The context of ICT4D and development in rural areas: a case study of South Africa

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Abstract
Rural places are predominantly described as remote and sparsely populated areas outside urban centers where agriculture is the main economic activity. This paper reflects on the rurality classifications used by Statistics South Africa by exploring the link between improved public service delivery and ICT proliferation. The services referred to in the study are water, sanitation, education and health care. The study is based on a literature review and a statistical analysis on the central theme of ICTs and access to improved service delivery in South African rural places. Logistic regression models were fitted to the 2014 South African General Household Survey (GHS) data to investigate the significance of variables which determine access to Internet in rural households. The study showed that the education level of the household head and household income are the most influential factors in the determination of access to household Internet particularly in rural farm areas, while female headed households are more likely to have access to the Internet in both rural farm areas and rural tribal areas. The study also showed the significance of access to household electricity as a determinant of access to the Internet in tribal areas.

Keywords
ICTs, service delivery, rurality

Introduction
South Africa's Department of Rural Development and Land Reform (2009) describe rural South African areas as sparsely populated places where agriculture is a prominent activity and economic activities are focused on the production of food and raw materials.

As is the case in other developing countries, South African rural places are associated with poor service delivery (water, sanitation, electricity, education and health) because of economic disadvantages to providing services in vast areas with low population density. On the other hand, studies have shown that ICTs can be used to bridge distances and support development by introducing services in areas with sparse populations.

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> Established information and communications technologies (ICTs) include radio and television, while new ICTs relate specifically to mobile phones and the Internet...ICT represents the mobile network, and mobile tools used for data collection and analysis, and the technology (hardware, software and services) that expedites the data flow
> (Schouten 2013).

Heeks (2009) states that ICTs are the basis for development because they provide information without which development is not possible.

ICTs are quickly changing relationships, facilitating the measurement and monitoring of interventions, and enabling practitioners at a local level to use evidence to guide decision making for the equitable and sustainable extension of water, sanitation and hygiene services (Schouten 2013). This paper presents the findings of a study investigating the context of ICT proliferation and access to improved service delivery in South African rural places.

Study aim

Rurality is the extent to which an area bares the characteristics of rural places defined in a country. The concept of rurality changes as the defining features of rural places evolve with time. Emerging and improving ICTs characterize the current South African rural context. There have been various debates about how ICTs stimulate development in Africa. For example, some authors argue that there can be no development without information, ICTs improve the planning and management in development projects, and that information acquired through ICTs is important for development (Heeks (2009), Chapman & Slaymaker (2002)). On the other hand, Langmia (2005) argues that in a country like South Africa, rural communities cannot benefit from ICTs before the infrastructure which supports ICTs are set up.

This study aimed at investigating the context of rural development in South Africa by analyzing literature and statistical data in order to identify the context of rural development and ICTs. The variable used to define development was the provision of public services.

Methods

The study used the methods of a systematic literature review and a statistical analysis. The literature review focused on publications about information and communication technologies for development (ICT4D) in South Africa. The literature searches were done using the following academic databases: Google Scholar, JSTOR, Mendeley and Worldcat. The searches were limited to the themes, “ICT4D”, “service delivery” and “South African rurality”. Only literature published after the year 2000 was considered. Literature reviews were also carried out using the South African government publications, which focus on rural development. For example, the National Development Plan 2030, the comprehensive rural development programme (CRDP) and its predecessor the integrated sustainable rural development plan (ISRDP).

The literature review was supported by analyzing descriptive statistics on the 2011 South Africa Census, 2014 General Household Survey (GHS) data and the 2001 to 2013 South Africa Afrobarometer data sets. Logistics regression models were used to investigate the determinants of access to the Internet in rural households. Other methods such as the

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discriminant analysis were not used because the data did not pass diagnosis tests. As such, logistic regression modelling is best suited to the study because it has less strict data assumptions. Logistic Regression has been used in a similar study by Askar (2015) to predict the use of ICTs for task-related teaching. Equation 1 represents the model which was fitted to the 2014 GHS data.

$$\textbf{logit}\ (p_i) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 + \ldots + \beta_k x_k + e_i, \quad \text{Equation 1}$$

Where x_1, $x_2 \ldots x_k$ represent the **k** number of variables determining access to the Internet

α is a constant,

$\beta_1, \beta_2, \beta_3, \ldots \beta_k$ are the coefficients

and e_i is an error term for each estimation.

p_i is the probability of access to the internet for **i**th scenario of the variables. Hence, **logit** (p_i) represents the logarithm of the odds of event p_i.

The odds of the event occurring is given by the exponent of $[\alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 + \ldots + \beta_k x_k]$. Therefore, the larger the value of any given β_k value, the larger the odds of event p_i occurring when the effects of other variables are held constant (the converse is true).

