Research Article

Toward Digital Inclusion: Understanding the Literacy Effect on Adoption and Use of Mobile Phones and the Internet in Africa

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Abstract

Mobile phones and the Internet are central components of the information and communication technology (ICT) landscape. ICTs are at the forefront of economic and social inclusion in contemporary societies. The accrued benefits, however, are not being realized fully in some regions. Although access has generally increased across Africa, the extent of adoption and use is suboptimal, thus undermining the role of ICTs in facilitating digital inclusion. This article looks at how three levels of literacy—basic, English-language, and e-skills—might affect adoption and use of mobile phones and the Internet in selected African countries. It sheds light on the role of literacy in the adoption process through evidence-based analysis. The analysis consists of logistic regressions performed on data from 12 African countries surveyed in relation to ICT access and use and supplemented by focus group data from six of these countries. It was found that, on average, both adoption and range of ICT uses correlated with increased basic literacy. Adoption and use increased even more when English-language and/or e-skills literacy were also present.

Introduction

While the gap between those who have voice services and those who do not have voice services on the African continent has narrowed, the divide between those who are able to access the Internet (and the full range of enhanced services) and those who are not is still wide. Across 17 countries surveyed by Research ICT Africa (RIA) in 2008, on average fewer than 5% of households had a working Internet connection, with most countries below 1% (RIA, 2008). The 2012 RIA ICT survey of 12 countries showed a slight increase, to 5.4%. However, less than 1% of households had a working Internet connection in four of those countries. Individual use of the Internet also remains relatively low. The 2012 survey found that, on average, only 15.3% of individuals (aged 15 and above) used the Internet. There are signs of increased mobile phone use on the continent, but the RIA 2012 study found that only 54% of individuals indicated they owned a mobile phone (RIA, 2008, 2012).

The absence of necessary skills marginalizes even those who can access and afford to use ICT services (Stork & Schmidt, 2009). Individuals must develop certain skills, such as the ability to understand, use, modify, and create Internet content and services, to fully benefit from using the Internet on a computer or mobile phone.

Broader literacy skills can help individuals develop Internet skills, such as the ability to modify Internet content, required to experience the full benefits and make optimal use of ICTs. "Literacy is an important consideration in a broader definition of access, and user skills for access imply other kinds of literacy" (Osborn, 2006, p. 86). However, existing literature on the relationship between literacy and ICT in Africa is insufficient. E-readiness studies aiming to describe a country's ability to participate in and benefit from the information society often uses broad macrolevel indicators (Stork & Schmidt, 2009). Only a small number of studies have

Table 1. Dependent Variables.

ICT outcome	Characteristics of variable
Mobile phone adoption	Individual owns a mobile phone = 1; otherwise = 0
Internet adoption	Individual uses Internet = 1; otherwise = 0

looked at the impact of educational attainment and e-skills on ICT use (Deen-Swarray, Gillwald, & Morrell, 2013; Gillwald, Milek, & Stork, 2010; Stork & Schmidt, 2009). Moreover, there has been little evidence gathering to date on correlations between mobile phone and Internet use and level and type of literacy.

The Research

To collect more data and investigate potential effects of literacy on use of mobile phones and Internet in Africa, the following questions were raised.

- To what extent does a lack of basic literacy (reading and writing ability) affect adoption and use of mobile phones and/or the Internet in Africa?

- To what extent does a lack of English-language proficiency affect adoption and use of mobile phones and/or the Internet in Africa?

- To what extent does a lack of e-skills affect adoption and use of mobile phones and/or the Internet in Africa?

The study used the data set generated by the 2012 Research ICT Africa (RIA) Household and Individual ICT Access and Use Survey (RIA, 2012). The survey covered 12 countries: Botswana, Cameroon, Ethiopia, Ghana, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, and Uganda. The RIA survey data is nationally representative at the household level for individuals 15 years and older.[1] *Basic literacy* was conceptualized in terms of reading and writing abilities, *English-language literacy* in terms of ease of reading and writing in English, and *e-skills literacy* in terms of completion of tertiary or secondary education.

Logistic regressions were used to investigate potential impacts of three levels of literacy—basic literacy, English-language literacy, e-skills literacy—on adoption and use of mobile phones and the Internet. To deepen the analysis, focus group discussions were conducted in Cameroon, Ghana, Kenya, Nigeria, South Africa, and Uganda, looking at skills barriers to access and use of ICTs.

The following hypotheses were tested:

H1₋The degree of literacy does not affect adoption or use of a mobile phone in Africa.

H2:The degree of literacy does not affect adoption or use of the Internet in Africa.

Logistic regression models were used to estimate the incidence of mobile phone and Internet adoption in each of the 12 survey countries. The literacy variables were then included to test their potential relationships with the ICT outcome variables (mobile phone and Internet adoption), while controlling for income, gender, location (i.e., rural vs. nonrural), labor market status, and country dummies (a statistical control for country-specific differences).

Table 1 highlights the dependent variables. Table 2 presents expected relationships between the variables.

The variables used were not exhaustive. For example, a variable such as "ability," which was not included in the analysis, may impact literacy variables and, in turn, influence mobile and Internet use. Nevertheless, we are confident that the variables reported provide sufficient probability for the conclusions we drew from the data analysis.

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1. See RIA Survey Methodology Brief on how sampling was done at http://www.researchictafrica.net/docs/Survey%20 Methodology%202011:12.pdf

Table 2. Relationship Between Literacy Independent Variables and ICT Outcome Variables.

