electronic decision support – information, protocols, algorithms, checklists, Provider-to-provider communication, Provider training and education and Provider work planning and scheduling (Cargo, 2013).

III. Research Procedure

The main aim of this research was to assess the mobile security and network challenges faced by Botswana as a developing country in adopting mHealth and mMoney services. This assessment was done using both Primary research and secondary research. Secondary research gave an insight of what other countries are doing to address mobile security and how their network infrastructures are set up to ensure that these services are correctly used with little exploitation and at the same time can reach all service users.

Ethical considerations

The principal consideration of an ethical nature in relation to this research programme was the potential sensitivity of the information before processed by mobile apps (i.e. health records and financial data). Before research was carried out permission was sourced from those involved and a letter of permission was written and given to participating organizations. Questionnaire participants were given a written brief which they were to read before taking the questionnaire. The questionnaires were anonymous to protect the participant's confidentiality. Participants took the questionnaire and the interview voluntarily. Interviews were conducted face to face with the participants during their time of work. The findings in this paper are reported with honesty even for conflicting results.

3.1 Proposed Approach

Data was collected from four groups of participants being participants from the general population in rural, urban and farms/lands, experts in mHealth and mMoney, health workers and mMoney agents. The collected data is analyzed to answer the research questions earlier highlighted.

Summary of data collected

The data was collected using interview and questionnaires. The questionnaire collected opinions of the general population and the interviews got expert views on the subject matter. The interviews supported the questionnaire in that it elaborated the questions that were asked in the questionnaire.

1.3.1. Interview

The interviews were given over a period of 3 months. All the interviews given were successful and all questions were answered. All interviews were conducted face to face with the interviewees hence the interviewer was able to clarify all questions. Appendix 2 shows interview structure and the interview results. All interviews were recorded during the interviews and later on transcribed.

1.3.2. Questionnaire

A questionnaire was also given to 150 participants over a period of 3 months. A random selection was used to pick the participants. The questionnaire was given to participants aged over 18 years and could read and write the English language. 100 of the questionnaires were online questionnaires. The same questionnaire was taken and printed and given to another 50 participants who did not have access to a computer or internet access. A link was sent to 75 participants in Gaborone, the Capital city of Botswana and another were given to 60 questionnaires were given to participants in Otse a small village 60 km from Gaborone. And 10 questionnaires were distributed in Mmanoko a farming area in the South Eastern part of Botswana. Age, gender and education were not considered when distributing the questionnaire. But from the 150 questionnaire given only 97 participants completed the questionnaire. The response rate was 65%. The online questionnaire was done using Google forms and after the paper questionnaires were complete they were captured in to the online questionnaire response sheet. Table 1 tells details of the questionnaire participant.

Location	Qualification							Total
	Certificate Level	Degree	Diploma	JC	Masters/ Postgraduate	PHD	BGCSE	
City/Town	3	17	11			2	31	64
Student								
18 to 24		3	2	0			31	36
25 to 34	3		7					10
Unemployed								
18 to 24		4						4
25 to 34		6	2					8
Work fulltime								
25 to 34		4						4
55 to 64						2		2
Lands/Farm		2		4				6
Unemployed								
25 to 34		2						2
65 to 74				2				2
Part Time								
25 to 34				2				2
Village		8	8	4	2		5	27
Student								
18 to 24		6	4				1	11
Unemployed								
18 to 24				2				2
25 to 34			2					2
55 to 64				2				2
Full time								
25 to 34					2			2
35 to 44		2					2	4
45 to 54			2					2
Part Time								
25 to 34							2	2
Total								97

Table 1 Breakdown of Questionnaire by Location, age and employment status

3.2 Data Analysis

The Adoption of mMoney and mHealth and the security challenges posed in Botswana is analyzed as per the below sections.

3.2.1 Findings on Adoption of mMoney and mHealth

In order to achieve all the objectives set for this dissertation it was essential to first identify the current status of both advanced networking technologies in Botswana. The findings are given below:

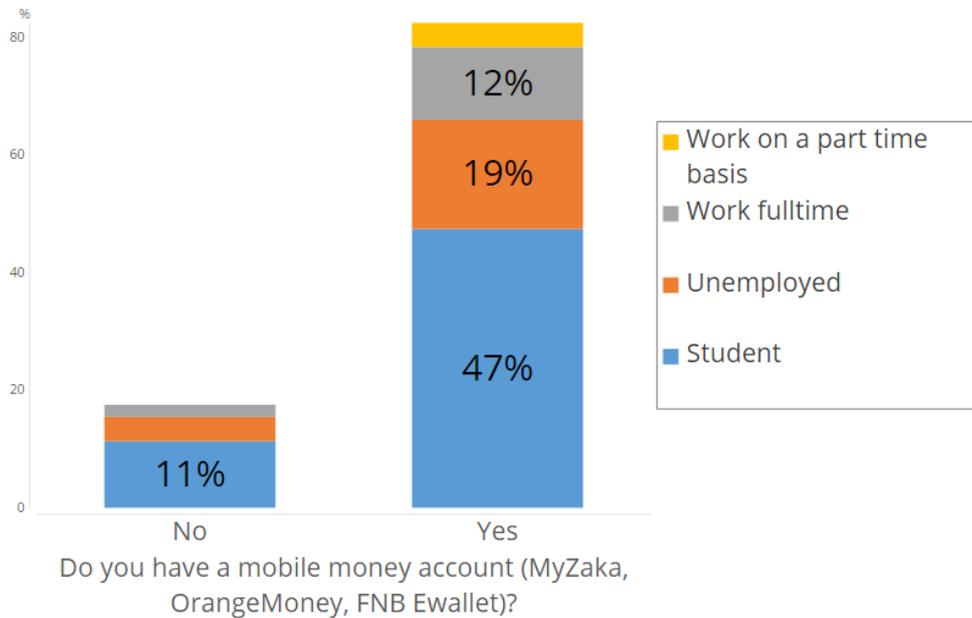


Figure 1 Adoption of mMoney services by employment

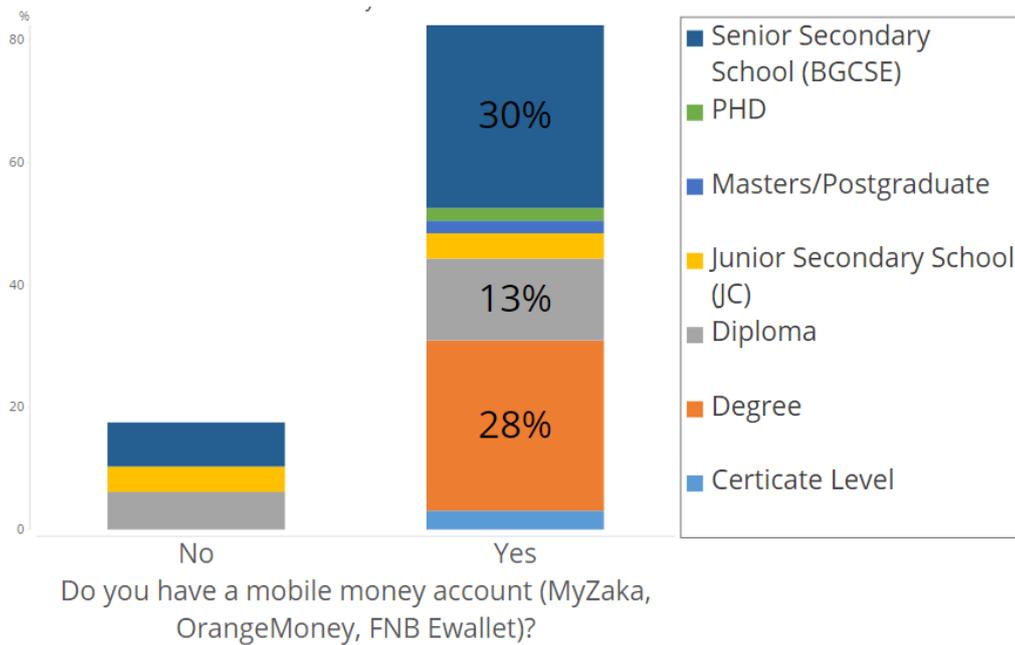


Figure 1 Adoption of mMoney education

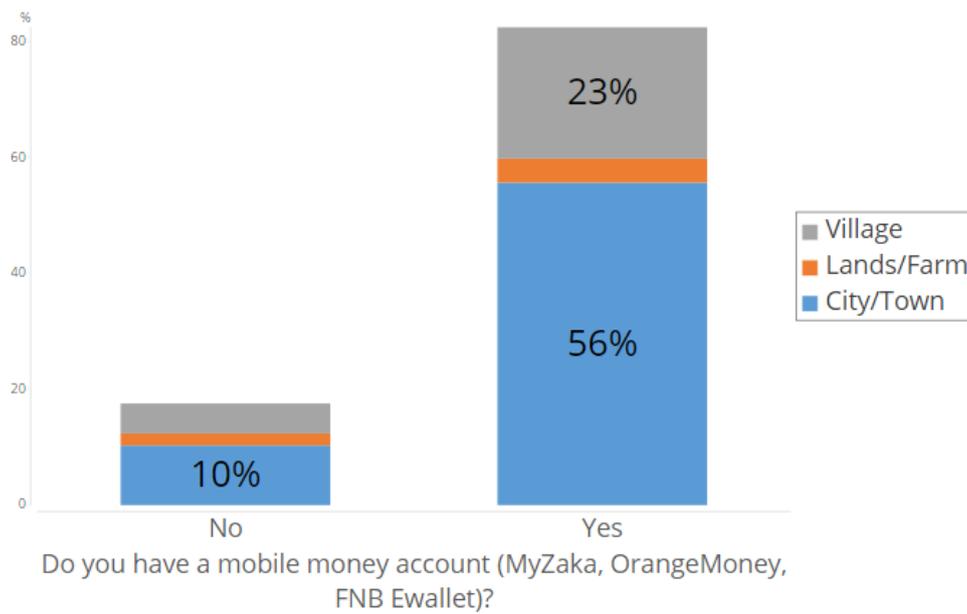


Figure.2 Adoption of mMoney by location

Do you have a mobile money account (MyZaka, OrangeMoney, FNB Ewallet)?

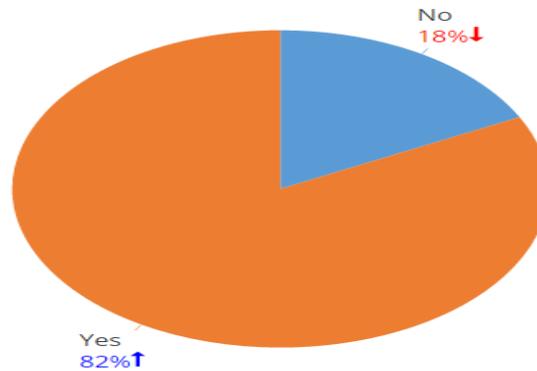


Figure 3 Respondents who own a mMoney account

Figure 1 Shows that from the questionnaire most of the respondents own a mobile account. People who have part time jobs all owned a mMoney accounts and from the literature review, it has been shown that people with low incomes often opt to own a mMoney account. Figure 2 goes on to further shows that the adoption rate is low for people with the lowest qualification who are Junior Certificate leavers. According to the literature review, one of the factors that hinder adoption of mMoney is illiteracy and this goes on further to prove this phenomenon as correct. Figure 3 suggests that people from cities, villages and farms own a mMoney account. Hence based on the collected data illustrated in Figure 4 a majority of the respondents have adapted well to mMoney though according to Appendix 3 users underutilize mMoney accounts as they are mainly used to purchase airtime. Further research would, however, be necessary to verify that indeed the respondents underutilize mMoney.

