International Journal of Public Administration in the Digital Age
Volume 6 • Issue 1 • January-March 2019

Determinants of Digital Divide in Africa and Policy Implications

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ABSTRACT

This article investigates the reasons most African households are not using the internet and discusses the policy implications for bridging the digital divide. The International Telecommunication Union (ITU) reports that at the end of 2014, only 7 percent of households in LDCs, most of whom are in Africa, had Internet access. This study analyses data from the ITU database and other sources to identify the determinants of the digital divide in Africa. Results show that peculiar challenges such as affordability and digital literacy do influence the percentage of African households who do not use the internet.

KEYWORDS

Affordability, Africa, Digital Divide, Households, Internet Penetration, Internet Use, Mobile Broadband, Mobile Cell Phone Subscription

INTRODUCTION

This study investigates the reasons why most households in Africa are not using the internet, and discusses the policy implications for bridging the digital divide. For the purpose of this study, digital divide is defined as the gap between households with effective access to computers and the Internet and those with very limited or no access. The International Telecommunication Union (ITU, 2012) argues the Internet is improving the lives of people in developing nations and facilitating access to economic opportunities and social welfare that were previously inaccessible to the poor. Unfortunately, many African countries lag behind other developing nations regarding the number of households using the Internet. Indeed, there has been widespread concern that while the digital divide in basic services between developed and developing countries has diminished in recent years as a result of the spread of mobile telephony, digital divide in the availability of broadband networks and services may have been growing between the rest of the world and the least developed countries (ITU, 2015), especially those in Africa. In particular, 72 percent of Africans do not use the Internet (Internet World Statistics, 2015), resulting in their inability to access the opportunities and gains offered by broadband. If Africans are to equally participate and reap the benefits of the information society, the reasons for many African households not using the Internet have to be empirically investigated to find workable solutions to such challenges.

DOI: 10.4018/IJPADA.2019010104

BACKGROUND

Statistics reported by the ITU (2015) suggest the presence of global broadband digital divide. According to a report issued by the United Nations Conference on Trade and Development (UNCTAD, 2009), the rate of individuals utilizing broadband services in rich nations was eight times greater than the rate in poorer nations, with the gap projected to widen in the near future. Recent ITU assessment of the global digital divide indicates that more than 70 countries have no fixed-line broadband service and more than 30 countries have less than one broadband subscription per 100 residents (ITU, 2009; 2010). Indeed, 32 of 38 African countries studied by the ITU had fixed broadband penetration of less than 1 percent at the end of 2013 (ITU, 2014).

Concerned about the inadequate broadband connectivity in the developing world, the ITU and its partners have launched series of summits aimed at connecting the developing nations. In October 2007, the Connect Africa Summit was organized by the ITU, the African Union and the World Bank, along with a number of UN agencies and other intergovernmental agencies in the Rwandan capital of Kigali. The summit proceedings set out a number of objectives for improving Africa's ICT infrastructure. Connect Africa was the first in a series of ITU initiatives that were designed to tackle the problem of low access to ICT in the developing world.

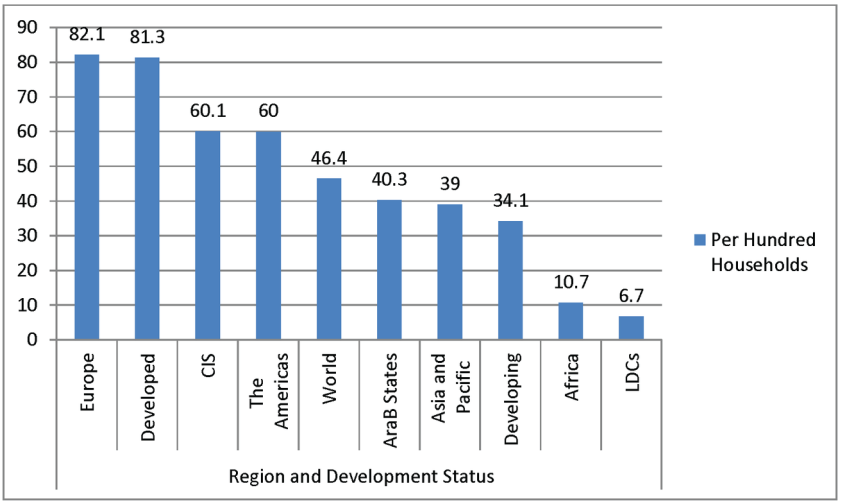
In September 2015, the United Nations (UN) General Assembly convened for the adoption of the agreed upon Sustainable Development Goals (SDGs). The outcome document, *Sustaining our World: The 2030 Agenda for Sustainable Development*, acknowledges that, 'the spread of information and communication technology and global interconnectedness has great potential to accelerate human progress and to develop knowledge societies (Broadband Commission for Digital Development, 2015). The document sets out ambitious ICT development targets in the goals for education, gender and infrastructure with ICTs recognized as the 'means of implementation' of for all SDGs.