Factor	Characteristics of variable	Relationship	Assumptions and expectations
Reading literacy	Dichotomous; reads "easily" = 1; otherwise = 0	Positive	Being able to read is expected to improve ICT use.
Writing literacy	Dichotomous; writes "easily" = 1; otherwise = 0	Positive	Being able to write is expected to improve ICT use.
English-language literacy	Dichotomous; "Can easily read and write English" = 1; otherwise = 0	Positive	Being literate in English, the most common medium of online content, is expected to improve ICT use.
E-skills literacy (tertiary or secondary education)	Dichotomous; completion of tertiary or secondary education = 1; otherwise = 0	Positive	Secondary and tertiary educations are expected to provide the skills to use ICTs.

Study Context: Digital Inclusion and Literacy

The issue of digital inclusion is high on the agenda of nations globally as they endeavor to find ways by which citizens can access ICTs. However, despite such efforts, many across the continent remain either excluded completely or limited by various factors. Many African individuals are either illiterate or have a low level of literacy. Those who are literate might only read and write in local languages. Achieving digital inclusion is a great challenge. While cost, affordability, availability, and quality of service still remain major obstacles to digital inclusion, literacy could be central to the digital inclusion challenge across the continent.

Most reports on ICT access and use put little focus on education and skills. The few that do, tend to address them through available educational attainment indicators and are often merely supply-side statistics. For example, Hargittai's (2002) study of Internet skills (using both observed capacity and self-reported skills) among U.S. users found that education is correlated with Internet skills, with higher levels of education implying more exposure to technology. But educational attainment is only one indicator that could be used to assess limitations to ICT access and use. To comprehensively address the digital exclusion challenge, multiple aspects of literacy should be examined.

Effective ICT use requires e-skills, or the ability to use computer and network sources as a way to achieve particular goals and improve one's position in society (van Dijk, 2005). The process of taking advantage of ICT involves being aware of the opportunities presented through devices and knowing how to use the tools.

Broadband access, along with other technologies, is changing the world and the information in it (Headrick, 2000). Tools used in learning and literacy are evolving at a rapid rate (Bruce, 2001). Accordingly, definitions of literacy must take on varying dimensions to encompass what it actually means to be literate in today's information age.

The contemporary concept of literacy should encompass more than merely reading and writing. Traditionally, adults were categorized as either "literate" or "illiterate." Literacy has been treated as a condition that adults either have or do not have. According to the Organisation for Economic Co-operation and Development's (OECD, 2000) International Adult Literacy Survey report (IALS), literacy is no longer defined in terms of an arbitrary standard of reading performance, which distinguishes the few "illiterates" who completely fail the test, from the "literates" who reach a minimum threshold.

This study therefore defines *literacy* as a particular capacity and mode of behavior: "the ability to understand and employ printed information in daily activities, at home, at work and in the community—to achieve one's goals, and to develop one's knowledge and potential" (OECD, 2000, p. x).

This study adopts this broad definition of literacy. Specifically, this study assessed literacy in terms of

(1) basic literacy, (2) English-language literacy, and (3) e-skills literacy. These are identified as specific skillsets that can enable or hinder the optimal use of mobile phones and the Internet.

Basic Literacy

Basic literacy refers to reading and writing abilities. The lack of either of these can prevent an individual from completing activities on a mobile phone and on the Internet. In sub-Saharan Africa, the adult literacy rate or the percentage of the population aged 15 years and older with the ability to read and write stands at 59% (UNESCO, 2013). The figure is low in comparison to many other regions of the world.

English-Language Literacy

Kralisch and Mandl (2006) point to the importance of language literacy, showing that language has an impact on the structure of the Web. The design and provision of content found in the digital space is mostly in English. While it is also the official medium of communication in most African countries, vast majorities of the continent's population communicate in indigenous languages.

The reliance on major European languages, namely English, French, and Portuguese, as a medium for Internet content puts those unskilled in these languages at a disadvantage (Osborn, 2006). A few African languages, while represented on the Web, are not the primary languages of Internet content.

E-skills Literacy

E-skills are those necessary to use technology. The more advanced an individual's e-skills are, the more that person is expected to be able to navigate technology and tap into its benefits. Those lacking particular skills are likely to lag behind in their use of ICTs (Stork & Schmidt, 2009). Stork and Schmidt (2009) found that the completion of either tertiary or secondary education as the highest level of education attained had a strong correlation with high e-skills and, thus, identified this variable as an appropriate indicator of e-skills. This study accordingly uses completion of tertiary or secondary education as a proxy for possession of e-skills.

Research Findings

Basic Literacy

The 2012 RIA ICT Survey collected data on the basic literacy (reading and writing abilities) of respondents (aged 15 and above) on a scale ranging from "easily" to "with difficulty" to "not at all." The survey found that, on average, across the 12 countries surveyed, only 52.2% claimed they could read easily. Another 18.4% stated they could read, but with difficulty, while 29.4% said they could not read at all (RIA, 2012). At the country level, the percentage of respondents who said they could read easily ranged from a high of 81.7% (Kenya) to a low of 29.6% (Ethiopia). The share of people who said they could read easily was found to be above 70% in only Kenya, South Africa, and Botswana (Figure 1).

When RIA survey respondents were asked to rate their level of competence in writing a letter, similar levels of literacy were found. An average of 52% of respondents indicated they could write easily, 18.2% stated they could do so only with difficulty, and 29.8% said they could not write at all (RIA, 2012). Only in three countries—again Kenya, South Africa, Botswana—was the share of individuals able to write with ease found to be above 70% (Figure 2).

English-Language Literacy

The survey data shows that in the majority of the 12 study countries, an African language remained the main household language (see Table 3). Only in Cameroon and Mozambique were figures somewhat high for the European-language category, at 44.6% and 53.6%, respectively. This is because French is pervasive in Cameroon, and Portuguese is commonly spoken in Mozambique in households, though in highly colloquial forms.

