Correlates of ICTs and Employment in Sub-Saharan Africa

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Introduction

The uptake of ICTs on the African continent has lagged the rest of the world but growth rates are in the double digits and the continent is fast catching up. Mobile penetration measured by sim ownership has reached over 100% in many African countries (GSMA, 2014). The same extent of take-up is not seen with internet, which for Africa still lags the rest of the world quite significantly, but in the decade following the early 2000's massive rises in mobile broadband infrastructure have taken off. These increases in mobile broadband investment and promoted access to the internet have started a mobile internet revolution on the continent, for which critical masses are still to be garnered. Thus far much of the emphasis of multilateral organizations and academic literature has focussed on understanding the limitations to access and better ways through which access can be provided.

However, as the continent increasingly catches up with the technologies seen in the global north, questions surrounding *how* ICTs are used in the development discourse are necessary. ICTs have already been linked to increased capabilities and freedoms for individuals (Wang, 2015). Related to such capabilities are whether these ICTs enable individuals to secure improved labour market outcomes. The aim of this paper is to evaluate just that.

This paper strives to move beyond simple access measures of ICT use and to gauge whether the level of ICT use that an individual carries out over their mobile phone or the internet o, whether basic, intermediate or advanced exhibits any correlation with their labour market status. The literature provides evidence that this should be the case, in at least some countries, and is evaluated next.

Literature Review

Labour markets in developing countries play an important role in facilitating economic and social progress as employment status is a key determinant of whether a household, and individuals, reside in poverty. Obtaining a well-paid, secure job is the best way for individuals to escape the cycle of poverty. However, labour markets, particularly those in developing countries, are regarded as inefficient - characterised by large skills mismatches and imperfect information - acting as an impediment to economic growth and development. Often, suitably qualified individuals might be unable to obtain a job in another part of the country because they are unaware that such a job opening exists. Furthermore, even if an individual is aware of a job opening, it is often prohibitively expensive to travel long distances. However, the advent of wireless communications–especially mobile technologies in developing countries – has provided new possibilities for a more efficient labour market.

The focus on mobile cellular technologies, rather than other ICTs (e.g. computers or tablets) in Africa is well-justified. Taking the entire SSA region into account, the mobile penetration rate is 41 percent, which is forecast to increase to 49 percent by 2020 (GSMA, 2015). However, when only individuals over the age of 15 are considered, the mobile penetration rate jumps to 69 percent (Handjiski, 2015), and is naturally higher in countries like South Africa and Ghana with penetration rates of 62.1% and 59.8% as early as 2008 (Research ICT Africa, 2008). Mobile broadband connections in SSA are set to increase from 24 percent in 2015 to 57 percent in 2020, and smartphones from 160m to 540m (GSMA, 2015).

The mass uptake of mobile telephones in Africa has had many distinct benefits with regards to labour markets. Firstly, mobile telephones greatly reduce the costs of finding a job (Aker & Mbiti, 2010). Secondly, the flow of information on a mobile telephone is much faster than that of a radio or newspaper (Aker & Mbiti, 2010). This allows job applicants to respond faster to job openings. Finally, the large geographic spread of mobile telephone networks allows users to easily contact individuals far away from their location of residence (Aker & Mbiti, 2010).

While the mobile industry can create jobs - within the ICT sector - formal jobs, informal jobs and indirect jobs are also created (Hughes, 2013). Aker and Mbiti (2010) state that because many individuals in African countries rely on pre-paid airtime, mobile phone operators have had to develop relationships with small businesses in the informal and formal sector. Secondly, additional shops have opened to sell and repair mobile telephones, generating additional employment. Stork, Moyo and Deen-Swarray (2013) show that mobile phones remain the most commonly used ICT among informal businesses. This may lead to direct or indirect employment effects with job losses occurring due to improvements in labour productivity and job gains occurring as a result of improved competitiveness and innovation (Hughes, 2013).

The GSMA estimates that in Africa in 2010 the mobile phone ecosystem employed, directly or indirectly, nearly 5.8 million people corresponding to 1.4% of the total African workforce (GSMA, 2013). This corroborates a study by World Bank (2015) which states that while direct job creation in the technology industry is significant, the larger impact has been through the users of digital tools, including basic ICT users.

Indeed, there is extensive evidence that gaining access to ICTs enables individuals previously excluded from important economic networks, access to these networks. This allows for the potential to enhance the wellbeing of individuals, households and informal businesses (De Silva et al., 2009; Rong, 2015). Aker and Mbiti (2010) outline four mechanisms through which mobile phones can provide economic benefits for Africans. Firstly, mobile phones can reduce search costs by up to 50% and improve market efficiency. Not only through direct lower costs for job-search, but also but also obtaining prices for products, finding buyers and sellers and information regarding significant events, often without needing to travel.

Mobile telephones can also potentially improve coordination between firms and their suppliers (Aker & Mbiti, 2010). Qualitative research on small businesses conducted in South Africa and Egypt showed that the use of mobile telephones increased profits, turnover and the number of customers (Vodafone, 2005). Chair (2014) found that women in the South African informal sector used mobile phones in the everyday running of their businesses, resulting in increased communication with customers and suppliers and increased community interaction.

Mobile telephones have also generated employment and entrepreneurship opportunities (Aker & Mbiti, 2010). While more skilled people are easily enabled to enter the formal labour market, many find micro-entrepreneurial opportunities through the networks of mobile phone card sales, repairs services and increasingly dated internet cafés. People need a place to purchase or repair mobile telephones, especially in remote or far removed areas. Furthermore, the informal sector has taken advantage of this growing sector by selling prepaid mobile telephone cards – a crucial component influencing the take up of mobile telephones in Africa, since many do not have the required documentation for contracts (Aker & Mbiti, 2010).

