Assessing the e-Readiness of Marginalised Communities for e-Government Services: A Case of Oniipa, Namibia

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Abstract. A community network is highly regarded as an alternative method for extending services to marginalized communities. However, the success of community networks remains low as the host community often fails to take the ownership of such projects in a sustainable way. The literature recommends the use of baseline surveys and needs assessment to identify fundamental roles that could be played by a community network within a given society. It is argued that aligning community networks to the needs of the community could potentially contribute to their success. This study conducts a baseline survey with the aims of understanding key roles that a proposed community network could play within the context of e-Government and m-Government services provision. Community in Oniipa Town in Namibia was selected as a case study. It was found that the identified community had a poor electricity infrastructure, but an encouraging growth of mobile phone adoption, even though mobile phone credit is considered expensive. Despite these challenges, the community showed a keen interest in m-Government and e-Government services. Accordingly, the proposed community network shall engage the community through a human-centered design methodology in an effort to develop e-Government services suitable for the community. The community network shall rely on solar energy and the use of e-Government and m-Government is expected to reduce population mobility in search of government services something that could reflect positively on climate.

Keywords: Community network · Connectivity · Electricity · e-Government · m-Government · Information and Communication Technologies (ICTs) · Rural areas

1 Introduction

Information and Communication Technologies (ICTs) are a critical strategic resource that can be used to promote social and economic development initiatives in rural (marginalised) communities [1]. They keep families connected by facilitating communication and enable access to a multitude of services at a lower cost [1, 2]. However,

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marginalised communities are often characterised by a poor ICT infrastructure as they are considered a less appealing market for ICTs [2]. This is partly because of the remote locations of the marginalised communities with less infrastructure, roads, and even lower literacy rates. Accordingly, researchers are contemplating various approaches for using ICTs to extend government services more equally to citizens in marginalised and rural communities. The use of mobile phones and community networks has the potential to promote "a people-centered, inclusive and development-oriented Information Society" [3, p. 118]. Stork, Calandro and Gillwald [4] reports of a steady growth in the use of mobile phones to access the internet in Africa. Ochara and Mawela [5] went on to argue that mobile government (m-Government) has the potential of bridging the digital divide between citizens of different social standing [5]. Thus, with m-Government, citizens with access to mobile phones can equally access government services through. Similarly, previous studies motivate the use of community networks as a viable way for extending the sustainability of ICTs access projects to marginal communities [2, 3, 6]. Nonetheless, community networks have recorded a low rate of success in marginalised communities of developing countries where they have been implemented [2]. Lack of project ownership by the community as a result of not using bottom-up methodologies when implementing community networks is one of the reasons that has led to the failure of community networks [2]. This is further complicated by a failure to understand fundamental needs of the local community members when deploying a community network [1].

This calls for initiating community networks with the conducting of needs or electronic readiness (e-Readiness) assessment [1, 2]. Pade-Khene, Mallinson and Sewry [1] marked the beginning of a community network (Siyakhula Living Lab) with a baseline survey to understand the context and level of e-Readiness. Similarly, the Mankosi community network had its needs assessment done prior to commencement in 2012 [2]. In addition, such efforts paves way for human-centred design Information and Technology (IT) projects. Accordingly, this study presents an e-Readiness assessment of a marginal community (Oniipa town council) that was identified as the host of a community network courtesy of the ongoing Fusion Grid research project. Fusion Grid research project focuses on extending ICTs and related supporting infrastructure, being off-grid electricity to marginalised communities. Findings from this study are expected to guide the direction for the full rollout of the community network research project. The project aims to use solar-powered ICT infrastructure for internet access and off-grid power system for electricity distribution as described in [7, 8]. The technology base used in the project is integrated with off-the-shelf components, introducing a less complex, modular, Plug and Play concept that suits rural communities that are characterized by un-skilled individuals.

2 Literature Review

This section explains community networks and goes on to explore measures of e-Readiness.