Goal 1.1 of the Connect 2020 agenda agreed upon in 2014 by member states of the ITU states that worldwide, 55 percent of households should have access to the Internet by 2020. Goal 2.1B states 15 percent of households in Least Developed countries (LDCs) should have access to the Internet by the same year. However, the ITU (2015) argues the digital divide is proving stubbornly persistent in terms of access to broadband Internet, including the challenge of extending last-mile access to infrastructure to remote and rural communities. According to ITU, 43% of the world's population is now online with some form of regular access to the Internet. This leaves 57% or some 4.2 billion of the world's people who still do not enjoy regular access to the Internet (ITU, 2015). In the Least Developed Countries (LDCs), many of whom are in Africa, only one out of every ten people is online.

The ITU (2013) argues the basic indicator for monitoring consumer uptake regarding the number of people using ICTs worldwide is the number of households with access to the Internet. Although the proportion of households with Internet access in developing countries increased from 12 percent in 2008 to 34 percent in 2015, a comparison across geographic regions reveals that by far the lowest household Internet penetration is found in Africa (ITU, 2015). Figure 1 shows the percentage by region and development status with Internet access per 100 households in 2014. As shown in Figure 1, while 46 percent of households worldwide and 82 percent in Europe had access to the Internet, only 10.7 percent in Africa had access. Households in the Least Developed Countries, many of whom are in Africa, had only 6.7 percent access. Figure 1 also shows the gap between Africa and Asia and Pacific, the two regions with the lowest household Internet penetrations, is substantial, with a penetration rate of 39 percent in the latter, compared to the 10.7 percent for the former (ITU 2015).

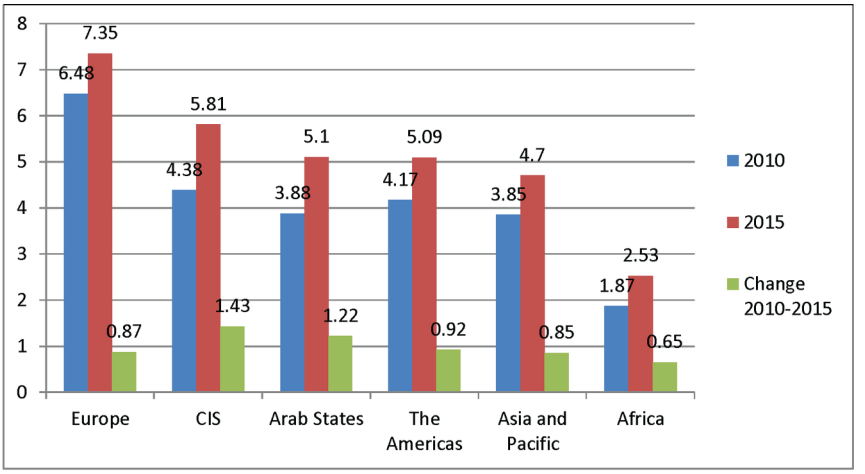
Figure 2 also shows the Information Development Index (IDI) by region in 2015. The IDI is a composite index of three dimensions. These are 1) ICT Access – the availability of ICT infrastructure and access; 2) ICT Use - a high level of ICT use, and 3) ICT skills – the capability to use ICT effectively, derived from relevant skills. The index is designed to capture the evolution of the information society as it goes through its different stages of development. As can be seen from figure 2, Africa has the lowest average IDI among all regions, with 2.53 index in 2014 compared to 7.35 for Europe, 5.09

Figure 1. Households with internet access by region and development status - 2014



Source: Adapted from ITU – Measuring The Information Society, 2015

Figure 2. Comparative average IDI by region, 2010 and 2015



Source: Adapted from ITU - Measuring The Information Society, 2015

for the Americas and 4.7 for Asia and the Pacific. Additionally, Africa has the lowest change in average IDI index from 2010 to 2014. The evidence in Figures 1 and 2 demonstrates Africa is far behind so far as the Connect 2020 goal 1.1 is concerned and is at the risk of not been able to leverage technology for development. This implies in order to realize the anticipated role of ICTs as a means of implementation for all SDGs, there is the need to empirically investigate and understand the factors that make it difficult for households in Africa to use the Internet and to formulate and implement workable policies that will help address the challenges to ensure greater connectivity.

