

**ANALYSIS OF THE FACTORS AFFECTING INFORMATION AND  
COMMUNICATION TECHNOLOGY DEVELOPMENT IN KENYA:  
THE CASE OF NETWORK OPERATORS**

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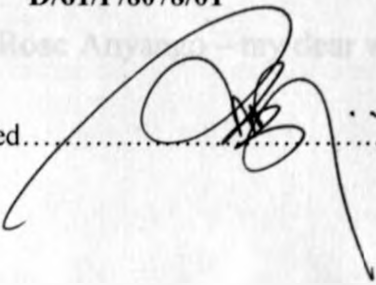
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**DECLARATION**

This research project is my original work and has not been presented for the award of any degree in any other university

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# DEDICATION

This work is dedicated to members of my family for having inspired me:  
sons-George, Franklin and Victor Senaji, daughter-Nightingale Khamonya;  
and Rose Anyango – my dear wife; and Alfred Induri (R.I.P)

## **ACKNOWLEDGEMENT**

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## **ABBREVIATIONS**

<b>AOR</b>	-	<b>Atlantic Ocean Region</b>
<b>CCK</b>	-	<b>Communication Commission of Kenya</b>
<b>DAI</b>	-	<b>Digital Access Index</b>
<b>EASSy</b>	-	<b>East African Submarine Cable System</b>
<b>EM</b>	-	<b>Emerging Market</b>
<b>GDP</b>	-	<b>Gross Domestic Product</b>
<b>GPRS</b>	-	<b>General Packet Radio System</b>
<b>ICT</b>	-	<b>Information and Communication Technology</b>
<b>IOR</b>	-	<b>Indian Ocean Region</b>
<b>ISP</b>	-	<b>Internet Service Provider</b>
<b>ITU</b>	-	<b>International Telecommunication Union</b>
<b>JV</b>	-	<b>Joint Venture</b>
<b>KDN</b>	-	<b>Kenya Data Network</b>
<b>KPLC</b>	-	<b>Kenya Power and Lighting Company</b>
<b>LDC</b>	-	<b>Least Developed Country</b>
<b>MNC</b>	-	<b>Multinational Corporation</b>
<b>NE</b>	-	<b>New Economy</b>
<b>OFC</b>	-	<b>Optical Fibre Cable</b>
<b>PANATEL</b>	-	<b>Pan African Telecommunication link</b>
<b>TKL</b>	-	<b>Telkom Kenya Limited</b>
<b>UK</b>	-	<b>United Kingdom</b>
<b>US</b>	-	<b>United States</b>
<b>VPN</b>	-	<b>Virtual private Network</b>
<b>WAP</b>	-	<b>Wireless Access Protocol</b>

## **Abstract**

This study sought to analyse the factors that affect information and communication technology, ICT development in Kenya. Primary data was collected with the aid of semi-structured questionnaire. Data was analyzed using descriptive statistics such as percentages, proportions and mean. The results obtained are analyzed in this report.

The study analysed the main factors that influence information and communication technology, ICT implementation in Kenya and ranked them as follows: Factor one was outlined as investment in ICT. This factor comprised attributes such as sources of finance, adequacy of capital and willingness of financial institutions to fund ICT projects. This was followed by ICT infrastructure, which comprised variables such as fixed telephony, mobile telephony, IP service, VSAT and data communication; and other infrastructure which support ICT such as availability of power supply and transportation means. Factor three, knowledge and skills in ICT, comprised of requisite knowledge and skills in ICT, sufficiency of skills to satisfy client requirements and impact of skills on service delivery among others. Factor four, ICT policy, consisted of ICT policy facilitation, liberalization, effect of ICT policy and government efforts in implementation of ICT; while affordability of service came last as factor five.

The two most important factors that affect ICT implementation in Kenya are investment in ICT and infrastructure; both scoring a mean of 4.667. Knowledge and skills in ICT (4.533) was next in terms of importance while policy and affordability ranked fourth and fifth with means of 4.333 and 4.133 respectively on a 5-point Likert scale.

Further, though knowledge and skills in ICT is an important factor that influences ICT implementation, it is not in short supply among ICT network operators in Kenya. With a mean of 3.6408 on a scale of 5, network operators said they possessed the knowledge and requisite skills to deploy ICT.

### 1.0 INTRODUCTION

#### 1.1 Background

The current information and communication technology (ICT) situation in Kenya is characterised by inadequate infrastructure, inadequate awareness and requisite ICT skills; limited local content, limited capital, transitional legal and policy framework; and last but not least an economy with limited disposable income to spend on ICT services; the per capita income is US\$271 (2003). As a consequence, Bridging the digital divide and provision of universal access to ICTs are crucial to country's ultimate emancipation and full integration into the global community. With teledensity figures of 0.16 (rural) and 4 (urban) in 100 and a mobile phone penetration of about 7 in 100, most of the population has no access and therefore the urgent need for ICT infrastructure. A market like this no doubt presents a very attractive opportunity for investors in the Kenyan ICT sector. However, poor infrastructure: roads, electricity and telecommunication have been cited as a major hindrance to investment in Kenya and this remains a big challenge. Teledensity and power supply are generally accepted as drivers of economic growth in developing countries (Saunders, Warford and Wellenius, 1994). The economic growth in 2003 was 1.4% and is estimated to grow to 2.6% in 2004 (<http://www.state.gov/r/pa/ei/bgn/292.htm>); while the population growth rate was 1.7% in 2003. The GDP is US\$ 12.7 billion (2003) corresponding to per capita income of US\$ 271.

The attribution of ICT to economic and human development has attracted a lot of interest among academics, businesspeople, policy makers, regulators, investors among others. It is worthwhile, therefore to study the various factors that affect the implementation or diffusion and use of ICTs. This is particularly so because ICT contributes to economic development (Piatkowski, 2002).

It is therefore important for Kenya to be e-ready in order reap the benefits of the 'new economy'. Though Kenya with a digital access index, DAI, of 0.19 (Digital Access Index, ITU, 2003) compared to the possible maximum of 1.0, and ranked 14 in Africa present an attractive incentive and opportunity for growth, affordability will remain a critical obstacle to the realisation of the full potential of ICTs as long as 56% live below poverty level (less than US\$ 1 per day since per capita income is US\$ 271 p.a.). The challenge is therefore to increase the diffusion and use of ICT in order to stimulate growth and by extension reduce poverty levels. According to Wolf (2001), the spread of new ICT technologies is driven by GDP per capita which is an indicator of affordability.

Venture capitalists and well developed capital markets coupled with enabling policy and legal framework are important for a vibrant ICT sector; in addition to availability of requisite ICT, skills and infrastructure. It is important to point out that ICT investment of less than 1% of GDP has negligible impact on economic growth (Derrick, 2001).

Studies have been carried to find out factors which influence the implementation ICT and the attribution of ICT to economic development. According to ITU (2002), Gillis and Mitchell (2000) and Piatkowski (2002) policy, infrastructure, level of ICT knowledge and skills, availability of capital/investment and affordability are some of the factors which influence the implementation/diffusion of ICT in a country. However, no studies have been done to document how these factors influence the implementation of ICT by network operators in Kenya. From studies already conducted the following relationship is apparent: that is government policy, infrastructure, level of knowledge and skills, capita/investment and affordability influence the implementation of ICT. It is therefore of interest to find out to which extent this applies to the implementation of ICT by network operators in Kenya.

