



# ICTS AND ECONOMIC GROWTH IN AFRICAN COUNTRIES

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## ABSTRACT

It is well established that Information and Communications Technologies (ICTs) are strong drivers for economic growth. While many studies have shown the strong correlation between ICT and economic development in a number of developed and developing countries, little research has been done on African countries in general and Nigeria in particular. This paper is aimed at identifying the relationship between ICT and economic growth in order to provide the way forward for Nigeria to use ICT for economic development. An analysis of the actual relationship between ICT and economic growth is made which identifies the necessary as well as sufficient factors that provide the catalyst to turn ICTs into drivers for economic growth. This is used to explain why the use of ICTs in many African countries does not result in the desired economic growth. A broad discussion is provided on the use of ICTs as a service sector as well as an economic sector. It is obvious that while both sectors can lead to economic growth, developing countries that use ICT as an economic sector are likely to do much better in generating wealth and providing job opportunities. A broad survey is made of the use of ICTs in Africa with particular emphasis to the experiences of a few countries namely Botswana, Mauritius, Egypt and South Africa. An attempt is then made to bring out the true relationship between ICTs and economic growth by analyzing the theoretical models on the major factors that drive ICTs in bringing about economic growth and emphasizing the way forward for countries that have not exploited ICTs as engines for economic growth.

**Keywords:** *ICTs, Economic Growth, Business Process Outsourcing, IT Parks, African Countries*

## 1. INTRODUCTION

Information and Communications Technologies (ICTs) combine the broad range of technologies that are used for the collection, storage, analysis, transfer and dissemination of information. As explained in [1], they constitute a broad spectrum including the rapidly evolving hardware technologies for computation and storage, the wide array of telecommunications technologies, the various mass media technologies that have revolutionized mass communications and the educational technologies that are rapidly moving education into cyberspace.

It is well established that these Information and Communications Technologies (ICTs) are currently having the greatest impact on humanity and the world as a whole and are strong drivers for economic growth. Like other technologies, ICTs bring about innovation and such innovation brings about enhanced human capabilities which result in more efficient methods of production leading to economic growth. However, when they are perceived in the context of technologies that

collect, analyze, transfer information and knowledge, their impact on economic growth can be seen to be much greater because they reduce transaction costs, offer much cheaper substitutes for traditional means of communicating and transacting business and increase choice in the market place. ICTs also have a life of their own when they are viewed from the context of the general services they offer and also from the perspective of the applications that run on them. Their impact on economic growth is so great whether they are looked at as a service sector strengthening other sectors or they are viewed as an economic sector by themselves.

While many studies have shown the strong correlation between ICTs and economic development in a number of developed and developing countries, little research has been done on African countries. This paper is aimed at showing the strong relationship between ICTs and economic development for African countries, identifying the major factors that drive ICTs to promote economic development. This is done by closely studying successful African countries that



have used ICTs to spur economic development and relating the factors that have assisted these countries with theoretical models on the contribution of ICTs to economic growth. The paper starts by analyzing the actual relationship between ICT and economic growth identifying the necessary as well as sufficient factors that provide the catalyst to turn ICTs into drivers for economic growth. This is used to explain why the use of ICTs in many African countries does not result in the desired economic growth. It then discusses the use of ICTs as a service sector as well as an economic sector. It is obvious that while both sectors can lead to economic growth, developing countries that use ICT as an economic sector are likely to do much better in generating wealth and providing job opportunities. This is followed by a broad survey of the use of ICTs in Africa with particular emphasis to the experiences of a few countries namely Botswana, Mauritius, Egypt and South Africa. This leads to a discussion of theoretical models showing the major factors that drive ICTs in bringing about economic growth and emphasizing the way forward for countries that have not exploited ICTs as engines for economic growth. There is a short conclusion at the end of the paper.