2.1 Community Networks

A community network is a decentralised information and communication network that is built, owned and/or operated by a community [3, 6]. The government; independent individuals; the private sector often come into such projects as the project sponsors who help raise funds for the infrastructure. For example, the Siyakhula Living Lab (SLL), established in 2009, is a collaboration between universities (Rhodes University and the University of Fort Hare), the South African Department of Trade and Industry (Technology and Human Resources for Industry Programme (THRIP)), the Cooperation Framework on Innovation Systems between Finland and South Africa, the Meraka Institute and the Nokia Siemens Networks [1]. SLL facilitates the provisioning of new technology and skills to a selected marginalised community in South Africa. The SLL project made available computers and internet access to schools that were selected for the project. The Mankosi community network extended the use of a wireless mesh network to Mankosi community, a marginalized community in the Eastern Cape province of South Africa. The mesh network was used to facilitate communications (Voice over IP (VoIP) calls) using internet. The network used solar energy for powering up the ICT devices. The project was initiated through the University of Western Cape. However, members of the community participated as technicians, and took part in the setting up of the network [2]. Similarly, this study focused on the provision of a community network in Oniipa town council (OTC), Namibia. The study aims to use the Oniipa community to test the viability of implementing m-Government through a community network.

2.2 e-Readiness

SITA GovTech (2010) in Gumbo, Jere and Terzoli [9] define e-Readiness as a measure of the extent to which an identified organisation is prepared to engage and make use of ICT.

Fathian, Hoorali and Akhavan [10] shared a similar view by stating that e-Readiness is an organisation's ability to adopt, use and benefit from ICTs. This implies that a marginalised community's e-Readiness is the degree of its preparedness to adopt and use a community network. For sustainability purposes, a community taking part in a community network would need to own the network and use it to its benefit. Measures of e-Readiness are diverse and often overlap from one to another. In general, measures of e-Readiness include the availability of the ICT infrastructure, the magnitude of the use of the ICTs, a local ICT economy, human capacity and a supportive policy framework [11]. However, Pade-Khene et al. [1] used different measures to evaluate the e-Readiness of a community to a community network. They suggested that if a community is to become a partner in a community network engagement, readiness would be determined by "existing communication patterns, information needs and values, and current technology and media use" [1, p. v]. In a community network project, findings from the initial assessment could be revisited in the future, and make comparisons to assess the impact of the community network. This study assumes measures used by Pade-Khene et al. [1] in assessing e-Readiness. The framework proposed by Pade-Khene et al. [1] was evaluated in a marginalised community that is comparable to the one considered in this study. In addition, their framework was used within the context of a community network, being

something that makes it suitable for this study. Accordingly, understanding existing communication patterns, information needs and values, and current technology and media use shall help to evaluate the impact of the research project on Oniipa town council as it influences the way the community members accept and access the government services by use of their mobile phones.

3 Methodology

A qualitative case study research methodology was used in this research. A community was identified to pilot test ICTs for a rural community. It should be noted that the community network research project reported in this study is a result of a collaboration between the industry, university and public sector. The three main pillars of the research project are electricity provision (solar PV-based power system integrated with energy storage; Lithium-ion batteries, and power electronics), connectivity (4G LTE mobile network base station), and digital services (electronic learning (eLearning), mobile payments, and e-Government or m-Government). Oniipa was identified and selected as the community for piloting the exploratory Fusion Grid concept platform, the case for this research. The research project is a 2.5 years long. In particular to ethical concerns, related Namibian Offices/Ministries/Agencies (OMAs) were engaged to gain approval for the research project to be hosted by Oniipa town council. Table 1 shows activities that were done in preparation of the Fusion Grid concept piloting in Namibia.

Table 1. Fusion Grid project initiation activities.

Dates	Activity	Outcome
April 2018	*Doing Business with Finland* seminar by Team Finland, visiting ministries and other beneficiaries in Namibia	Project approval, beneficiaries and key players identification
December 2018	Exploration of pilot sites, visits (including Oniipa Town Council)	Baseline survey-data collection and sites evaluation
February 2019	Fusion Grid Project and Oniipa Town Council Delegation Meeting	Discuss project pilot setup including electricity and connectivity provisions

Data gathered in this project was used for research purposes alone. The identity of participants was kept anonymous.

3.1 Data Collection and Analysis

This study focuses on the data gathered during the baseline survey. Data was gathered using a questionnaire with open and close ended questions prepared by the research group in the study. Randomly selected respondents from the Oniipa region were targeted. Descriptive statistics were used to analyze data that was gathered using close ended

questions. Qualitative data analysis techniques of content analysis was used in analyzing data that was gathered by use of open ended questions. Findings from each open ended question were categorized and grouped together. The analysis involved a comparison of views from different respondents.