Finally, mobile telephones can reduce risk (Aker & Mbiti, 2010). As Africa remains a continent where the majority of workers are in agriculture, it usually bears a substantial economic cost whenever

there is a natural disaster, health epidemic or a violent conflict. The faster flow of information through the use of mobile telephones can be used to warn farmers of potential shocks, allowing farmers to decide which crops to plant (Aker & Mbiti, 2010).

Jensen (2007) investigates the effects that mobile telephones have on the fisheries market in Kerala, India. Jensen finds that having access to a mobile telephone reduces the variability of fish prices, benefiting both producers and consumers: fishermen's profit increased by approximately 8%, while prices decreased by 4%. Aker (2008) analyses the effects of the introduction mobile telephones on the grain traders market and finds that grain price dispersion between different markets is reduced by a minimum of 6.4%. This reduction is primarily as a result of traders using their mobile telephones to reduce search costs and accumulating key market information. The author also finds that the greater the distance and the poorer the quality of roads between markets, the greater the impact of mobile telephone coverage on prices, illustrating the gained efficiencies for these farmers.

Klonner and Nolen (2010) investigate the effect of mobile phone coverage on labour market outcomes in rural South Africa. Their results show that when a locality receives mobile phone coverage, employment increases by 15%, with most of this attributable to an increase in employment among women. All the gains in employment are in wage-employed occupations, with no effect on the number of individuals who are self-employed. Lastly, there seems to be a sectoral shift in employment: agricultural employment decreases, especially amongst males, as mobile phone coverage is rolled out.

In summary, the studies show that mobile telephones have increased profits and employment and decreased costs. Internet use only increases the propensity for ICTs to reduce the costs of job search. Job applicants can view online job websites or monitor social media for job opportunities. To do this, job applicants would have to purchase mobile data, although this is far cheaper than buying a newspaper (Aker & Mbiti, 2010). However, the potential for the internet to play a role as a job search mechanism is stifled by access and affordability: the type of technology used, the cost of data, and infrastructure roll-out. Chair (2014) found that women in South Africa's informal sector faced extremely high data costs, leading to exclusion from using this ICT as a medium of conducting business. Nevertheless, beyond access, local content generation in local languages, accessible to those in rural areas who are less likely to be proficient in English compared to those in urban centers are important. Ultimately as the mobile telephone becomes the primary means of accessing the internet in Africa, it is the beyond access issues that will determine its success as an enabler of human freedoms (Wang, 2013). These include issues such as literacy, which serves to reduce educational and socioeconomic gender gaps that exist between men and women.

Finally, there has been a paucity of research into the demographic profile of mobile users in Africa. Having said that, the limited data available reveals some interesting patterns. Khan, Chair and Deen-Swarray (2015) found that gender gaps between men and women exist when it comes to mobile ownership in a survey of twelve SSA countries, but that these gaps are amplified between rural and urban geolocation. While males are more likely to own a cell phone than women, the inequality observed in ownership can be explained by education and income level. Women are economically more disempowered than men in these countries, and more so in rural areas (Khan, Chair & Deen-Swarray, 2015).

Methodology and Model

Methodology - ICT use and employment

Two ICTs are considered in this paper - mobile ownership and use, and internet use. The relationship between employment and mobile ownership or internet use is not simple or one-directional. It is likely that employment more readily enables individuals to acquire a mobile phone or use the internet. However, as discussed in the literature review, decreases in the transaction costs associated with job search, and increased efficiencies gained for those who are self-employed (mainly in the agricultural sector) have been documented. Thus, the argument can be made that ICTs have assisted individuals in finding employment.

The technology industry has directly created millions of "digital jobs" (World Bank, 2015). These jobs are depicted by the red and dark orange circles in Figure 1 and include those that make use of advanced tools and specific software as a main element of their work irrespective of the industry. As mentioned in the literature review, the larger impact of technology on jobs is claimed to be generated through digital tool users which comprises of "Basic ICT users". This includes those who make use of ICTs in their every day job, but also simpler mobile telephone and mobile internet users. It is precisely the employment outcomes of those within and on the fringe of Basic ICT use that are being estimated in this paper, and a comparison is drawn relative to unconnected workers (grey circle in Figure 1).

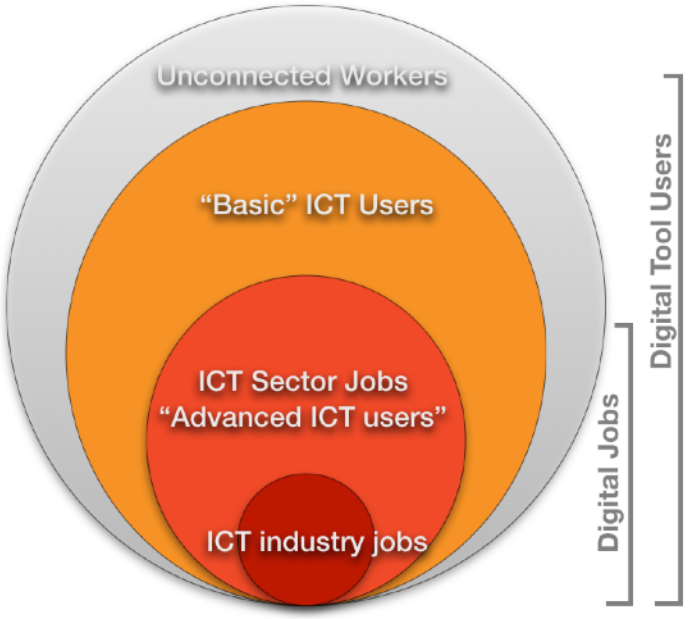

FIGURE 1: RELATIVE SCALE OF POSSIBLE IMPACT OF TECHNOLOGY ON WORK, WORLD BANK, 2015.

