BIDPA Working Paper 68

March 2019

Impacts of Access to ICTs on Employment Status in Botswana

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BIDPA is part-funded by the Government of Botswana.

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ISBN: 99912-65-75-9

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ABSTRACT

It is clear that technology has brought about significant changes in the livelihoods of people, creating new forms of employment and advancing the traditional forms of employment for individuals. Many countries continue to invest in Information and Communication Technologies (ICTs) with the view to tackling some of the economic challenges such as unemployment. Botswana like other African countries has made annual budgetary allocations towards ICT Infrastructure. Despite, the Government's efforts to invest and improve access to ICT, the country still faces a high unemployment rate, particularly for the youth. This study therefore, investigates the impact that access to ICTs has on the employment of individuals in Botswana. In order to provide a detailed analysis of the impact of ICTs on employment we apply a probit model for binary choice responses to being employed or not being employed, using the data from the 2014 Botswana Household Access and Individual use of Information Communication Technology Survey carried out by the Statistics Botswana. The empirical results provide evidence that access to ICTs collectively has a positive impact on employment in Botswana. However, disaggregating the ICTs forms presents slightly different results, e-skill training and access to the internet in Botswana are not significant in explaining an individual's employment status, this may be associated with low uptake of internet and ICTs skills by individuals in Botswana. The policy message from this study is that there is a need for aggressive implementation of collective ICT. [In addition, there is need to improve collective ICTs infrastructure to create more employment].

Keywords: Botswana, ICTs, Employment, Probit

1. INTRODUCTION

Globally, Information and Communications Technologies (ICTs) have become a necessity for everyday life for most people. Over 2 billion people now own phones with internet connection, and these have brought a wide range of opportunities to average people. These technologies have conjointly expanded capabilities for firms and governments. In the private sector, companies are able to use new technologies to increase production and reduce high input costs, thus increase productivity and profits (Chorafas, 2011).

ICTs provide developing countries with an exceptional opportunity to meet vital development goals, such as employment creation, poverty reduction, access to basic healthcare, education, and democratic participation enhancement, among others. Empirical research that analysed the impact of ICTs on employment have found that there has been a slow move from high labour intensive industries to services and high technology manufacturing industries.

African countries have not been left behind, as they have undergone a remarkable ICT revolution in the last two decades, with intensive use of advanced technologies in all aspects of life. Recent statistics show that more than two thirds of adults in Sub-Saharan Africa have mobile phones and about 16 adults per 100 people have access to the internet (ITU, 2017). In fact, most of the African countries experience a widespread of technological equipment such as, computers, mobile phones and internet. These technologies have given people the ability to quickly obtain information anytime and from anywhere in the world. Accessible data through networks and software applications have made jobs and/or tasks much easier. Increased amount of economic activities now take place with the support of these technologies.

Many developing countries particularly in Africa, have started to invest in education and advance their educational system in order to prepare employees for the ICT business, as well as for the e-Government base (Doucek, 2011). Additionally, access to ICTs and skills to use ICT, both at country and individual level, can boost the inclusion of marginalised groups. This inclusion can occur through different channels, such as improving participation in democratic processes; providing basic healthcare, permitting participation in the labour market, etc.

In Botswana, the Government has made deliberate efforts to improve the ICT infrastructure with the aim of harnessing dividends that ICTs could bring along into the economy. Since National Development Plan (NDP) 10 and the current NDP 11, the Government has continued to increase expenditure towards ICT infrastructure. In the 2018/19 national budget, P461.35 million was proposed to improve the Government ICT infrastructure, including expansion of the Government data network and installation of ICT infrastructure in secondary schools. Such investments are expected to facilitate

economic growth and address some of the country's major economic challenges, among others high unemployment levels (Republic of Botswana, 2018).

Despite these Government efforts to invest and improve access to ICT, the country still faces major economic challenges such as high unemployment rate, especially among the youth and other vulnerable groups. Past studies (Siphambe, 2003; Siphambe, 2007; Essilfie, 2014; Maunganidze, Faimau and Tapera, 2016; Mogomotsi and Madigele, 2017; Pheko and Molefhe, 2017), have made a contribution to literature on the spectrums of unemployment, but not on the role of ICT access on individual's probabilities of employment.