3.2 The Study Site

Oniipa town council is located in Oshikoto region (province), north of Namibia. Oniipa town council has a population of approximately 30 000. Oniipa town council attained a town council status on the 3rd of April 2015. According to the Namibian Local Authorities Act, a town council is an urban settlement that can rely on its own financial resources to pay for part of its operations and does not have to rely on government support alone. The donor agents and the central government are expected to contribute additional funding for the operation of a town council. The status of a settlement is key to anticipating the level of service provision such as roads and infrastructure. It is important to realise that the growth of Namibian urban settlements were partly influenced by the developments in the colonial era. Oniipa town council is on the north of the Red Cordon Fence that was erected during the colonial era. During the apartheid rule by South Africa, the Red Cordon Fence divided Namibia into two, the north, dominated by villages (Bantustans) and the south dominated by urban settlements. This implied that the Bantustans, like Oniipa town council, were to be administered by Traditional Authorities with little or no government support while the southern part of Namibia was under the then homeland government. Furthermore, the Red Cordon Fence was used to control the movement of previously disadvantaged black populations to the southern urban settlements of Namibia. To date, out of Namibia's fourteen regions, it is those regions that are located in the north with a big proportion of rural areas that have the poorest people namely Kavango region (55.2%), Caprivi (50%) and Oshikoto (44%), home to Oniipa town council [13]. The level of poverty and poor infrastructure in Namibian rural areas make these regions less attractive for business investment especially those in the ICT sector. Figure 1 shows the location of Oniipa.

The overall terrain for Oniipa is mostly flat with silt to sandy soils. The environmental temperature is usually within the range of 3 to 31 °C with rainfall ranging between 400 and 450 mm per annum. The Namibia Statistic Agency [14] has suggested the Oshikoto region, home to Oniipa, to be a major player in communal agriculture. The Oshikoto region recorded the highest number of households that applied for agriculture loans between the years 2010 and 2015 [14]. This arguably explains the monthly average income of participants per month that is pegged at NAD $3761.29 (approximately US $266.18). A family based in Oniipa has an average size of six members. Furthermore, government departments that include health and education are major source of employment for the locals.

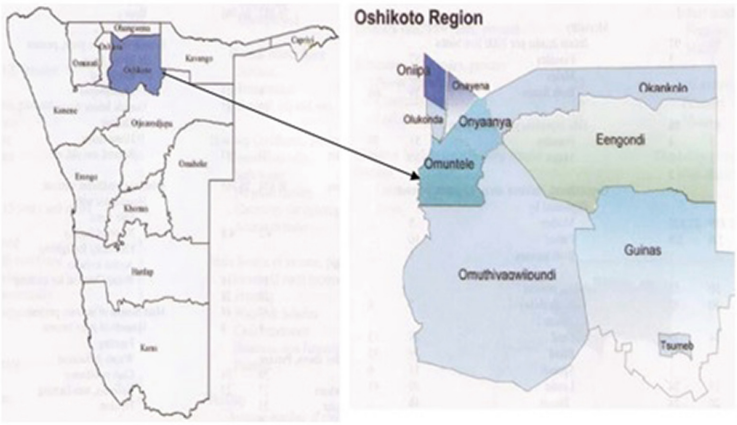

Fig. 1. Geographical location of Oniipa.

4 Results

A total of 100 questionnaires were distributed, hand delivered, and collected in Oniipa. Out of the delivered 100 questionnaires, 62 were completed (62%). In terms of gender distribution of respondents, 68% were female while the remaining were males (32%). The age distribution of respondents is shown in Fig. 2. The majority of respondents were more than 30 years old. The general trend in Namibia is that, the elderly are mostly found in the rural areas as the youth have migrated to urban settlements for educational or employment purposes [12].

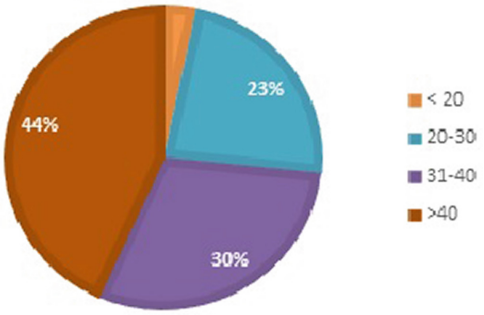

Fig. 2. Age distribution of respondents.