The range of activities that can be carried out on mobile phones and the internet are integral to deconstructing the impact that these ICTs have on the probability of finding a job. Table 1 below shows that when the entire sample is looked at collectively just over half of the sample (54%) owns a mobile phone, and just 15.3% of the sample uses the internet.

Table 1: ICT Ownership and Use 2012 - Entire Sample

Mobile Activities Carried Out		Internet Use and Activities	
Criteria	Percentage of Sample Conducting Activity	Criteria	Percentage of Sample Conducting Activity
Mobile Phone Ownership	52.7%	Internet Use	15.2%
Basic Activities		**Activities performed on the Internet**	
Calls	99.4%	Email	79.8%
SMS	83.5%	Social Networking	63.7%
Please Call Me/ Missed Calls	83.5%	VOIP	61.3%
Phone as Organiser/ Calendar	50.6%	Obtaining info on goods/services	56.0%
Games	47.7%	Interacting with Govt Organisations	33.8%
Intermediate Activities		Formal learning activities	29.5%
Radio	46.3%	Online shopping	28.1%
Transfer Airtime	41.9%	Internet Banking	23.9%
Photos/Video	39.3%		
International Calls	21.3%		
Send Money (Mobile money)	18.4%		
Advanced Activities			
Browse the internet	17.2%		
Social Networking	16.0%		
Download Apps	15.0%		
SMS to TV or radio	14.7%		
Email	13.5%		
Roaming	5.3%		
VOIP	3.1%		

Of those who do use mobile phones, the activities are split into basic, intermediate and advanced activities. Basic activities include calling, SMSing and functions that can be completed on a basic mobile device. Intermediate activities include additional activities that a feature phone may offer, including using the radio, transferring airtime and making international calls. Browsing the internet and other activities such as roaming, VOIP, email and social networking are considered advanced.

These advanced activities were categorized by proportion of use in the population and a consideration of what technologies were widespread at the time of the survey (2012).

Since only 15.3% of the sample uses the internet, it does not make sense to separate the activities by level of complexity. Nevertheless, one can see that like mobile activities, some activities are carried out by more individuals than others. For instance, emailing is conducted by a larger proportion of the internet using population than internet banking.

Economic Model

Using two models, a logistic regression latent variable model and multinomial regression model, the probability of employment is modeled dependent on the ICT variables and other socioeconomic and demographic characteristics of each individual. The models are specified as follows:

$$\Pr(y_{i,t} \mid \mathbf{X}) = G(\beta_0 + \mathbf{X'\beta}) \text{ where G is a logistic function}$$

Equation 1 - Simple Logit Model

$$\Pr(y_{i,t} = j \mid \mathbf{X}) = G(\beta_0 + \mathbf{X'\beta}) \text{ where G is a logistic function and } j = 0, 1, 2.$$

Equation 2 - Multinomial Logit model

yi,t is the employment outcome variable, and it varies between the simple logit model and the multinomial logit model. In the case of the simple logit model (Equation 1) there are two employment outcomes and in the case of the multinomial logit model there are three employment outcomes. These employment outcomes are defined in the table below.

In the case of the simple logit model the employment outcomes are simply whether or not an individual holds any form of employment or not. However, as indicated in the literature review the potential effects of ICTs on the employment outcomes and nature of work for rural and particularly self-employed individuals tends to be different from those in urban areas and those who are employed by other institutions.

Table 2: Employment outcome variables

(1) Simple Logit Model Employment Outcome	(1) Multinomial Logit Employment Outcomes
$y_{i,t}$ = *0 if individual does not have a job*	$y_{i,t}$ = *0 if individual does not have a job*
$y_{i,t}$ = *1 if individual has a job (employed, or self-employed)*	$y_{i,t}$ = *1 if an individual is a rural & self-employed worker*
	$y_{i,t}$ = *2 if an individual is a rural & not self-employed worker; or individual is an urban employee (either self-employed or not)*

The probability of the employment outcomes specified in Equations 1 and 2, are conditional on a vector of explanatory variables (**X**) which contains an individual's sex, age, marital status, geolocation, their education level, and the ICT controls (see Table 3).

Table 3: Covariates and controls

List of independent (X) variable categories and controls	
Mobile ICT Use (Degrees of advanced usage)	Internet Use
Sex	Years of formal education
Urban/Rural location	Marital status
Age	Country

The primary explanatory variables of interest in these models are the ICT variables since we are interested in determining what the effect the intensity of ICT use has on the probability of employment. The size of the effect of an increase in ICT intensity associated with the probability of employment are measured using average marginal effects.

Table 4: Simple logits estimated based on heterogenous sub-populations

Sub-population	Outcome Variable: (Probability of) Employment
1	Whole Population
2	Urban / Rural
3	Male/Female
4	Youth / Non-Youth

Deen-Swarray et. al (2015) showed that ICT take-up patterns differ markedly between rural and urban areas. Given this evidence four model specifications, each based on a unique subpopulation, will be estimated for the employment outcome (Equation 1) to investigate whether the impact of the mobile and internet use has differing effects on the employment outcome of different subpopulations. The next section discusses the data and results of this analysis.

Data and Descriptive Statistics

Data

The data used for this study is based on two sets of nationally representative cross sectional data collected by Research ICT Africa in 12 African countries in the periods 2007/2008 and 2011/2012. This RIA Household Survey Data was sampled using two stage stratified random sampling. First EA's were sampled using probability proportional to size, then within each EA households were selected using simple random sampling. Metropolitan, urban and rural areas were all taken into account for the sampling design. One individual (15 years of age or older) from each household was randomly selected to represent the household.