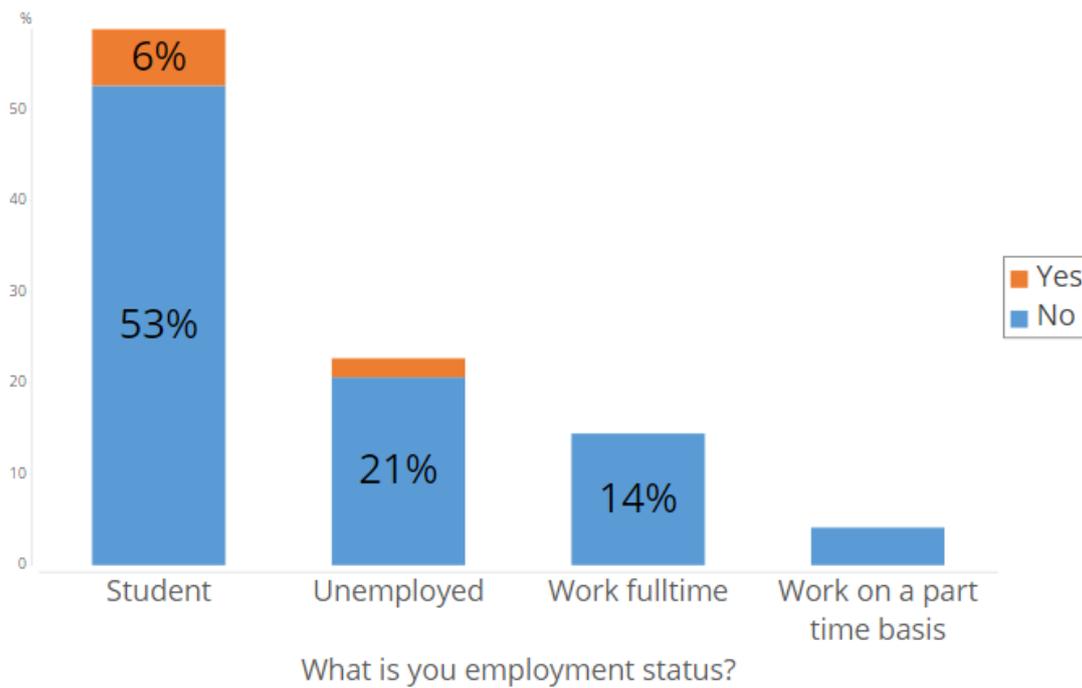


Figure 4 mHealth Knowledge by employment

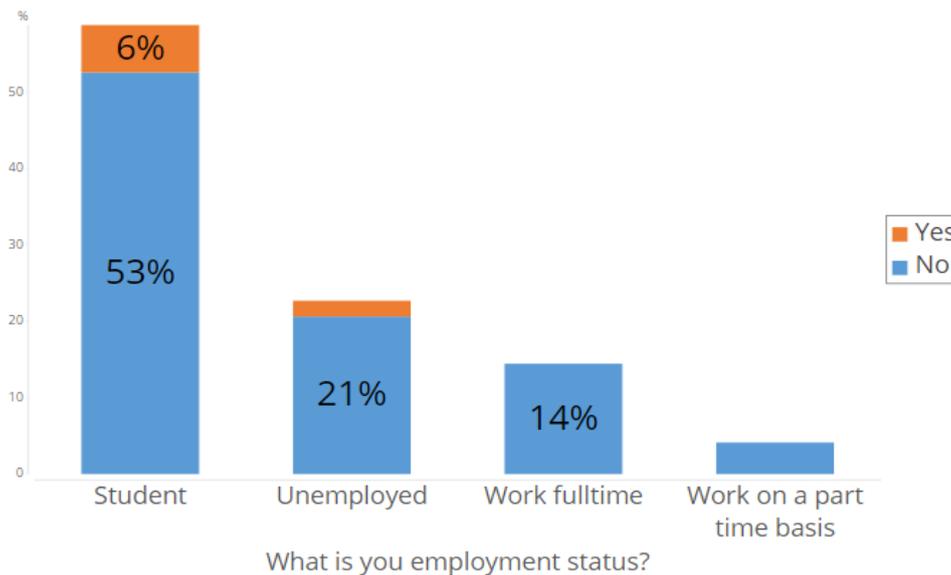


Figure 5 mHealth Knowledge by location

Figure 5 shows that a majority of the respondents were not aware of the concept of mHealth. However, when the respondents were further asked if there is any way that their mobile phone may be assisting them with their health, 69% of the respondents do use their mobile phones to monitor their health. This shows that though the respondents do not know of the word “mHealth”, they do engage in this advanced networking technology. Figure 6 below illustrates this. Figure 7 and 8 show that mHealth is common amongst people aged 18 to 24 years and they have a mHealth applications installed on their mobile phones. The same trend is followed by people aged 25 years to 34 years. Findings on security challenges for mHealth and mMoney. An Evaluation report on mHealth Adoption Barriers particularly on Privacy and Regulation by Vodafone (2013) indicates that there is a body of knowledge that suggests there is no proper structure in individual consent to use patient’s personal data in MHealth. With knowledge of this, the respondents were asked if they are aware of the risks they are faced when they share information about their health through mobile applications and the responses were as show in Figure 9.

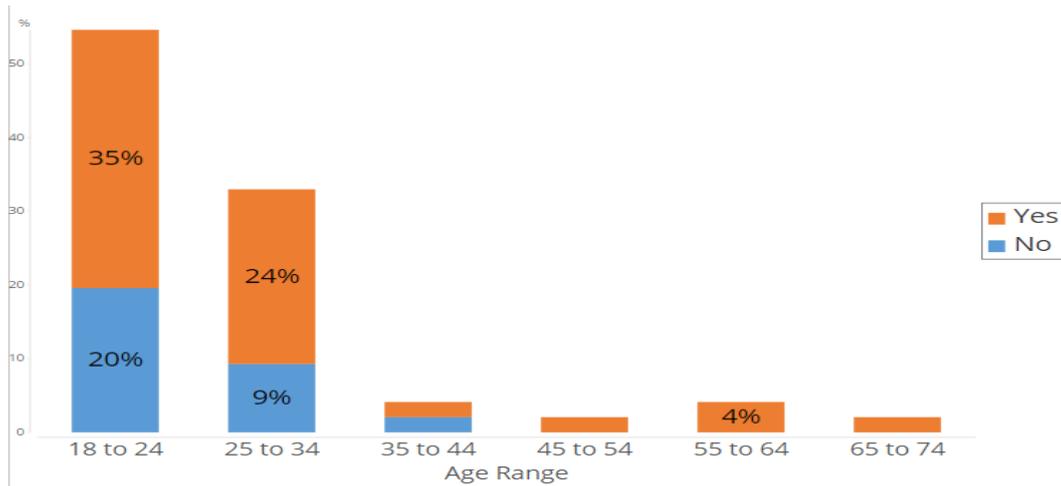


Figure 6 Response whether mobile phones assist the respondent monitors their health by age