4.1 e-Readiness

Key findings on the level of e-Readiness of participants from Oniipa include access to education, current media and use, communication patterns, and the use of e-Government and m-Government.

Access to Education. The level of education in a society is considered one of the key measures of e-Readiness. Education promotes human capacity development, being something that promotes the adoption of new technologies and modern ways of doing things [11]. The majority of respondents from Oniipa town council indicated that they prefer to have access to education (61%). Approximately 83% of the respondents had formal education as shown in Fig. 3. The majority of respondents had metric (high school) and certificates or a diploma.

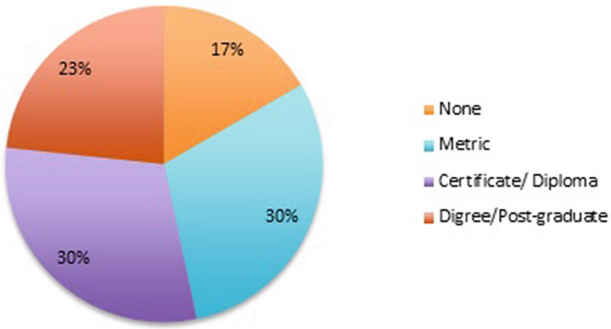

Fig. 3. Respondents' educational background.

Current Media and Use. Respondents were asked to indicate if they have access to electricity or their other source of energy, their ownership of selected household electrical goods and ICT devices. It was found that only 47% of the respondents had access to electricity. Accordingly, respondents were asked to indicate their sources of energy.

Figure 4 shows findings on source of energy for respondents from Oniipa town council. Only 38% indicated that they have access to the national electricity grid. Forty five percent of the respondents indicated that the question was not applicable suggesting that they neither use electricity, solar or a generator as a source of energy. This group most likely rely on firewood or charcoal. These results were corroborated by further findings showing that electricity access (81%) is the most preferred service by participants from Oniipa. This is followed by access to clean water (71%), healthcare (61%) and education (61%).

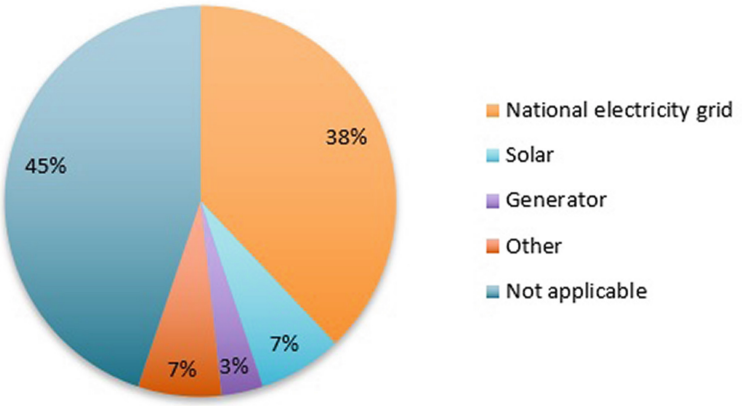

Fig. 4. Source of electricity.

In addition, respondents were asked to indicate electrical household goods they own. Figure 5 shows that a small proportion of the participants owned consumer appliances. This could be explained by a lack of access to electricity.