Access to the Internet at home was chosen as the dependent variable with the response variables being: age of household head, education level of household head, annual household income and gender of head. The statistical analysis was done by using STATA statistical package and Excel Spreadsheets.

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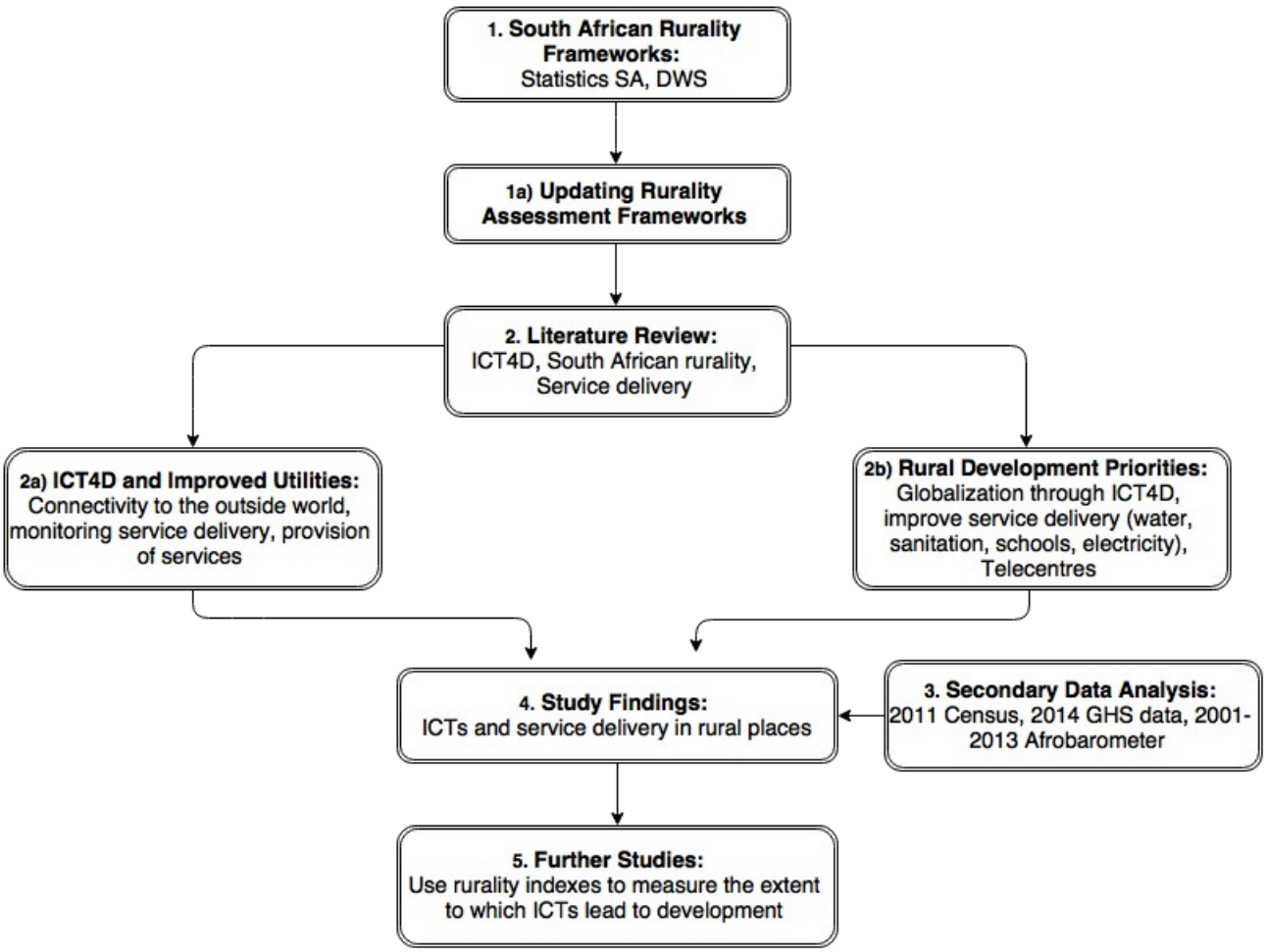

Figure 1. Structure of study

Household income and the gender of the household head are taken to represent measures of the household wellbeing. Access to electricity is important because it supports access and use of the Internet. Education also determines the ability of individuals to use and accept ICTs. Budlender (2003) outlines that household head variables are sometimes used as household indicators because there are no alternatives. For example, the education level of the household.