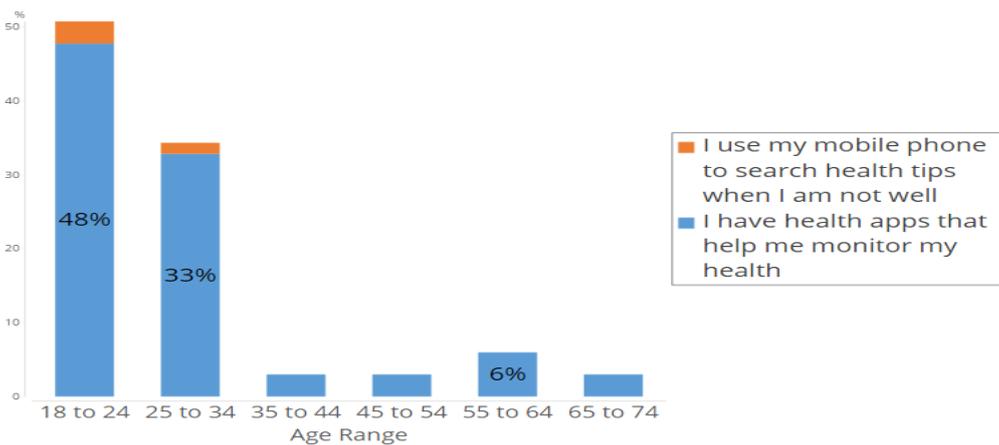


Figure 7 Purposes for mHealth by age

This shows that 88% of mHealth users are unaware of the risks involved in sharing their mobile information through the mHealth apps they use. According to (Hogben et al,2010) most mobile applications have privacy settings but since many users are unaware or forget that their data is going to be transmitted by using these mobile applications they do not take advantage of these feature in mobile apps. The assumption is that if 88% of the respondents are unaware of the risks involved in sharing their data through mobile applications then they face a great risk of having their information wrongly used.

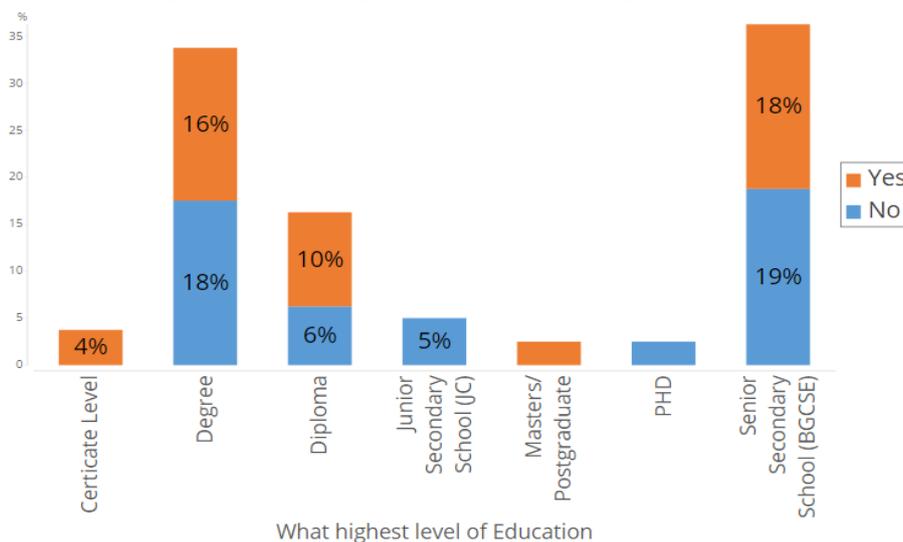


Figure 8 Are the respondents aware of the risks involved in sharing their health information by Qualification