Their relationship to be studied is as follows:- The Washington University, WSU model identifies three stakeholders (1) “community members”, (2) “ICT investment” and (3) “public policy” as being key in implementation of ICT and hence the attribution of ICT to economic and human development (Gillis and Mitchell, 2002).

A number of players are involved in the implementation of ICT in Kenya among them are the network operators. Network operators are involved in the purchase, installation, testing and commissioning of ICT equipment and operation of the ICT systems for purposes of providing services to the consumers of these services (telephone, fax, e-mail etc).

Though up to 24 companies have been licensed by CCK in various categories as network operators, 18 comprising 8 PDNOs, 3 Internet gateway operators, 3 commercial VSAT operators, 2 mobile phone operators and 2 fixed telephone operators have commenced operations in Kenya. The rest are yet to start operations.

### **1.1.1 Information Communication Technology, ICT**

Information communication technology, ICT refers to those technologies that enable the generation, processing and conveyance of information in electronic form between two or more locations. With the convergence of telecommunications and computing; and the Internet explosion, the distinction between telecoms and IT is no longer clearly discernible thanks to the convergence of info communication made possible by the Internet. Another way is to look at what ICTs are used for. In this respect they can be defined as technologies and tools that people use to produce, share, distribute, gather, and organize information and to communicate with one another, one on one, or in groups, through the use of the computers, computers networks, the Internet and related or complementary technologies (Harvard ITG/CID E-Readiness guide. Glossary)

The relationship between ICT and economic development has been studied and the results show that for developed countries ICT contribute significantly to macroeconomic development (Piatkowski, 2002). However, on the other hand, the diffusion of ICTs has not produced any significant impact on the macroeconomic development in transitional economies also known as 'emerging markets' (Garten 1996, 7). Therefore, the least developed countries such as Kenya are yet to transform into 'new economies' which are driven by technology thanks to ICT. Information and communication technology, ICT is now part of the fabric of life. Desks without computers look strangely empty. The trill of mobile phones is part of the soundtrack of modern life (Holloway and Hutton, 2001). This scenario is yet to be realised in the Kenyan setting.

### **1.1.2 Digital Divide**

Whereas the developed countries are reaping the benefits of an information society - 'digital dividends' - the least developed countries, LDCs including Kenya are struggling to bridge the digital divide, which separates them from the developed world. The "Digital divide" is a contemporary term used to describe the gap in access to and use of ICTs between developed and developing countries (<http://acdi-cida.gc.ca/ict>); for example in 2000 the developed world had 49.5 phone lines per 100 people, compared to 1.4 phones per line per 100 people in developing countries. 'Digital divide' is in part a reflection of broader socioeconomic divides, many of which exist within societies e.g. the divide between men and women, rich and poor, etc.

### 1.1.3 ICT and Development in Kenya

It is widely accepted that ICTs contribute significantly to economic and human development. The extent to which this is true is a subject of many studies (e.g. Wolf, 2003 and Piatkowski, 2002). This attribution of development to ICT may partly explain why countries in the West and Asia, which have high levels of ICT diffusion, are more developed in both human and economic dimensions than countries with limited diffusion of and access to ICTs. The more e-ready a country is the more it is in a position to realise human and economic development.

An examination of the characteristics of emerging markets, EMs (Garten, 1996, 7) reveal that Kenya can be classified as an EM on three counts (a) Low level of economic development, (b) Transitional economy (society) and (c) A huge room for growth (e.g. inadequate infrastructure such as ICT, roads, electricity etc); except on the account of economic growth which is 1.4% in 2003 and is forecast at 2.6% in 2004 for Kenya. This is less than 5% proposed (Garten, 1996, 7); and sadly lower than the population growth rate of 1.7% (2003 estimate). The GDP (2003) for Kenya is US\$12.7billion; and the per capita income is US \$271 (<http://www.state.gov/r/pa/ei/bgn/2962.htm>). When Kenya is viewed from the 'emerging markets' perspective the potential to harness ICT for development is enormous. Similarly, Kenya's EM characteristics present enormous incentive for participation by various players such as Multinational corporations, MNCs and local investors in the ICT sector to enable a vibrant growth in ICT.

Currently, there are a number of network operators in Kenya categorised as: fixed telephone network operators (PSTN), mobile network operators (MNO), commercial VSAT operators (CVO), public data network operators (PDNO). The fixed telephone network operator is Telkom Kenya who provides fixed telephone service throughout Kenya while there are two mobile phone operators namely Safaricom and Celtel.



In addition, three (3) commercial VSAT network are in operation: Telkom Kenya, Gilat Alldean (Africa) limited AfSAT communications Kenya Limited VSAT network. Further, there are three (3) Internet gateway operators Telkom Kenya Limited, Jamii Telecom limited and Kenya Data Networks Ltd, (KDN). Lastly, there is a lot of competition in the data communication market segment with eight (8) PDNOs active: Telkom Kenya Limited (TKL), Kenya Data Networks (KDN), Open Systems, Simbanet Com Ltd, Broadband Access Ltd, Pegrume Ltd, Satallite Data Networks Ltd and Microage Ltd are actively participating in the market.

#### **1.1.4 ICT penetration in Kenya: the Digital Access Index, DAI**

The international telecommunication union, ITU has developed a new tool, which measures the e-readiness of nations; the tool is known as the digital access index, DAI. Initially countries were classified according to the teledensity – the number of telephone lines per 100 people. The higher the teledensity the better it is for the country in terms of access to the telecommunication services. But a research by ITU has shown that other factors such as affordability and education are equally important in determining the e-readiness. Infrastructure is not the only barrier to access and use of ICT. Kenya with a digital access index, DAI, of 0.19 (Digital Access Index, ITU, 2003) compared to the possible maximum of 1.0, and ranked 14 in Africa represents very low penetration of ICT and therefore an opportunity for ICT growth.

#### **1.1.5 ICT Implementation in Kenya**

The ICT infrastructure in Kenya broadly comprises cables, wireless systems and satellite based systems for access and central office equipment for switching and routing calls. Specifically, the infrastructure include optical fibre transmission/communication systems, Wireless access systems, intelligent network systems, Internet protocol, IP based systems, Satellite communication systems; and Digital subscriber line, DSL technologies.

Kenya is connected to the rest of the world using satellite communication systems. Further, the East African coast is due to be served by optical submarine cable and linked to the rest of the world cable systems. The landing point for this cable will be at Mombasa. Within national boundaries ICT services are carried over a combination of terrestrial microwave systems, terrestrial OFC, copper cables, and wireless access systems. In addition to this there are central office systems such as telephone exchanges that process the information which control the switching and routing of information.