Most prior researchers have focused on the broadband digital divide in developed countries (e.g. Distaso et al., 2006; Frieden, 2005; Hudson, 2008) and the role of several factors in bridging this divide, including competition specific to providing broadband service (e.g. Lee, 2008). Other

researchers have focused on the determinants of Internet usage in the advanced world (Godfarb and Prince, 2008; Coneus and Schleife, 2010; and Drouard, 2010). Studies of determinants of Internet adoption have also mostly focused on the developed world, with some examining the discrepancies in adoption between developed and emerging countries (Chinn and Fairlie, 2004; Mocnik and Sirec, 2010; Wuvanna and Lieter, 2008; Andres et al., 2008; Liu and San, 2006; Madden et al., 2004).

Although economic benefits of broadband have been seen in both developed and developing nations, the existing infrastructure, regulatory and policy environment, the urban-rural divide and other factors that affect broadband diffusion and the digital divide are often different in developing nations. For example, unlike many African countries, developed countries such as the United States and Germany do not face problems pertaining to broadband infrastructure such as energy availability. Studies of digital divide and Internet accessibility in Africa (e.g. Ahmed, 2007; Alzouma, 2005; Igun, 2011; Mutula, 2008; Le Roux & Evans, 2011; Roycroft and Anantho, 2003; Oyelaran-Oyeyinka and Lal, 2005; Penard et al., 2012; Penard et al., 2015) have paid little attention to the peculiar factors of Africa such as inadequate infrastructure, the policy environment, affordability and their effects on digital divide. Most importantly, many of these studies focus on Internet adoption and use, and have not analyzed the specific reasons why most households do not use the Internet. Drawing on the theories of technological diffusion and adoption, this study aims at addressing the above-mentioned research gap by arguing that Africa's unique problems of inadequate infrastructure, affordability, digital skills and broadband policy environment are key factors that likely contribute to most household not having not using the Internet.

THEORETICAL FRAMEWORK

Research on digital divide in Africa is relatively few but some key notable ones have focused on open access as a solution bridging the digital divide (Ahmed, 2007), the use of ICTs to leapfrog Africa into the technological world (Alzouma, 2005), and digital divide in South Africa (Blignant, 2009). Some have focused on the relationship between digital divide and gender in Sub-Saharan Africa (Brännström, 2012), levels of division in Africa (Fuchs & Horak, 2008), barriers to ICT adoption (Gyamfi, 2005) and the link between digital divide and economic development (Mutula, 2008). Others have focused on the impact of Global System Mobile broadband on communication services (GSMA, 2015), bridging of digital divide in Africa (Igun, 2011), cloud computing as a bridge to the digital divide in South African secondary education (Le Roux & Evans, 2011).

Other researchers have examined the expansion on Internet accessibility (Roycroft and Anantho, 2003), the rate of Internet use in Sub-Saharan African countries (Oyelaran-Oyeyinka and Lal, 2005), comparison of the determinants of Internet and cell phone adoption (Penard et al., 2012) and Internet adoption and usage patterns in Cameroon (Penard et al., 2015). Although these studies make significant contributions to the literature, they are mostly country specific and samples do not cover most African countries in addition to ignoring the specific reasons most African households are not using the Internet.

Diffusion and adoption theories allow us to explain why a large percentage of households in African countries are not using the Internet. Theories of technological diffusion were developed by the work of Tarde (1903) and Sorokin (1941), and advanced by Rogers (1995) and Katz (1999). These theories suggest that the adoption of many successful innovations has commonly followed an 'S' (Sigmoid) shaped pattern (Rogers 1995). New technologies have often experienced a slow rate of initial adoption, followed by a substantial surge that peaks when penetration levels reach saturation point and demand subsequently slows. In advanced countries such as the United States, the spread of many previous innovations had usually followed a sigmoid (S- shaped) time path characterized by a slow pace of initial adoption, followed by a significant advance, and then a gradually tapering of demand (Norris 2001). Televisions in America experienced a rapid surge

of sales in the 1950s, and VCR sales saw a similar surge in the late 1980s. In contrast, the sale of some other technologies like radio receivers and the telephone took far longer to spread throughout the American population (Norris, 2001).