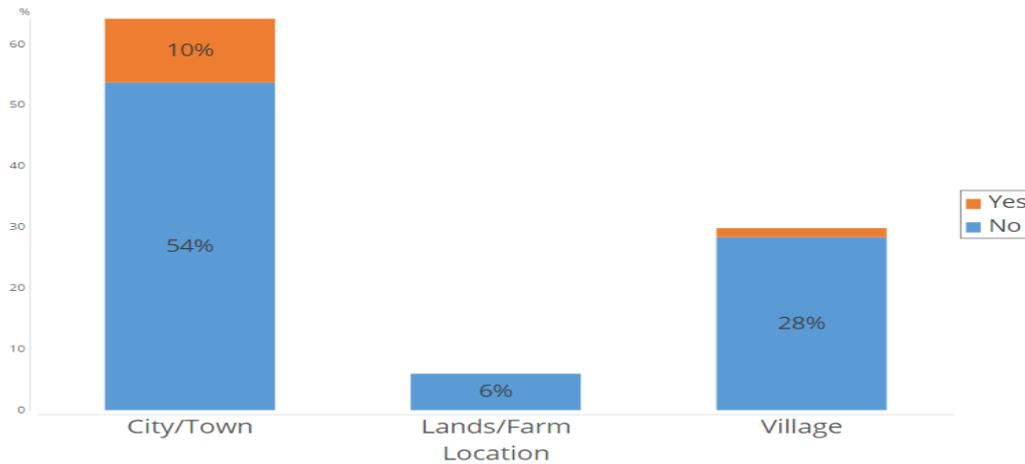


Figure 9 Are the respondents aware of the risks involved in sharing their health information by Location

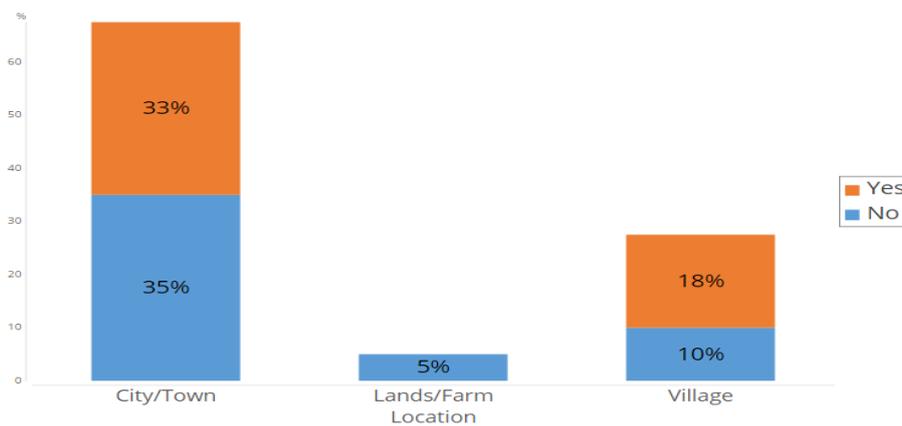


Figure 10 Are the respondents aware of the risks involved in mMoney based on location?

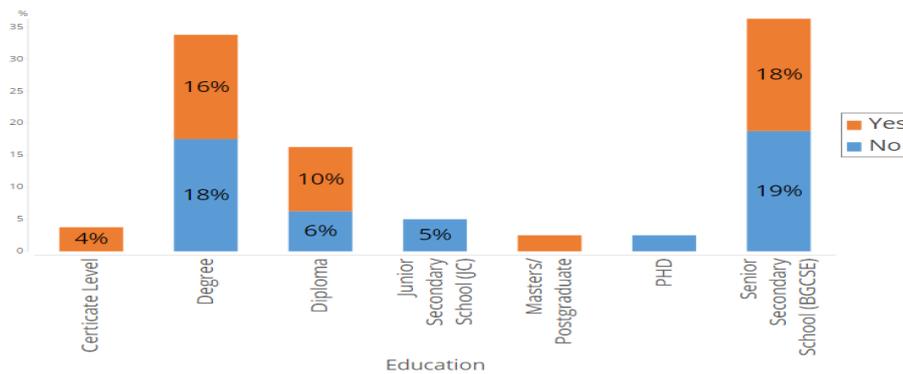


Figure 11 Are the respondents aware of the risks involved in mMoney based on education?

Figure 11 illustrates that only 50% of the respondents across all the three locations selected were aware of the risks involved in using mMoney. This must mean that 50% of the respondents are prone to being attacked. Appendix 5 shows results of an interview with four mMoney agents. When the agents were asked about the security challenges that exist in mMoney they indicated that the mMoney clients were the ones faced with the most risk as they are too free to pass on their mMoney credentials. Figure 12 shows that people with the lowest level of education are at the most risk as they are not aware of the risks involved in mMoney. From the respondents, all 5% of the Junior Certificate (JC) leavers were unaware of the risks of mMoney. And there was a significant increase in the percentage of respondents as the education levels further progressed. However when we got to Ph.D. holders none of the respondents were aware of the risks in using mMoney. Ph.D holders in the survey are within the age range of 45 to 54 years old as per Table 1. Figure 11 in comparison with Figure 12 illustrates that respondents are more aware of the risks involved in mMoney than mHealth. Figure 15 illustrates percentage of mobile device owned.

Should you loose your phone are you aware of the measures you should take to protect your information?