In the 1980s and early 1990s the evident debate was on whether technologies/automation would replace human labour in industries. Literature in the developed world then, suggested that countries that have a greater penetration of ICTs were more likely to experience labour disruption faster than those with lower penetration. Anderson and Harris (1989), concluded that technological developments would not radically affect employment until the year 2000. During that time, analyses had shown that the effects of ICTs on employment might not have been significant because many companies had not yet started to exploit the full potential of automation tools and high-speed communication networks (Anderson and Harris, 1989). Anderson and Harris (1989) further concluded that ICTs were creating new jobs requiring higher skill levels, while low-skill and low-wage jobs were decreasing in industries that heavily used communications. In addition, it has been argued, that the rate of unemployment is higher in the recent years compared to years before technology advancement and over the last two decades, unemployment rate in the European Union countries has increased significantly. (Chorafas, 2011).

It is clear that technology has brought about substantial changes in the lives of people, including, of course, the types of employment available. This is often necessary for sustainable economic growth. People that possess a wider range of technological skills are often able to access varied job opportunities.

Given the above non-converging literature and the increased investment by the Government of Botswana towards ICT improvement, the question that remains obvious is, "does access to ICTs impact employment in the developing nation of Botswana?" It is essential to have knowledge of the extent to which access to different forms of ICTs have on predicting the probability of employment for individuals. Hence, the aim of this study is to evaluate the impact that the access to ICTs has on the employment of individuals in Botswana. The specific objectives of the study are to determine; i) the independent impact of access to ICTs (use of mobile phones, computer, internet and ICT skills), on employment and ii) the collective impact of access to ICTs on employment.

The rest of the paper is structured is as follows: the review of literature is undertaken in section 2, followed by methodology and data in section 3. The empirical results and

discussion are presented in section 4, and the conclusion and recommendations are presented in section 5.

2. LITERATURE REVIEW

This section presents a broad discussion of the literature that deals with the relationship between ICTs and employment. The aim is to provide the background for a discussion of how ICTs affects individual probabilities of employment. Section 2.1 covers the empirical findings on individual's characteristics and employment, while section 2.2 discusses the relationship between ICTs and employment. This is done from the perspective of the job seeker, thus the supply-side in the labour market.

2.1 INDIVIDUAL CHARACTERISTICS AND EMPLOYMENT STATUS

There is rich empirical literature on employment and unemployment in both developed and developing countries (Mathebula, 2017; Khumalo and Eita, 2015; Ogbeide, Kanwanye and Kadiri, 2015; Kassa, 2012; Malema, 2011; Wamuthenya, 2010). These studies conclude that an individual's characteristics are important in determining their employment status.

In India, a study by Tripathi, (2016) found that the probability of being in a salaried employment increased for urban dwellers with technical degrees and for males. These results confirm that probability of being in a paid job increases with high educational attainment an individual has and place of residence.

Comola and Mello, (2009) found that unemployment in Indonesia is particularly high for the youth and for workers with secondary and tertiary education. The study also found that a rural individual is more likely to work in the informal sector than to be active in the formal sector. These results are in line with educational attainment which was seen to be a powerful predictor to job market outcomes. The probability of being employed rose along with higher educational attainment.

In a township in South Africa, Dunga and Sekatane, (2014) found that age reduces the probability of getting a job. The study also found that education of the head of household was significant at 10% confidence level. In addition, Duncan, (2013) argue that in South Africa well-educated workers acquire better jobs, earn higher incomes and are more productive. This is not a unique result as employment is mostly correlated with education levels. Likewise, Mincer (1988), found that an extra year of education can diminish the possibility of unemployment by 1.3% points at different levels of experience. Similarly, Riddell and Song (2012) found that an additional year in school leads to a 2% increase in the probability of re-employment. Furthermore, Güell and Petrongolo, (2007) argue that there is some evidence that people with higher levels of education have higher prospects of securing a permanent job as compared to those with low levels of education (Charlot

and Malherbet, 2013). However, it should be noted that advanced skills and knowledge are also obtained through experience, suggesting that there are wage increases related to job experience rather than to schooling (Sicherman, 1990).

In Botswana, Shiphambe, (2003) found that being younger reduces the chances of being employed, while education significantly enhances the chances of being employed. However, residing in an urban centre or in the rural area were found not to have no significant influence on employment. In the Okavango region, Kemiso and Kolawole, (2017) found a positive correlation between a youth's level of education and their unemployment.

In a macroeconomic analysis of unemployment in Botswana, Sechele, (2016), found that women and youth are most hit by unemployment, female unemployment rates were higher than male unemployment rates for all age groups. This implies that being female decreases the probabilities of being employed in Botswana's labour market, while males have better probabilities of being employed.