## 2. ICTS AND ECONOMIC GROWTH: THE MAIN ARGUMENTS

When ICTs are regarded as just simply technologies, their role can be regarded, as explained in [2], as enablers and enhancers of human capabilities including amongst others, healthy life, creativity and greater participation in the socio-economic and political life of the society. However, when they are perceived in the context of technologies that collect, analyze, transfer information and knowledge, their impact on economic growth can be seen to be much greater. They reduce transaction costs thereby improving productivity and offer immediate connectivity improving efficiency, transparency and accuracy. They also offer, as discussed in [3], much cheaper substitutes for traditional means of communicating and transacting business and they increase choice in the market place just as they widen their geographic scope.

Perhaps, what makes it difficult to quantify the impact of ICTs on economic growth is the fact that they affect the economy in numerous ways, each way often positively complementing others but occasionally inversely. Furthermore, ICTs also greatly affect, in one way or another, the

conventional factors of production. The simplest way is to consider ICTs as infrastructure in the same way that roads are in which case their effect is to reduce transportation costs and bring products closer to markets leading to greater overall productivity. Valid as this analogy may be, it is worth considering whether ICTs should be compared with transport infrastructure or the more ubiquitous energy infrastructure. The reason for this argument is not far fetched. ICTs are increasingly becoming necessary inputs to virtually all systems in the same way that energy is.

ICTs also have a life of their own when they are viewed from the context of the general services they offer. For example, telecommunication networks allow easy communication amongst individuals, organizations and even nations and this brings about increased productivity and efficiency of workers. The communications services work in a strange way with transportation services; they often enhance them but they are also replacing them in rather innovative ways leading to what is often termed “the death of distance.” In the same way, ICTs such as computers have revolutionized the way that information is collected, stored, analyzed and used. The productivity and efficiency gains that they bring about is hard to quantify. The same argument holds for other ICTs whether they be radios, TVs or multimedia projectors.

As if this is not enough, ICTs have another trajectory of impact when they are studied from the perspective of the applications that run on them. The applications are wide and varied defying any simple method of categorization. Some of them are fairly simple just replacing old ways of doing things. Teleconferencing replaces regular meetings, e-banking substitutes conventional banking and online shopping becomes a welcome alternative to traditional shopping. Others are more novel and exotic with online social networks gradually eroding traditional relationships, multi-user virtual learning environments replacing traditional classes and interactive narrowcasting revolutionizing the practice of advertising. In virtually all such applications, especially when they are used in business, there are efficiency and productivity gains brought about by a multiplicity of factors including ease of use, wider coverage, less cost and removal of time and distance constraints. Clearly, because of all these complexities, it is not easy to analyze the overall impact of ICTs on economic growth. An interesting study reported in [4] gives a glimpse of the complex ways in which ICTs affect economic



growth. In this study, mobile phone development (an important component of ICTs) is seen not only to directly contribute to economic growth but also positively affects financial inclusion and this by itself brings about economic growth.

In order to really understand the relationship between ICT and economic growth, it is important to further analyze the impact of ICT at the level of the individual and the firm. It is easy enough to see that ICT, even in its simplest forms – whether it is a mobile phone or a standalone computer or a computer connected to the Internet – greatly improves the productivity and efficiency of individuals in carrying out personal or business tasks. At the firm level, as explained in [5], ICT has been found to be “a substantial contributor to productivity, profitability and growth.” The impact of ICT on productivity as further described in [6], is generally at the organizational level where improvements are made to organizational routines allowing labour to be redeployed thus reducing the time required to produce a particular product or service. This is largely the result of improving existing forms of co-ordination or creating new ones. It is, however, important to note that “ICT utilization does not automatically translate into economic impacts, but require a range of complementary factors.” The most important of these factors are new marketing strategies, capital investment in equipment and organizational change. New marketing strategies together with ICTs bring about increased profitability just as they are “ a means by which new and more efficient production processes can be achieved when combined with new equipment.” Organizational change assisted by ICT brings about “greater labor productivity, lower operational costs and higher revenues.” The specific nature of the products or services that a firm produces also has a bearing on the extent of the impact of ICT on the firm’s performance. Firms that deal with products or services that are information intensive, (whether in the product characteristics or the transaction characteristics) are more likely to better improve their performance through ICT.

In the final analysis, it is instructive to note that whichever way ICTs are viewed as, whether as technologies, services or applications, their impact on the economy is profound.