Descriptive statistics

The employment outcome by country

Figure 2 below presents the employment rates for the twelve countries studied for the year 2012, the figures presented include self-employment measures which may inflate the total employment statistic. Figure 1 shows that Ghana has the highest rate of employment from the countries in the sample and South Africa and Namibia have the lowest employment rates.

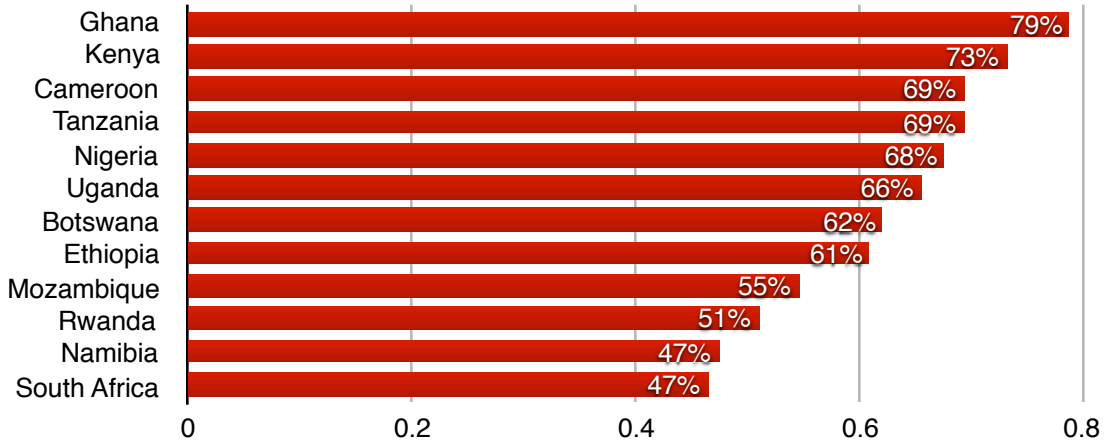

Figure 2: Employment rates (2012)

The measure of the labour force used does not take into account discouraged workers. This is because the survey is an ICT adoption and use survey implying that the labour market outcomes are not as detailed as a labour force survey would be. No cross checks were included in the survey design to check the formality of employment, or length of unemployment and duration of job search.

Table 5 below breaks down the share of self-employed and other employed individuals between rural and urban areas. The share of employed individuals who are self-employed is higher in rural areas in all countries except South Africa and Namibia. This is because subsistence agriculture and employment tend to be higher in rural areas. Since the survey does not account for sector of em-

ployment or type of job, this split between rural self-employment and other employment is useful and is used to model the employment outcome. It shows that for Tanzania, Ethiopia, Uganda, and Rwanda substantially more than half of the employed population is rural and self-employed. In Tanzania, Ethiopia and Cameroon more than 90% of the employed are self-employed. Alternatively, in countries like Kenya, Namibia, South Africa and Botswana more than 50% of the population are employed by other institutions and are not considered self-employed.

In most countries self-employment is higher in rural areas, and not-being self-employed is higher in urban areas. Table A1 in the appendix also shows that the high self-employment rates manifest in lower intrasex differences in employment rates between urban and rural areas.

Table 5: Type of Employment as a share of total employment (2012)						
Country	Self-Employed			Other Employed		
	Total	Urban	Rural	Total	Urban	Rural
Tanzania	*95%*	17%	77%	*5%*	4%	1%
Ethiopia	*92%*	11%	81%	*8%*	7%	1%
Cameroon	*90%*	42%	49%	*10%*	8%	2%
Uganda	*78%*	7%	71%	*22%*	6%	16%
Ghana	*75%*	30%	45%	*25%*	16%	9%
Nigeria	*74%*	34%	40%	*26%*	14%	12%
Mozambique	*61%*	15%	46%	*39%*	20%	19%
Rwanda	*58%*	7%	51%	*42%*	16%	26%
Kenya	*42%*	10%	32%	*58%*	10%	48%
Namibia	*26%*	9%	17%	*74%*	35%	39%
South Africa	*22%*	15%	7%	*78%*	59%	19%
Botswana	*11%*	7%	4%	*89%*	60%	30%
Average	**60%**	**17%**	**43%**	**40%**	**21%**	**19%**

Mobile ownership and internet use

The Methodology section showed that the average mobile ownership rate across all twelve countries was 54% but Table 6 below illustrates that mobile ownership rates vary greatly between countries. South Africa has an ownership rate of 84.2% of the population, compared to Ethiopia that has an 18.3% ownership rate. For many countries, the ownership rates differ between men and women - for instance in Uganda 56.2% of men owned a mobile phone in 2012, compared to only 34.5% if women. Countries like Cameroon and Uganda had a more egalitarian split of ownership between gender. In general, mobile ownership rates are higher in urban than rural areas.

Table 6: Mobile Ownership by Country, Geolocation and Sex (2012)					
Country	**Whole Population**	**Male**	**Female**	**Urban**	**Rural**
South Africa	**84.2%**	86.3%	82.4%	86.3%	80.8%
Botswana	**80.0%**	76.1%	82.7%	86.7%	69.4%
Kenya	**74.0%**	83.8%	67.9%	73.2%	74.1%
Nigeria	**66.4%**	76.5%	54.9%	71.5%	61.3%
Ghana	**59.5%**	61.2%	58.2%	74.8%	45.6%
Namibia	**56.1%**	54.9%	57.0%	76.5%	46.1%
Uganda	**46.7%**	56.2%	34.5%	57.8%	45.0%
Cameroon	**44.5%**	44.2%	44.9%	62.6%	19.2%
Mozambique	**42.5%**	42.8%	42.1%	67.1%	29.8%
Tanzania	**35.8%**	41.7%	30.9%	59.1%	27.4%
Rwanda	**24.4%**	27.6%	21.2%	47.0%	17.8%
Ethiopia	**18.3%**	24.8%	10.4%	51.4%	11.3%
Average	***52.7%***	*56.3%*	*48.9%*	*67.8%*	*44.0%*

Mobile penetration tends to be much larger in the countries studies than internet use. Table 7 shows that the country with the highest percentage of the population using the internet in 2012 was South Africa with a usage rate of 34%. Internet usage rates drop drastically between countries and are at below 5% of the population in Tanzania and Ethiopia.