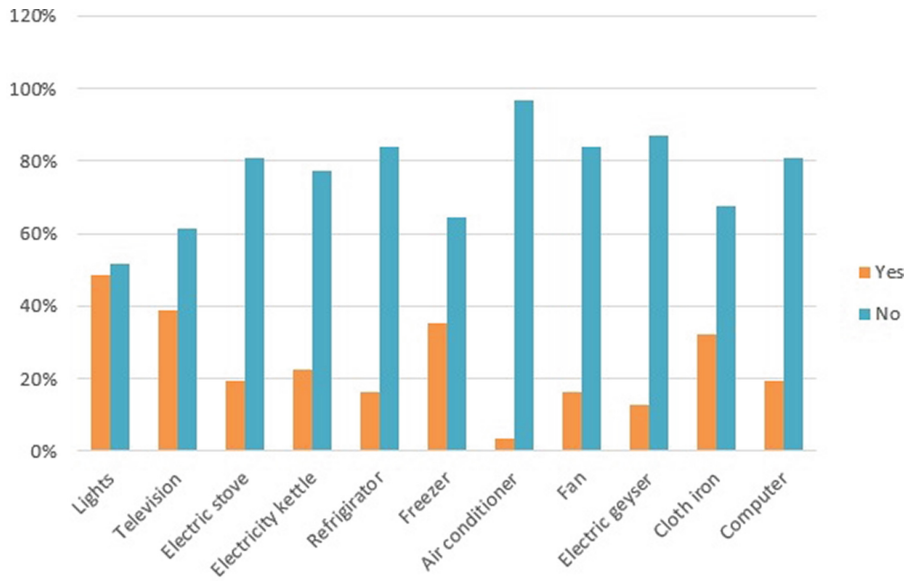

Fig. 5. Household goods owned by respondents.

However, respondents indicated that they either own or have access to ICT, namely radio (87%), mobile phone (74%), smart phone (58%) and a television set (52%) as shown in Fig. 6. When asked what they would prefer to own, respondents indicated that

they would prefer to have lights (77%) and a mobile phone (65%). Having internet access (52%), a radio (45%), television set (35%) and laptop/computer (19%) are surprisingly among the least preferred gadgets or ICTs.

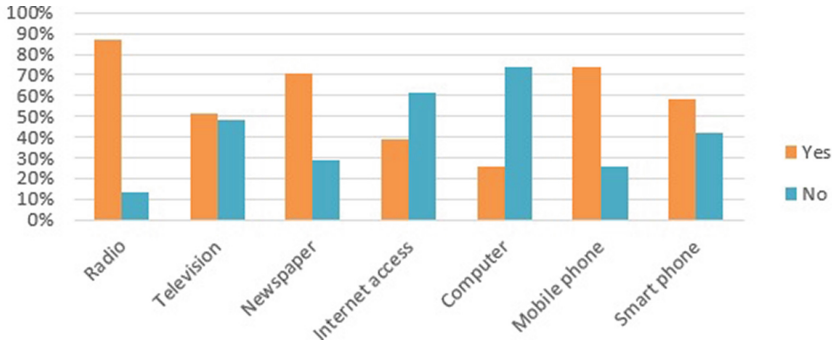

Fig. 6. ICT appliances and services owned or accessed by respondents.

Further data was gathered to establish how often respondents bought credit for their mobile phones. The majority (42%) of respondents indicated that they purchase credit on a weekly basis. Sixteen percent of the respondents indicated that they buy credit twice a week while the other sixteen percent indicated that they buy credit for mobile phones twice a month. Mobile phone credit is mainly (81%) used to communicate with family members, conducting business (45%) and making payments (35%), these being illustrated in Fig. 7.

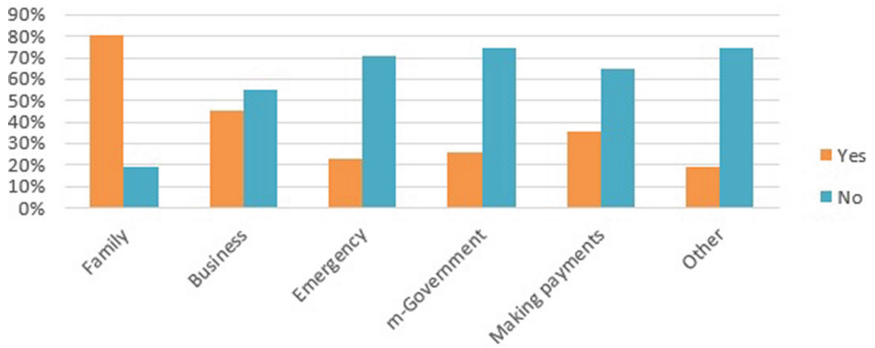

Fig. 7. Uses of mobile phones.

Communication Patterns. In addition, data was gathered to evaluate the existing communication patterns. If a community network is to be a success, project sponsors need to understand the need and use of ICTs within the community and explore ways of influencing user behaviour or seek to integrate ICTs with existing practices. Data on

communication patterns 1) within a village, 2) between villages and 3) within Namibia was gathered. Findings on communication patterns in these three cases are reported next:

1) Findings suggest that communication within a village is mainly by use of a mobile phone (87%) and word of mouth (74%). Internet (35%) and meetings (32%) are not often used. These findings might suggest that the use of mobile phones within the context are mainly based on text message or voice calls. Hence, one of the objectives of the community network, suggested by the study, could be promoting the use of internet. Figure 8 shows communication patterns within a village.