### 3. ICT AS A SERVICE SECTOR VERSUS ICT AS AN ECONOMIC SECTOR

It is useful to differentiate between the role of ICT as a service sector and its position as an economic sector. When ICT is considered as a service sector, it implies that it is used to serve other sectors. As is well known, ICT can greatly enhance other sectors – whether they are education, health, government or industries – and make them more efficient. The effect of ICTs on these sectors is multidimensional and the overall impact of all these dimensions is that these sectors become more efficient and this increased efficiency leads to economic growth.

However, over and above this contribution of ICT to economic development, ICT can also be considered as an economic sector in itself. This can be divided into a number of broad areas. First there is the area dealing with the manufacture and supply of the hardware and software components whether they are the computers that have become ubiquitous, their operating systems, the mobile handsets that so many people now possess or the large array of gadgets that make up the vast ICT networks all over the world. This is an area where very huge capital investments continue to be made with the resultant huge revenue flows and large numbers of new jobs being created. There are many countries whose economies greatly depend on such products. Finland, for example, according to [7], depends almost entirely on the Nokia company with its contribution to the economy being as much as 25% from 1998 to 2007. USA, China and Korea all have sizeable contributions to their economies from the manufacture of ICT products.

Secondly, there is the segment that deals with the direct services that derive from the sector. These include the extremely large telecommunications area, which is a sector in itself, and the equally vast computer area, both of them employing large numbers of people and gulping up huge capital investments. The telecommunications sector, in particular, since the advent of mobile telephony, has been a source of economic growth for many developing countries. In many African countries, the telecommunications sector contributes substantially to GDP and employs large numbers of people. Even in countries like Nigeria, which depends heavily on the oil sector, according to [8], the telecommunications sector contributes as much as 8.5% to GDP.



It is the third area that is the most interesting. This is the area which encompasses all the applications that are built on top of the ICT services. Clearly, this is an area that is difficult to measure or quantify given the vast array of applications that ICTs have brought about ranging from e-commerce to e-banking to e-learning. The most significant constituent of this area is outsourcing which has been rapidly increasing and is likely to continue to do so in the foreseeable future. It is perhaps worth noting that the economies of a number of countries depend almost entirely on outsourcing.

#### 4. THE STATUS OF ICTS IN AFRICA: A BROAD SURVEY

Africa is a vast continent with 58 countries having a total population of more than one billion people. Africa has for long been a troubled continent suffering from a myriad of interconnected problems including underdevelopment, poverty, illiteracy, unemployment, civil wars and environmental disasters. Things, however, are beginning to change for Africa in the 21<sup>st</sup> century. Some of the major challenges are being addressed and the economy has been growing at a steady rate. According to [9], Africa has witnessed so much remarkable growth since 2000 that it “has been hailed as the next frontier for opportunity and a potential global growth pole.”

ICTs are being hailed as having contributed significantly to this positive development in Africa. In the last few decades, Africa has seen an unprecedented growth of ICT, especially mobile telecommunications, infrastructure and this has brought about phenomenal development in ICT services, in general, and telecommunications services in particular. According to [10], before the turn of the century, Africa had less than 50 million telephone lines, with more than 50% of them being mobile, which made its average tele-density barely one in 20 inhabitants. For sub-Saharan Africa, the situation was particularly chronic where the number of lines was “about three times worse than the ‘average’ low-income country.” Things, however, have considerably changed for the better especially with the advent of mobile telephony. By 2012, according to [11], “there were almost 650 million mobile subscriptions in Africa, more than in the US or the European Union, making Africa the fastest growing region in the world.” Other ICT infrastructure has also impressively increased, even if it has not developed at the same phenomenal rate. This includes infrastructure that has made Internet

services more widely available especially the large national backbone networks that have been laid in several countries and the submarine cables that join the African countries to each other and to other continents.