As shown in Figure 3, the ability to read and write "easily" in English was found to be challenging for respondents in a majority of countries surveyed. Only in Kenya, South Africa, and Botswana did the majority of respondents claim to be able to easily read and write in English. Even in countries such as Namibia, Ghana, Nigeria, and Uganda, where English is the official language, about half of respondents stated they could not read or write easily in English.
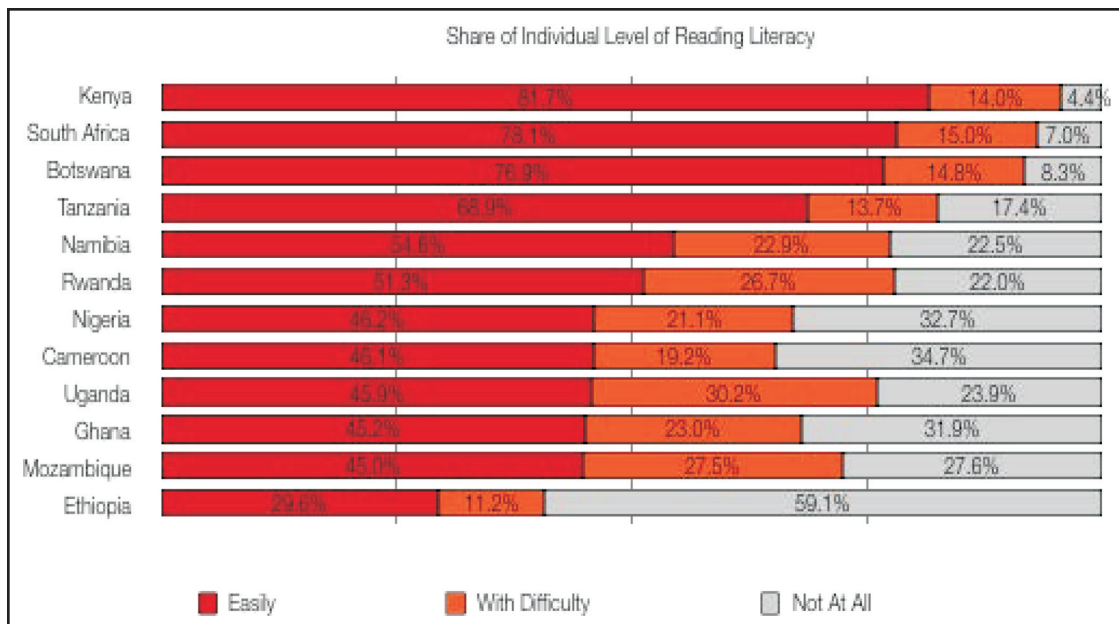
Figure 1. Reading ability.
Source: RIA (2012).
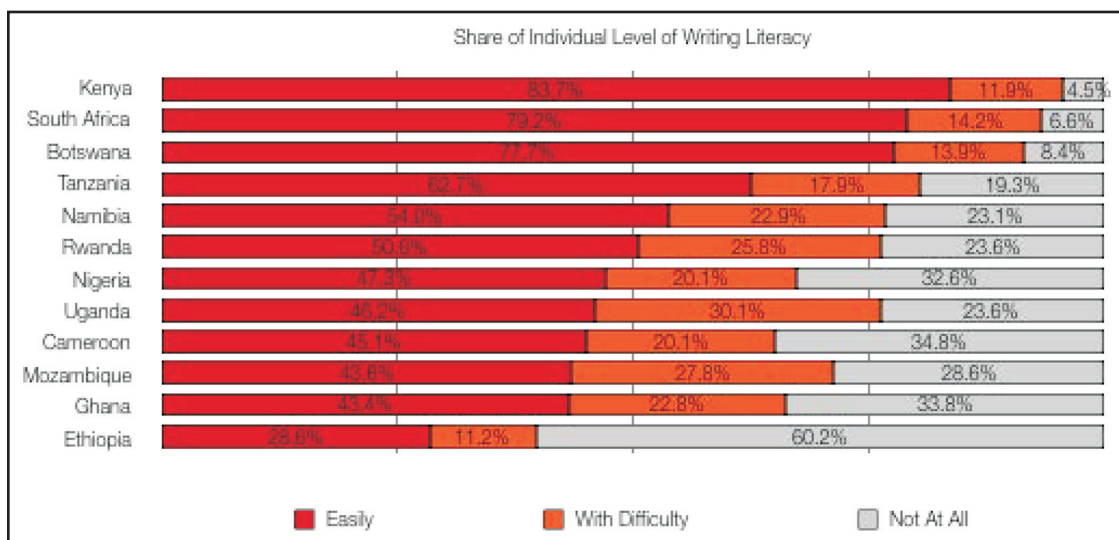
Figure 2. Writing ability.
Source: RIA (2012).

Ethiopia and Tanzania recorded the lowest percentages of respondents able to easily read and write in English, at 12.7% and 12.3%, respectively. This is not particularly surprising. Ethiopia's official language remains Amharic, and Swahili has official status and is used regularly by many in Tanzania.

E-skills Literacy

Figure 4 shows the percentages of respondents across the 12 study countries who completed tertiary, secondary, or primary education or had no education at all. Possession of tertiary or secondary education was used as

Table 3. Main Household Language by Percentage.