The Internet constitutes a technological innovation that is diffusing in African societies with the potential to transform the continent. Available trend data indicates that in Africa, the Internet has begun to show an "S-Shaped" diffusion pattern with generally slow usage in the early years and uptake in recent years. The percentage of people using the Internet in Africa has increased from less than 10 percent of the population in 2010 to 17 percent by the end of 2013 (ITU, 2014) and to 28 percent by November 2015 (Internet World Statistics, 2015). This is due primarily to the growth of mobile broadband and installation of sub-marine cables on the west and east coasts of Africa. The Internet World Statistics (2015) show that the growth rate of the Internet in Africa between 2000-2015 was 7,231 percent, compared to growth rates of 457 percent and 190 percent for Europe and North America respectively in the same period. Despite this growth, it is important to note, as indicated earlier, that Africa still lags behind the rest of the world in Internet access.

While diffusion theory focuses primarily on the temporal aspect of the innovation's dispersion and how the social system responds, adoption theory determines whether or not each household decides to implement the innovation. Rogers and Shoemaker (1971) argue the primary difference between diffusion theory and adoption theory is that diffusion occurs among units of a social system, while adoption takes place in the mind of an individual. This implies adoption theory emphasizes the role of individual characteristics in the household in determining whether or not adoption occurs on a case-by-case basis. For example, households with individuals who have high income and have affordability are more likely to use smart phones to access the Internet. Additionally, households with persons who have skills by virtue of higher education levels are more likely to be early adopters of mobile Internet access.

This high growth rate of Internet uses in Africa in recent years depicts a surge following the slow rate of initial adoption as argued by the diffusion theory. Despite the surge in recent years, empirical evidence indicates serious digital divide in African household penetration. As of the end of 2013, on the average, less than 10 percent of households in Africa had access to the Internet, compared to 40 percent global average and 28 percent developing nations average (ITU, 2014). Looking at the country level, only 4 out of 38 countries in Africa recorded more than 30 percent of households with Internet access (ITU, 2014). The fact that 72 percent of African households are not using the Internet (Internet World Statistics, 2015) implies household adoption is likely plagued by obstacles pertaining to reliability and high cost of infrastructure, affordability of broadband devices and services, skills regarding broadband literacy, ineffective government broadband policy and the like.

Inadequate and unreliable infrastructure in Africa likely serves as a barrier that slows Internet diffusion and limits the bridging of the digital divide. This may include availability of reliable electricity, fiber optic lines, cell towers, wireless spectrum and the like. Empirical evidence (e.g. Strover, 2009) shows nation-wide broadband access, especially in developing countries, takes time due to broadband infrastructure appearing earlier in urban areas as a result of higher population densities and income levels. There is a significant and persistent urban-rural digital divide, whereby urban citizens enjoy ubiquitous mobile network coverage while the opposite is often the case in rural and remote areas of many developing countries. In a study conducted by Informa Telecoms & Media (Jostischky et al., 2011), 55% of the respondents claimed infrastructure costs are the most significant impediment to expanding broadband. The more available and reliable the broadband infrastructure, the less likelihood of higher percentage of African household that will not be using the Internet. Therefore, our first hypothesis is stated as:

H1: There is a negative relationship between availability of reliable infrastructure and the percentage of African households not using the Internet.

The decision of households to use the Internet is also likely influenced by affordability of broadband services and devices. Global income statistics reveal that almost one-quarter of the world lives at a subsistence level on less than $1.25 per day. The Oxford poverty and Human Development Initiative estimates that about 1.6 billion people fall below that threshold and live in extreme poverty. Twenty nine percent of those individuals, about 464,000,000 people, live in Sub-Saharan Africa (Basu, 2014). The ITU (2015) reports despite improvements in recent years, Africa still stands out as the region with the least affordable mobile cellular prices because although prices are similar to other regions, the gross national income (GNI) per capita in Africa is much lower. Even for those with higher incomes, expensive devices and data costs make it impossible to access digital services (West, 2015). This implies the less the affordability of broadband services and devices such as cell phones and smart phones, the higher the percentage of households that are unable to use the Internet. Consequently, our second hypothesis is stated as follows:

H2: There is a negative relationship between broadband affordability and the percentage of African households not using the Internet.

