

An Assessment of Information Communication Technology (ICT) Penetration in Kenya on Economic Development

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Abstract

The Communication Commission Authority of Kenya (CAK) formerly Communication Commission of Kenya (CCK) is the regulator of telecommunication services in the country. Licensing of foreign suppliers is restricted through a requirement to partner with local firms, with foreign firms holding a maximum shareholding of 40%. The current scenario does not guarantee universal access, both in terms of policy and available infrastructure. This study assessed influence of information communication technology (ICT) penetration in Kenya on economic development. Four economic development indicators were surveyed guided by the study hypothesis that: ICT penetration in Kenya is determined by per capita income, stock of human capital, openness of the economy and electrical infrastructure. Descriptive and econometric approaches were used. The study utilized time series data covering seven years collected from local and international sources. A series of regression equations were applied to test the hypothesis. The ordinary least squares method of regression was used to estimate the model and linear regression estimated the results. The four economic indicators were used to construct regression equations. The regression model was analyzed at the 0.5 level of significance. With reference to the four economic indicators, the study findings revealed that: while both an educated population and openness of the economy to the outside world through air travel are significant determinants of ICT growth in Kenya; Per Capita GDP and electricity infrastructure are not significant. The study concludes that; ICT penetration in Kenya is dependent upon a high level of openness to the global economy, as it promotes technology transfer across the borders. Further, an educated work force is also important for the rapid adoption of ICTs. The study findings make a crucial contribution to the field of economic research by addressing strategic economic policies that are key to the capacity of a region to exploit ICT for realization of trade development objectives.

Keywords

Information Communication Technology, Economic indicators, Econometrics, Time Series, linear regression.

I. Introduction

Kenya's communication sector is currently underdeveloped with the area of coverage by technological infrastructure quite small, with low efficiency levels and high service costs. The Communication Commission Authority of Kenya (CAK) formerly Communication Commission of Kenya (CCK) is the regulator of telecommunication services in the country. Licensing of foreign suppliers is restricted through a requirement to partner with local firms, with foreign firms holding a maximum shareholding of 40%. The current scenario does not guarantee universal access, both in terms of policy and available infrastructure. By the mid 1990's the country possessed about 60 automatic telephone exchanges and 256 manual exchanges spread in various parts of the country (Ikiara & Nyandemo, 2002).

Both Internet and mobile telephone service are relatively new in Kenya, but have grown at highly impressive rates. By the end of 2000, there were 50 Internet service providers. Internet service providers face a number of regulation constraints with regard to the expansion of their infrastructure. They are neither allowed to build their networks nor to own or lease their own international data gateways.

There is little doubt that information communication technology is a key policy consideration for an economy since it is considered an enabler or supporter of strategic development actions. The global economy is undergoing a profound shift towards a networked and knowledge-based economy, a process that Kenya needs to be part of towards realization of its first Vision 2030 pillar, economic development. As with other development challenges, the responsibility of sustained development lies in being able to find efficient and affordable solutions to tackle the challenge of ICT access in the country. This study endeavors to contribute to the field of economic research by addressing strategic economic

policies that are crucial to the capacity of a region to exploit ICT for realization of trade development objectives.

A. Statement of the problem

The rapid progress in ICT and its impact in the global economy have intensified in the recent years leading to a new economic system that has attracted a great deal of interest. It has also raised debate on the extent of ICT diffusion and economic opportunities and challenges imposed by ICT on the developing world. World Bank Report (2002) showed that, lack of knowledge is a major factor behind stagnation and economic growth in Africa. The rate of diffusion of ICT to developing countries such as Kenya had been rapid. Just 10 years after the 'start' of the ICT revolution, developing countries already had about 10% shares of internet subscribers in 2000 (ITU Statistical Yearbook, 1999)

Rapid growth of the Internet in Kenya is being constrained by inadequate investment in ICT. Installation of ICT relies on the widespread use of electricity as the medium for the transmission of information. The cost of installing electricity is prohibitive to many people in developing countries. This limits their access to ICT services.