There is a larger sex discrepancy in internet use between males and females across all countries compared to mobile phones, perhaps pointing to the fact that men may be early users or have easier access to internet capable devices than women. Rural areas also lag behind urban areas with respect to rates of internet use.

Table 7: Internet Use by Country, Geolocation and Sex (2012)					
Country	**Whole Population**	**Male**	**Female**	**Urban**	**Rural**
South Africa	**34.1%**	40.6%	28.6%	41.7%	21.8%
Botswana	**29.0%**	32.6%	26.5%	35.1%	19.3%
Kenya	**26.3%**	35.8%	20.5%	26.0%	26.4%
Nigeria	**18.4%**	22.8%	13.4%	21.8%	15.1%
Namibia	**16.2%**	18.7%	14.2%	37.6%	5.7%
Cameroon	**14.1%**	13.4%	14.7%	22.4%	2.5%

Ghana	**12.7%**	17.8%	8.5%	15.9%	9.7%
Mozambique	**11.1%**	12.6%	9.3%	26.1%	3.3%
Uganda	**7.9%**	11.8%	3.1%	17.3%	6.5%
Rwanda	**6.0%**	6.9%	5.2%	14.7%	3.5%
Tanzania	**3.50%**	3.40%	3.50%	8.50%	1.70%
Ethiopia	**2.70%**	3.90%	1.10%	9.20%	1.30%
Average	***15.20%***	*18.40%*	*12.40%*	*23.00%*	*9.70%*

Patterns of ICT use

To evaluate the differing impacts of mobile phone use and internet use on the employment outcome, mobile phone use was split into categories based on whether the activities conducted were basic, intermediate or advanced (Table 1). Table 8 below shows that looking at the various categories of use highlights different patterns based on sex or geolocation.

For basic activities such as calling, SMSing, or sending Call Me Backs there does not seem to be a large difference in patterns of use between men and women, nor between urban and rural areas. For intermediate use such as listening to the radio, transferring airtime, taking photos/videos or sending mobile money gender gaps and gaps between urban and rural areas start to become more evident. Men conduct more of the activities the more advanced they become, with the exception of utilising mobile money services. In rural areas the intermediate activities that are used more include mobile money and airtime transfers. This makes sense since financial infrastructure may be in short supply.

Table 8: Mobile activities carried out by gender and geolocation (All countries - 2012)

Activity	Female	Male	Urban	Rural
Basic Activities				
Calls	99.4%	99.4%	99.2%	99.6%
SMS	83.9%	83.3%	85.0%	82.1%
Call Me Back/ Missed Calls	82.6%	84.2%	81.8%	85.2%
Phone as Organiser/ Calendar	51.6%	49.7%	51.8%	49.3%
Games	43.6%	51.0%	48.9%	46.4%
Intermediate Activities				
Radio	41.9%	50.0%	49.2%	43.4%
Transfer Airtime	40.5%	43.0%	41.5%	42.3%
Photos/Video	35.8%	42.0%	44.8%	33.7%
International Calls	20.0%	22.3%	25.7%	16.9%

Table 8: Mobile activities carried out by gender and geolocation (All countries - 2012)				
Activity	**Female**	**Male**	**Urban**	**Rural**
Send Money (Mobile money)	21.6%	15.8%	12.8%	24.0%
Advanced Activities				
Browse the internet	13.4%	20.3%	21.2%	13.3%
Social Networking	12.8%	18.6%	19.2%	12.8%
Download Apps	10.8%	18.4%	17.3%	12.7%
SMS to TV or radio	12.5%	16.5%	15.4%	14.0%
Email	10.5%	15.9%	15.0%	12.0%
Roaming	5.2%	5.3%	5.8%	4.7%
VOIP	2.8%	3.3%	3.5%	2.6%

For more advanced activities mostly related to use of the internet, the gender gap widens. For instance, 18.6% of men use social networking on their phones compared to just 12.8% of women. Men use more internet related activities than women which makes sense since actual internet usage rates are higher for men (Table 1). All advanced activities are used more in urban areas than rural areas.

As discussed in the methodology section, because internet use is prevalent among such a small proportion of the population, it in and of itself is an advanced activity it will be controlled for by using a binary variable for internet use. Nonetheless it is still interesting to see how the patterns of use differ by sex and geolocation.

Table 9: Activities carried out on the Internet by gender and geolocation (All countries - 2012)				
Activity	**Female**	**Male**	**Urban**	**Rural**
Email	76.2%	82.2%	77.0%	84.8%
Social networking	59.6%	66.4%	65.7%	60.5%
Formal learning activities	59.4%	62.5%	59.3%	64.8%
Getting info on goods and services	45.6%	62.6%	55.5%	56.9%
Accessing government services	24.1%	40.0%	31.1%	38.3%
VOIP	19.9%	35.6%	30.0%	28.6%
Online shopping	19.2%	33.8%	26.7%	30.6%
Internet Banking	16.8%	28.5%	27.5%	17.7%

Overall, the large differences in patterns of use based on sex and geolocation may influence the labour market outcomes of people employed in rural areas compared to urban areas as well as self-employed compared to non-self-employed individuals. Since the self-employed make up such a large proportion of the employed in most countries studied, and given that most of these self-employed are located in rural areas it is important to account for this in the structure of the models to account for nuanced effects dependent on the nature of the structure of these labour forces.