Another key finding was that youth aged between 12 years and 29 years had high prevalence of unemployment, and that generally the unemployment rates dropped when age increases. Unemployment rates for all youth categories are higher than the national rate, the most affected age group are between 15 and 24 years, whose rates are either double or more than double the national rate of unemployment (Statistics Botswana, 2015). The 2014/15 Botswana Multi-topic household Survey indicates that the highest unemployment rate of 48.9 % is of people aged 18 and 19 years (Statistics Botswana, 2017).

2.2 ICTS AND EMPLOYMENT STATUS

ICTs are found to impact employment directly both collectively and even when disaggregated. Katz, (2009) argues that ICT diffusion can increase employment in at least three ways; (i) direct jobs created during the construction of broadband infrastructure, (ii) jobs generated indirectly in retail businesses that trade broadband goods and/or services, and (iii) induced jobs in other sectors of the economy. Predominantly ICTs continue to have a profound impact on employment across all sectors. Evangelista, Guerrieri, and Meliciani (2014) used aggregate data for European Union countries, and found that digitalisation is linked to an increase in the employment in manufacturing sector. In Turkey, the association between employment and ICT applications is positive and significant, with a stronger association for firms with wide ICT applications than for firms with more specific ICT applications, (Atasoy, Banker and Pavlaou, 2016).

Biagi and Falk, (2017) found no evidence supporting the hypothesis that ICT applications destroy jobs, in fact, ICT enablers and most ICT systems applications were relatively

neutral to employment, demonstrating that the substitution effects and the compensation effect of ICT system and employment neutralises each other. In contrast, a study which covered more than 7000 firms in Europe found that the use of e-commerce technologies is correlated to a decrease in employment (Koellinger, 2008).

Impacts of computer-use and employment dates as far as 1960s (Crossman, 1965; Borodin and Gotlieb, 1972; Osterman, 1986). In recent studies, (Schleife, 2005) found that, age has a significant impact on the probability of using a computer on the job. For older workers (aged 55 to 64 years) the impact is negative and implies a decline in probability of computer use compared to younger workers, even after controlling for many other variables.

Friedberg, (2003) argues that the educational level has an important influence on the probability of using a computer. The higher the level of education of workers, the higher the extent of computer use on the job. However, the level of education shows almost no significant relation with computer use when analysing workers aged 50 to 60 only. Recently in Europe, Menon, Salvatori and Zwysen, (2018) found that computer use increased within all education groups. In fact, computer use remains much higher among workers with higher levels of education.

Recent studies investigate the link between internet/broadband access (internet as a one form of ICTs) and employment at the macroeconomic level. In the Unites States, using data between 1999 and 2006 (Kolko, 2012) found that broadband penetration is linked with both population and employment growth. Atasoy (2013) found a direct and significant association between broadband access and employment rate. Additionally, Jayakar and Park, (2011) concluded that countries with enhanced broadband connectivity had slightly lower unemployment rates. Internet connectivity is also associated with better job search and job changing, thus internet can lead to better paying jobs (Stevenson, 2006). In contrast, in the United Kingdom De Stefano, Kneller, and Timmis (2014) found that broadband penetration is neutral in affecting employment.

In Africa, findings from Hjort and Poulson (2018) are that internet impacts worker's relative demand for skilled and unskilled positions similar to developed countries. Using a panel data analysis (Ebaidalla, 2014) investigated the effect of ICTs on youth unemployment in Sub Saharan Africa and found that the coefficient of mobile phone subscriptions was inversely and statistically different from zero, indicating that an increase of mobile networks results in negative effect on youth unemployment. Thus, the increased use of communications played a significant role in reducing youth unemployment.

The use of mobile phones seems to be more profound than computers in Africa, (World Telecommunication ICT Indicators Database, 2017). This is affirmed by the Pyramid Research, (2010) who found that in Nigeria the growth of mobile phones use influences growth in the industry itself and related industries, and has created employment.

3. METHODOLOGY AND DATA

3.1 METHODOLOGY

The objective of this study is to analyse the impact of access to different forms of ICTs on employment in Botswana. In order to provide a detailed analysis of the impact of ICTs on employment we apply a probit model[1] for binary choice responses to being employed or unemployed. The dependent variable takes on the values of 0 and 1; 1 if employed and 0 otherwise. Therefore, the study is based on the general function below;

$$Y_i = X_i'\beta + U_i \quad (1)$$

Where is the probability of being employed for individual and has a linear relationship with the possible factors of employment, X_i'. β is a vector of slope parameters for the factors and U_i is the stochastic error term which takes care of all the possible factors determining employment and which might have not been included in the model. Unpacking equation 1 above, employment is a function of individual characteristics and ICT access variables, as given in the following general function;

$$\text{Prob}(Employed = 1) = \emptyset(\beta_1 + \beta_2 Age + \beta_3 Gender + \beta_4 Edu\_level + \beta_5 District + \beta_6 MPU + \beta_7 CU + \beta_8 CST + \beta_9 IU) \quad (2)$$