Figure 1 shows a diagrammatic representation of the structure of the study. First, an analysis of ICTs and service delivery in rural places was done in order to understand the differences of the characteristics of South African rural places. The study investigated the various types of rural places as identified by sector classification frameworks and their representativeness of the current rural context. In stage 2, the theme of ICT as a current agent of rural development was explored. In stage 3, statistical analysis of the primary data sources was carried out to complement the literature review. Finally, the findings of the study were discussed in stage 4.

South African rurality

Rurality is sometimes used as a basis for allocating development resources. The nature and character of rural places changes over time. As such, it is important to investigate the

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nature of rural places consistently (Prieto-Lara & Ocaña-Riola 2010). ICTs can stimulate development because they improve the connectivity between rural and urban areas. ICTs also provide platforms on which services can be provided.

Urban-rural classifications in South Africa

Laldaparsad (2011) defines three types of areas used by Statistics South Africa, namely: rural farm areas, rural tribal areas and urban areas.

Laldaparsad states that rural farm areas were described by the following characteristics in the 2011 South African census:

- coloured as the main race group of the household head
- persons with some primary schooling
- households using water from borehole
- low income persons
- households using gas, paraffin, wood and coal as the main source of energy for cooking

Tribal areas were defined by

- african as the main race group of household head
- households using animal dung or solar as the main source of energy for cooking
- households using river spring water as the main water supply
- persons living in a hut or traditional dwelling

Urban areas where defined by

- persons with complete primary and secondary education
- households accessing water from water schemes operated by municipality or other private providers
- relatively smaller number of children ever born per household
- high population density
- households with flush toilets connected to sewer, septic tank, pit with ventilation or bucket toilets
- higher income persons
- persons living in a formal house or shack in squatter camp/backyard

The two types of rural places are characterized by poor service provision. That is, farmland areas are characterized by households which use borehole water and the use of gas, paraffin or coal as the main source of energy for cooking. The inhabitants of tribal lands typically use spring water as the main water supply and they dwell in traditional structures.

In the initial urban-rural classifications of places by the Department of Water and Sanitation (DWS), former homeland areas where classified as rural. DWS classifications were based on population size and density, historical background (homeland and township) and economic activities.

Other departments use the integrated sustainable rural development program (ISRDP) development nodes as a basis for determining ruralness. ISRDP nodes consist of areas ranging from large towns, farming districts and ‘deep’ or ‘very rural’ local municipalities (Jacobs & Hart 2012). The ISRDP was developed to contribute towards poverty reduction by ensuring that all programmes implemented in a district operate in an integrated manner (Public Service Commission 2010). However, Schmidt (2012) points out that the selection

of the nodes was influenced by political considerations such as the equitable implementation of rural allowances amongst provinces.

ISRDP nodes are for example used by the Department of Health to identify rural places where rural allowances are used as a strategy to attract health specialists.This is despite the fact that the nodes were designed on the basis of poverty indicators and not specifically the shortage of health personnel. This highlights the need to understand the current South African rural context and to update existing area classifications in relation to the current context of ICT proliferation.

ICTs and service delivery in rural South Africa

Limited telephone line infrastructure is a major barrier to connecting remote places to Internet services. Langmia (2005) highlights this by asking a critical question, “How can technology progress be possible when the infrastructure that go along with the Internet like basic telephone lines are still a distance dream to a vast majority of the African population?” Besides the challenge of telephone lines, aspects such as the availability of electricity impact on the success of ICTs. Electricity is another important precondition for the effectiveness of ICTs. Langmia refers to fitting indigenous South African languages into ICT systems in order to create relevance of ICTs for indigenous population groups. The most popular mechanism for communication in rural South Africa is the cell phone. The 2011 South Africa Census data shows that 84 percent of the households in rural areas (both tribal and farming) have access to cell phones. However, the widespread use of cell phones does not necessarily translate to Internet connectivity or development. The ability of people to use a cell phone for more than communication is seen as defining factor for development. For instance, Brown and Molla (2005) explain that mobile banking in rural South Africa was less successful due to the lack of skills and negative perceptions by cell phone users.

ICTs are seen to be a driving force of the modern globalization by connecting people and businesses across vast geographical areas (Borghoff 2011). Langmia (2005) notes that globalization pushed African countries to digitalize radio and television broadcast systems as a means of connecting to the whole world. South Africa responded by digitalizing television and radio transmission. As per requirement by the international telecommunications union (ITU), all countries where required to make the transition from analogue to radio and television digital broadcasting systems. Digitalization improved the quality of television and radio reception as well as the number of channels offered by South Africa Broadcasting Commission (Langmia 2005).