Digital literacy could also pose a challenge to some African households in using the Internet. Studies in the USA (Goldfarb and Price, 2008) and Europe (Drouard, 2010; Coneus and Schleife, 2010) show disparity in online usage is mainly explained by disparity in Internet skills. A report from McKinney & Co. (2013) estimates that 28 percent of global non-Internet users are illiterate and may not have any digital skills. This implies the lower the digital skills of African household members, the more likely of higher percentage of those households not using the Internet. Therefore, our third hypothesis is stated as:

H3: There is a negative relationship between digital skills and the percentage of African households not using the Internet.

Many older Africans may not use the Internet because they either do not understand its benefits or fear the risks (West, 2015). McKinsey & Co. (2013) estimates 18 percent of global non-Internet users are senior citizens and 52 percent are female. These imply although mobile broadband requires fewer ICT skills than are required to operate a computer, many households with members age 65 and older are not likely to access the Internet using these devices. On the other hand, most working members of households ages 15 to 64 may be more inclined to use broadband services and devices to access the Internet. Thus, the more individuals age 65 and older in an African household, the more likely of higher percentage of households not using the Internet. The more individuals ages 15-64 in an African household, the less likely of higher percentage of households not using the Internet. Our fourth and fifth hypotheses are constructed as follows:

H4: There is a positive relationship between older African population and the percentage of households not using the Internet.
H5: There is a negative relationship between younger African populations and the percentage of African households not using the Internet.

In many African countries, barriers that protect monopoly providers from new companies limit Internet diffusion by not opening up the markets, not encouraging venture capital firms to provide financing of new players, and not allowing smaller operators to using existing networks. Addressing major broadband policy barriers as happening in elsewhere in the world could help improve household Internet accessibility and use in many African countries. In Mexico for example, the Federal Telecommunication Institute is reducing entry barriers to telecommunication by altering

the rules of network sharing and allowing new firms to utilize lines of established operators, with the hope of doubling the country's Internet penetration as exists in places such as Brazil (Malkin, 2014). The Broadband Commission for Digital Development (2015) states research conducted for the Commission in 2013 suggested that the introduction or adoption of a broadband plan is associated with 2.5% higher fixed broadband penetration, and 7.4% higher mobile broadband penetration on average. The implementation of a good broadband policy is therefore more likely to reduce the percentage of African households not using the Internet. Our sixth hypothesis is therefore stated as:

H6: There is a negative relationship between the implementation of broadband policy and the percentage of African households not using the Internet.

The relatively smaller wealth of African countries is also a likely barrier to the number of households using the Internet. Global data suggests that wealthier countries are far more likely to be advantaged in committing resources to enhancing their technological infrastructure than relatively poorer nations (Torres et al., 2005; WEF, 2011). McClelland (1967) and Goldthorpe et al. (1968) also observed the existence of a positive association between national affluence and the capability to use technological innovations to engender social change and progress across nations. Data from the World Bank (2014) reveals at least 24 African countries have GNI per capita of less than $1000 and more than 50 percent of the countries on the continent have GNI per capita of less than $1,500. This resource constraint makes it difficult for African governments to invest in the needed infrastructure to boost Internet penetration. This implies the lower the GNI of African nations, the larger the percentage of households not using the Internet. Our seventh hypothesis is stated as:

H7: There a negative relationship between the GNI of African countries and the percentage of African households not using the internet.

The proliferation of mobile broadband and cellular phones has had a tremendous influence on Internet penetration in Africa in recent years. The mobile industry in Sub-Saharan Africa has grown rapidly in recent years, reaching 367 million subscribers in mid-2015 with migration to higher speed networks and smartphones. Mobile broadband connections are projected to increase from 20% of the connection base in 2015 to almost 60% by the end of the decade (GMSA, 2015). Over the past decade, mobile broadband has extended the reach of the Internet and has become the primary method of access for people around the world. In 2010, the number of mobile broadband Internet subscriptions surpassed the number of fixed broadband subscriptions and mobile broadband is changing the way people access the Internet (Bold & Davidson, 2012). This implies the more subscription of mobile broadband and mobile telephones, the less likely higher percentage of African households will not use the Internet. We therefore control for the effects of mobile broadband and mobile phone subscriptions by predicting that:

H8: There is a negative relationship between mobile broadband subscriptions and the percentage of African households not using the Internet.
H9: There is a negative relationship between mobile phone subscription and the percentage of African households not using the Internet.