While the impressive growth in telecommunications infrastructure has no doubt contributed significantly to the economic development of the continent, it is important to note that it is the applications that are being run on top of the infrastructure that have resulted in the more than 7% contribution of the ICT sector to the GDP of Africa. These include, in particular, the various government services that are available through the Internet, the financial services that are accessible through mobile handsets and the other business services that have become available through It is also worth noting that while virtually all African countries have witnessed significant development in their ICT infrastructure and services, there is wide disparity in the approaches of the individual countries and in the achievements they have recorded. Some countries have recorded much better successes than others in their attempts to improve the lives of their citizens and grow their economies through ICTs.

Some of the experiences of the most successful countries are discussed below:

##### 4.1 Botswana

Botswana presents a beautiful example of an African country that has effectively used ICT to spur its economic development. A landlocked country located just above South Africa, Botswana, as explained in [12], is one of the first countries to formally graduate from LDC (Least Developed Countries) status to a developing country. It is instrumental to note that Botswana has used ICT more as a service sector than as an economic sector by itself. The impressive economic growth recorded has been as a result of political stability, good leadership, proper planning, and “wise economic policy and prudence” that “has been supported by the nationwide deployment of ICT and the implementation of performance management systems in almost all facets of public activity and in the private sector.” It is interesting to note that as early as 1966, when it gained independence from Britain, Botswana began using computers in the Accountant General’s office and since then it has gradually expanded ICT services to all aspects of government and especially to the management of the economy which largely depends on mining.



The use of ICT in the public and private sectors to drive economic development has largely been possible because of the efforts to provide connectivity throughout the country. With the introduction of mobile telephony in the 1990s, Botswana was quick to expand ICT access to its citizens so that by 2009, “the country had reached nearly 1.5 million mobile cellular subscriptions – almost one per inhabitant -, and had 80,000 Internet users, 6,000 Internet hosts and a PC penetration of 6.5%.” This was as a result of the regulatory reform that greatly liberalized the telecommunications sector and allowed the private sector to invest heavily in rolling out infrastructure and providing services. The fact that the Government actively promoted the use of these services and was perhaps the largest client for the service providers must have played a part in rapidly expanding the sector. This is in addition to the various government initiatives to expand access to rural and other underserved areas.

It is a little bit strange that Botswana has, over the years, made substantial efforts to develop the ICT sector as a thriving economic sector in itself but these efforts have largely failed. This may be because mining has become so predominant or its small population may not provide the large employee base. It could also be as a result of insufficient human capacity development or any other factors that are crucial to the success of the ICT economic sector.

#### 4.2 Mauritius

Mauritius is an island off the South African coast east of Madagascar. With its small population of barely 1.3 million, it has made great economic strides and has moved from a low income island to a middle income country. The economy of Mauritius traditionally relied on sugar and textiles exports but the government, in the last few years, has come up with an aggressive policy aimed at diversifying and expanding its economy through “tourism, agriculture, offshore financial services, manufacturing and ICT-BPO” As stated in [13], Mauritius is paying particular attention to the development of the ICT economic sector especially through the growth of the outsourcing industry. Starting at the low end of basic data entry tasks, the industry has rapidly grown and graduated to more sophisticated financial services and other back-office processing activities.

Mauritius presents a good example of an African country that has made great strides in developing an

ICT economic sector. One of the factors that has helped in achieving this feat is political stability together with proper planning and strong political will on the part of the government to push the country forward towards the vision of making it a “cyber” island. There is also a strong ICT policy in place with well set-out goals and objectives and clearly defined fiscal incentives to foreign and local companies and other inducements including “electricity at preferential rates, the opportunity to buy property and land, and permanent resident status.” The government has also made huge investments in providing a modern and state-of-the-art telecommunications network in the country. The idea is to allow the establishment of digital parks all across the island that will compete with other IT parks all over the world in providing conducive and enabling environments for carrying out outsourcing and other ITES services. Another unique factor that is favourable to the BPO sector in Mauritius is the multilingual (English and French) nature of majority of the workforce. This is partly due to history in the sense that the “population is an unconventional mix of Arabic, Indian, Creole, Singhalese, French, English and European all mixed in together...” and the fact that both English and French are considered as official languages.