Country	% speaking African language	% speaking European language	% speaking Other languages (%)
Botswana	96.8	3.2	0.0
Cameroon	48.6	44.6	6.8
Ethiopia	100.0	0.0	0.0
Ghana	99.3	0.7	0.0
Kenya	97.4	2.6	0.0
Mozambique	43.2	53.6	3.2
Namibia	84.2	3.0	12.7
Nigeria	94.8	5.0	0.2
Rwanda	99.3	0.7	0.0
South Africa	78.3	9.8	11.9
Tanzania	100.0	0.0	0.0
Uganda	98.5	1.5	0.0
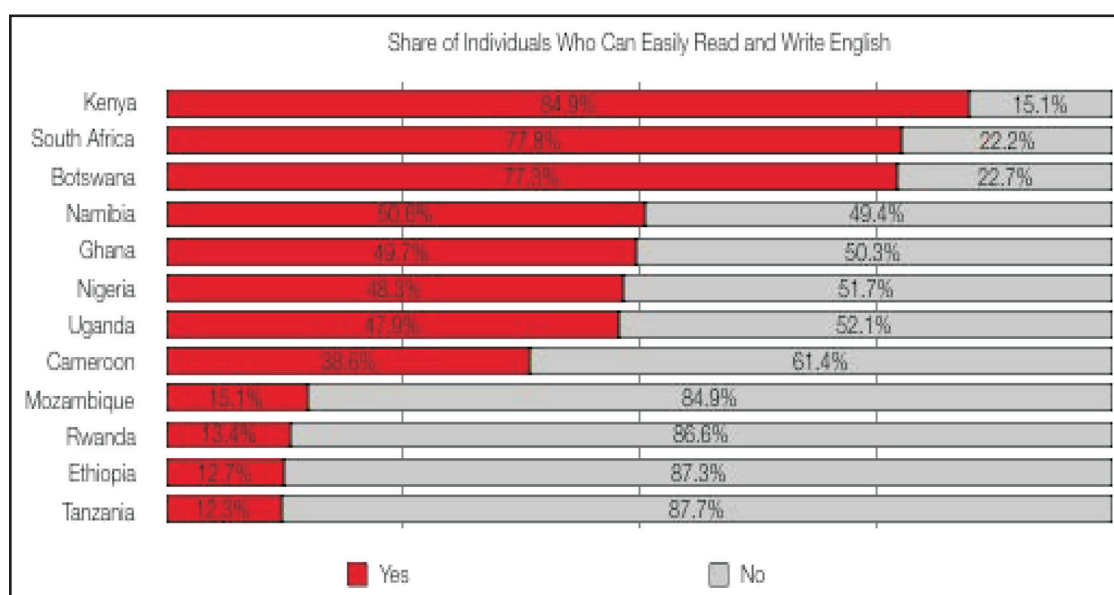
Figure 3. English-language literacy.
Source: RIA (2012).

a proxy for e-skills acquisition. With education level as an approximation for e-skills acquisitions, Figure 4 reveals that e-skill levels only exceeded 50% in Kenya, Botswana, Nigeria, and South Africa.

The percentages for tertiary education (those who have a diploma or certificate, Bachelor's, Master's, or PhD) were very low. A fifth or more of the population had a tertiary education in only Kenya and Botswana.

Literacy Effect on Mobile Phone and Internet Adoption and Use

Mobile Phone Adoption
There was, on average, a 10% increase in mobile phone adoption among the adult populations of the study countries between the 2008 and 2012 surveys (RIA 2008, 2012). Some countries, such as South Africa and

Figure 4. E-skills literacy (tertiary or secondary education used as proxy).
Source: RIA (2012).
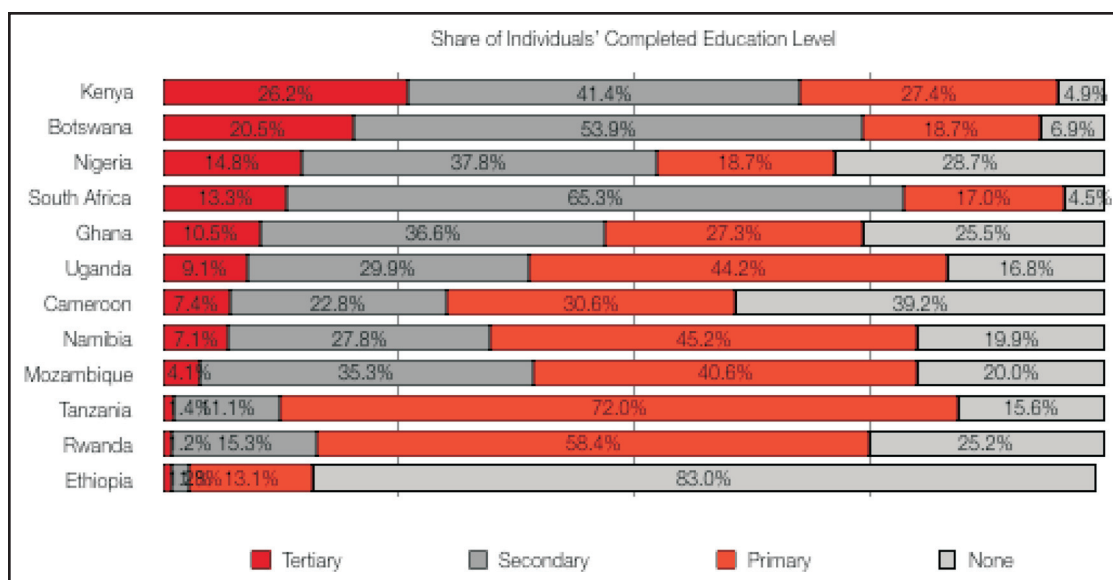
Table 4. Mobile Phone Adoption by Basic Literacy (by Percentage Owning a Phone).