Individual characteristics are; age, gender, education level, and district of residence. ICT access proxied by the following variables; mobile phone usage (MPU), computer usage (CU), computer skills training (CST), and Internet usage (IU). The choice of the ICT Variable was mostly influenced and limited by availability of data.

3.2 DATA

The study uses data from the 2014 Botswana Household Access and Individual use of Information Communication Technology survey carried out by the Statistics Botswana. The survey covered the whole of Botswana during 2014 and data was collected from individuals aged 10 years and older. The total sample size of the survey was 4,984. This study however used a sample size of 3,035, due to data cleaning and limiting the sample to individuals aged 18 years to 65 years.

Table 1 of the study gives a more detailed variable explanation and the corresponding questions as they were asked on the individual's questionnaire. The variable District is the residential districts of an individual, Cities and towns was author computed by combining resident from Botswana Cities and Towns (Gaborone, Francistown, Lobatse, Jwaneng, Sowa, and Selibe-Phikwe), Southern District the author combined Ngwaketse

1 The probit model is a statistical probability model with two categories in the dependent variable and is based on the cumulative normal probability distribution.

and Borolong districts and lastly North West was obtained from combining Ngamiland and Chobe Districts. This was done in accordance to the Botswana Administrative Mapping.

Table 1: Variables definitions as per the 2014 ICT Survey (Individual Questionnaire)

Variable	Questions as per the questionnaire	Responses
Dependent Variable		
Employment Status	Did you do any type of work for pay or profit in the last 12 months?	Yes, No
Individual characteristics		
Age	How old are you in completed years?	Open ended with only two digits
Gender	Sex	Male, Female
Level of Education	What level are you attending/did you complete?	No formal education, Primary, lower secondary, upper secondary, tertiary and other unspecified
District	Individual's City/Town/District	
Access to ICT		
Mobile Phone Use	Do you have/own a mobile cellular telephone?	Yes, No
Computer Use	Have you used a computer (of any type, desktop, laptop tablet or notebook) from any location in the last 12 months?	Yes, No
Computer Skills Training	Have you ever taken a training course (of at least 3 hours) on any aspects of computer use in the last 12 months?	Yes, No
Internet Use	Have you used the internet from any location in the last 12 months?	Yes, No

Source: 2014 Botswana Household Access and Individual use of Information Communication Technology survey

Table 2: Definition of Variable Used in the Model

Variable	Variable Description
Dependent Variable	
Employment Status	1 if individual is employed, 0 otherwise
Individual's characteristics	
Age	Number of completed years
Gender	1 if Male and 0 if Female
Education (Highest level of education completed)	
No formal Education	1 if no formal education has been attained, otherwise 0
Primary education	1 if highest education completed is primary education, otherwise 0
Secondary education	1 if highest education completed is secondary education, otherwise 0
Tertiary education	1 if highest education completed is tertiary education, otherwise 0
District of residence	
Cities/Town	1 if residing in a city or a town, otherwise 0
Southern	1 if residing in Ngwaketse and Borolong Districts, otherwise 0
South East	1 if residing in South East district, otherwise 0
Kweneng	1 if residing in Kweneng district, otherwise 0
Kgatleng	1 if residing in Kgatleng district, otherwise 0
Central	1 if residing in Central district, otherwise 0
North East	1 if residing in North East district, otherwise 0
North West and Chobe	1 if residing in Ngamiland and Chobe districts, otherwise 0
Ghanzi	1 if residing in Ghazi district, otherwise 0
Kgalagadi	1 if residing in Kgalagadi district, otherwise 0
Access to ICT	
Mobile Phone Use	1 if mobile phone was used, otherwise 0
Computer Use	1 if a computer was used , otherwise 0
Computer Training	1 if attained some computer skills training, otherwise 0
Internet Use	1 if internet was used, otherwise 0

Source: Authors Definitions

Descriptive statistics are presented in Table 3. Most of the variables are dummies, with exception of age, education level and district, which are continuous and categorical respectively. Table 3 shows that 56% of the individuals in the sample were employed, implying that 44% were unemployed. The average age of the individual in the study is 35 years, the youngest individual in the study was 18 years old, while the oldest was 65 years old. The sample comprises of 44% of the males and 56% females, and covered 28% individuals residing in the cities and towns, while the rest were residing in villages in different districts of Botswana. Over 87% of individuals had access to mobile phone,

while about 40% had access to both computer and internet. The proportion of individuals with computer skills (individuals who attended computer skills training within the last 12 months of the study period) was 13% of the total sample.