#### 4.3 Egypt

Egypt is one of the largest countries in the continent with a population of over 80 million and a GDP of above US\$520 billion. Realizing the importance of ICT for economic development, Egypt has embarked on serious efforts towards making it an attractive offshore and outsourcing destination. The efforts have largely paid off and, within a short time, the country has become a major outsourcing destination.

Perhaps, the greatest factor that has contributed to the success of Egypt is the strong political will on the part of the government to attain the vision of developing a strong export-oriented ITES (IT-enabled services) sector. This political will is seen in the creation in 1999 of the Ministry of Communications and Information Technology (MCIT) that has been pursuing several initiatives which, according to the online Wikipedia encyclopedia, includes the provision of highly subsidized dial-up and high-speed broadband Internet services, promotion of innovation and ICT industry development, including research and development, training, investment and e-business and establishment of technology parks. The activities of the Ministry are backed by a strong





ICT policy with regularly updated, well articulated and coherent strategies that have been passionately and vigorously pursued by the government. The policy, as enunciated in [14], aims at “encouraging investment in IT-enabled service infrastructure at international standards”, “strengthening legislation and regulations supporting IT-enabled service export industries”, developing “the capacities of individuals, SMEs and industries to take full advantage of the commercial opportunities in the sector” and “developing a coherent long-term strategy to promote Egypt as an offshore and outsourcing destination in IT-enabled services.”

The primary vehicle towards the attainment of this vision has been the establishment of a 120 hectare smart village located in Sixth of October City outside the city of Cairo. With immaculate green lawns, superb buildings and state-of-the-art ICT infrastructure, many IT companies have already become tenants. The most prominent amongst them has been Microsoft which has one of the buildings that houses the Microsoft Developer Support Center for the Middle East and Africa.

When former President Hosni Mubarak inaugurated the project, as described in [15], he specifically made mention of the most valuable asset; “a large pool of talented, multilingual and experienced workforce with a distinguished skill set...” With Egypt’s strong system of education serving its large population, there is no shortage of skilled staff for the variety of jobs that the outsourcing sector requires whether they be data entry clerks, call center customer service personnel or computer programmers.

#### 4.4 South Africa

South Africa has a population of over 50 million and is the largest economy in Africa with a GDP of \$363.9 billion. Historically, the economy depended principally on mining (gold and diamond) but it has gradually been diversified to include other sectors such as manufacturing, financial services, tourism and ICT. Despite its strong economy, South Africa still suffers from high unemployment rates (as much as 25%) with a large proportion of the black population living below the poverty line.

The ICT sector is rapidly growing and increasingly contributing to the country’s economy. According to [16], “it is estimated that the ICT industry contributes close to seven (7%) percent to the gross national domestic product (GDP).” South Africa has made phenomenal progress in the development

of its ICT infrastructure particularly in the telecommunications sector. The fact that it has the second highest network readiness score in Africa, according to [17], shows the extent to which it has succeeded in this area. This achievement is largely as a result of the huge investment of private sector companies in the telecommunications sector. In spite of this success, South Africa is lagging behind in the use of advanced ICT applications beyond telephony. According to [18], it has only 17.2% Internet penetration rate which is relatively poor compared to other countries in the continent such as Morocco, Nigeria, Kenya, Mauritius, Seychelles and Tunisia.

As depicted in the Department of Communication’s vision, to make South Africa “a global leader in the development and use of information and communication technologies for socio-economic development”, it would appear that South Africa views ICT both as an economic sector as well as a service sector and wants to exploit both for the development of the country. This is also seen in the strategic objectives which amongst others, as listed in [16], are “to enable the maximization of investment in the ICT sector and create new competitive business opportunities for the growth of the ICT industry for socio-economic development”, “ensure that ICT infrastructure is accessible, robust, reliable, affordable and secured to meet the needs of the country and its people”, “accelerate the socio-economic development of South Africans and facilitate the building of an inclusive information society through partnerships with business and civil society and 3 spheres of Government”, “improve Departmental performance and enhance the role of ICT SOEs as the delivery arms of Government” and “contribute to the global ICT Agenda prioritizing Africa’s development”