Perceptions of the impact of ICTs on the employment outcome

One interesting thing to look at in conjunction to the actual effect of ICT use on the employment outcome is the perception of the usefulness of ICTs to finding jobs. Figure 3 shows the difference in mobile phone ownership rates between 2008 and 2012 and differences in the percentage of the population that believed that owning a mobile phone would help them find a job. What figure 3 shows is that with the exception of Cameroon, Rwanda and Ethiopia increases in mobile ownership are associated with a lower proportion of the population that believe mobile phones help them find work. Rwanda and Ethiopia have the lowest overall mobile ownership rates in the sample, and the increase in optimism between 2008 and 2012 could be because the technology is not very wide spread and the large proportion of non-owners may believe that newfound acquisition of a mobile phone may help them find a job. There is no relationship between the size of mobile ownership increases and the size of changes in the perception of mobile ownership helping individuals find jobs.

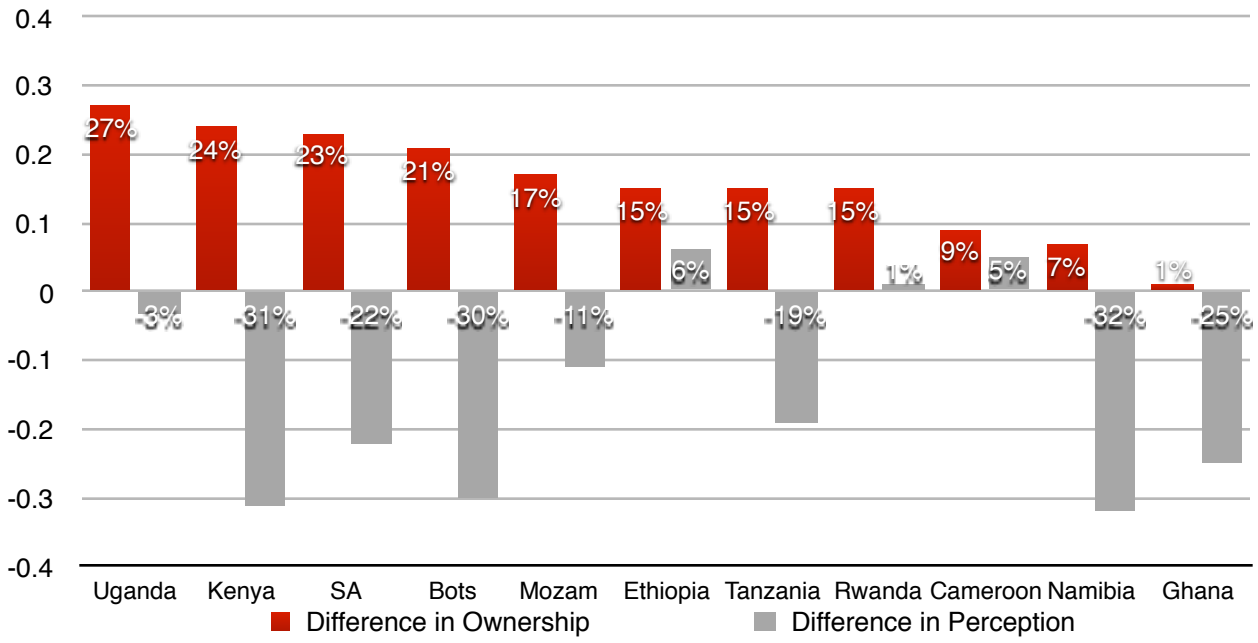

FIGURE 3: MOBILE PHONE OWNERSHIP GROWTH RATES AND CHANGES IN THE PERCEPTION THAT HAVING A PHONE HELPS PEOPLE FIND WORK (2008 - 2012)

Results

Tables 10 and 11 present a summary of the countries that showed evidence of a correlation between ICT use and the employment outcome.

Table 10 presents the results of Model 1 (Equation 1) that looks at the relationship between employment (all types) and ICTs. The models were estimated for the entire population, then for the urban, rural, male, female and youth and non-youth subpopulations respectively.

Mobile ownership is seen to have a positive impact on the probability of employment in Uganda, Cameroon, Namibia and Mozambique - four out of the eleven countries studies[1]. However, splitting the sample by sub-population changes this result dramatically - the probability of employment is positively affected by mobile ownership in the urban areas of six countries, more so for males than females, and more so for the older population in a larger number of countries. Put differently, owning a mobile phone is likely to increase the probability of employment of rural individuals only in Ghana, of female individuals only in Cameroon, and of the younger population only in Namibia. In Uganda owning a mobile phone as an under 25 is associated with a lower probability of finding a job.

Table 10 : Countries showing significant effects of the impact of ICTs on the probability of employment Simple Logit Models (2012)

Variable	Whole Population	Sub-population					
		Urban	Rural	Male	Female	Youth	Non-Youth
Own a Mobile	Uganda* Ghana* Cameroon** Namibia* Mozambique*	Uganda* Cameroon* Nigeria* Namibia** Mozambique** Botswana**	Ghana**	Uganda* Ghana* Mozambique*	Cameroon**	Namibia* Uganda(-)*	Uganda* Ghana* Cameroon* Nigeria* Namibia*
Intermediate	Kenya* South Africa* Botswana*	-	Botswana*	South Africa*** Botswana*	-	Uganda** South Africa* Ethiopia(-)* Namibia(-)*	Kenya** Botswana*
Advanced	Kenya* South Africa* Botswana**	-	Kenya*** SouthAfrica* Botswana*	Botswana***	South Africa*	South Africa*	Botswana*
Internet	South Africa*	Tanzania* South Africa* Kenya(-)*	-	South Africa* Kenya(-)* Ghana(-)* Nigeria(-)*	Cameroon(-)**	Tanzania* Cameroon(-)*	South Africa* Kenya(-)* Ethiopia(-)*

****p<0.01, **p<0.05, *p<0.1*

Employed other contains urban self-employed, and urban and rural individuals employed by other people/entities.