Table 3: Descriptive Statistics of Variables Used in the Model

Variables	Mean	Std. Dev	Min.	Max
Dependent variable				
Employment Status	0.559	0.497	0	1
Individual characteristics				
Age	35.042	12.118	18	65
Gender	0.443	0.497	0	1
Education (Highest level of education completed)				
No formal Education	0.100	0.300	0	1
Primary education	0.179	0.381	0	1
Secondary education	0.477	0.500	0	1
Tertiary education	0.246	0.431	0	1
District of residence				
Cities/Town	0.280	0.449	0	1
Southern	0.098	0.297	0	1
South East	0.041	0.199	0	1
Kweneng	0.113	0.317	0	1
Kgatleng	0.032	0.183	0	1
Central	0.195	0.396	0	1
North East	0.026	0.158	0	1
North and Chobe	0.108	0.311	0	1
Ghanzi	0.039	0.194	0	1
Kgalagadi	0.065	0.246	0	1
Access to ICT				
Mobile Phone Use	0.872	0.490	0	1
Computer Use	0.398	0.490	0	1
Computer Skills Training	0.129	0.335	0	1
Internet Use	0.400	0.490	0	1

Source: Author computed from 2014 2014 Botswana Household Access and Individual use of Information Communication Technology survey

Table 4 presents the cross-tabulation of the ICT indicator and employment status. The table shows that from the total sample of 3035, the employed individuals were 1696, while the unemployed individual were 1339. From those employed around 92%, 47%, 45% and 13% used mobile phone, computers, internet and went for ICT training respectively, while around 8%, 53%,55% and 875 of those employed did not use mobile phone, computer, internet and went for ICT training respectively. For those unemployed 82%, 31%, 34% and 13% used mobile phone, computers, internet and went for ICT training respectively. The unemployed who did not use mobile phone, computers, internet and did not attain ICT training were 18%, 69%, 66% and 87% respectively. From the table we note that mobile phone use is the most popular form of ICT used in Botswana, while a large sample of individual in 2014 did not attend ICT training in the previous year of data collection.

Table 4: Cross-Tabulation of Employment Status and ICT Variables Used in the Model

		Mobile Phone Use		Computer Use		Internet Use		E-Skills Training	
		No	Yes	No	Yes	No	Yes	No	Yes
Unemployed	Freq.	247	1,092	920	419	888	451	1,164	175
	Row %	18.45	81.55	68.71	31.29	66.32	33.68	86.93	13.07
Employed	Freq.	141	1,555	907	789	934	762	1,479	217
	Row %	8.31	91.69	53.48	46.52	55.07	44.93	87.21	12.79
Total	Freq.	388	2,647	1,827	1,208	1,822	1,213	2,643	392

Source: Author computed from 2014 Botswana Household Access and Individual use of Information Communication Technology survey

2.3 DATA LIMITATIONS

Data used for this study present the following limitations; employment status is a binary variable and is considered homogenous, thus it does not indicate different professional occupation of the individuals. This is notwithstanding that different forms of employment may require different forms and access to ICTs. Education variable is considered categorical variable, while in an optimal situation it should have been considered a continuous variable (Number of years of schooling), this may lead to lower explanatory power of the overall model.

4. EMPIRICAL RESULTS AND DISCUSSION

In this section, the empirical findings for the probit model investigating the impacts of the ICTs on employment are presented. Due to high expected association between the ICT variables, before conducting the probit model, we carried out a correlation test[2]. If correlation is found between two variables it means that when there is a systematic change in one variable, there is also a systematic change in the other; thus the variables change together. As anticipated the results (Table 5) indicate the existence of correction among all ICT indicator variables. If correlation is not treated, it may lead to over estimation of coefficients.