**(a) International Connectivity**

Kenya is connected to the rest of the world via satellite; there are two earth stations in Longonot and Kericho. The Longonot Earth station has two Standard A antennas one facing the Indian ocean region IOR on 60 deg.; and the other on the Atlantic ocean region. AOR on 335 deg. The earth stations are used for both telephony and Internet, and operate Intelsat satellites. For global Internet connectivity, the country is connected via Jambonet, the Internet international gateway operated by Telkom Kenya. Arising from the change in the regulatory framework, Communications Commission of Kenya, CCK has licensed other Internet gateway providers: Telkom Kenya (TKL), Jamii Telecommunications and Kenya Data Networks (KDN). The ISPs connect to Jambonet and in turn Internet users are connected to the ISPs using either dedicated leased lines provided by both Telkom Kenya (Kenstream) and by other public data network operators, PDNOs; or via dial up connections using telephone lines supplied by Telkom Kenya. Access to the ISP service is also possible by use of mobile phones, which have a possibility for wireless access protocol, WAP; also referred to as WAP enabled mobiles. It is important to point out that all Internet communications ride on telecommunication infrastructure.

## **(b) National Connectivity**

Within the national boundaries, digital microwave systems operating in Giga Hertz frequency are used to connect communication nodes (switches) country wide; and to connect to the two other East African countries, Tanzania and Uganda. The main national microwave radio trunk routes are: (1) Nairobi – Mombasa, (2) Nairobi- Western Kenya into Uganda and (3) Nairobi – Ethiopia (also known as PANAFTEL link). All the network operators have interconnected their systems either physically or logically and can exchange information ranging from voice calls to Internet packets.

Within major cities and towns, Telkom Kenya has deployed optical fibre transmission systems deployed in ring network configuration in Nairobi. Last mile connectivity is achieved by use of copper cables, wireless local loop systems or optical fibre cables. All the telecommunication systems are manned on 24/7/365 basis to ensure continuity of services throughout.

## **(c) ICT Services**

The following are some of the ICT services available in Kenya:

### **Fixed telephone**

Currently, it is Telkom Kenya Limited, which is the sole provider of public switched fixed telephone network (PSTN) service in Kenya. However, the second national operator (SNO) to compete in the same market segment is due for licensing. In addition local loop operators, LLO, which will utilise the facilities of, licensed operators to extend telephony and other ICT services to end users, are being licensed.

## **Mobile phones**

There are two mobile phone operators in Kenya namely Kencell, a joint venture (JV) between Sameer Group of companies and Celtel; and Safaricom which is a JV between Telkom Kenya and Vodaphone of UK. Further, the process of licensing a third mobile phone operator, Econet Wireless is almost completed. In addition to voice communication service, the mobile operators provide data communication service using general packet radio system, GPRS. The phenomenal spread of community phone (Simu ya Jamii) in the last two years is a direct benefit of liberalisation.

## **Internet Services**

Internet services include Internet backbone service, which enables access to global Internet. Currently Jambonet provided by Telkom Kenya Limited and other Internet gateway operators allow connection of Internet service providers (ISPs), to the global Internet. In turn, Internet services are extended/ provided to end-users by ISPs and Cyber cafes.

## **Value Added Services, VAS**

The VAS ride on the basic services highlighted above and include free phone service, premium rate service, short message services, SMS access to content such as weather information, news etc. For instance, there is a range of value add services that the ISPs provide in addition to basic access to the Net such as e-mail, Virtual Private networks (VPNs) etc.

### **1.1.6 Comparative Perspectives**

#### **Penetration of ICT**

Africa is seen as a continent of enormous growth potential for ICT. it is therefore no wonder that major MNCs specializing in ICT have found the African market attractive both in provision of service and sale of ICT equipment.

The continent has the lowest penetration of ICT infrastructure and there is an urgent need to bridge the ever-widening gap between Africa and the rest of the world – the digital divide. Kenya is no exception. While there is limited access to ICTs in Kenya, the situation in US, Europe and Far East including Japan, Korea, and Singapore etc is very different; the ICT penetration is much higher and thus the delivery of ICT services. The populations in these countries are truly an information society and active members of the global village.

The distance between people has become irrelevant and somebody in Australia is just a mouse click away from Nairobi. While telecommunication/ICT sector is fully liberalised in most of these countries, the case in most African countries including Kenya is different; monopolies are still a common feature though now faced with imminent extinction. The new regulations requirement is opening up the ICT sector for July participation on first-come-first-served basis.

### **Global optical fibre connectivity**

Whereas there are major international optical fibre submarine cables, OFC deployments linking the whole world; such as transpacific optical fibre cables linking Asia and US - and transatlantic optical fibre submarine cables linking America and Europe; and a submarine cable running from the South African coast through West African coastline and linking with other cable into US and Europe, there is no linkage between Kenya and the rest of the world by optical fibre cable. However, there is a project christened EASSy (East African Submarine cable System), which will have a landing point at Mombasa. Whether this will result in lower costs of communication is yet to be seen.

### **Basic access versus “information society”**

While the DCs in the West and Asia are concentrating on innovatively improving the lifestyle of their citizens in the context of what is now known as ‘an information society’, Kenya is still on the basics – struggling to provide basic access to a telephone line.

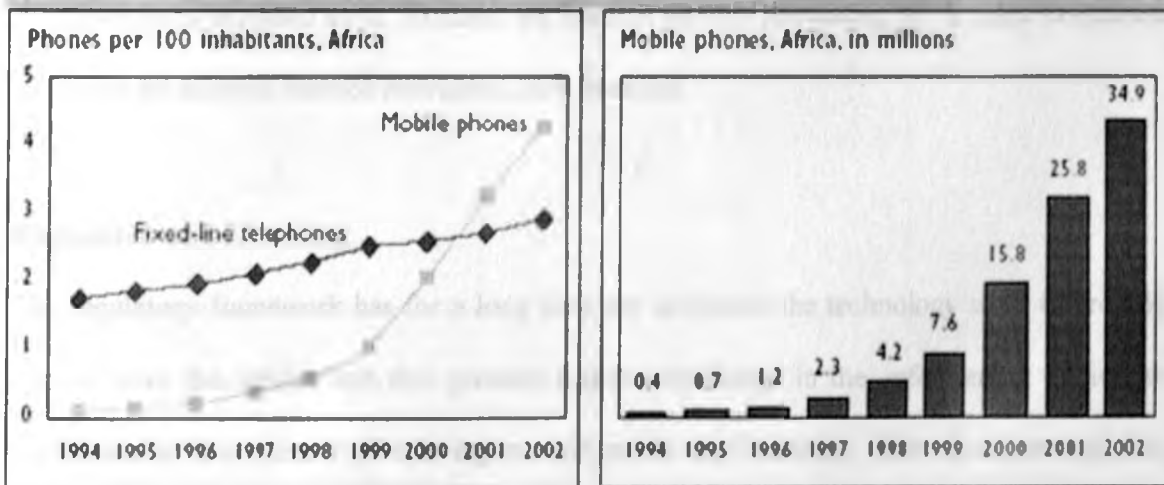
Africa, where the potential for growth abounds, was the first region of the world where the number of mobile phones overtook the number of fixed line telephones, and it continues to lead the way. In Uganda for instance, there are more than half a million mobile users as compared to fewer than 60,000 fixed lines. In Morocco, there are six times more mobile users than fixed line.

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In the period between 2001 and 2004, mobile subscribers in Africa have more than doubled. In Nigeria, a nation of 130 million people, mobile subscriptions jumped from 40,000 in 2001 to 1.5 million in just over a year. In Kenya, there are over 2.1 million mobile subscriptions compared to just over 300,000 fixed lines. This represents about seven times as many mobiles as fixed lines in a span of less than four years. Figure 2 shows the diffusion of mobile phones in Africa.