Household Internet adoption could also be influenced by fixed broadband subscription in Africa. As stated above, the ITU (2014) states in its Measuring Information Society Report that the vast majority of African countries – 32 out of 38 examined – had a fixed-broadband penetration of less than 1 per cent by end 2013. In fact, only two countries, Seychelles (13 per cent) and Mauritius (12.5 per cent) have notable numbers of fixed-broadband subscriptions. Therefore, the case can be made

that lower fixed broadband subscriptions are likely associated with higher percentage of African households not using the Internet. Therefore, our tenth hypothesis is stated as:

H10: There is a negative relationship between fixed broadband subscription and the percentage of African household not using the Internet.

METHODOLOGY

This research analyzed secondary datasets on 37 African countries from five sources available on the Internet to investigate the reasons most African households do not use the Internet. The sources are the a) the 2014 ITU's world telecommunication/ICT indicators database, b) the 2014 World Economic Forum's networked readiness sub-index, c) the 2014 GNI data on African countries from the World Bank database, d) data on country broadband policy in the 2014 State of Broadband Report issued by ITU's Broadband Commission and e) 2014 and 2013 United Nations Development Program's (UNDP's) human development statistical tables.

The data from the ITU's world telecommunication/ICT indicators database shows a percentage of households not using Internet, mobile broadband subscriptions per 100 population, and mobile cell phone subscriptions per 100 population. The World Economic Forum's networked readiness sub-indices were infrastructure, affordability and skills. The data from the UNDP statistical tables were population ages 15-64 and age 65 and older. African countries that did not have complete data on the number of households not using the Internet were excluded from the study. Although secondary data analysis can be more cost-effective than the use of primary data, the fact that the researcher has no control over how the data was collected raises ethical issues including permissibility. However, in a study of ethical issues and challenges of secondary data analysis, Trhipathy (2013) argues if the data is freely available on the Internet, permission for further use is implied as long as ownership of the original data is acknowledged.

Our dependent variable of interest is percentage of households not using the Internet (coded as PHSONI), and the independent variables are infrastructure (INFSTR), affordability (AFOBTY), skills (SKILLS), broadband policy (BRDPOL), GNI per capita (GNIPC), population ages 15-64 (AGEPOP) and age 65 and older (OLDPOP) as well as fixed broadband subscription per hundred population (FXBRD100). As noted above, the control variables are mobile broadband subscription per 100 population (MOBRD100) and mobile cell phone subscriptions (MCELPS). The data for the variable percentage of households not using the Internet was calculated by deducting the percentage of households using the Internet in the ITU database from 100.

The World Economic Forum (2015) computed the infrastructure index as an aggregate of four sub-indices. These are electricity production, mobile network coverage rate, international Internet bandwidth and secure Internet servers. Affordability was measured as an aggregate of three sub-indices. These are prepaid mobile cellular tariffs, fixed broadband Internet tariffs, and Internet and telephony competition. Skills were computed as an aggregate of four sub-indices. They are quality of educational system, quality of math and science education, secondary education gross enrollment ratio, and adult literacy rate. Data for broadband policy was collected by asking government officials in the 37 African countries responsible for ICTs whether they have adopted broadband plans, and if so, how long such plans have been in existence. Mobile telephone subscriptions were measured as the number of subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. For mobile broadband subscriptions, this study utilized active subscriptions. The ITU measured these subscriptions as the sum of standard mobile broadband and dedicated mobile broadband subscriptions to the public Internet. This indicator was divided by the population and multiplied by 100 to obtain mobile broadband subscriptions per 100 inhabitants.

Fixed (wired) broadband data is collected by asking all Internet Service Providers in the country to provide the number of their fixed (wired)-broadband subscriptions (by type – cable, DSL, fiber optic,

other). This indicator was divided by the population and multiplied by 100 to obtain fixed (wired)-broadband subscriptions per 100 inhabitants. Population ages 15-64 refers to the de facto population in that age group in each country in our sample as of July 1, 2014. Population age 65 and older refers to the de facto population in that age group in each country in our sample as of July 1, 2014. GNI per capita is measured as the gross national income of each country in US Dollars divided by the population. It is the figure for 2013 or latest available year adjusted with international inflation rates.