Locally, the South African development plan by National Planning Commission (2012) explicitly outlines the importance of building ICT infrastructure to support economic development and connecting schools, hospital and individuals to affordable information services. The National Planning Commission’s strategic plan is aided by programs such as the Digital Doorway, which was designed to provide rural and disadvantaged communities with computer equipment and allow them to experience computers and other ICTs without formal learning (Mulder *et a*l. 2008).

Other ICT projects include setting up of multi-purpose community centers (MPCCs) or telecenters in rural and disadvantaged areas. MPCCs provide facilities which offer computers, the Internet, telephones and other forms of ICTs to rural communities.

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> Telecenters were initiated in 1999 as one of the primary vehicles for the implementation of development communication and information and to integrate government services into primary rural communities. This was done to address historical, social and economic factors, which limited access to information, services and participation by citizens, as they had to travel long distances to access these services
> (Government Communication and Information Systems [GIS] 2014).

Among other uses, the centers provided ICTs for rural students enrolled to distance learning institutions such as the University of South Africa (UNISA). MPCCs have successfully provided ICTs to some rural communities. For example, Dlodlo (2009) cites Moutse village in Mpumalanga, where villagers receive training on using ICTs at Ndlovu medical clinic's IT center. The area has a cellular network coverage of 90 percent and most households in the village have access to electricity. Hence most households have a television or a radio. The area also has a community radio station.

How are ICTs used in the provision of basic services?

ICTs are inherently designed to create connections through communication. In the context of basic services, communities and service providers rely on each other and service delivery can be improved by supporting aspects such as monitoring of infrastructure, supporting feedback and integrating data collection. For instance, the Telehealth Project for rural KwaZulu-Nata connects rural hospitals to specialists at University of KwaZulu Natal's Medical School (Mars (2008)). Wood *et al*. (2008) also cites the Western Cape's provincial health recording system, eKapa, which is used by health practitioners to keep track of patients on TB and AIDS treatment.

In South Africa, cell phones are used to offer e-learning services such as Dr Maths and M4Lit (Butgereit & Botha (2011), Vosloo, Deumert, & Town (2008)). Dr Maths was developed by the council for scientific and industrial research (CSIR). It is an application that is used on a social network platform called MXit. Dr Maths provides guidelines to solve mathematics problems by providing an interface through which students interact with tutors. M4Lit is used to encourage a reading and writing culture amongst leaners by providing a platform to publish content in indigenous languages.

Cellular service providers in collaboration with financial institutions offer money transfer and bill payment services by providing mobile banking and Internet banking facilities through which customers can send and receive money or pay utility bills. The majority of South Africa's banks agree that online banking and cell phone transactions have been growing at an impressive rate. ABSA's cell phone banking customers [had] increased by 113 percent to 1.5 million, while Internet banking grew 11 percent to 1.1 million customers (Mawson 2010).

Quantitative data analysis

South Africa's rural population is shaped by a history of labor migration to cities and towns. Since 1994, there has been a continuing flow of migrants from rural places to large urban centers such as Johannesburg, Durban and Cape Town. Due to this, the population in rural South Africa is characterized by a larger percentage of the aging population and a relatively small percentage of the working population. In addition, age distributions differ

between people living in farm areas compared to those in tribal rural areas. The analysis is based on data from the 2011 Census, 2014 GHS data and the 2001-2013 Afrobarometer data. Statistics South Africa define two types of rural areas in the 2011 Census and the 2014 GHS. These are, tribal or farm areas in the Census data and tribal or formal rural areas in the GHS data. Besides the difference in terminology, both surveys identify tribal rural areas. Hence, formal rural areas in the GHS survey are taken to be the same as farm areas in the 2011 Census data.

Case study of the Eastern Cape: service delivery in tribal and farm rural areas

The Eastern Cape Province was selected as a case study because of its history of service delivery backlogs and because it's diversity in terms of geographic characteristics. Amathole, Chris Hani, OR Tambo, Cacadu, Joe Ggabi and Alfred Nzo are districts in the Eastern Cape Province. Cacadu district will not be used for district level area comparisons. 55 percent of the population in Eastern Cape lives in rural places. Of this percentage, 52 percent live in tribal areas, while the remaining three percent live in farm areas. The modal household size in tribal areas is 3 people and 2 people for farm areas. 56 percent of the households in tribal areas are female headed and 21 percent of the households in farm areas are female headed. 15 percent of the population in tribal lands is employed compared to the corresponding value of 75 percent on farm areas. As such, the median income range is higher in farm lands compared to tribal lands.