Clearly, the objectives are to make South Africa to use ICTs both as a service sector and as an economic sector. As observed in [19], at the turn of the 21<sup>st</sup> century, South Africa started well to use ICTs as a service sector especially with respect to their use for e-government applications to improve the delivery of public services to citizens. However, barely a decade later, it was surpassed by much less developed countries. On the other hand, South Africa has made steady progress in the last several years to become an outsourcing destination. According to [20], South Africa is very attractive as an outsourcing destination but not yet ready. The authors reached this conclusion after they conducted a very extensive analysis based mainly



on interviews where they took into account several attractiveness and readiness factors including technical infrastructure, business infrastructure, regulatory interface and people factors. According to the analysis, South Africa is attractive primarily as a result of its advanced ICT infrastructure and robust business structure but not ready mainly because it lacks highly skilled labour.

## 5. THE ROLE OF ICT IN THE FUTURE ECONOMIC DEVELOPMENT OF AFRICA

Having looked at the general status of ICTs in Africa and discussed the experiences of some of the most successful countries who have used ICTs to spur their economic development, it is now appropriate to explore the role of ICTs in the future development of Africa. Before doing this, it is useful to distinguish between the role of ICTs in developed, developing and least developed economies. According to [21], countries can be categorized into 3 stages of economic development. First stage economies are factor-driven relying mainly on unskilled labour and natural resources. Second stage economies, on the other hand, are efficiency-driven depending largely on the production of goods and services. Finally, third stage economies are innovation-driven and for them the emphasis is on the production of highly sophisticated and unique goods and services that bring about much larger returns.

It is instructive to note that irrespective of the stage of development, the proper utilization of ICTs will have a positive impact on the economy. However, the stage of development that a particular country is in may decide the optimal usage of ICTs and, in combination with the other factors affecting the economy, will ultimately determine the role that they would play in spurring economic growth. First stage economies would likely find ICTs useful in developing their probably weak institutions, expanding communications services in order to bring about greater efficiency and improving the productivity of workers and the quality of their products.

As explained in [22], ICTs could also help in making accurate and appropriate market data promptly available which would lead to market expansion and improvement just as it could reduce the risks of doing business by reducing overstocking of goods on the part of traders – both strong drivers to pro-poor growth. However, as

explicitly stated in [2], there is no evidence to indicate that ICT infrastructure can substitute other forms of infrastructure (roads, energy, water). Rather they can enhance such traditional infrastructure.

Second stage economies can get even more leverage from ICTs. In addition to what is available for first stage economies, their level of development would allow them to improve the efficiency of their manufacturing and service sectors just as they could use advanced ICT services to increase the efficacy of their governments leading to better enabling environments for their private sectors. They could also exploit ICT as an economic sector. This would require a number of factors to be in place and, as has been seen in countries like India, as long as there is strong political will on the part of the government and the private sector, these factors can easily be assembled and the ICT economic sector can be a very handsome way of generating enormous revenues, creating jobs and growing the economy at double digit rates.

It is interesting, however, to note that these factors, as discussed in [20], do not have to permeate the entire country. As long as they are present within the designated areas where the ICT or ICT enabled services are being produced, such as IT parks, the country can be successful in developing a strong ICT economic sector. The best example of this is seen when one studies the network readiness index 2013 listing of countries, illustrated in [17], and observes that India is at the 68<sup>th</sup> position. This suggests that it does relatively poorly in the various sub indices that make up the overall index which include political and regulatory environment, business and innovation environment, infrastructure and digital content, affordability, skills, individual usage, business usage, government usage, economic impacts and social impacts. This may be true when one looks at the country as a whole but these factors are clearly present in the specially designated IT parks that are present in places such as Bangalore, Chennai and Hyderabad. That is why India tops the list of outsourcing countries, as given in [23] raking in revenues of over US\$100 billion a year from the ICT and ICT enabled services (ITES) sector.

Third stage economies tend to use ICTs to perfect their institutions, push their innovation efforts to new levels and keep ahead of the competition of their peers.