B. Objective of the study

The aim of this study was to assess the influence of ICT penetration in Kenya on economic development.

C. Hypotheses

The study was guided by the hypothesis that: ICT penetration in Kenya is determined by per capita income, stock of human capital, openness of the economy and electrical infrastructure.

II. Literature Review

Micro-economic evidence suggests that ICT is likely to affect not only the organization of workplaces, but, by reducing communication cost, ICT has the potential to raise international trade, reduce domestic market bias, boost cross-border financial flows and facilitate technology transfer (Portes & Ray, 1999). Dasgupta, Lall and Wheeler (2001) point out that what explains the patterns of diffusion of new technologies includes: countries with relatively high growth rate, greater urbanization and a superior economic policy environment which expands citizens use of cell phones and faster internet connection. Once these factors are controlled for, those with low usage catch up.

In their findings, Caseli and Coleman (2001) and Keyani and Dymond (1997), reinforce these assertions by arguing that, high levels of human capital are strongly correlated with the rate of adoption of ICT. Since the new technology is typically embodied in new equipment, high investment speeds up adoption. A policy regime that is open to imports and foreign investments raises the likelihood of opening up global market through ICT (Caseli and Coleman, 2001).

Keyani and Dymond (1997) add that, strong growth and effective policies raise the rate of ICT adoption, which, in turn, has long-term beneficial growth effects. This implies that, there is a likelihood of a "virtuous circle," with growth, policies, urbanization, education, trade and information technology reinforcing each other. People on the margins of domestic and international markets can be bought into the mainstreams through the provision of better information and the reduction of transport costs.

However, Pohjola (2000) avers that, despite the many specific examples of ICT benefits in developing countries, the aggregate impact has this far been limited. This in part reflects some fundamental constraints, including the lack of complimentary human capital, telecommunication sectors that are not yet sufficiently responsive, and policy or organizational rigidities.

Low cost wireless solutions are now available to urban and rural areas of Kenya. The advantage of wireless system over traditional wired solution is that they can be relatively easy to deploy, avoiding the complex problem of laying cables, and managing them properly (Sabater, Dymond & Juntenen, 2002). The trio adds that, satellite systems, particularly very small aperture terminals (VSATs) are now reaching remote area. Investment in VSAT technology is affordable, with the cost of the equipment raring as low as \$3000 to \$4000.

III. Model Specification And Data Sources

This study used an ICT index proposed by Onyeiwu, (2002) which computes the inter-country levels of digitalization, namely, penetration of Internet services, computers, fixed, and mobile telephone services. The model choice was guided by the fact that, some of the existing IT indexes include indicators that cannot be measured objectively (Rouvinen, 2002). Onyeiwu (2002) proposed the following index for computing the inter-country levels of digitalization:

$$\text{ICT Index} = [1/10 (A + B) + 10 (C + D + E)]/50 \quad (1)$$

Where

A = number of Internet hosts per 10,000 of the population

B = Internet users per 10,000 of the population

C = number of personal computers per 100 of the population

D = telephone lines per 100 of the population

E = cellular phones per 100 of the population

A completely digitalized economy would have an IT index of 100, implying that there is an Internet host for every person in the country and also that everyone in the economy owns a personal computer, that there is a telephone line for every person, and also that everyone in the country owns a cellular phone. This is obviously a highly idealized and Utopian scenario, but it does provide a useful benchmark for assessing the level of digitalization in Kenya (Mungai & Vundi, 2015).

A series of regression equations were applied to test the study hypothesis that:

ICT penetration in Kenya is determined by per capita income, stock of human capital, openness of the economy and electricity infrastructure.