Table 5: Pairwise Correlation Results for ICT Indicators

	Mobile phone Use	Computer Use	Computer Skills training	Internet Use
Mobile Phone Use	1.000			
Computer Use	0.2428	1.000		
Computer Skills Training	0.1092	0.4636	1.000	
Internet Use	0.2580	0.7259	0.3777	1.000

Source: Author computed from 2014 Botswana Household Access and Individual use of Information Communication Technology survey

To address the problem of correlation between the ICT variables, the study adopted two widely used methods: (i) simply dropping other ICT variables and interchanging the indicators in different independent models, thus the study estimated four different models (model 1 to 4) with different ICT variables, and (ii) computing an index with the four ICT indicator variables and using it to undertake factor analysis (FA)[3], and this is presented by model 5. Prior to constructing an index, it is important to verify if the variables used are compatible for factor analysis. We conducted a Bartlett test of sphericity which rejected the null hypothesis that the 4 ICT indicator variables are not inter-correlated. In addition, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was found to be 0.653, which gives us enough evidence that factor analysis is appropriate to be applied on the variables of interest.

The results obtained from the estimation of the probit model are presented in Table 6. The coefficients give the probability of being employed against variation in the

2 Correlation analysis is a method of statistical evaluation used to study the strength of a relationship between two, numerically measured, continuous variables. This particular type of analysis is useful when a researcher wants to establish if there are possible connections between variables.

3 Factor Analysis is a method for modelling observed variables, and their covariance structure, in terms of a smaller number of underlying unobservable (latent) "factors." The factors typically are viewed as broad concepts or ideas that may describe an observed phenomenon.

explanatory variables. The level of significance of the explanatory variables is given by their respective p-values (p>z). The overall level if significance of the models is given by the log likelihood ratio (Prob.>chi2). All the models are significant at 99% level of confidence, which implies that overall all the models are significant and the independent variables are fit for the models.

4.1 INDIVIDUAL CHARACTERISTICS

The probit results for all the 5 models show that the age is significant and positive, indicating that the older an individual gets, the higher the probability of being employed. Thus, the behaviour of the variable, age conforms to the human capital theory in the sense that the employment and work experience increases with age. This result is in line with previous study (Siphambe, 2003) which found that the increased number of years decreased the chances of unemployment in Botswana.

The positive and significant gender variable indicates that being a male positively impacts the probability of being employed. From all the models, males have roughly 14% higher probability of being employed compared to their female counterparts. This result confirms that Botswana is still lagging behind in improving gender equality in the labour markets despite several initiatives (for example the special funding for women in business) by the government to encourage women to participate in the labour market.

The level of education attained is a categorical variable with categories: no formal education, primary education, secondary education and tertiary education. The reference category is no formal education. The probability of being employed increased as the level of education increase for individual with formal education compared to individuals without formal education. For instance, in model 5, the probability of being employed for individuals with primary, secondary and tertiary education is 10.1%, 24.8% and 28.2% respectively, higher than the probability of being employed for an individual with no formal education. Similarly, Tripathi, (2016), and Riddell and Song, (2012) found that education plays an important role in determining individual's employment. Higher educational attainment is associated with technological knowledge acquisition which makes job seekers more marketable. Continued investment in the education sector, particularly tertiary education, is a step in the right direction for combating the high unemployment in Botswana.

Place of residence significantly explains the employment status of individuals. The variables for residence are categorical and the reference category is individuals residing in cities and towns. The negative signs on all residence variables indicates that residing in these locations decreases the probability of employment compared to residing in cities or/and town. Among all the districts, residing in Ghanzi is not significant in predicting employment status. Botswana is sparsely populated making infrastructure development difficult, especially in rural areas, with cities and towns having better infrastructure.

Thus, better infrastructure development in cities and towns leads to more employment opportunities compared to rural areas.

4.2 ACCESS TO ICT INDICATORS

As indicated above the ICT indicators were run on different models to avoid the correlation among these variables. Model 1, indicates that owning a mobile phone has a significant and positive impact in the probability of being employed. An individual that owns a mobile phone has 13.8% higher probability of being employed compared to an individual who does not own a mobile phone. This could be due to high mobile phone usage in the country, thus most people in Botswana own a mobile phone and hence most employed people would own a mobile phone.

Model 2, the coefficient of the use of a computer is positive and significant. This implies that an individual who has access to a computer is 9.3% more probable of being employed than an individual who does not have access to a computer.