## 6. THE DRIVING FACTORS OF ICTs FOR ECONOMIC DEVELOPMENT: A THEORETICAL MODEL

It has clearly been demonstrated that ICTs have the potential of bringing about substantial economic growth in African countries similar to what has been obtained in the countries of Europe, North America and Asia. There are already a number of shining examples in Africa, some of which have been given above, that have succeeded in using them to bring about economic development in their countries. This section looks at the major factors that are required. It is interesting to note that, even though countries have a choice of either adopting ICTs as a service sector or as an economic sector, the factors are largely the same, the main difference being the fact that for the development of ICTs as an economic sector, the requirements are at a higher level but they only largely need to be present where the ITES services are being produced.

### 6.1 Infrastructure

It is well known that the availability of infrastructure is key to the successful use of ICTs to promote economic development. Studies have clearly shown the relationship between infrastructure and economic growth. According to [24], mobile phones alone contribute an average of 16.2% to national output. Other ICTs have also been found to have similar effects as shown in the research reported in [24], which indicates that for OECD countries, “after a country had introduced broadband, GDP per capita was 2.7 – 3.9% higher on average than before its introduction and an increase in the broadband penetration rate by 10 percentage points raised annual growth in per capita GDP by 0.9 to 1.5 percentage points.”

Clearly, the impressive figures above illustrate that the economic returns on ICT infrastructure investment are attractive. How should a country develop its infrastructure? Which ICTs should a country concentrate on? Factor-driven economies, it would appear, are best served when they develop basic telecommunications infrastructure. Numerous examples abound that show the successful application of ICTs for the enhancement of small scaled businesses and the improvement of the living conditions of rural and urban populaces. They all require adequate telecommunications coverage, especially mobile networks. The examples, as cited in [11] include the mFARM project in Kenya that

gives prices of products over SMS and provides wholesale buying service to farmers, Mobile Baby project in Tanzania that joins together health care professionals, insurance companies and government agencies to support pregnant mothers and the horticultural remote irrigation system in Niger that allows the control of irrigation systems from mobile handsets.

In order to model the contribution of ICT infrastructure to economic growth, we can start from the most general formula for economic growth which is shown below:

$$Y = A \times K^{\alpha} \times L^{\beta} \quad (1)$$

where the total output (Y) is a function of total-factor productivity (A), capital input (K), labor input (L), and the two inputs' respective shares of output,  $\alpha$  and  $\beta$ , for K and L respectively. The capital input (K) is further decomposed in [25] to take the form:

$$Y = A.X(K_n, K_c, K_s, K_t, L) \quad (2)$$

where  $K_n$  is non-ICT capital and  $K_c$ ,  $K_s$  and  $K_t$  are the capital assets for hardware, software and telecommunications respectively.

This model is used to capture the magnitude of ICT contribution to output growth for 50 economies, which constitute the major ICT spending countries, over two five year periods; 1990 – 1995 and 1995 – 2000. As shown in table, when these economies are grouped on the basis of their regions (which to some extent translates to level of development), it is instructive to note that the magnitude of ICT contribution to economic growth varies from 0.27 for G7 economies to 0.10 for Eastern European countries during the 1990 – 1995 period. However, irrespective of the region, the magnitudes greatly increase during the second period (1995 to 2000) in most cases by a factor greater than 2. Also the net return on IT investment was much larger than the corresponding figures on non-IT investment showing clearly that “investment in IT fosters the efficiency of growth.”

### 6.2 Education and Skills in ICTs

Given the fact that ICTs constitute technologies that are fairly new and that require some requisite skills in order to be effectively used, it is not surprising that the level of education and skills of given population can affect the level of adoption of ICT which in turn affects economic growth. It is





important to note there are at least three ways in which this level can have a bearing on the economy. In [25], these ways are highlighted. The first is the general level of education which is often measured by the average years of schooling. This, as explained in [24], has been shown to have a strong correlation with the level of ICT diffusion through measures such as the use of mobile computers, penetration of computers and usage of the Internet.

The second degree is about the specific skills required by people to use ICTs in their places of work. This ranges from the office automation skills that most white-collar workers, for example, must have to much more complex and complicated software or hardware skills that specialists working in particular fields must have in order for them to efficiently carry out their functions. Such skills are likely to be acquired in secondary or tertiary institutions of learning or through on-the-job training. The third degree is at the level of research, development and innovation in the advancement of the ICTs which generally takes place in universities and research institutes but is increasingly also been undertaken by “small consultancy companies, high technology start-ups and co-operative think tanks.”