Country	Ability to read			Ability to write		
	Easily	With difficulty	Not at all	Easily	With difficulty	Not at all
Botswana	86.5	65.7	45.6	86.1	67.7	43.6
Cameroon	71.0	44.9	9.1	70.9	45.5	9.7
Ethiopia	37.2	22.7	8.0	37.9	23.0	8.2
Ghana	70.0	64.8	40.9	69.0	67.7	41.8
Kenya	81.0	43.8	39.2	79.8	45.1	41.4
Mozambique	62.6	31.6	20.5	62.0	33.7	21.1
Namibia	70.7	50.0	26.6	71.0	50.1	26.9
Nigeria	84.8	84.5	28.6	85.2	84.7	27.6
Rwanda	36.7	12.0	10.9	36.5	14.2	9.7
South Africa	87.8	74.8	64.9	87.5	74.7	65.2
Tanzania	45.4	20.3	9.9	45.5	27.1	12.3
Uganda	64.8	43.1	16.3	64.6	42.5	16.9

Source: RIA (2012).

Botswana, were found in the 2012 survey to have mobile ownership figures reaching over 80%; however, other countries, namely Ethiopia, Rwanda, and Tanzania, still had relatively low levels of penetration, at 18%, 24%, and 36%, respectively.

Table 4 shows the results of the statistical analysis of a possible correlation between mobile phone adoption and literacy levels. The results show that while the share of individuals who own a mobile phone is much higher among those with strong levels of basic literacy (reading and writing), with low levels of basic literacy, or none at all does not necessarily deter individuals from getting a mobile phone. More than 60% of individuals
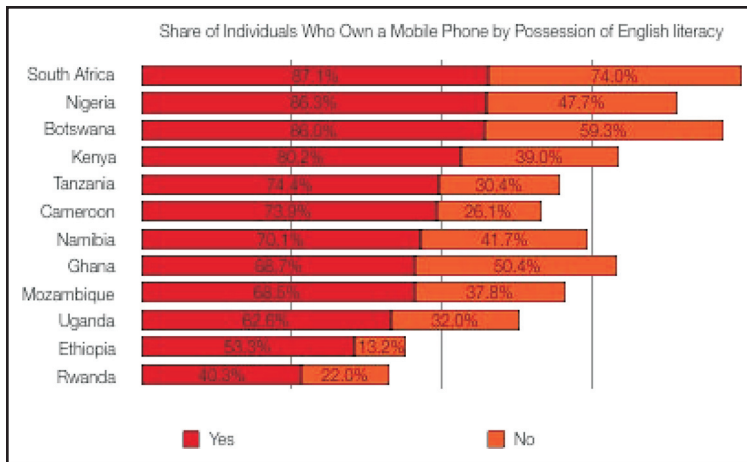
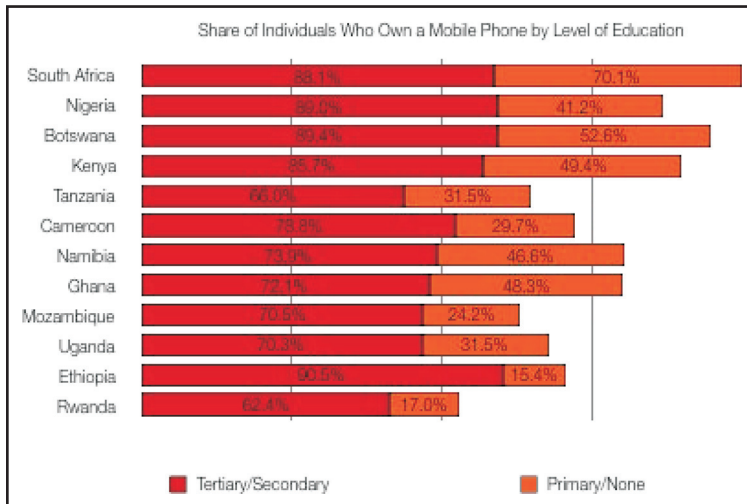*Figure 5. Mobile phone adoption by English-language literacy.*
Source: RIA (2012).

Figure 6. Mobile phone adoption by e-skills literacy (i.e., tertiary or secondary education).
Source: RIA (2012).

in Nigeria, South Africa, Botswana, and Ghana who claimed to read and write with difficulty had mobile phones, and each of the 12 countries had phone owners who lacked basic literacy.

Figure 5 shows that lack of English-language literacy did not necessarily present a barrier for mobile phone adoption (although the gap in ownership was found to be wide in some of the countries between the numbers of English-literate and non-English-literate mobile owners).

The results outlined in Figure 6 show that a higher proportion of individuals with e-skills literacy owned a mobile phone compared to those with only a primary education or no education at all.

The logistic regression results for correlations between mobile phone adoption and different variables shows that while controlling for variables such as income, gender, location, age, and employment status, the literacy variables have a positive and significant relationship to mobile phone ownership (i.e., having basic literacy, English-language literacy, or e-skills literacy increases the probability of mobile phone ownership).

When controlling for literacy, income shows a positively stronger and statistically significant correlation with mobile phone adoption, while age and location are negatively correlated with mobile phone adoption.

At the country level, the relationship between literacy levels and mobile phone adoption is mostly positive. Being able to read with ease shows a positive correlation with mobile phone ownership in all countries except Nigeria and Botswana, but it is only a significant correlation in Kenya, Rwanda, South Africa, and Mozambique. A positive, yet less significant and widespread correlation is also shown between writing literacy in only seven of the 12 countries (Table 5).

The results also show that English-language literacy is positively correlated with mobile phone ownership in 10 of the countries surveyed, with significant correlations in Tanzania, Ethiopia, Ghana, Cameroon, Nigeria, and Mozambique (Table 5).

The insignificance of the literacy variables in some of the countries could be attributed to country-specific dynamics that are beyond the scope of this study. A few focus group discussions were conducted in selected countries in an attempt to understand some of these country specifics.