To estimate the results, Gujarati (1979) linear regression models were used:

ICT penetration = f(per capita GDP, tourist arrivals, stock of human capital, openness of economy and electricity consumption)

SO:

$$Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + \epsilon_t \quad (\text{Equation 2})$$

WHERE

Y_t = ICT penetration variable

X_{1t} = GDP per capita

X_{2t} = Openness of economy

X_{3t} = Stock of human capital (high school enrolment)

X_{4t} = Consumption of electricity

ϵ_t = Unexplained variables in the equation

Equation (2) can be written as :

K

$$i = 1, 2, \dots, N$$

Where X_i and Y_t is the independent and dependant variable respectively, combined with

N observations in cross-section data. The constant term is β_0 , while ϵ_t is assumed to be a

random error with 0 mean and σ^2 variance.

The t distribution will be used to test the hypotheses where; $H_0: \beta_0 = 0$ $H_1: \beta_0 \neq 0$

The ordinary least squares method of regression will be used to estimate the model, because of it is considered fairly compact, simple, straightforward ability to explain the ICT determinants (Rosslet, 2001). Time series secondary data on ICT was extracted from Kenya Statistical Surveys, United Nations Statistical Website Database, International Telecommunication Union's Website Database, and, economic surveys from the World Bank, World Tourism Organization (WTO) and UNCTAD (UNCTAD, 2000).

IV. Data Analysis

The collected data was first analysed to establish numerical values of each of the ICT development indicators in Kenya. The data sought to establish the number of internet hosts and internet users per 10,000 people, and number of computers, fixed and mobile telephone lines per 100 people in Kenya. Table 4.1 summarizes the results.

Table 1: ICT Penetration in Kenya 1995 - 2002

Year	10000		Cell Phones		Weighted Sum	IT Index	
	No. per Hosts	People Internet Users	No. PC's	per 100 people Fixed Tel. Lines			
1995	0	0	0.07	1.01	0	10.8	0.216
1996	0.05	1	0.19	1.03	0	12.305	0.2461
1977	0.16	4	0.28	0.99	0.03	13.516	0.27032
1998	0.24	5.17	0.36	0.99	0.04	14.441	0.28882
2000	0.56	62.21	0.49	1.05	0.42	25.877	0.51754
2001	0.86	159.78	0.56	1.04	1.92	51.264	1.02528
2002	0.93	159.78	0.56	1.03	4.15	73.471	1.46942

Source: United Nations Statistical Division (2003) (Weighted average and IT index computed by author)

Table 1 reveals that there was a significant and rapid growth in ICT penetration from an index of 0.216 in 1995 to 1.469 in 2002. This study

was built on the hypothesis that: ICT penetration is affected by the following indicators - Openness of the economy, GDP per Capita, Stock of Human Capital and electrical consumption. To assess the responsiveness of ICT penetration to the above economic indicators, the regression equation shown in table 4.2 was constructed.

Table 2: ICT Penetration Indicators

Variables	Measure	Coefficients	T values
Constant			-4.036
GDP CAP	GDP per Capita	0.176	2.406
AIRARRV	Arrival by Air	0.792	11.943
SECSCH	Secondary School enrolment	0.221	2.824
ELECON	Electricity consumption	-0.043	-0.503

Adjusted R² = 0.982 Standard Error = 1.382 Degrees of freedom = 5 F statistic = 124.241

Data from table 4.2 was discussed with reference to each of the study's four economic indicators as per the study hypothesis that: ICT penetration in Kenya is determined by per capita income, stock of human capital, openness of the economy and electricity infrastructure. The regression model was analyzed at the 0.5 level of significance.

On the basis of the multiple determination R², we note from table 4.2 that, together, the four variable explain 98% of the factors that influence ICT development.

A. GDP per capita

From table 4.2, the coefficient for GDP per capita is 0.176. It has a positive sign. However, the coefficient is not statistically significant at the 5% level. We thus accept the null hypothesis and conclude that Per Capita GDP is not a significant factor influencing ICT development in Kenya.

B. Stock of Human Capital

Stock of human capital, which is represented by secondary school enrolment has a coefficient of 0.221 (Table 4.2). The coefficient is significant at the 5% level. Thus we reject the null hypothesis and conclude that an educated population is a significant factor in ICT growth.