Figure 1: Mobile Phones in Africa

MOBILE AFRICA



Source: ITU World Telecommunication Indicators Database

## **Liberalisation of ICT sector in Kenya**

In 1998, the giant Kenya Posts and Telecommunication Corporation was split into Telkom Kenya Limited, Postal Corporation of Kenya (POSTA) and Communication Commission of Kenya (CCK) through the Kenya Communications Act 1998. In the recent past there has been a lot of activity in the ICTs sector where the entry of a competitor to Telkom Kenya in public switched telephone network was delayed with claims of irregularities in the tendering process. (Daily Nation July 28, 2004).

In most developed countries, the ICT sector has been fully liberalised, but Telkom Kenya has enjoyed exclusivity in fixed telephony till 30<sup>th</sup> June 2004 when the exclusivity expired. However, with the full liberalisation policy currently in force, it is expected that a number of other players will enter the market with the necessary investment that will result in an increased diffusion and use of the ICTs. The mobile phone market already has two players: Safaricom Limited and Celtel Kenya Ltd – formerly Kencell Communications Limited. A third mobile is expected soon. Further, the Internet service provision, ISP is fully liberalised with over 80 Internet Service Providers, ISPs licensed.

## **Regulation and Licensing**

The regulatory framework has for a long time not de-linked the technology used to provide service from the service and this presents a major challenge in the enforcement of license conditions in the context of convergence of media and services. This situation has also slowed down the development of ICT. According to Gillis and Mitchell, 2002, policy and legal framework are critical to the development of ICT.

For any meaningful investment in the Kenyan ICT sector to take place conducive environment for investors that is devoid of corruption and other vices is necessary. Therefore in order to reap the benefits that come with ICT, which include faster economic growth, the policy and regulatory environment has to be right and enabling –full liberalisation and privatisation. The trend worldwide is full liberalisation with technology neutral approach to licensing. It is gratifying to note that the policies are increasingly moving towards enabling multiple providers of ICT in order to drive down prices of ICT services by attracting more investment in the sector and achieving economies of scale.

A landmark regulatory strategy has been unveiled by the Communication Commission of Kenya, CCK (Daily Nation 8<sup>th</sup> September, 2004 and <http://www.cck.go.ke/>) where “The new approach provides equal licensing opportunities to all players on a first-come first served basis, subject to the potential licensees’ demonstration of adequate capacity to provide the service for which they are seeking license.” said Mr. Sammy Kirui, Director General, CCK. In addition, the regulatory framework will be technology neutral and the ICT sector fully liberalised following the expiry of Telkom Kenya’s five-year monopoly on 30<sup>th</sup> June 2004. The auctioning of ICT licenses also scrapped in the new strategy.

### **1.1.7 Benefits of ICTs**

The world of electronic data has merged with the more embracing arena of e-commerce and more emphasis is being placed on the business issues relating to the use of such technology. Interest in the Internet continues to grow and to present opportunities for both large and small firms to benefit from the use of electronic trading. Modern business is characterised by ever-increasing supply capabilities, ever increasing global competition, and ever increasing customer expectations. In response, businesses throughout the world are changing both their organisations and their operations, thanks to the possibilities availed by ICTs. They are flattening old hierarchical structures and eradicating the barriers between company divisions.



They are lowering the barriers between the company and its customers and suppliers. Business processes are being re-designed so that they cross these old boundaries. We now see many examples of processes that span the entire company and even processes that are jointly owned and operated by the company and its customers or suppliers. Electronic commerce is a means of enabling and supporting such changes on a global scale. Nowadays we do not have to show up at the market, and do not even need physical currency to conduct business. Electronic commerce is the most recent step in the evolution of business transactions. It replaces the swapping of money or goods with the exchange of information from computer to computer. All these innovations are made possible by ICTs. It is therefore not a surprise that a lot of firms are investing heavily in ICTs in order to be competitive in the market place. Online learning – E-learning is another very important application of ICT which is transforming the learning experience in universities.

According to study by Siror (2003), several benefits have been realised with the adoption of telecommuting practices, which are made possible by ICT. These include: enabling an individual to work from home instead of commuting to work in the office, bringing service to the most convenient location for the customer, moving work to the most cost effective place, distributing work to the most competent people wherever they may be and; bringing work to the unemployed or under employed.

## **1.2 Statement of the Research Problem**

For economic development to grow faster, governments need to use ICT. In developed countries it has been proven that ICT can speed up economic development (Piatkowski, 2002). Network operators have difficulty in implementing ICT in developing countries including Kenya. This is brought about by a number of factors.

This study therefore focuses on the problem of finding out the role of a number of factors in the implementation of ICT by network operators in Kenya. It will be of interest to see how government policy, infrastructure, adequate ICT knowledge and skills, capital and affordability influence the implementation of ICT by network operators in Kenya.

### **1.3 Objective of the Study**

The objective of this study is to find out how the government policy, infrastructure, knowledge and skills, availability of capital/investment and affordability of ICT services affect implementation of ICT by network operators in Kenya.

### **1.4 Importance of the study**

The 'new economy', NE implies the economic growth driven by technology- in this study information and communication technology, ICT. Sadly though, the impact of the NE on the worldwide economy, despite the recent hype, has so far been quite limited, particularly in terms of its geographical reach. The 'new economy' has been mostly felt in developed countries, some examples to the contrary notwithstanding (Bangalore in India is a fitting and often-cited example). However, the contribution of new technologies to growth in developing and transition economies has been minimal, particularly when viewed from a macroeconomic perspective (Piatkowski, 2002). On the microeconomic front, some progress has been made in retail, banking etc but the effect is not of any macroeconomic significance. The study will therefore be important to the following audiences:

#### **(i) To Government officials**

By understanding clearly the relationship between policy and ICT implementation, the policy makers will be able to formulate legal and policy implementation framework that supports fast ICT implementation in the country. The study will enable the policy makers and senior government officials to assess the effectiveness of the legal and policy framework in stimulating the growth of the ICT sector.

They will also appreciate how poor/good economic and human development is attributed to their ICT policies and thus formulate appropriate interventions.

**(ii) To firms that invest in ICT**

Since the study finds out and documents the factors that affect ICT implementation/development, the information will assist the investors in ICT to pursue strategies that will address those factors in order for them (ICT investors) to obtain the required returns on the investment. The information will also assist them in deciding whether or not to invest in the ICT sector in Kenya. In order for any meaningful investment to take place in a foreign market, in-depth knowledge of that market is a critical consideration. Through this study, potential investors in ICT will be able to understand the factors that shape the Kenyan ICT sector. It is acknowledged that investment in the ICT is a critical component (indicator) if a meaningful economic growth is to be realised.

**(iii) International business, IB**

International business depends heavily on availability of fast and reliable means of communication made possible by ICT. E-commerce, which rides on ICT infrastructure, is now critical in international business (international trade included). For example, ICT is critical in improving the efficiency of handling import and export transactions including procurement and supply logistics. E-mail and e-commerce enable this. This study will provide IB practitioners with the information regarding the ICT implementation and the gaps (opportunities) that exist and which need to be filled in Kenya. For instance a deficiency in ICT infrastructure clearly presents an incentive for an ICT multinational to enter the market. ICT is therefore of great importance for the day-to-day conduct of international business. Besides import and export (international trade), IB also involves investment and analysis of the global business environment for purposes of deciding whether or not to venture into a foreign/international market Yabs (2003).