Whatever degree is being considered, it is important to realize that it results in a movement from an unskilled workforce to one that is skilled which is a positive development. The relationship between the skilled and unskilled workers in an economy is given below, as shown in [26]:

$$Y = AK^\phi[\beta L_u^\psi + (1-\beta)L_s^\psi]^{(1-\phi)/\psi} \quad (3)$$

where  $A$  is the level of technology constant,  $\phi$  is the share of capital in total output,  $\beta \in (0,1)$  is the parameter that controls the intensity in which skilled vs unskilled labour is used and  $\psi$  is the parameter that determines the degree of substitution between skilled and unskilled labour.

Starting from this equation, the author goes on to prove that an “economy with the higher elasticity of substitution has a higher level of income per capita” and also that, assuming a steady-state exists, it would have “a higher capital-labor ratio, a higher skilled-unskilled ratio, and a higher level of income in steady-state.”

Clearly, the different degrees highlighted above would have different impacts on economic growth

but would also interact amongst themselves. Which of the degrees should African countries pay more attention to? This is a question that each country would have to answer for itself based on the current status of education and other factors. It would, however, appear that countries wanting to use ICTs as a service sector are likely to require more basic education that will lead to greater use of ICTs in all aspects of life while those desirous of having ICT as an economic sector would have to train large numbers of their population in the specific skill sets that are needed for the particular areas that the countries are trying to focus on.

### 6.3 Enabling and Conducive Regulatory Environment

One of the most important factors necessary for the successful use of ICTs for economic development is the availability of an enabling environment for the rapid development and use of ICTs. In most cases, the responsibility for this lies with governments. In the first instance, any government wanting to put its country on the right path to ICT advancement must formulate a strong ICT policy that clearly gives a blueprint on how to go about this development. As described in [27], the main thrust of this policy should be the development of a market-driven ICT sector since this has generally been proven to be the most ideal for the growth of ICTs. The policy should adequately cover such topics as competition, licensing of operators, funding, intellectual property and privacy.

This should be followed by the enactment of suitable legislation that will propel the rapid development of the sector. Because of the importance of the private sector in the development and especially financing of ICT infrastructure, one of the most critical aspects of the legislation would need to deal with liberalizing the sector, motivating the private sector to invest in the sector and ensuring investors have no hindrances that would discourage them from investing. Needless to say, it is not so much the formulation of a strong policy or even the enactment of appropriate legislation that ultimately leads to the successful use of ICTs for economic development. Rather, it is the political will, on the part of governments, to vigorously pursue this policy and to enforce the supporting legislation.

It is fairly difficult to model all these factors into the equation (1) above. For one, there is a lot of debate regarding the actual role of policy with respect to economic growth. In [28], for example, it

is argued that policies do not create economic growth by themselves because “they typically do not determine any element in the growth process. Rather, they operate to permit or impede these elements.” On the other hand in [29], it is shown that policies do indeed have a bearing on economic growth both negatively and positively. Whatever the case, it is important to bear in mind that, directly or indirectly, good policies and legislation in African countries would go a long way in strengthening the development of ICTs while bad policies would certainly impede their progress.

## 6. CONCLUSION

This paper has clearly demonstrated the strong relationship between ICT and economic development in the various countries in different parts of the world and identified the necessary as well as sufficient factors that provide the catalyst to turn ICTs into drivers for economic growth. It then discussed the use of ICTs as a service sector as well as an economic sector and showed how countries such as Botswana, Mauritius, Egypt and South Africa have used them to greatly improve their economies. These were carefully studied and that provided a basis to the discussion of theoretical models showing the major factors that drive ICTs in bringing about economic growth and emphasizing the way forward for countries that have not exploited ICTs as engines for economic growth.

One of the major limitations of this study is that it has not been possible to provide some quantitative measures of the factors that drive ICTs and relate them to the economic development of the countries studied. It is hoped that this will be done in the near future.

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