[1] Rwanda was omitted from the estimation due to small sample size.

The results are equally varied for the types of mobile phone activities carried out, intermediate and advanced mobile phone use is associated with a higher probability of employment in Kenya, South Africa and Botswana relative to basic users. In Urban areas, the sophistication of mobile activities conducted has no impact on the probability of employment. In Namibia and Ethiopia, advanced use is associated with a lower probability of employment. For most countries, the level of mobile phone use by sex and age do not affect the probability of employment, although in Uganda and South Africa mobile phone savvy is likely to increase the probability of employment of those under 25.

Internet use is largely associated with no impact on the probability of employment, bar South Africa and Tanzania, who show weak evidence of internet use leading to increases in the likelihood of employment.

A few of the marginal effects presented in Table 10 are negative, indicating that ICT use in those countries and subpopulations may be associated with a decrease in the likelihood of finding a job. However, it is important to note that the correlation between ICTs and employment is tenuous. The coefficients presented, where significant, are generally only significant at the 10% or 5% level. What the negative coefficients may be capturing is an already high level of unemployment among those groups coupled with relatively higher rates of ICT use.

Table 10 above considers employment as a simple binary outcome, however the literature showed that the impact of ICTs on employment may vary dependent on the type of work being done. Table 11 below shows the impact of ICTs on the probability of employment of those who are self-employed in rural areas, and all other forms of employment.

Table 11 : Countries showing significant effects of the impact of ICTs on the probability of employment Multinomial Logit Models (2012)

Variable	Whole Population	Sub-population					
		Urban	Rural	Male	Female	Youth	Non-Youth
Outcome 1: Self-Employed in Rural Areas							
Own a Mobile	Tanzania*	-	-	Cameroon***	Ghana*	-	Ghana*
Intermediate	Tanzania (-)* Ghana (-)*	-	-	Cameroon(-)**	Ghana(-)*	Ethiopia(-)*** Namibia(-)** South Africa(-)***	Tanzania(-)* Ghana(-)*
Advanced	Ethiopia*** Tanzania(-)* Ghana(-)*	-	Nigeria(-)*	Ethiopia*** Cameroon(-)***	Ghana(-)**	-	Ghana(-)*
Internet	Kenya(-)** Ethiopia(-)** Namibia(-)* Botswana(-)*	-	Kenya(-)** Namibia(-)**	Ethiopia(-)*** Kenya(-)***	Uganda* Namibia(-)** Botswana(-)**	Namibia*	Kenya(-)** Nigeria(-)* Namibia(-)** Botswana(-)***
Outcome 2: Employed (Other)							

Own a Mobile	Ghana *** Namibia* South Africa*	Ghana** Namibia** South Africa ** Mozambique* Botswana*	Ghana*	Nigeria*	Ghana* Namibia* South Africa**	-	Ghana** Nigeria* Namibia** South Africa*
Intermediate	Uganda* Kenya** South Africa *** Botswana*	Kenya** South Africa**	Botswana*** Ethiopia(-)*	South Africa***	Uganda* Botswana*	-	Uganda* Kenya** Tanzania* SouthAfrica* Botswana*
Advanced	Kenya*** South Africa*** Botswana*	Kenya*** South Africa*	Kenya* South Africa** Botswana***	Ethiopia** South Africa**	Kenya** South Africa* Botswana*	-	Kenya*** South Africa** Botswana*
Internet	Tanzania*	Kenya**	Tanzania(-)**	-	-	Cameroon(-)*	Mozambique*

****p<0.01, **p<0.05, *p<0.1*
Employed other contains urban self-employed, and urban and rural individuals employed by other people/entities

Separating the employment outcome between rural self-employed and other shows that for Tanzania, Cameroon and Ghana, mobile ownership is associated with a higher probability of self-employment for those in rural areas. In Cameroon, rural men who own mobile phones face a positive and significant probability of finding self-employment in rural areas. The same holds for women and older individuals in Ghana.

Aside from mobile ownership the activities used on mobile phones, and internet use are either not significant or associated with a negative impact on the probability of self-employment in rural areas. This correlation could possible reflect the growing use of technologies among those who are unemployed.

Considering the all other types of employment except rural self-employment, Table 11 shows that the results first presented in the simple logit models still hold, but for more countries, implying that the rural-self employed may have been skewing the results. Table 11 shows that in a selection of countries, namely; Tanzania, Uganda, Kenya, South Africa, Botswana, Namibia, Ghana, there are persistent effects of ICT use on the probability of employment, of these, the most impactful is owning a mobile phone.

For instance owning a mobile phone is associated with an increased probability of “other” employment in Ghana, Namibia, and South Africa, with significant effects in urban areas, among females and among non-youth. Further, Intermediate and advanced activities carried out on mobile phones, increase the probability of employment compared to those conducting basic activities for Kenya, South Africa and Botswana.

The results change however when we consider internet use - Kenya and Tanzania are the only countries who show an association between internet use and employment. However, this association is quite weak (significant at the 10% level) and may not be robust.

Table 11 also shows that, for employment that is not rural self-employment, ICTs have no impact on the probability of young people finding a job in any of the countries considered. This is interesting since it may be illuminating structural challenges faced by young people when it comes to entering the job market.

The results show that for a handful of countries there seems to be evidence of a positive association between any form of employment that does not include rural self-employment and ICTs. What this association means for policy is discussed in the conclusion.