The understanding of the ICT environment in Kenya through this study will aid IB practitioners in making informed decisions about the Kenyan market.

**(iv) To academics**

Though it is widely acknowledged that ICT contributes to economic development, the relationship between ICT implementation and development is not direct and is complex. Academics are interested in this relationship, which is the attribution of human and economic development to implementation of ICT. This study will provide some information on this relationship. Of particular importance, from a global "public welfare" perspective (Gillis and Mitchell, 2002), is the unrealized economic and human development potential that could be achieved through information communication technologies. On an individual basis, this forgone development activity translates into higher rates of poverty, poorer health, lower literacy and quality of life than is necessary. With these important implications, it is not surprising that the connection between the expansion of information communication technologies and economic development is currently receiving considerable attention by practitioners, policy makers, researchers and funding organizations; and, there is good reason for this attention. Of particular interest is why the diffusion of ICT in developing countries has not resulted in any significant impact on the macro-economic development of the developing countries.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

The attribution of economic development to ICT implementation has attracted a lot of interest from academics and researchers. One model has been suggested (Gillis and Mitchell, 2002) as a useful tool for understanding the attribution of economic and human development to ICT. In the model three stakeholders are clearly identified namely (1) "community members" (2) "ICT investment and (3) "Public policy". The top stakeholder group in this model is the "Community Members" since ICT is of no productive social value if it does not contribute to the economic and social values desired by "Community Members". 'Community' refers to a broad grouping of individuals aligned around the common interest of building and maintaining a quality of life in which current and future generations will be safe, healthy, happy and prosperous (positive social change).

The stakeholder group labelled "Community Members" includes members of the other two stakeholder groups. In other literature "E-readiness" which is measured using digital Access Index, DAI refers to a country's ability to take advantage of the Internet as an engine of economic growth and human development. E-readiness has several components, including telecommunications infrastructure, human resources, and legal and policy framework. An e-readiness assessment can therefore be used as an information-gathering mechanism for countries as they plan their strategies for ICT development. It can help a society better understand what impediments to Internet development exist and what initiatives are needed to overcome them. One measure of the e-readiness is the digital access index, DAI as described below.

A study by ITU (2002) found that digital access index DAI combines eight variables: (1) Fixed telephone subscribers per 100 inhabitants, (2) Mobile cellular subscribers per 100 inhabitants, (3) Internet access price as percentage of Gross National Income per capita), (4) Adult Literacy, (5) Combined primary, secondary and tertiary school enrolment level, (6) International Internet bandwidth (bits) per capita, (7) Broadband subscribers per 100 inhabitants, and (8) Internet users per 100 inhabitants to provide an overall country score.

The areas covered are: (1) Availability of infrastructure, (2) Affordability of access, (3) Educational level, (5) Quality of ICT services, and (5) Internet usage.

([www.itu.int.int/newsarchive/press\\_releases/2003/40.html](http://www.itu.int.int/newsarchive/press_releases/2003/40.html)). It is clearly discerned that infrastructure and level of education affect the implementation of ICTs, which in turn affects the role of the ICT in economic and human development. This indicator (DAI) includes three (3) of variables- infrastructure, level of education and affordability- which will be studied.

Given the wide-range of potential benefits ICT can offer communities in terms of development, there are two imperative ingredients for the provision of ICT infrastructure responsive to community needs: (1) the marshalling of investment resources and (2) the oversight and regulation that provides a stable and supportive environment for investment.

Again, it is clear that government policy and investment are crucial in implementation of ICT. In this model, two stakeholder groups are described as being responsible for the investment and regulation of ICT infrastructure. The first stakeholder group is called "ICT Investment" because this collection of private organizations and businesses is primarily responsible for building the ICT infrastructure. The second stakeholder group, labelled "Public Policy", consists of the makers of the public policies that enable and regulate the primary builders and providers of ICT infrastructure. Hence according to the Washington State University (WSU) model, these three stakeholders (community members, policy makers and ICT investors) are bound in an interactive, inter-dependent relationship.

While dealing with the attribution of human development to ICTs the object of evaluation is social change; in the particular context of this study the social change in relation to the introduction and use of ICTs. Social change can be defined as transformation of structures, processes, social classes and relationships between groups. These changes in turn change the power relationships (whether social, economic, cultural, religious) between groups. It also was defined as a “change in the quality of life”. Assessment of social change implies looking at the transformation of structural power relations among social groups.

ICTs are a powerful tool whose potential to change the structural conditions of underdevelopment is probably greater than any other technology or tool (Stoll *et al.*, 2002). When ICTs are introduced as part of development activities, one may consider that an implicit judgment is already made with regard to their appropriateness and usefulness for achieving the overall development objectives. Assessing ICTs themselves is thus not the question.

Despite negligible macroeconomic impact, the IT revolution seems to have contributed to productivity and output growth on a microeconomic level in certain industries (retail, financial services, and transport) and specific enterprises. Anecdotal evidence abounds – management information systems together with the use of e-mail seem to have been the most appreciated for their contribution to better productivity. Yet, these effects are seemingly too small to reflect on the macro picture (Piatkowski, 2002). We now examine literature on five (5) variables that affect ICT implementation in Kenya.

## **2.1 Conceptual Framework**

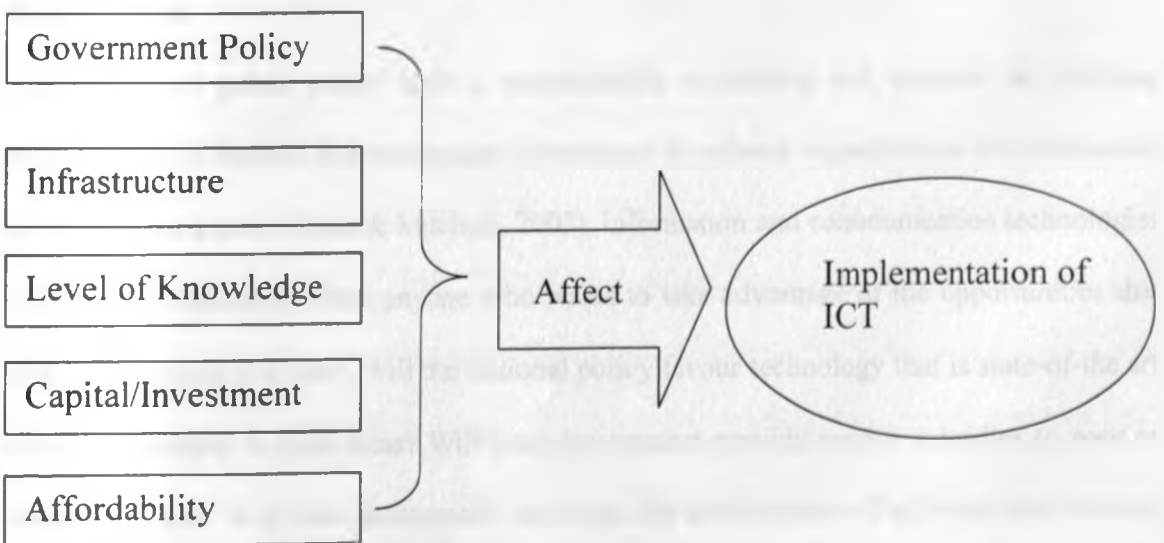
The ICT sector is continuously undergoing liberalisation to attract private sector investment in order to stimulate the growth of the sector and to realise increased DAI. It's widely acknowledged that the access to and use of the ICT is critical for economic growth of any nation.