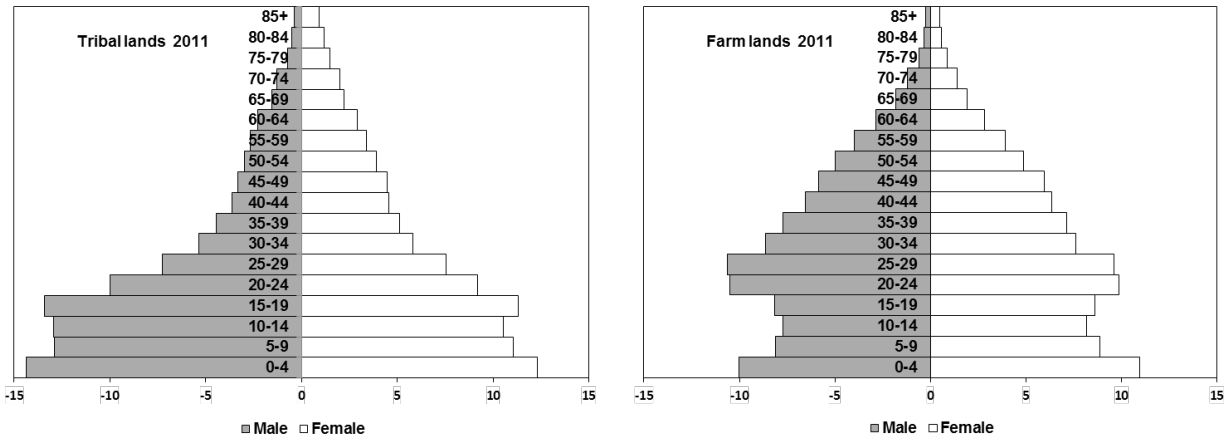

Figure 2. Age distributions of farm and tribal land dwellers in the Eastern Cape (2011 Census)

Figure 2 shows the age distributions of people in farm and tribal areas of the Eastern Cape Province according to the 2011 South African census data. The age distribution of the farm land dwellers is characterized by a large percentage of people in the economically active ages and such a distribution is expected to favor higher access to ICTs because of higher income obtained from employment.

Comparison of access to ICTs and service delivery in the farm and tribal areas of the Eastern Cape Province

Table 1 presents the percentages of Eastern Cape households with access to water, sanitation, electricity, household goods and the Internet.

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	Province		Amathole		Chris Hani		OR Tambo		Cacadu		Joe Gqabi		Alfred Nzo	
	Tribal	Farm	Tribal	Farm	Tribal	Farm	Tribal	Farm	Tribal	Farm	Tribal	Farm	Tribal	Farm
WATER														
Pipe water within 200m	38.2	74.1	42.6	57.3	54.8	77.5	24.8	81.6	_	77.3	43.8	78.4	31.3	83.3
Operated by WSP	30.2	20.4	36.5	9.4	41.1	9.8	17.0	33.4	_	17.1	36.5	4.8	23.1	4.0
TOILETS														
Basic Toilets	33.1	44.4	21.3	30.4	32.1	35.3	37.9	35.0	_	50.0	37.0	33.7	37.1	34.0
ELECTRICITY														
Electricity for cooking	40.9	54.0	48.0	43.5	48.0	55.1	37.6	24.8	_	63.1	53.1	49.1	24.6	51.1
HOUSEHOLD GOODS														
Computer	2.2	16.9	2.3	12.7	1.9	12.9	2.3	7.5	_	16.5	2.4	13.7	38.9	50.1
Satellite TV	5.7	20.3	4.0	15.4	5.5	17.3	6.0	8.3	_	22.2	13.7	19.7	4.7	13.3
Television	47.2	57.1	51.2	53.0	49.1	54.4	46.6	19.9	_	63.0	41.9	47.4	38.9	50.1
Radio	55.0	66.1	59.7	70.8	55.9	69.1	49.4	47.3	_	63.1	57.6	63.8	54.6	56.4
Landline/phone	1.7	15.2	1.9	12.3	1.7	13.0	1.8	2.2	_	15.5	1.1	14.2	1.5	10.1
Cell phone	78.5	77.7	76.2	81.8	79.6	78.8	79.2	89.4	_	75.3	78.7	75.6	79.2	74.9
INTERNET														
From home	0.8	7.9	0.7	6.0	0.7	6.0	1.0	2.5	_	7.9	0.8	8.0	0.8	4.4
From cell phone	10.5	9.2	9.7	11.4	10.3	6.9	11.6	9.7	_	8.9	10.3	6.1	10.7	8.6
From work	0.8	3.0	0.7	2.3	0.7	1.0	0.9	2.9	_	3.3	0.7	1.0	0.8	3.9
From elsewhere	2.2	1.8	1.8	1.2	2.2	1.5	2.4	1.1	_	1.8	1.9	1.6	2.4	0.8
No access to internet	14.4	21.8	12.8	20.9	13.8	15.5	15.9	16.1	_	21.9	13.7	16.6	14.8	17.7