Policy implications and Conclusion

The results are by no means unilateral and do not fit into a cookie cutter approach. But what this does show is the potential for ICTs to assist in the employment outcome.

When it comes to the internet, local content generation will become increasingly important in creating accessibility. Local content generation builds and manages online communities that offer young people opportunities to discuss topics related to health, education, jobs and entertainment with their peers and subject matter experts on mobile, helping users to generate content that matters most to them In addition, social networking sites such as Facebook can function as platforms for user-generated content specific to the interests, wants and needs of people in developing countries. http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/11/GSMA_Digital-Inclusion-Report_Web_Singles_2.pdf

References

Aker, J. C. (2008). Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger. Bureau for Research and Economic Analysis of Development (BREAD) Working Paper 177.

Aker, J. C. and I. M. Mbiti. (2010). Mobile Phones and Economic Development in Africa. Journal of Economic Perspectives, 24 (4): 207 – 32.

Banks, K. (2008). 'Mobile Phones and the Digital World', PC World, July 29. [Online]. Available at: http://www.pcworld.com/article/149075/mobile_phones.html
[Accessed 21 July].

Beurmann, D. (2011). Telecommunications Technologies, Agricultural Profitability and Child Labour in Rural Peru. Central Bank of Peru, Working Paper Series, 2011-12.

Boyera, S. (2007). The Mobile Web to Bridge the Digital Divide? In IST-Africa Conference 2007, 9 – 11 May, Maputo, Mozambique.

GSM Association (GSMA). (2014). The Digital Inclusion Report, GSMA Development Fund. Available at: http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2014/11/GSMA_Digital-Inclusion-Report_Web_Singles_2.pdf [Accessed 20 July 2016].

GSM Association (GSMA). (2015). The Mobile Economy: Sub-Saharan Africa in 2015. [Online]. Available at: https://www.gsmaintelligence.com/research/?file=721eb3d4b80a36451202d0473b3c4a63&download
[Accessed 19 July 2016].

Handjiski, B. (2015). 'Mobile Connectivity in Africa has Already Arrived', Brookings, 18 March. [Online]. Available at: http://www.brookings.edu/blogs/future-development/posts/2015/03/18-africa-mobile-connectivity-handjiski
[Accessed 19 July 2016].

International Telecommunications Union (ITU). (2015). ICT: Facts and Figures 2015. [Online]. Available at: http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf
[Accessed 21 July].

Jensen, R. (2007). The Digital Provide: Information (Technology), Market Performance and Welfare in the South Indian Fisheries Sector. Quarterly Journal of Economics, 122(3): 879–924.

Klonner, S. and P. Nolen. (2010). Cell phones and rural labour markets: Evidence from South Africa. Unpublished mimeo.

Melamed, C. (2011). 'Is the "mobile revolution" really for everybody?', Global Dashboard, June 22. [Online]. Available at: http://www.globaldashboard.org/2011/06/22/is-the-mobile-phone-revolution-in-africa-really-for-everybody/
[Accessed 21 July].

Muto, M. and T. Yamano. (2009). The Impact of Mobile Phone Coverage Expansion on Market Participation: Panel Data Evidence from Uganda. World Development, 37(12): 1887-96.

Pew Research Center. (2015). Cell Phones in Africa: Communication Lifeline. [Online] Available at: http://www.pewglobal.org/2015/04/15/cell-phones-in-africa-communication-lifeline/ [Accessed 19 July 2016].

Pew Research Center. (2015). Global Attitudes and Trends – Datasets. [Online].
Available at: http://www.pewglobal.org/category/datasets/2014/
[Accessed 25 July].

Statistics South Africa. (2011). Census 2011: Census in Brief. [Online]. Available at: http://www.statssa.gov.za/census/census_2011/census_products/Census_2011_Census_in_brief.pdf [Accessed 22 July].

UNESCO. (2015). Data Center. [Online]. Available at:
http://www.uis.unesco.org/datacentre/pages/default.aspx
[Accessed 22 July].

Vodafone. 2005. Africa: The Impact of Mobile Phones, Vodafone Policy Paper 3.

World Bank. (2015). World Development Indicators. [Online]. Available at:
http://wdi.worldbank.org/tables
[Accessed 22 July].

Appendix A

Table A1: Employment by geolocation and sex (2012)							
Country	Whole Population		Urban Subpopulation		Rural Subpopulation		Total employment rate
	Male	Female	Male	Female	Male	Female	
Ghana	87.4%	72.5%	88.5%	70.6%	86.4%	74.4%	**78.8%**
Kenya	89.6%	63.2%	94.1%	65.3%	88.8%	62.6%	**73.2%**
Cameroon	90.1%	50.1%	86.1%	45.1%	93.7%	58.5%	**69.4%**
Tanzania	86.8%	56.4%	86.0%	47.3%	87.1%	60.0%	**69.3%**
Nigeria	90.1%	42.4%	88.9%	46.0%	91.0%	38.1%	**67.6%**
Uganda	86.1%	42.6%	86.4%	42.1%	86.1%	42.7%	**65.5%**
Botswana	74.1%	54.2%	82.5%	57.9%	58.1%	49.4%	**62.1%**
Ethiopia	84.4%	32.7%	90.5%	54.6%	83.4%	27.4%	**61.0%**
Mozambique	73.4%	35.9%	79.2%	43.4%	70.6%	33.1%	**54.6%**
Rwanda	58.0%	44.7%	52.5%	50.9%	60.0%	43.2%	**51.1%**
Namibia	59.6%	38.7%	78.3%	57.2%	50.5%	30.4%	**47.4%**
South Africa	65.0%	31.1%	75.2%	37.1%	46.9%	20.9%	**46.5%**