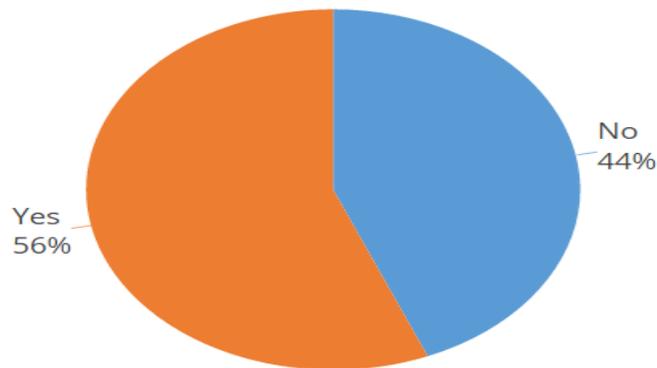


Figure12 Are the respondents aware of what they should do should they lose their mobile phone?

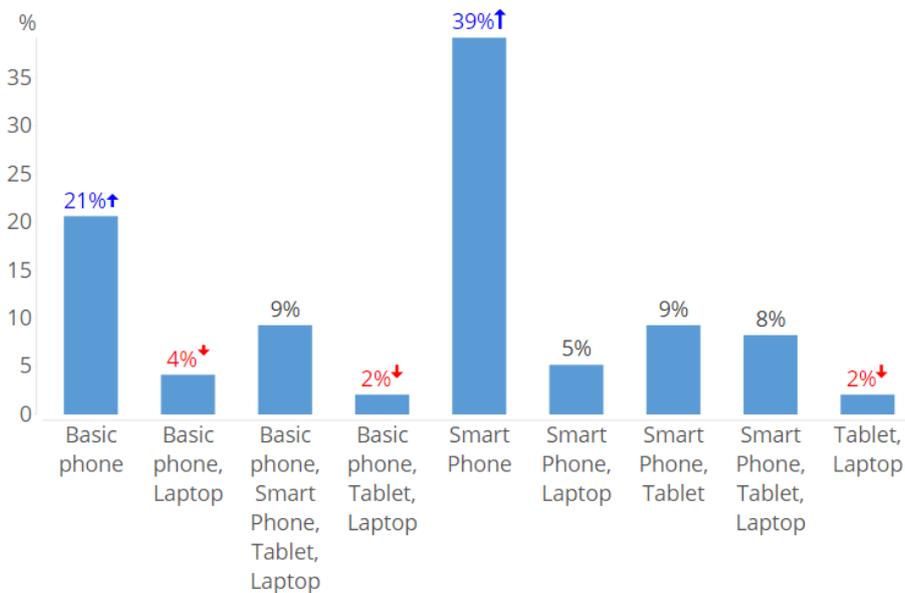


Figure 13 Mobile devices owned

1.3.3. Findings on network challenges for mHealth and mMoney

According to Nkwe (2012) some of the challenges facing e-government implementation in Botswana is that there is a low level of internet penetration and also lack of a proper communication infrastructure. According to the questionnaire respondents, 60% of the respondents in cities indicated that the network was fairly accessible and in farms and lands 50% showed that the network accessibility is quite a challenge whilst in villages 55% showed that it is fairly accessible shown in Figure 15. This shows that in villages and cities the network is fairly accessible whilst in farms and lands there is a more serious problem accessing the mMoney services. This is a challenge in that mMoney services should assist the unbanked and the people in farms and lands should be the core users of mMoney services.