Table 1. Percentage distribution of households with access to services and household goods in Eastern Cape Province (Source: 2011 South Africa Census)

The table shows that farm communities have a higher percentage of households with access to water within 200m of a homestead throughout the province although the data show that tribal land dwellers are more likely to be connected to water sources operated by water service providers. However, this disparity is largely explained by the fact that farm dwellers draw their water from borehole (35.4 percent relative to 5.4 percent for tribal dwellers). 37.3 percent of tribal dwellers draw their water from rivers or streams compared to 5.5 percent for farm dwellers. Drawing water from a stream means that tribal land dwellers are more likely to access unsafe drinking water. This pattern is consistent in the five districts of the province.

Larger percentages of farm area dwellers have access to computers, satellite TV, radio and telephone in the province except in OR Tambo district. The percentage of households with access to the Internet is higher for farm households although Internet connectivity is still low even among farm area dwellers since only 7.9 percent of the households have access to the Internet from their homes. In sum, farm area dwellers are generally more

likely to have access to ICTs compared to tribal area dwellers.

Logistic regression for household access to ICTs in South African rural households (2014 GHS data)

Table 2 and Table 3 show the coefficients of logistic regression models which predict the likelihood of household access to the Internet in the tribal and formal rural areas of South Africa.

Logistic regression					No of obs	8122
Log likelihood = -4420.8679					LR chi2(5)	855.27
					Prob>chi2	0.0000
					Pseudo R2	0.0882
InternetAccess	Odds Ratio	Std. Err.	Z	P>|z|	[95% Conf. Interval]	
hhIcome	1.8403180	0.0524945	21.38	0.00	1.7402540	1.9461360
head_age	0.9781143	0.0016873	-12.83	0.00	0.9748129	0.9814269
Q527Access	0.4126833	0.0450309	-8.11	0.00	0.3332238	0.5110904
head_sex	1.2387660	0.6624460	4.00	0.00	1.1155010	1.3756510
educlevel	1.3693930	0.1064539	4.04	0.00	1.1758650	1.5947730
_cons	0.0149956	0.0043783	-14.38	0.00	0.0084613	0.0265762

Table 2. Logistic regression model coefficients for Internet household access in South African tribal areas (2014 GHS)

Key:
InternetAccess is a dichotonous variable reflecting household access to Internet. i.e. 0 represents no access and 1 represents access. Internet access refers to connection within the household, library or community hall or telecenter, school or university and Internet café within 2km of household
educlevel is a dichotonous variable such that 0 means no education and 1 means at least primary education
hhIcome is the logararithm of the monthly income
head_age is the age of the household head
head_sex is the gender of the household head such that 1 represents males and 2 represents females
_cons is a constant
Significant tests for the model and the coefficients: Tests are done at the 5 percent level of significance. The p-value for the model is less than 0.025 and all the p-values for the four variables are less than 0.025. Therefore, all the variables have significant influence on access to household Internet.

Logistic regression					No of obs	1020
Log likelihood = -441.4252					LR chi2(5)	323.74
					Prob>chi2	0.0000
					Pseudo R2	0.2683

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InternetAccess	Odds Ratio	Std. Err.	Z	P>|z|	[95% Conf. Interval]	
hhIcome	3.5481850	0.3758620	11.96	0.00	2.8829540	4.3669140
educlevel	3.7370530	1.3389460	3.68	0.00	1.8516240	7.542332
Q527Access	0.2813089	0.0836002	-4.27	0.00	0.1571162	0.5036700
head_age	0.9776439	0.0062579	-3.53	0.00	0.9654552	0.9899864
head_sex	1.8283610	0.3700830	2.98	0.00	1.2296120	2.7186650
_cons	0.0000156	0.0000168	-10.30	0.00	0.0000002	0.0001284

Table 3. Logistic regression model coefficients for access to household Internet in South African formal rural areas (2014 GHS)

Key:

InternetAccess is a dichotonous reflecting household access to Internet. i.e. 0 represents no access and 1 represents access. Internet access refers to connection within the household, library or community hall or telecenter, school or university, Internet café within 2km of household.
educlevel is a dichotonous variable such that 0 means no education and 1 means at least primary education.
hhIcome is the logararithm of the monthly income.
head_age is the age of the household head.
head_sex is the sex of the household head such that 1 represents males and 2 represents females
_cons is a constant
Significant tests for the model and the coefficients: Test are done at the 5 percent level of significance. The p-value for the model is less than 0.025 and all the p-values for the four variables are less than 0.025. Therefore, all the variables have significant influence on access to household Internet.