Table 5. Mobile Phone Adoption—Logistic Regression Results Using Sampling Weights.

Variables	All Countries	Uganda	Kenya	Tanzania	Rwanda	Ethiopia	Ghana	Cameroon	Nigeria	Namibia	South Africa	Botswana	Mozambique
Income	+***	+***	+***	+***	+**	+***	+***	+***	+***	+***	+***	+***	+
Female	−	−	+	+	−**	−***	−	−	−	−	+	+**	+***
Rural	−***	−***	+**	−***	−***	−***	−***	−***	−***	−***	−	−***	−***
Age	+***	Negative parabolic relationship that is statistically significant for 10 countries											
Reading literacy	+***	+	+***	+	+***	+	+	+	−	+	+**	−	+*
Writing literacy	1***	1	2	1***	2	1	2	1*	1	1	1	2	2
English literacy	+***	+	+	+***	−	+**	+***	+***	+***	+	−	+	+***
Higher education	+***	+***	+***	+*	+***	+***	+***	+***	+***	−	+*	+***	+***
Student	2***	2*	1	2***	2**	2***	2**	2	1	1	2***	2	1
Grant/pension	−**	−	−	+**	−	−	+	+*	+	−	−*	−**	−
Employed	+***	+***	+*	+**	+	−	+***	+	+	+***	+**	+**	+***
Self-employed	+***	+**	−	−***	−	−**	+*	+*	+*	+**	+***	+	+***
Pseudo R2	0.2964	0.2499	0.3118	0.2696	0.2451	0.3979	0.2654	0.3599	0.2522	0.2558	0.1187	0.2617	0.2617
Chi-squared	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Log Likelihood	−7,175.5	−600.9	−518.7	−606.6	−569	−633.1	−590.6	−529.8	−725.1	−460.2	−592.5	−305.3	−611.4

Note: *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.
Source: RIA (2012).

A focus group discussion in Uganda specifically identified lack of English-language literacy as a barrier to mobile phone use. Most male respondents stated they did not know "how to effectively use their phones because they did not understand the MENUs in English" (RIA, 2013). They claimed not knowing English limited their use to only basic functionality.

E-skills literacy was found to have a significantly positive correlation with mobile phone ownership in all but one of the 12 countries, further highlighting the importance of education in ICT adoption.

Mobile Phone Use

Although mobile phone ownership is increasingly widespread on the African continent, the extent to which individuals use the phones is often suboptimal. A qualitative study among informal businesses on the continent found that people are familiar with and make use of voice services the most (RIA & Intelecon, 2012). Using only voice is a low level of functionality compared to the wide variety of activities that can be carried out on a mobile phone. Table 6 presents activities a mobile phone can perform and how the RIA 2012 ICT survey respondents with varying literacy levels used their handsets.

The difference between those who are literate in a particular skill and those who are not is more pronounced when it comes to more sophisticated mobile phone activities and those that relate to the Internet. As shown in Table 6, more than 20% of those with basic reading literacy use social networks and browse the Internet on their mobile phones, while fewer than 3% without basic reading literacy conduct these activities. This pattern is similar across all literacy levels on the use of social networking activities. The shortcomings of individuals without the different skills are also highlighted in the low share of those who download applications or read and write emails using their phones (Table 6). For instance, most of the participants in a Kenyan focus group claimed that "it was easier to use the Internet on the mobile phone than on a computer" and in rural Kenya the participants mainly access the Internet through their mobile phones (RIA, 2013).

Internet Adoption

The importance of Internet penetration in economic and social development is now an accepted fact. In sub-Saharan Africa where fixed Internet connections are scarce, it is the emergence of mobile Internet, coupled with wider adoption of Internet-capable mobile phones, that contributes most to Internet adoption. Average Internet adoption in the RIA ICT survey countries increased from less than 10% in 2008 to 15.5% in 2012. The 2012 RIA survey findings further revealed that about 7% of those using the Internet did so first on their mobile phone (RIA, 2008, 2012).

The data analysis provided in Table 7 shows that Internet adoption is minimal among individuals with low or nonexistent levels of reading and writing. There is a wide gap in Internet adoption between those lacking reading and writing literacy and those who read and write "easily." The widest gap was recorded in South Africa, with about 39.4% more individuals who can read "easily" making use of the Internet compared to those who read "with difficulty." The results were similar in terms of writing literacy.

The results also suggest a lack of English language literacy associated with lower Internet uptake. On average a 30% gap in Internet adoption between those with English-language literacy and those without was recorded. The percentage of non-English-literate respondents using the Internet was found to be below 8% in all countries, compared to between 13.3% (Ethiopia) and 42.7% (South Africa) Internet use by those with English-language literacy (RIA, 2012).

Focus groups, however, do not necessarily confirm that English literacy is a barrier to uptake. Ugandan focus group participants said low-English-language capability was a barrier to using the Internet, but some voiced concern that "providing content in local languages would even be much more complex compared to English and would still require substantial investment in teaching those illiterate in English how to use the Internet" (RIA, 2013).

In Nigeria some said that even though they were comfortable in English, they would rather use the Internet in their local languages. Focus group participants in Ghana stated that accessing content in local languages would be a challenge, because many local-language users speak it but can hardly read or write in it (i.e., are not fully literate). Even catering Internet content to local languages might not be sufficient. Broader literacy levels must be achieved.

Table 6. Mobile Phone Use by Literacy Levels (by Percentage).