The Washington State University (WSU) model identifies three stakeholders (1) “community members”, (2) “ICT investment” and (3) “public policy” as being key in implementation of ICT and hence the attribution of ICT to economic and human development (Gillis and Mitchel, 2002). According to a study by Marcin Piatkowski (2002) new economy is the economy driven by technology. Ten (10) ‘new economy indicators’ NEI were considered namely: (1) Quality of regulations and contract enforcement, (2) Infrastructure, (3) Trade openness, (4) Development of financial markets, (5) R&D spending, (6) Quality of human capital, (7) Labour market flexibility, (8) Product market flexibility, (9) Entrepreneurship, and (10) Macroeconomic stability.

Further, study by ITU which resulted in a new tool, DAI for assessing e-readiness includes three of the variables whose impact on ICT implementation is the subject of this study: education, infrastructure and affordability. This study is based on the relationship between the independent variables (factors that affect the implementation of ICTs by network operators) and the dependent variable (level of implementation of ICT) as follows:

**Independent Variables, IV**

**Dependent Variable,**



**Figure 2: Conceptual Framework**

**Source: Author’s own compilation**



For the purpose of this study five (5) variables are considered as indicated. This conceptual framework is therefore consistent with other research in the same area. Nonetheless, the impact of political, social and cultural factors on economic growth, and on adoption of new technologies, remains a rich field for further research.

## **2.2 Government policy**

The government must set the stage for a vibrant ICT through appropriate policy and regulation together with supportive institutional framework. In this regard, the following statement has often been quoted in the context of telecommunication reform: "I am not an advocate for frequent and untried changes in laws and constitutions, but laws and constitutions must go hand in hand with the progress of the human mind. As that becomes more developed, more enlightened, as new discoveries are made, new truths disclosed, and manners and opinions change with the change in circumstances, institutions must advance also, and keep pace with the times", Thomas Jefferson to Samuel Kercheval, 1816 (ITU,1999).

### **Role of policy**

The makers of public policy have a responsibility to develop and maintain an enabling regulatory environment that encourages investment by private organizations and businesses in ICT infrastructure (Gilles & Mitchell, 2002). Information and communication technologies (ICT) policy decisions affect anyone who wants to take advantage of the opportunities that new technologies can offer. Will the national policy favour technology that is state-of-the art but not affordable in rural areas? Will your government provide service subsidies to poor or disabled people? Will your government encourage the development of software that illiterate people can use? All of these are pressing questions whose answers depend on the ICT policy choices made by governments and other official decision-makers (<http://www.apc.org/english/capacity/policy/index.shtml>).

## **Sector Policy Statement of Kenya**

In the sector policy statement by the government recognises the crucial role that ICT plays in the development of a market-driven knowledge and information based economy. The policy pronouncement in the Ministerial statement Telecommunication and Postal sector statement, December 2001 attests to this as contained in the policy objectives and targets as outlined below: “The overall government objective for the sector is to optimise its contribution to the development of the Kenyan economy as a whole by ensuring the availability of efficient, reliable and affordable communication services throughout the country. In the area of telecommunications services for instance, it is intended: a) To improve penetration in the rural areas from the present 0.16 lines to 5 lines per 100 people by the year 2015. b) To improve service penetration in the urban areas from the present 4 lines to 20 lines per 100 people by the year 2015. These targets translate to installation of 1.5 million fixed lines in rural areas and 2.4 million in the urban areas respectively”, (<http://www.cck.go.ke/>). This does not include the mobile phones. As seen from these policy targets, there are tremendous opportunities for ICT companies to participate in the Kenyan market given that currently there are just over 300,000 active fixed telephone lines in Kenya compared to over 2.1 million mobile phone lines - seven times the fixed lines in only four years.

## **New Regulatory Strategy**

A landmark regulatory strategy has been unveiled by the Communication Commission of Kenya, CCK (Daily Nation 8<sup>th</sup> September, 2004 and <http://www.cck.go.ke/>) where “The new approach provides equal licensing opportunities to all players on a first-come first served basis, subject to the potential licensees’ demonstration of adequate capacity to provide the service for which they are seeking license.” said Mr. Sammy Kirui, Director General, CCK. In addition, the regulatory framework will be technology neutral and the ICT sector fully liberalised following the expiry of Telkom Kenya’s five-year monopoly on 30<sup>th</sup> June, 2004.

The auctioning of ICT licenses was also scrapped. Arising from this change, it is also expected that more Internet gateway providers will be licensed to compete with Telkom Kenya's International Internet backbone (Jambonet), which has been operational since 1998.

### **2.3 Infrastructure**

One way to look at information and communication technologies is to list the artefacts that they encompass, e.g. « ICTs include telecommunications technologies, such as telephony, cable, satellite and radio, as well as digital technologies, such as computers, information networks and software » (Harvard ITG/CID E-Readiness guide. Glossary).

Broadly, infrastructure that supports the implementation of ICTs in Kenya include telephone systems both fixed and mobile, internet systems such as Jambonet, energy supply such as availability of commercial power from KPLC and KenGen, computers to enable access to online information in order to conduct business in real time and last but not least road network to enable access to sites where installation of ICT equipment is required. Obviously lack of access to ICTs constitutes what is described as 'digital exclusion' which denies those affected the enormous opportunities and efficiencies that come with this access.

Recognising that ICT is required for public good; and although the community stakeholders may have significant interest in the aggregate economic growth that can be leveraged from ICT, a broader common interest that brings community members together is the widespread availability of affordable services and the ability to utilize technology to expand local education, enhance local health care, improve civic interaction and develop mechanisms for community support (e.g. daycare co-ops, carpooling, crime-watch, etc.). This spectrum of community application of ICT defines "demand" for ICT investment at the local level.

From the policy targets, it is clearly discernible that there is a lot of work to be done as far as provision of infrastructure for ICT is concerned. Specifically, the telecommunication infrastructure over which ICT services ride is urgently required. According to ITU (2002) Kenya has a digital access index DAI of 0.19 compared to the possible maximum of 1.0, and ranked 14 in Africa.

Since teledensity and power supply are generally accepted as drivers of economic growth in developing countries (Saunders, Warford and Wellenius, 1994); it is evident that the development of the telephony (ICT) and power infrastructure is important for economic development. For example, telecom services can substitute for other forms of communication (postal, personal travel) and build stronger, more productive and complex patterns of communication; this reduces costs through improvement of efficiency.

## **2.4 Knowledge and Skills**

The role of human capital in economic growth is widely acknowledged. Various empirical studies have found that human capital is positively correlated with GDP growth rates (Benhabib and Spiegel 1994, Barro and Sala-i-Martin 1995, Bassanini and Scarpetta, 2001b)

Though infrastructure has often been regarded as the main barrier to bridging the Digital Divide, research (ITU, 2002) suggests that affordability and education are equally important factors. To measure the overall ability of individuals to access and use ICTs, an ITU study (Minges 2002) has gone beyond the traditional focus on telecommunication infrastructure, such as mobile phones and fixed telephone lines. For example, nearly 40 % of Peruvians responding to the survey said they either did not have a computer or could not afford Internet services, which points to affordability as a critical success factor (Minges, 2002). Research has also shown that Internet use is closely linked to education (also AoL case: Pearce and Robinson, 2000).