RESEARCH FINDINGS

Table 1 shows the model summary, Table 2 shows the overall significance of the model and Table 3 shows the overall coefficients of the model. As noted in Table 2, the probability of F statistic (P>F) is 0.000 and as shown in Table 1, the adjusted R Square is 0.753. This implies there is a statistically significant relationship between the Percentage of Households Not Using the Internet and the overall linear combination of independent variables. As stated earlier, this study controlled for the effects of Mobile Broadband Subscription and Mobile Cell Phone subscription due to their potential to confound the results. Kerlinger (1986) noted that a potential extraneous variable can be controlled by including it as another attribute, an observed variable, in the study. By considering the extraneous variables in their own right, we were able to determine how they interact with the independent variables of interest and the extent to which they influence the Percentage of Households Not Using the Internet in Africa, either individually or in combination with the independent variables of interest.

A closer review of Table 3 reveals percentage of households not using the Internet is a function of AFOBTY (P = 0.031), SKILLS (P = 0.026), AGEPOP (P = 0.020) and MCELPS (P = 0.031). Specifically, there is an inverse relationship between PHSONI and AFOBTY, SKILLS, AGEPOP and MCELPS. This result supports hypotheses 2, 3, 5 and 9 respectively that there is a statistically significant negative between the percentage of households not using the Internet and affordability, skills, and population ages 15 to 64. This implies the R Square value of 0.753 means 75 percent of the variation in the Percentage of Households Not Using the Internet is affected by these four variables.

Table 1. Overall model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.908[a]	.824	.753	7.1347
Predictors: (Constant), MCELPS, GNIPC, BRDPOL, AFOBTY, MOBRD100, FXBRD100, INFSTR, SKILLS, OLDPOP, AGEPOP				
Dependent Variable: PHSONI				

Table 2. Analysis of variance showing overall sum of square significance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5949.386	10	594.939	11.688	.000[b]
	Residual	1272.583	25	50.903		
	Total	7221.969	35			
Dependent Variable: PHSONI						
Predictors: (Constant), MCELPS, GNIPC, BRDPOL, AFOBTY, MOBRD100 FXBRD100, INFSTR, SKILLS, OLDPOP, AGEPOP						

Table 3. Overall coefficients of the model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	122.152	6.877		17.761	.000
INFSTR	-3.308	2.116	-.223	-1.563	.131
AFOBTY	-2.493	1.091	-.249	-2.285	.031
SKILLS	-5.293	2.238	-.367	-2.365	.026
AGEPOP	-.656	.264	-.867	-2.489	.020
OLDPOP	4.442	3.847	.384	1.155	.259
MOBRD100	.070	.084	.098	.835	.412
FXBRD100	-.810	.414	-.219	-1.955	.062
GNIPC	-8.387E-5	.000	-.021	-.178	.861
BRDPOL	-.253	3.118	-.008	-.081	.936
MCELPS	-3.092E-7	.000	-.622	-2.285	.031

* Dependent Variable: PHSONI – Percentage of Households Not Using the Internet

DISCUSSION AND POLICY IMPLICATIONS

The results of this study reveal that the more affordable broadband services and devices, the lower the percentage of African households not using the Internet. For African households that do not have adequate disposable income, their ability to purchase devices such as cell phones and gain access to the Internet and digital services is limited. Therefore, if the Connect 2020 goal 2.1 B of reaching 15 percent of African households having access to the Internet by 2020 is to be achieved, these households should be able to utilize cheap broadband services and devices in order to gain the benefits of the information society and technological revolution. For this to happen, African policy makers who have not already done so need to formulate and implement a set of broadband policies that will facilitate reduction of telecommunication costs through measures such as lower taxes and licensing fees and enabling competition in the broadband market.

For example, from regulatory policy standpoint, enabling environments for broadband infrastructure competition can be created by liberalizing telecommunication markets to encourage infrastructure investments and cost sharing to drive down prices, by removing legal restrictions to encourage new entrants, and by releasing spectrum to ensure better services and additional government revenues. From fiscal policy standpoint, reducing taxes can lower the cost structure of Internet service providers thereby motivating them to make the needed investments that can ultimately improve services and reduce overall cost for consumers.

The research results also show a statistically significant negative relationship between digital skills and the percentage of African households who do not use the Internet. In particular, the less skills possessed by members of African households, the higher the percentage of households who do not use the Internet. To combat this, policy makers can put in place policy initiatives that train the less skilled individuals on how to use the Internet. For example, Governments can target senior citizens and those living in rural areas that may be using the Internet for the first time and train them on how to use the Internet to download needed applications and access pertinent information on government and market activities to enable them make prudent decisions.