Activities	Reading literacy (reads "easily")		Writing literacy (writes "easily")		English-language literacy		E-skills literacy (tertiary or secondary education)	
	Yes	No	Yes	No	Yes	No	Yes	No
Making and receiving phone calls	99.4	99.2	99.4	99.2	99.5	99.1	99.5	99.2
Making and receiving international calls	24.9	13.2	25.2	12.5	25.9	13.1	25.3	13.6
Sending and receiving text (SMS)	92.9	62.3	92.7	62.8	94.0	65.0	92.1	67.2
Sending SMSs to radio/TV programs	15.6	12.7	15.6	12.8	18.0	9.0	19.0	6.7
Playing games	51.9	38.1	51.5	39.1	55.0	34.8	55.3	33.1
Listening to music/radio	52.5	32.5	51.7	34.1	53.2	34.3	55.1	29.6
Using Skype/VoIP	3.6	1.8	3.7	1.7	3.4	2.6	3.2	2.9
Social networking	22.0	2.3	21.7	3.0	23.1	3.3	22.1	4.4
Browsing the Internet	23.6	2.8	23.2	3.7	24.7	3.9	24.1	4.2
Downloading applications to mobile phone	19.0	5.9	19.3	5.2	21.0	4.3	21.0	3.7
Reading and writing emails	17.8	3.8	17.2	5.1	19.1	3.6	18.0	5.1

Source: RIA (2012).

Very few of the 2012 survey respondents who had completed only primary schooling or had no education used the Internet. Use was below 9% in all the countries surveyed, dropping to as low as 1.6% in Rwanda and Mozambique.

The focus group discussion in Kenya revealed that a lack of e-skills hindered Internet adoption more than English-language capability.

The logistic regression results for Internet adoption correlated with 10 variables show that the correlations between Internet use and the literacy variables when other variables are controlled for are generally positive and significant across the 12 countries, with increased probability of Internet adoption among individuals with basic literacy (reading and writing), English-language literacy, and/or e-skills literacy.

Being able to read with ease and to write with ease showed positive correlations with Internet adoption in 10 and eight of the 12 countries, respectively. English-language literacy was found to have a positive and significant correlation with Internet adoption in 10 of the countries. E-skills literacy showed a positive and significant correlation with Internet adoption in all 12 countries (Table 8).

Internet Use

Table 9 provides the findings from the analysis of Internet activities by literacy levels. The responses ranged across four categories: Never, Occasional, Weekly, or Daily. This study then grouped Occasional, Weekly, and Daily into a single Yes response and Never into a No response to analyze Internet use irrespective of frequency. Activities conducted on the Internet were minimal for even literate users. At most, 21% of people with e-skills in a given country used the Internet for email purposes. The most common activities were email (17.5%), social networking or using video-sharing websites (16.2%), and fact finding (15.6%) among those with reading literacy. Those activities were also the ones most commonly carried out by individuals with writing literacy, English-language literacy, and e-skills literacy. Degrees of use actually increased among those with English literacy and an advanced level of education. For nonliterate Internet users, fewer than 1% performed any of the activities studied (Table 9).

Table 7. Internet Adoption by Basic Literacy.

Country	Reading literacy			Writing literacy		
	Reads "easily" (% adopted Internet)	Reads "with difficulty" (% adopted Internet)	Does not read at all (% adopted Internet)	Writes "easily" (% adopted Internet)	Writes "with difficulty" (% adopted Internet)	Does not write at all (% adopted Internet)
Botswana	35.4	7.6	7.5	35.0	10.9	3.4
Cameroon	27.4	4.9	1.5	27.4	6.0	1.5
Ethiopia	7.2	0.2	0.8	7.4	0.4	0.8
Ghana	25.1	4.5	1.0	25.6	5.0	1.3
Kenya	31.3	5.4	0.3	30.5	6.3	1.6
Mozambique	21.1	3.4	2.3	20.0	3.7	4.7
Namibia	28.4	1.9	1.0	28.6	2.1	1.0
Nigeria	35.5	8.8	0.6	33.9	11.3	0.3
Rwanda	11.0	1.3	0.2	11.3	1.3	0.0
South Africa	42.5	3.1	6.6	41.3	7.3	5.1
Tanzania	4.7	0.1	1.2	5.0	1.3	0.7
Uganda	15.3	2.5	0.8	15.7	1.5	1.0

Source: RIA (2012).

Table 8. Internet Adoption: Logistic Regression Results Using Sampling Weights.

Variables	All Countries	Uganda	Kenya	Tanzania	Rwanda	Ethiopia	Ghana	Cameroon	Nigeria	Namibia	South Africa	Botswana	Mozambique
Income	+***	+***	+***	+***	+***	+	+	+**	+***	+***	+***	+***	+***
Female	-***	-	-	+	-	-***	-***	-	-***	-	-	+	+
Rural	-***	-***	-	-	-***	-	-***	-***	-**	-***	-***	-	-***
Age	-**	Negative parabolic relationship, but only statistically significant for two countries											
Reading literacy	+***	-	+	-	+	+	+**	+	+	+	+**	+	+*
Writing literacy	+**	+	+	+	+	-	-	+	+	+	-	+	-
English literacy	+***	+***	+	+***	+***	+***	+***	+***	+**	+*	+***	+	+***
Higher education	+***	+***	+***	+*	+***	+***	+**	+***	+***	+**	+***	+***	+***
Student	+***	+	+***	-***	+***	+	+	+**	+**	+***	+***	+***	+
Grant/pension	-	+*	-	+	+*	+	+	+	+	e	-		
Employed	+***	+	-	+***	-	+	-	+	+	+	+***	+	+***
Self-employed	-*	-	-***	+	+	+	-***	-*	-	-*	+	-***	+
Pseudo R2	0.3061	0.2266	0.3192	0.2923	0.4395	0.3513	0.2964	0.2455	0.2732	0.3719	0.2753	0.2168	0.3405
Chi-squared	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Log Likelihood	-4890.7	-401.6	-485.4	-184.9	-194.3	-239.5	-318.4	-400.3	-569.9	-358.3	-729.2	-439.4	-311.4

Note: *** indicates significance at the 1% level; ** indicates significance at the 5% level; * indicates significance at the 10% level.
Source: RIA (2012).