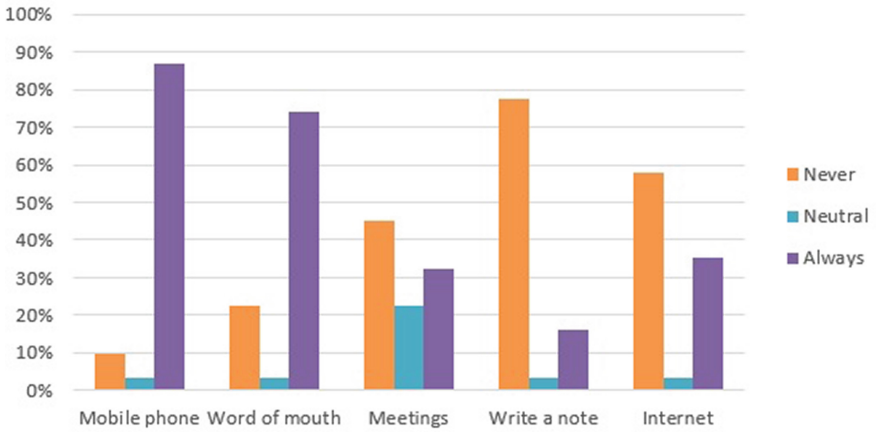

Fig. 8. Communication within the village.

2) Respondents were also asked to indicate communication patterns between villages. Results shows that mobile phones (87%) remained the popular form of communication followed by word of mouth (74%) and radio (74%). It has to be noted that there is a slight increase in the use of meetings for communication between villages. Respondents went on to indicate that the information on *"funerals, job opportunities, scholarship, outbreak diseases……. scholarship opportunity, jobs and terrorism news"* are examples of information often exchanged between villages. Similarly, another respondent indicated that they share *"information about health services [and] job opportunities."* Suggesting the use of word of mouth, another respondent indicated that they share *"hot gossips"*. Figure 9 show findings on communication between villages.

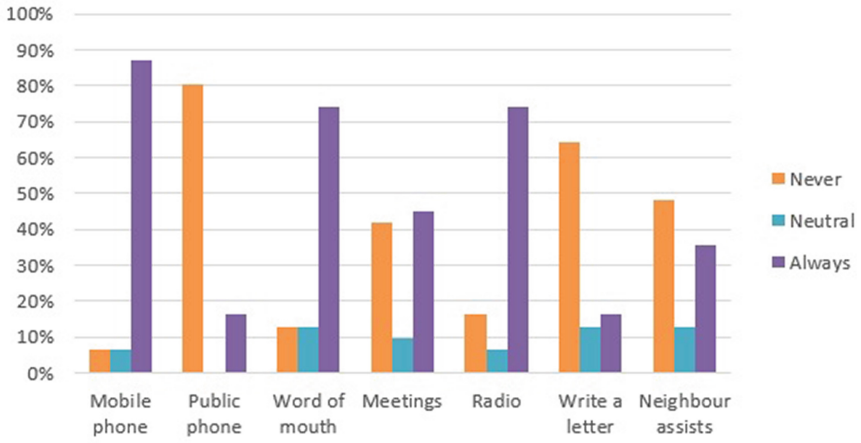

Fig. 9. Communication between villages.

3) Lastly, communication between people across Namibia relies on mobile phones and radio as shown in Fig. 10. News is the dominant piece of information found in communication across Namibia. One of the respondents suggested that we share *"whatever is going or happening in or out of the country"*. Another respondent adds that they share *"news, what is happening in the world and different news in my country"*.