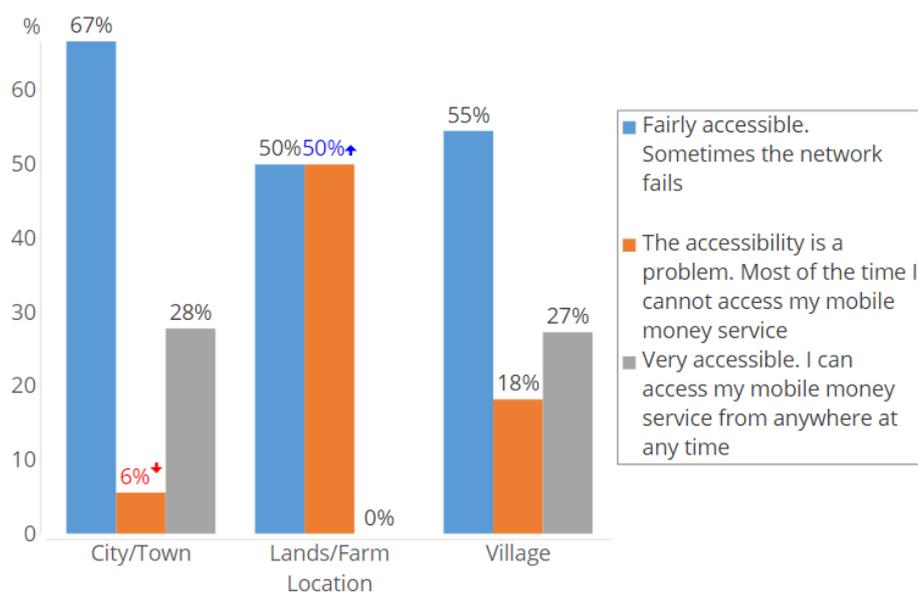


Figure 15 mMoney Network accessibility

IV. Conclusion

The analysis showed that though there are issues with mMoney, this is not obviously inhibiting the growth in its use. Users also seem relatively unaware of the risks involved in mMoney, which might explain why it has not affected the adoption of this technology. At the time of this research no incidents of mMoney hacking or fraud had been reported in Botswana as per the literature review and also as per the survey participants in Botswana. There has been no need thus for Botswana do not put much thought into mMoney security. This however does not mean that they are completely safe from mMoney threats.

Though mMoney is growing in Botswana, it is from a very low base and so may not have reached the critical mass required for criminals to achieve necessary return on investment. But as the numbers increase like in countries like Kenya, there is a chance that more criminals are likely to target the mMoney industry in Botswana. It is therefore important that an awareness of the risks that come with mMoney be created.

The Advanced Networking technology, mHealth is still a very new phenomenon in Botswana with not more than two projects being piloted at national level. From the participants of the questionnaire, they use mHealth applications in their cell phones. However, the hindering factor is that they are also not aware of the risks involved in using these applications. mHealth applications have privacy settings but unfortunately if the users are not aware of them or the risks they are not likely to enable these settings. The integrity of data is a challenge for mHealth not just in Botswana but around the world. Laws governing the security of mobile data are still lacking and no proper policies are set around mHealth.

From the literature review it became apparent that some areas in Botswana face serious problems with the network. These areas do not have access to even cell phone reception. Through initiatives such as Nteletsia II government is trying to bridge this gap but still the issue is not fully resolved as of now. In these areas it is impossible to use the services of mHealth nor mMoney yet these are the places that need these services the most as they are far from towns and cities. From the survey it was apparent that even in areas where network availability should not be an issue mMoney services were still not available at all times. Also from the literature it became apparent that Botswana has an out dated network infrastructure. Government has secured under water fiber cables but the price of internet is still amongst the highest in Africa. This will impact the use of mHealth as it requires high speed bandwidth accessible at all times for it to be successfully implemented.

Kenya and Ghana are developing countries like Botswana but they have been able to fully utilize both mMoney and mHealth products successfully. This is because their service providers are alert of the risks that can occur in mMoney and mMoney agents are educated about these. Also the network policies set between network service providers are more reasonable hence they are able to provide and cover a wider area of network. Their internet prices are low hence users are able to access advanced networking technologies such as mHealth and mMoney.

Looking at the results from the objectives it is clear that security may not be hindering technology of mMoney but however it can be a setback. mHealth neither because the adoption rate is still low hence users have not been able to encounter or even think of the security of this technology advanced networking technology. Network availability is however a major issue. People need to be able to access a service at all times for them to gain trust on it.

V. Recommendations

For the successful adoption of mHealth and mMoney, the following recommendations were made:

1. People should be made aware of the risks involved in using mMoney and mHealth and educated on how they can mitigate these risks.
2. The cybercrime law in Botswana out to be reviewed and updated to cater for current threats in mobile technologies.
3. To reduce the cost of internet in Botswana the policies on infrastructure sharing should be reviewed between service providers should be reviewed.
4. The implementation of the Nteletsa II project should be speedup as this is the only way that areas without network connectivity will be reached. The Nteletsa II project aims at maintaining network infrastructure, mainly the mobile infrastructure in rural areas. The project was set to be completed by 2011 October for 197 communities but to date this has not been completed. The completion of this project will address lack of network accessibility in rural areas thus allowing for implementation of mMoney and mHealth.
5. Networks should be set for all health care centers in the country. Internet should be setup at these health centers to allow medical practitioners to conduct necessary research. The network setup should enable wireless connectivity and allow for health workers to access the networks through their own mobile phones.
6. Network providers should come up with easy payment plans to ensure that more people own smart phones to as compared to feature phones because this will make it easier to access advanced network technologies.

VI. Further Work

The network infrastructure and network security seem to not be the only factors that limit successful adoption of mHealth and mMoney in Botswana. There is a need to further investigate the other factors. The study was also conducted with a small number of participants and more participants would give a more accurate picture. Further work should include network speed testing and security testing to determine exactly how poor the network really is as well as how unsecure the mMoney services in Botswana are.

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