Table 9. Internet Use: Activities by Literacy Levels (by Percentage).

Activities	Reading literacy (reads "easily")		Writing literacy (writes "easily")		English-language literacy		E-skills literacy (tertiary or secondary education)	
	Yes	No	Yes	No	Yes	No	Yes	No
Getting information about goods and services	12.2	0.4	12.0	0.6	14.5	0.5	14.8	0.6
Getting information related to health and health services	13.0	0.3	12.9	0.5	15.2	0.6	15.6	0.6
Getting information from government organizations	10.6	0.2	10.4	0.5	12.3	0.5	12.7	0.6
Reading or downloading online newspapers/magazines	12.2	0.2	12.0	0.4	14.0	0.7	14.6	0.6
Getting information for school- or university-related work, researching a topic	14.1	0.3	14.2	0.3	16.5	0.6	17.2	0.5
Finding or checking a fact, looking up a definition	15.6	0.3	15.5	0.5	18.2	0.8	18.7	0.8
Interacting with government organizations	7.3	0.3	7.1	0.5	8.5	0.4	8.8	0.5
Sending or receiving email	17.5	0.4	17.3	0.7	20.3	0.9	21.0	0.9
Telephoning over the Internet, VoIP	6.4	0.2	6.3	0.4	7.5	0.3	7.9	0.2
Social networking or using video-sharing websites	16.2	0.4	16.2	0.5	19.0	0.8	19.6	0.8

Source: RIA (2012).

When the literacy variables are used separately and in combination in the models, the results are similar to the previous models. A combination of the literacy variables also has a positive and significant relationship to Internet use.

Conclusions and Recommendations

This study looked at how basic literacy, English-language literacy, and e-skills literacy relate to adoption and use of mobile phones and the Internet in 12 sub-Saharan countries.

Literacy
Close to a third of the population across the 12 countries lacks basic literacy, and only three countries have populations in which 70% can read and write easily. African languages are the primary languages spoken in households in 10 of the 12 countries and English-language literacy is low across all the countries. Primary schooling was the most commonly reported level of educational attainment in seven of the countries. In Ethiopia, most respondents had no formal schooling. Only in four of the 12 countries did more than 50% of respondents report educational attainment at either the tertiary or secondary level. The majority of adults in eight of the countries lack the education necessary to acquire e-skills literacy.

Mobile Phone Adoption and Use
While the share of individuals who own a mobile phone is much higher among those with an advanced literacy level, lower levels of basic literacy or none at all does not deter individuals from getting a mobile phone. Similarly, English-language literacy does not necessarily present a barrier to mobile phone adoption. Nevertheless, the gap in ownership between those with English-language literacy and those without is wide in some of the

study countries. The relationship between literacy levels and Internet use is even more pronounced among mobile phone users. It is predominantly those with basic literacy, English-language literacy, and e-skills literacy who use a phone for more sophisticated messaging activities and the Internet.

Although the analysis shows that individuals own mobile phones irrespective of their literacy levels, the rate of adoption and range of uses are higher among those with e-skills literacy.

Internet Adoption and Use

The literacy effect is more pronounced on Internet adoption than on mobile phone adoption. In general, the activities conducted on the Internet were found to be minimal, even among those who are literate. The degree of Internet use was slightly higher among those with English-language literacy and e-skills literacy than for those with only basic literacy.

Recommendation

Policymakers should aim to ensure that citizens acquire the necessary e-skills, in addition to basic and English literacy, to enhance their ability to participate fully in the information age. Policymakers should also provide more intensive support for public-sector, private-sector, and civil-society initiatives that generate Internet content in the widely spoken local languages. Without such efforts, full digital inclusion is likely to be an insurmountable challenge in sub-Saharan Africa. ■

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Appendix 1. Summary of Descriptive Statistics of Variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
MaxIndInco~D	15076	137.0101	440.0164	0	30,487.8
female	15076	.5243433	.4994236	0	1
rural	15076	.3845848	.4865131	0	1
age	15072	33.80892	14.94516	0	103
readinglit~y	15076	.605134	.4888381	0	1
writinglit~y	15076	.5996949	.4899764	0	1
englishlit!y	15076	.4797028	.4996044	0	1
highereduc~n	15075	.4528027	.4977839	0	1
Student1	15069	.1432743	.350364	0	1
GrantPension	15069	.0333798	.1796322	0	1
Employed1	15069	.2262924	.4184445	0	1
SelfEmployed	15069	.332537	.4711378	0	1

Appendix 2. Country Sample Size Unweighted and Percentage.

Country	Nonrural number	Nonrural percent	Rural number	Rural percent	Total
Botswana	624	67.9%	295	32.1%	919
Cameroon	839	70.0%	360	30.0%	1,199
Ethiopia	960	59.7%	648	40.3%	1,608
Ghana	723	60.1%	480	39.9%	1,203
Kenya	868	70.1%	371	29.9%	1,239
Mozambique	718	59.9%	481	40.1%	1,199
Namibia	658	68.0%	309	32.0%	967
Nigeria	914	58.9%	638	41.1%	1,552
Rwanda	431	35.9%	769	64.1%	1,200
South Africa	1,086	68.3%	503	31.7%	1,589
Tanzania	745	62.0%	456	38.0%	1,201
Uganda	712	59.3%	488	40.7%	1,200

Source: RIA (2012).