Even though many international studies indicate that the use of internet, especially in developed countries plays a critical role on employment, this is not true for Botswana. The results from Model 3 indicate that the use of internet in Botswana does not have a significant impact on an individual's probability of being employed. Internet uptake in Botswana as a developing country is still very low, majority of citizens do not have access to internet and even if they do, they use mobile phone internet data. In fact, in 2016 Statistics Botswana found that only 36.75% of the population aged 10 years and older used internet in Botswana (Statistics Botswana, 2016). This is despite the fact that the Government has made notable investments in ICT infrastructure. Most internet users are found in urban areas, while most people outside the cities and towns do not have access to internet, let alone a broadband connection. On the other hand, the majority of jobs in Botswana do not require internet use hence the insignificance of internet use on employment. Another plausible explanation of the insignificant coefficient of the internet access variable on employment might be that most internet users do not use it to seek employment, suggesting that jobs are still advertised in print media.

Computer skills or e-skills variable is included in Model 4. During the data collection, individuals were asked if they had taken a training course (of at least 3 hours) on any aspects of computer use in the past 12 months of the study period. This variable is significant and negatively impacts an individual's probability of being employed. The results indicate that individuals that took a computer skills training had 11% lower probability of being employed. Thus, those that took computer training courses are more likely to be unemployed. A plausible explanation for this is that, individuals that are unemployed are more likely to take computer use training as a measure of improving their ICT skills and hence improve their chances of getting employed in the future.

As indicated by results from models 1 to 4, different ICT indicators have different impacts on individual's employment in Botswana. The study has constructed an index[4] composed all the ICT indicators together and used it in the estimation of model. Model 5 shows that access to ICTs has a positive and significant impact on individual's probability of employment. Increasing access to ICTs increases individual probability of being employed by 2.4%.

4 Through the Factor Analysis

Table 6: Probit estimates of the impacts of ICTs on employment

	Model 1: Mobile phone Use			Model 2: Computer Use			Model 3: Internet Use			Model 4 : e-skill Training			Model 5: ICTs Index		
	Coeff.	P > z	dy/dx	Coeff.	P > z	dy/dx	Coeff.	P > z	dy/dx	Coeff.	P > z	dy/dx	Coeff.	P > z	dy/dx
Age	0.019	0.000***	0.007	0.021	0.000***	0.008	0.192	0.000****	0.007	0.02	0.000***	0.008	0.021	0.000***	0.008
Gender	0.378	0.000***	0.147	0.366	0.000***	0.143	0.378	0.000***	0.147	0.369	0.000***	0.144	0.368	0.000***	0.144
Education Level															
Primary	0.195	0.040**	0.757	0.270	0.004***	0.104	0.260	0.005***	0.100	0.266	0.004***	0.103	0.260	0.005***	0.101
Secondary	0.551	0.000***	0.214	0.625	0.000***	0.242	0.678	0.000***	0.261	0.663	0.000***	0.256	0.641	0.000***	0.248
Tertiary	0.729	0.000***	0.269	0.699	0.000***	0.258	0.953	0.000***	0.340	0.832	0.000***	0.302	0.773	0.000***	0.282
Districts															
Southern	-0.729	0.000***	-0.173	-0.411	0.000***	-0.163	-0.461	0.000***	-0.182	-0.44	0.000***	-0.174	-0.431	0.000***	-0.171
South East	-0.252	0.043**	-0.100	-0.261	0.036**	-0.104	-0.240	0.055*	-0.095	-0.261	0.036**	-0.104	-0.264	0.034**	-0.105
Kweneng	-0.329	0.000***	0.130	-0.308	0.000***	-0.122	-0.361	0.000***	-0.143	-0.333	0.000***	-0.132	-0.322	0.000***	-0.128
Kgatleng	-0.369	0.006***	-0.147	-0.380	0.004***	-0.151	-0.391	0.003***	-0.155	-0.383	0.004***	-0.132	-0.380	0.004***	-0.151
Central	-0.363	0.000***	-0.144	-0.353	0.000***	-0.140	-0.399	0.000***	-0.158	-0.374	0.000***	-0.148	-0.364	0.000***	-0.144
North East	-0.288	0.060*	-0.114	-0.282	0.066*	-0.112	-0.330	0.030**	-0.131	-0.314	0.04**	-0.126	-0.302	0.048**	-0.120
North West	-0.307	0.000***	-0.122	-0.299	0.000***	-0.119	-0.337	0.000***	-0.134	-0.316	0.000***	-0.125	-0.308	0.000***	-0.112
Ghanzi	0.050	0.698	0.020	0.040	0.761	0.016	-0.034	0.796	-0.013	0.003	0.984	0.001	0.021	0.870	0.008
Kgalagadi	-0.396	0.000***	-0.157	-0.395	0.000***	-0.395	-0.446	0.000***	-0.176	-0.417	0.000***	-0.165	-0.405	0.000***	-0.160
ICTs Indicators															
Mobile Phone Use	0.347	0.000***	0.138	-	-	-	-	-	-	-	-	-	-	-	-
Computer Use	-	-	-	0.239	0.000***	0.093	-	-	-	-	-	-	-	-	-
Internet Use	-	-	-	-	-	-	-0.278	0.000***	-0.110	-	-	-	-	-	-
e-Skills Training	-	-	-	-	-	-				0.064	0.318	0.025	-	-	-
ICTs Index	-	-	-	-	-	-	-	-	-	-	-	-	0.062	0.048**	0.024