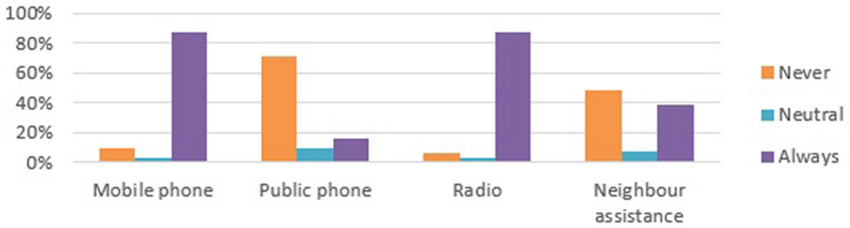

Fig. 10. Communication with people across Namibia.

e-Government Use by Marginalised Community. Data was gathered to establish e-Government and m-Government readiness of respondents. Study findings show a notable use of e-Government by respondents. For example, one of the respondents stated that he uses internet to pay *"for the municipality bills, applying for death, birth, Identification Document card/certificate"*. Similarly, another respondent stated that: *"It can be nice to pay bills online like electricity, water. Apply for services online than to go to the office for the queue"*. Another respondent stated that he access *"the government services in the internet"*. These findings suggest that some of the respondents are ready to use m-Government and e-Government services. It was also important to establish critical factors influencing one's readiness to e-Government and m-Government (Fig. 11). Social

influence is shown to have an influence towards m-Government as 52% strongly agreed that they would use m-Government if those around them used it. Ironically, only 32% indicated that they would not use m-Government (m-Gov) if those around them do not use the technology. However, a lot of respondents (77%) indicated that they do not use m-Government even though 65% expect it to be easy. Furthermore, respondents would need advice on m-Government use (58%) as they feel e-Government is less complicated than m-Government (58%). This could be down to the fact that respondents have little to no experience with m-Government and e-Government. In addition, there is a perception that m-Government would be expensive (58%). 61% of the respondents are of the opinion that mobile phone credit is expensive.

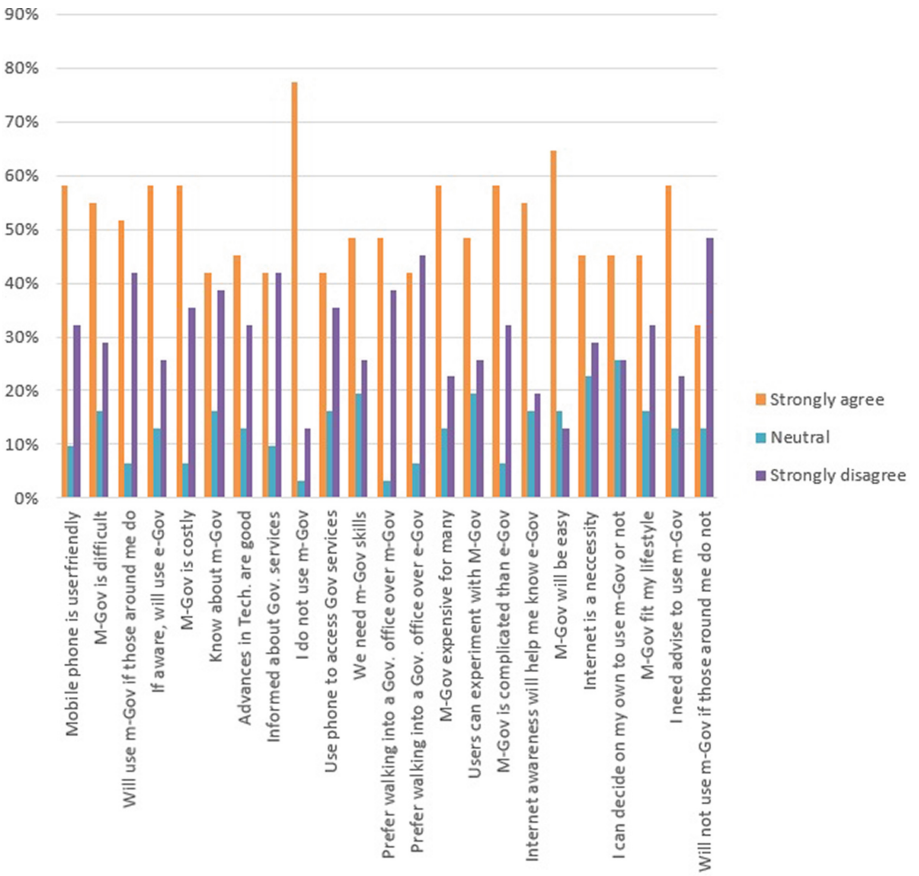

Fig. 11. m-Government and e-Government readiness of respondents.