In order to accomplish Connect 2020 goal 2.1B of 15 percent Internet access for least developed countries, not only do more households have to have Internet connectivity but also, they need to be

able to have the skills to use the technology to improve their livelihood. In recognition of this, the ministry of Education in Sri Lanka for example, promotes digital literacy by using computer learning centers and libraries to train citizens on how to use digital resources (McKinsy & Company, 2013). This is a strategy that can be emulated by African governments to improve the digitals skills of citizens and households. Additionally, governments should promote Internet use at Schools by providing the needed infrastructure for all levels of schools to have connectivity in order to improve digital skills.

The research results also indicate that the larger the population of ages 15 to 64, the lower the percentage of African households who do not use the Internet. This finding is not surprising, if one considers the fact that many people in this age bracket are most likely in school, in the labor force, digitally literate, and capable of paying for basic telephony and broadband services. The better Internet skills possessed by most people within this age bracket may be serving as a motivating factor to use the Internet. Consequently, the finding regarding the negative relationship between population ages 15 to 64-year-olds and the percentage of households not using the Internet buttresses the need for African governments and policy makers to focus more attention not only on rural dwellers but also on older citizens to provide training on digital literacy to help bring them to the information age.

The research findings also reveal a statistically significant negative relationship between our dependent variable of interest and the control variable – mobile phone subscription. The findings show that the higher the number cell phone subscriptions, the lower the percentage of household not using the Internet. This appears consistent with the recent exponential growth in mobile broadband and mobile phone subscriptions in Africa in recent years, and have profound implications for the Connect 2020 agenda. GMSA (2015) argues that by mid- 2015, 200 million individuals across the Sub-Saharan African region were accessing the Internet through mobile devices and this will double by the end of the decade. The mobile industry remains a key driver of economic growth and employment in Sub-Saharan Africa, with the broader mobile ecosystem generating 5.7 percent of GDP, thereby contributing over $100 billion in economic value in 2014 (GSMA, 2015).

The above research finding will help to provide evidence-based information to policy makers and regulators to implement policy guidelines that will improve the digitization of their economies. For example, the increasing mobile penetration poses a policy challenge in the area of spectrum management which requires cooperation between governments and industry to ensure effective spectrum release policy, enhanced spectrum efficiency and investments for greater capacity and wider coverage. Additionally, given the evidence of strong negative relationship between mobile phones subscription and percentage of households not using the Internet, African governments should implement policies that will encourage mobile operators to deploy infrastructure in remote and economically challenging areas in order to help achieve the Connect 2020 goal 2.1B.

This research is limited because its focus was on the determinants of digital divide in Africa and their policy implications, and not on broader Internet adoption and Internet usage patterns. Additionally, the societal impact of digital divide and the factors accounting for the surge of mobile broadband in Africa in recent years were outside the scope of this study. Furthermore, this study relied on secondary data gathered by international institutions which may have methodological issues. For example, in some countries, ICT data collection is initiated by government institutions such as ministries and agencies which promote ICT uptake. While these institutions may have technical expertise on the subject matter, their ability to conduct a household survey based on sound methodology may be limited unless they collaborate with national statistical offices that have statistical infrastructure such as master sample frame consisting of a list of randomly selected households that represent the whole population (ITU, 2014). These limitations notwithstanding, the findings are useful because the investigation of digital divide in Africa from the standpoint of the percentage of households not using the Internet has attracted little attention.

CONCLUSION

This study aimed at investigating the determinants of digital divide in Africa and their policy implications by analyzing the factors that account for the very high percentage of African households not using the Internet. The findings reveal that the percentage of African households not using the Internet is significantly influenced by affordability, digital skills, the population ages 15 to 64 as well as mobile phone subscriptions. In particular, more affordable broadband services and devices, higher digital literacy, high population of ages 15 to 64 and more cellular phone subscriptions do have the effect of lowering the percentage of African households not using the Internet. These findings have public policy implications for reaching the Connect 2020 goals.

First, regulatory policies that provide enabling environments for broadband infrastructure competition needs to be created by liberalizing telecommunication markets to encourage infrastructure investments and cost sharing to drive down prices, by removing legal restrictions to encourage new entrants, and by releasing spectrum to ensure better services and additional government revenues. Second, fiscal policies should include reduction of taxes on broadband devices and services, as well as tax incentives to help bridge the digital divide by enabling affordability to bringing more African households to the information age for development. Third, strategies should be put in place to expand broadband access to rural areas and provide training on digital literacy to less skilled older population and rural dwellers.

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