Household income, education status of household head and gender of household head all increase the likelihood of access to household Internet in both types of areas although the factors have a more pronounced effect in formal rural areas. Access to electricity has a higher effect in tribal areas (coefficient of 0.4126833) compared to rural formal areas (coefficient of 0.2813089). Household income and the education level of the household head both have the highest effect on access to household Internet in both areas. However, the effect of the two variables is higher in farm lands i.e. 1.840318 and 1.369393 for tribal areas compared to the corresponding coefficient values of 3.548185 and 3.737053 in farm areas. Age also has a positive significant effect on access to the Internet. The analysis also shows that female headed households are more likely to have access to the Internet although such a finding would require verification with other data.

	No interest	No knowledge	Access Elsewhere	Equipment or subscription cost	Exposure Concern	TOTAL
Tribal	32.5	47.7	0.6	19.0	0.2	100
Rural formal	37.3	44.6	1.0	16.9	0.3	100

Table 4. Percentage distribution of reasons for no access to the Internet in the tribal and formal rural households of South Africa (2014 GHS)

Table 4 shows the distribution of the reasons for no access to household Internet in tribal and rural areas as reflected by the GHS survey data of 2014. The table shows knowledge

and income as major reasons for not having access to household Internet as indicated in the variables “no knowledge”, “no interest” in the Internet and lack of “equipment or subscription cost”.

Distribution of rural people who received news over radio and TV, and participation in political discussions

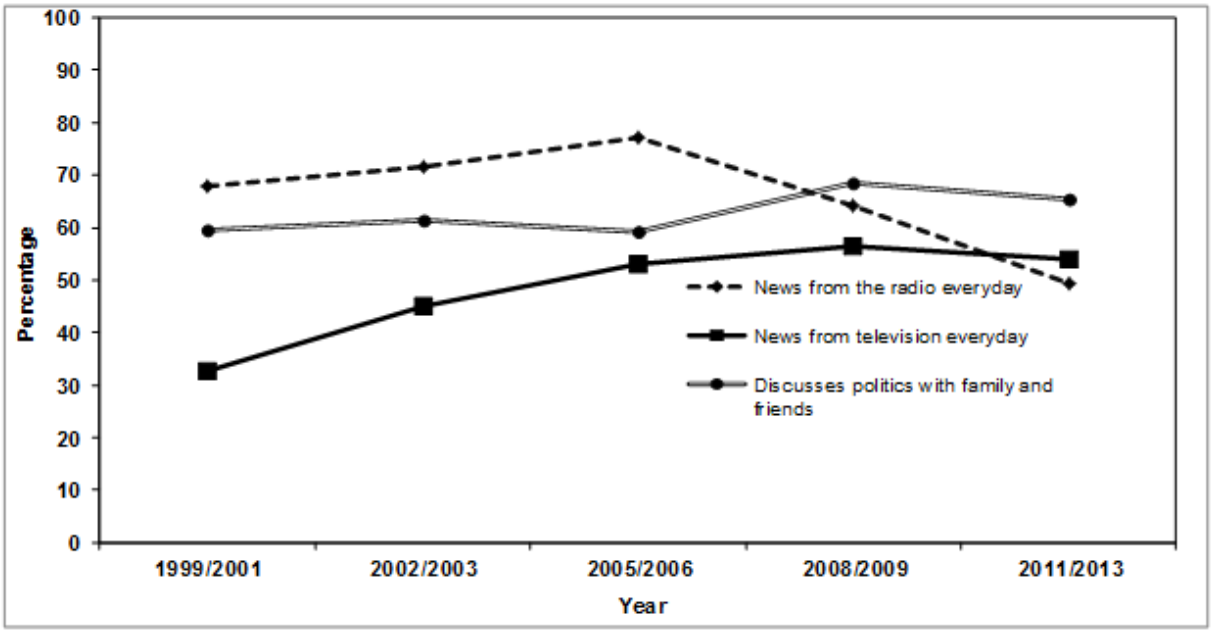

Figure 3. Percentage of rural people who received news through radio and TV, and participation in political discussions (1999 to 2013 Afrobarameter data)

Figure 3 shows line graphs derived from Afrobarometer data. It shows the percentage of people who accessed news by radio, television and those who reported participating in political discussions over the years 2001 to 2013. Afrobarameter data are used to investigate political perception and highlight how communities receive information about governance. The graph shows an increase in the percentage of rural people who use television. On the other had, the use of radio decreased probably as a result of emerging technologies such as the Internet or people prefering television. Therefore, increasing participation in political discussion can be explained by improved access to information through radios, TVs and other forms of ICTs.