5 Discussion

Marginalised communities are often excluded from accessing and using ICTs due to a number of factors, among them, a poor ICT infrastructure. The use of community networks is one of the ways for promoting ICTs growth and use in marginalised rural communities. This paper sought to enhance the success of a community network by conducting a pilot study in order to understand the needs of the community. The authors argue that enlisting suitable ICTs and aligning these to the needs of the community members will most likely promote sustainability of the project. Accordingly, findings from the base line survey were used to enlisting feasible services that could be extended through the community network to ensure beneficiaries to buy in. Environmental, socio-technical, economic and political factors were tabled in deliberating possible services that could be extended to Oniipa community through a community network. The following services were considered for the next steps to take in the study:

The Provisioning of Internet Connectivity. Results from data collection and analysis suggest a poor internet connectivity infrastructure in Oniipa and surrounding villages. So, the study proposed to offer connectivity via 4G/LTE base station, which in one key component of the Fusion Grid concept, and standard mobile phones operate as a customer end devices. *Expectations and the goal are that the concept platform continues its operation self-sustained by the community/new system operator even after the concept piloting period. To ensure self-sustainability, the systems considered in this study had respective business case models that highlighted potential benefits to the system owner/operator and/or community.* Internet connection shall be used to access other internet-based services that are available through the concept platform. A local mobile network operator; Telecom Namibia, was identified as a key partner to help with internet connectivity and later on support the sustainability of the project together with the community. The community is open to the possibility of free connectivity inside the base station coverage area. While this is interesting for a start, there are concerns that the interest towards connectivity was motivated by the fact that connectivity will be free during planned piloting period. As noted from the baseline survey, people from these rural communities have little disposable income.

The Provisioning of Electricity. Findings from data collection and analysis showed that electricity is the most preferred service by the Oniipa community. Thus, few participants indicated that they have access to the national electricity grid. Pade-Khene et al. [1] made a similar observation on Dwesa-Cwebe, a rural area in the Eastern Cape province of South Africa. However, it has to be noted that this finding comes as a surprise given that Oniipa is a town council where electricity provision is expected to be better. For sustainability, it was decided to engage the Oniipa town council as one of the sponsors in electricity provision. A modular off-grid system power cell, consisting of solar PV panels and Li-ion battery, with size of approximately 5 kW output power is suggested and planned to be implemented to one of the selected house of group of five houses, providing electricity to itself and four houses close by. It was noted that members of the Oniipa community owned few electric goods. Hence, power cell system with 5 kW as a starting power rating was considered adequate for basic and entry level needs of

charging mobile phones and possibly local computer servers, fridge, tv, radio and fans, small consumer appliances.

e-Government Services. e-Government services that could benefit the community were identified. Identification (ID) card application process and registration for death certificate systems were identified as possible solutions for the planned piloting period. It should be noted that so far people are travelling long distances, hitchhiking to and from government departments when applying for ID cards. Since it has been the traditional role and way of the government to offer IDs, it was decided to engage the government as one of the key players for e-Government. Another e-Government service that could be considered was online education; eLearning systems and/or applications. The government was also considered as a key player or sponsor for educational systems. It was resolved that local entrepreneurs could participate the development of websites and applications that could facilitate e-Government services. Alternatively, crowd funding or open source could be considered as alternative sources of funding. However, the observed major challenge in application development for e-Government was a lack of coding skills. While Namibia has good programmers, it was noted that the Namibian economy is yet to reach a state where it could sustain a lot of computer programmers. As such, locals may not be interested in pursuing entrepreneurial roles within these professions.

6 Conclusion

This study reported a baseline survey for the implementation of a community network in a marginalized community. It was found that electricity access remains a major challenge and accordingly, the highest priority of basic services to have in Oniipa town council. Furthermore, there appears to be a less interest in using internet. The majority of residence prefer to have access to electricity and own a mobile phone. The mobile phone is widely used as a communication tool locally, across villages and within Namibia. It is encouraging that respondents showed to have an interest in using m-Government and e-Government services. Respondents showed more interest in e-Government if there is awareness and the mobile phone is deemed affordable. In addition, culture might have a role in influencing the use of e-Government and m-Government services. These findings are critical for the proposed solution and its further plans described in the study that aims to address electricity, connectivity and digital services, including government service access challenges.

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