Source: Author computed from 2014 Botswana Household Access and Individual use of Information Communication Technology survey
***, **, * statistically Significant at 1%, 5% and 10%, respectively

In addition, literature indicate that the impact of ICT differs according to different groups in the society. This study further investigated how access to ICTs (using the ICT Index,) by different groups impacts their probability of being employed in Botswana and the results of such analysis are presented in Table 7.

Table 7: Probit estimates of the impacts of ICTs on employment against different groups

		Coeff.	P > z	dy/dx
Age	Youth	0.064	0.144	0.025
	Elderly	0.479	0.000	0.178
Education	Below Tertiary	0.049	0.116	0.019
	Tertiary	0.142	0.007	0.049
Location	Cities	0.102	0.098	0.036
	Villages	0.044	0.249	0.017

Source: Author computed from 2014 Botswana Household Access and Individual use of Information Communication Technology survey

The results indicate that, access to ICT by the youth is not significant in explaining their employment status, while access to ICT by individuals older than 35 years, but less than 66 years is significant implying that increasing access to ICTs for this age group increases the probability of employment by 17.8%. This results confirms that youth unemployment in Botswana is still a major challenge.

Tertiary education is seen as an important characteristic in explaining individual's employment status. The results are in alignment with this hypothesis that, increasing access to ICT on individuals who have tertiary education increases their probability of employment. The results show that increasing ICT access for individuals with tertiary education, increases their probability of employment by 4.9%, while increasing access to ICT for individuals with education attainment lower than tertiary education is not statistically significant. In many other studies such as Friedberg, (2003) it is stated that the educational level has an important influence on the probability of using ICT equipment. The higher the level of education workers have, the higher the extent of computer use on the job (Schleife, 2005).

Geographical location is also vital in explaining employment status. In Botswana, increasing ICT access in cities and towns increases the probability employment of the residents by 3.6%, while ICT access to residents from villages is not statistically significant. This suggests that ICT-led growth is strongly localised geographically.

5. CONCLUSIONS AND RECOMMENDATIONS

The main aim of this study was to analyse the impact of access to different forms of ICTs on employment in Botswana. The study has shown that access to ICTs collectively (Model 5 results) has a positive impact on employment in Botswana. However, disaggregating the ICTs forms (results on models 1 to 4) has slightly different results, e-skill training and access to internet in Botswana are not significant in explaining an individual's employment status. Furthermore, access to ICTs impacts societal groups differently. For instance, access to ICT by females and elderly population positively impacts their employment status. In addition, ICT access increases the probability of employment for individuals with tertiary education.

The insignificancy of ICTs access on youth employment could be due to the fact that a large population of the youth (18-25 years) are still pursuing their tertiary education, and those who have completed are still unemployed, thus excluding these individual from the labour market. Lastly ICT access in Botswana's urban cities and towns impacts employment of the residents and similarly increasing access to ICT in villages impacts employment. Based on the findings from this study several policy suggestions can be drawn as stated below.

- Aggressive implementation of ICT human resource development: access to ICTs collectively has the potential to improve the employment status in Botswana (as seen from Model 5) and in addition level of education plays a critical role in the employment of individuals. Therefore, to improve employment there ought to be a national education policy that favours ICT human resource development. Public and private universities should be granted adequate funds not limited to run the existing programs but also assist to equip student with relevant ICT skills necessary for job market and new opportunities in the labour market.

- Holistic investment on ICT infrastructure: Access to ICTs collectively leads to desirable outcomes on employment. Therefore, with the current government investment plans there is a strategic need for the government to channel resources towards improving ICT infrastructures collectively, without leaving other ICTs infrastructure forms behind.

- More empirical research on impacts of internet: There is no doubt that the internet is becoming a gold mine of resources to those who wish to improve their knowledge and the economy. The government continues to invest in ICT infrastructure particularly internet connection in the country but in this paper, does not find any evidence that internet is important in impacting employment. To this note we recommend more studies to be carried out which investigates the association of internet to other vital sector in the economy.

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