Discussion

In South Africa, farm areas are generally inhabited by higher income commercial farm dwellers, while tribal areas are generally characterized by diverse challenges such as poverty, poor service delivery and low literacy levels. As seen in the data analysis, in both rural farm areas and formal rural areas, the likelihood of household Internet access is largely determined by household income and the education level of the household head. The Afrobarameter data showed increasing percentages of people receiving news through radio and television in rural areas. This can be attributed to the improvement of radio and television signaling by the digitalization of broadcast systems as revealed in the literature review.

ICT innovations are expected to impact rural development in different ways. For example, the study revealed factors which determine ICT proliferation and use in rural areas. That is, the pre-existence of service infrastructure such as phone lines for Internet connection and electricity to operate ICT devices. The logistic regression analysis showed that electricity has a significant effect on household Internet access in both tribal and formal rural areas.

The GHS data show telecenters and libraries as alternative modes of access to ICTs. For example, telecenters are used by rural students who enroll for distance learning with learning institutions such as UNISA. Applications such as MXit and M4Lit are also revealed as potential modes of education. However, they need to be developed so that they facilitate the learning of science subjects in indigenous languages (Langmia (2005), Butgereit & Botha (2011)). Telehealth facilities such as eKapa and UKZN telehealth facilities have been developed to improve monitoring and communication within health facilities. However, such networks need to be extended to the most remote areas.

An analysis of the 2011 Census data of the Eastern Cape Province showed a high level of ICT use particularly television and mobile communication devices. Mobile communication devices in particular are a popular mode of communication in all rural areas. Therefore, a possible substitute is assessing smartphone distribution. Ideally, the mobile technologies available to the rural population should provide easy access to the Internet. The smartphone distribution was used by Mukandatsama (2015) as a more reliable indicator of the distribution of mobile communication devices in African countries for the purpose of assessing the contribution of mobile phones to development.

The logistic models fitted to the GHS data for the two types of areas showed that female headed households are more likely to have access to household Internet. The Swedish International Development Cooperation Agency (2001), state that female headed households should be viewed as heterogeneous units which should not necessarily be associated with poverty. Hence the significance of female headed households can be explained by the history of labor migration which meant that female households became common and thus were forced to become self-reliant. However, such a finding needs to be clarified by further studies.

Conclusion

This study was based on the notion that ICTs stimulate development because of their ability to improve information flow between service providers and the public. Essential services are increasingly being provided over ICTs. In addition, those excluded from the virtual world are not only deprived of wider access to information, public services, and other economic benefits, but also of an opportunity to pursue their rights as citizens, including political participation (Polat 2012). At the same time, it is argued that developing countries have more urgent development challenges such as eradicating poverty. While other studies have argued that governments need to develop infrastructure and services such as electricity and telephone lines so that ICTs can be used more efficiently. In sum, the impact of ICTs on development various based on the ability of people to use ICTs, their acceptance of the technologies and the accessibility of ICTs.

In the South African context, the provision of various services such as online learning, administration and management of patience in the health sector, online payment of service bills and reporting of service disruptions are increasingly being done using ICTs. In

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addition, rural dwellers are able to access services via ICTs at MPCCs and thus avoid travelling to urban centers to acquire services.

The findings of the statistical analysis show that access to household Internet is predominantly affected by household income and the education of the household head. The effect of income and education is more pronounce in farm areas. In addition, the study notes the importance of electricity particularly in tribal areas. Hence, reflecting the importance of improving access to electricity before ICTs are used effectively. The reviewed literature also showed that another obstacle to the effectiveness of ICTs is the language barrier. For example, Butgereit & Botha (2011) explained that the Dr Maths learning platform encountered challenges because it employed foreign tutors who could not communicate to leaners in indigenous languages. Ngwenyama *et al.* (2006) has previously argued that education is a prerequisite for the effectiveness ICTs as a stimulant of development.

The statistical analysis showed that cell phones are widely used in both farm and tribal areas. However, the impact of cell phone technologies needs to the studied closely, for example, Mukandatsama (2015) proposed the use of the smartphone distribution as a more effective measure of mobile phone penetration.

The development of telehealth facilities has improved the health sector. However, telehealth facilities are still under development throughout the country and in particular their success depends on the ability of rural dwellers to access and use ICTs. In addition, the UKZN telehealth facility can connect hospitals and health facilities with developed ICT infrastructure. Several challenges exist with regards to extending such a facility to remote places. For example, the capacity to build and maintain a large network.

There is a need to establish a direct link between access to ICTs and improved service delivery by conducting an independent study on household ICT use. This paper proposes a further study to understand rurality with respect to the current context of ICT proliferation by using rurality index measures which combine connectivity variables such as ICTs and access to services variables which would be combined with qualitative data.

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