C. Arrivals by Air

Passenger arrivals by air, was used in this survey to represent the level of openness on economy as it promotes technology transfer across the borders. From table 4.2, the co-efficient for passenger arrivals is 0.792. It has a positive sign as expected. The coefficient is significant at the 5% level. Thus we reject the null hypothesis and conclude that openness of the economy to the outside world through air travel, is a significant factor influencing tourist growth.

D. Electricity Consumption

This indicator does not have any relationship with ICT growth as evidenced by its negative coefficient of -0.043 (Table 4.2). Thus, at a 5% significance level, we accept the null hypothesis and conclude that ICT growth is not determined by electricity infrastructure in Kenya. The growth in ICT is stimulated by air passenger arrivals, making the country more open to foreign technology transfer, and the development of stock of human capital.

V. Conclusions And Policy Implications

1. Conclusions

The main objectives of this study was to assess influence of

information communication technology (ICT) penetration in Kenya on economic development. Four economic development indicators were surveyed guided by the study hypothesis that: ICT penetration in Kenya is determined by per capita income, stock of human capital, openness of the economy and electrical infrastructure.

The study findings lead to the conclusion that, ICT penetration in Kenya is dependent upon a high level of openness to the global economy, represented in this survey by air passenger arrivals, as it promotes technology transfer across the borders. An educated work force is also important for the rapid adoption of information communication technologies. ICT penetration in Kenya has a strong influence on the air travel industry. This implies that more local and international flight passengers are booking their flights using e-commerce (internet bookings). There are also strong indications that the air travel industry is more responsive to advertising through the Internet and television.

2. Policy Implications

General policies for the accelerated use of information communication technologies in Kenya should be adopted as implied by empirical results. This will stimulate growth in the air travel industry, which in turn, opens up the Kenyan market to spillover effects, which include: tourism, foreign direct investment and employment. Towards realization of this goal, the following strategies can be adopted:

One strategy is to reduce tariffs on the purchase and use of digital communication equipment. In addition, the Internet can be made a tariff-free zone for key industries such as tourism and travel. Lowering the tariff barrier induces more competition that will benefit the consumer. A tariff-free Internet zone can also stimulate domestic tourism as Kenyans can book holiday tours through e-commerce.

Another strategy to increase user accessibility to mobile phone services, is to increase the licensing of more cellular operators and internet service providers. This will have an effect of reduced prices and competitive telephone service provision. Another advantage of cellular telephony is that remote tourist lodges, which cannot be reached through the landline, can be connected to the expanded mobile phone networks.

Tourist promotion and air travel can be enhanced using the multi-media, namely the Internet and television. On-line marketing reduces marketing costs and reaches across international borders. Computer links with international tour agents should be fostered, to re-enforce international tour and travel market access. Many of the vast and growing numbers of Internet users are also tourists, thus providing them with information about current prices and airline timetables. This means that destinations that can promote their tourist products on-line at affordable prices, have a competitive advantages over destinations that are not on-line.

Tour and travel operators, to maximize economic benefits, can exploit electronic commerce. By offering direct on-line services to international customers through the internet, air ticket sales and hotel revenue can be generated, thus Kenya can substantially increase its share in the travel market. E-commerce can also be used to tap into unexploited tourist markets such as the Far East.

Transfer of technology to this country from advanced nations can be done through networks linking Kenyan expatriates and students abroad. ICT skill training should also be provided to trainees, employees and entrepreneurs in the tour and travel industry.

5.3 Suggestions for Further Research

Further research on factors affecting ICT development in Kenya is necessary. A comprehensive ICT impact analysis can be carried out to assess the social welfare benefits of information technology to this economy. Conducting a comprehensive sector-by-sector analysis and extensive field study can achieve interesting results. Poverty reduction strategies can also be developed using ICT models. This will ensure that resources are not wasted on ICT projects, which are not viable.

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