It is against this background that besides infrastructure, providers of ICT solutions also provide ICT training services, in addition to ensuring that their ICT solutions are cost effective in the market place so that the populations can access the ICTs.

According to Bill Venter, Altron chairman SA is fast becoming the hi-tech gateway to Africa, although there is still a shortage of skills in the information and communication sector that makes skills development a priority. However, “skills in the ICT sector are still very much in short supply and, therefore, skills development remains a priority,” he says. This observation is equally true in Kenya; there are no adequate skills to deploy, operate and use ICTs. This calls for the building of requisite ICT skills necessary to tackle the challenge of ICTs. Many training organisation provide training in ICTs however, most of the training is not standardised.

In a recent study on the cross country diffusion of the Internet, it is shown that the number of Internet hosts [per capita also depend on the level of education especially unavailability. Education seems to matter for Internet access as universities are among the first institutions with Internet access in many countries (Wolf, 2001)

Consequently, for the enormous potential of ICT to be realized, it is desirable that education and skills be provided to the population to enable them not only access the ICTs but more importantly use the ICTs meaningfully to assist them overcome the disadvantages associated with lack of access to the ICT.

It is evident that education also contributes to the driving demand for technological products. As argued by Quah (2001), the ‘new economy’ will not develop without demand for its products. Further, changing attitudes towards adoption of innovations is equally important.

## 2.5 Availability of Capital

Schumpeter (1912) already asserted that a developed financial sector is important to economic growth. This assertion was confirmed by King and Levine (1993), Levine (1997), and Greenwood and Smith (1997). Financial markets play an important role in collecting and aggregating savings and then redistributing it for productive purposes. A developed financial market is evidently critical for the 'new economy'. In particular, the value of venture capital (VC) investments is especially important as it finances start-up companies, which tend to predominantly utilize new technologies and ideas (as the experience of dot.coms suggests). Equity markets represent the second important channel for financing the 'new economy'. However, like in any other EM, the financial market is not well developed in Kenya to finance ICT projects.

ICT systems and particularly telecommunications systems are very expensive and require enormous capital outlay to deploy. Going by the performance of the Kenya n economy with GDP of US\$ 271 per capita, there isn't enough capital to invest in the ICT and therefore the need to have private investors' participation in ICT to enable the injection of the required capital. According Gilles & Mitchell (2002), the makers of public policy have a responsibility to develop and maintain an enabling regulatory environment that encourages investment by private organizations and businesses in ICT infrastructure.

One reason for the apparent lack of benefits from the diffusion and adoption of the NE in transition countries is still the relatively small value of IT investments – the most advanced transition countries (Poland, Czech Republic, Hungary, Slovakia) in 1999 invested in IT between 1.9% (Poland) to 4.2% (Czech Republic) of their GDPs, which compares to Sweden's 6.5%, 5.3% in the US and the overall OECD average of 4.3% (OECD 2001b). Also in absolute numbers the value of IT investments in Central and Eastern European countries were much smaller than in rich countries.

IT investments in less developed transition countries of Central Asia are not likely to exceed 1% of GDP. Thus it seems that investments are too small to bear upon economic growth.

The question is, why doesn't even this small investments yield positive returns? Kraemer and Dedrick (2001) suggest that developing countries, as opposed to developed countries, have not been able to profitably use ICT products and services due to the lack of complementary investments in infrastructure, human capital, and R&D.

## 2.6 Affordability

The availability of ICT infrastructure, its affordability and the ability of the populations to access and use ICTs, is described as the e-readiness of a country. "E-readiness" therefore refers to a country's ability to take advantage of the Internet as an engine of economic growth and human development. E-readiness has several components, including telecommunications infrastructure, human resources, and legal and policy framework (<http://www.internetpolicy.net/readiness/>).

Besides teledensity, i.e. number of telephone lines per 100 people, research by ITU has shown that affordability and level of education are significant factors that determine the overall ranking of the e-readiness of a country (Minges, 2002).

In this regard, Kenya with a GDP per capita of USD 271 represents an acute inability to afford the price of ICT services among the majority of the population regardless of the presence of ICT infrastructure and services. It is with this in mind that affordability is an important factor to study in order to find out the extent to which it affects the implementation and adoption of ICT in Kenya.

## 2.7 ICT and Development

According to Stoll, *et al* (2001) ICTs can be used in almost any type of activity whose goal is to contribute to development. In some cases they are only a material facility, e.g. when office automation substitutes older processes. In other cases they are a major component of an activity, which encompasses a number of other objectives, like the modernization of a public administration. In some cases they are, or seem to be, the main component of the activity, as for instance in the case of establishing an infrastructure for Internet access.

The geographic extension of the considered activities may vary from a particular place to the entire world, not to mention outer space applications. The population concerned may vary from a few individuals to all inhabitants of the planet. Some of the key issues (questions) to be considered in the assessment of attribution of development to ICT implementation are: (1) what are the trade-offs between the application and use of ICTs and the outcome of the development activities? (2) What social changes are associated with this outcome? And (3) how do they occur? This assessment is within the framework that is used by IDRC to assess the impact of ICT projects on human development. According to the Club of Rome report to world summit on the information society, WSIS Geneva (2003), information and communication technologies are the effective tools of this transition. They are a “tool for development”, not a “reward for development”. They have the potential to empower billions of people; to enable sustainable development, and enhance human dignity. They can offer new access to education for and by the people even in the most remote regions; bring improved health care; help eradicate poverty, empower women and build sustainable communities. They can enable self-expression, new knowledge creation and cultural diversity, and continued and sustainable economic growth. They must be harnessed to the goal of globally sustainable development.



The lack of macroeconomic impact of ICT on developing countries was confirmed by the results of a comprehensive cross-country empirical study on the returns of IT investment in developed and developing countries (Dewan and Kraemer, 2000). The study shows that returns on IT investment are 'positive and significant for developed countries, but not statistically significant for developing countries' (as quoted in Kraemer and Dedrick 2001, p 262). The estimate of IT output elasticity is 0.057 (positive and significant) for developed countries, but statistically indistinguishable from 0 for developing countries'.

Pohjola (2001a) shows that the relative contribution of IT to GDP growth in developing countries, to which transition countries belong, was less than 2% (China, India, Argentina, Chile, Brazil, Thailand, Venezuela) compared to more than 10% in the US, Finland, Canada, Sweden, and UK. No other studies, at least that the author is aware of, have found any sizable contribution of ICT to growth in developing countries. It seems that more research in this area is needed (however, lack of relevant data is a usual constraint).

## CHAPTER THREE

### 3.0 RESEARCH METHODOLOGY

#### 3.1 Research design

This was a cross-sectional survey design which answered the question: how (1) Government policy (2) Infrastructure (3) Knowledge and skills, (4) Capital and (5) Affordability affect the implementation of ICT by network operators in Kenya. It is a descriptive study.

#### 3.2 Population

The population for this study was all the eighteen (18) ICT network operators in Kenya. It was a census of all the 18 network operators namely fixed telephone network operators, mobile phone operators, commercial VSAT network operators (CVO), internet gateway operators and public data network operators (PDNOs). The population studied is included in Appendix 1 attached.

#### 3.3 Data Collection

Primary data was used, which was collected using a structured questionnaire aimed at answering the objectives of the study. The researcher administered the questionnaire through drop and pick later method. The questionnaire was administered to the chief executive officers, operational managers, and heads of strategy and heads of finance. The questionnaire was divided into two (2) parts; Part A was for collection of general network operator information while Part B was for collection of data regarding the role of Government Policy, Infrastructure, Knowledge and skills, Capital and Affordability in the implementation of ICT by network operators.

#### 3.4 Data Analysis and presentation techniques

Once data was collected it was edited for completeness and consistency. The data was analysed using descriptive statistics (Nachmias, 1996) like proportion, percentage and frequency distribution; and mean of the scores.

## CHAPTER FOUR

### 4.0 DATA ANALYSIS AND FINDINGS

#### 4.1.0 Introduction

This study had the sole objective of finding out how government policy, infrastructure knowledge and skills, availability of capital/investment and affordability of ICT services affect implementation of ICT by network operators in Kenya. In achieving this objective the study ranked the relative importance of the factors. A total of 18 questionnaires were administered to the officers who make decisions of every network operator. Of these 15 questionnaires were returned and successfully filled. The response rate was therefore 83.33%, which compares favourably with Aosa (1992), Karemu (1993), and Warsame (2002), with response rate of 15%, 55% and 20% respectively.

Before processing the responses, the completed questionnaires were edited for completeness and consistency. Data was then tabulated and classified according to their common characteristics. The data was analysed by use of descriptive statistics. This included the list of tables and percentages to represent the response rate and information on the variables that the study considered. Frequency distribution was also used to summarize the results for presentation.

The findings of the study are divided into two parts. The first part presents the general characteristics of network operators based on the period of existence and operations coverage. The second part presents the findings using frequency tables, proportions and descriptive statistics.

The analysis in this study required a census survey based on 18 network operators. The response rate is summarized in the table below.

**Table 4.1.0: Response rate**

Number of questionnaires	Number	Percentage
Number of questionnaires received	15	83.33%
Number of questionnaires not received	3	16.67%
Total distributed	18	100%

**Source: Research data**

A total of 18(100%) of questionnaires were distributed, out of which 15(83.33%) of the questionnaires were successfully completed. However 3(16.67%) were not received. The response rate was considered sufficient.

#### 4.1.1 General characteristics of network operators

The characteristics considered were the period of existence and operations coverage in terms of number of years they operated and cities covered by the operators.

##### 4.1.1a Period of existence

This subsection addresses the length of existence of the network operators. The period was categorized into less than or equal to one year, between two and three years, between four and five years and above five years.

**Table 4.1.1a Period of existence**

	Frequency	Percent	Valid Percent	Cumulative Percent
<=1 year	1	6.67	6.67	6.67
2-3 year	3	20.0	20.0	26.67
4-5 years	6	40.0	40.0	66.67
Above 5 years	5	33.33	33.33	100.0
Total	15	100.0	100.0	

**Source: Research data**

The table above shows the period of existence of network operators. It shows that most of the respondents (40%) had been in operation for more than three years while 33.33% had been in operation for more than five years. 6.67% of the respondents are relatively new as they have been operational for less than one year. 13.33% of the interviewed operators have been in existence for a period of between two and three years.

Most operators (66.67%) have been in operation for 5 years and less, this is supported by the fact that the liberalisation of ICT sector in Kenya commenced beginning late 1998 and most operators are therefore new entrants.

#### 4.1.1b Operations coverage

In this subsection, network operators were classified into two groups based on their areas of coverage. The operators were categorized into those with operations in the whole of Kenya and those with operations in specific towns as shown below.

**Table 4.1.1b Operations coverage**

Areas covered	Frequency	Percent	Valid Percent	Cumulative percent
Whole of Kenya	9	60.0	60.0	60.0
Some towns	6	40.0	40.0	100.0
Total	15	100.0	100.0	

**Source: Research data**

The table above shows that network operators covered different areas. It shows that most of respondents (60%) had their operations covering the whole of Kenya, while 40% covered only specific towns such as Mombasa, Nairobi, Kisii and Kisumu.

#### 4.2.0 Analysis of factors affecting implementation of ICTs

The factors, which were considered to affect ICT implementation to a very large extent, were given a ranking of 5 while a score of 1 was given to those factors considered neutral to ICTs implementation. The importances of these factors were also ranked and the results for the factors were tabulated showing the score on each of the factors.

**Table 4.2.1 Government policy attributes**

Factor	Very large extent		Large extent		Moderate extent		Small extent		No extent		Total
	F	%	F	%	F	%	F	%	F	%	
ICT policy facilitation	0	0	0	0	9	60.0	4	26.67	2	13.33	15
Effect of ICT policy	5	33.33	5	33.33	3	20	2	13.33	0	0	15
Government efforts	0	0	9	60.0	5	33.33	1	6.67	0	0	15
Liberalization	8	53.33	5	33.33	2	13.33	0	0	0	0	15

**Source: Research data**

The table above shows the extent to which government policy affects implementation of ICT. Out of 15 respondents, 60% indicated that Kenyan ICT policy has moderately facilitated the implementation of ICTs. Only 13.33% were neutral on this factor. 33.33% of the respondents indicated that the ICT policy has by a very large extent slowed down implementation of ICTs in Kenya. 13.33%, 20% and 33.33% of the respondents rated this factor as affecting implementation of ICTs to a small extent, moderate and large extent respectively. On the other hand, majority of the respondents (60%) felt that government had to a large extent made deliberate efforts to promote ICTs implementation. Majority of respondents (53.33%) indicated that a fully liberalized ICT sector was to a very large extent good for implementation of ICTs. Only 13.33% felt that this was moderately good for the implementation of ICTs.

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**Table 4.2.2 Regulation attributes**

Attribute	Very large extent		Large extent		Moderate extent		Small extent		No extent		Total
	F	%	F	%	F	%	F	%	F	%	
Regulatory regime	0	0	1	6.67	6	40	6	40	2	13.3	15
Regulatory framework	6	40	5	33.3	2	13.33	1	6.67	1	6.67	15
Convergence of services	0	0	2	13.3	2	13.33	11	73	0	0	15
Independence of licenses	0	0	6	40	3	20	4	26.7	2	13.3	15
Even playing field	0	0	0	0	5	33.3	7	46.7	3	20	15

**Source: Research data**

From the above results, 40% of the respondents felt that regulatory regime was moderately conducive for speedy diffusion of ICT. Only 6.67% of the respondents felt that this attribute was to a large extent conducive to speedy diffusion of ICT. The rest i.e. 40% and 13.33% felt that this attribute was to a small extent and no extent conducive respectively.

The table above also indicates that majority of respondents (46.67%) felt that there was no even playing ground among network operators.

**Table 4.2.3a Support Infrastructure**

Attributes	Very large extent		Large extent		Moderate extent		Small extent		Total
	F	%	F	%	F	%	F	%	
Transportation	0	0	0	0	5	33.3	7	46.7	15
Power supply	4	26.7	4	26.7	4	26.7	1	6.67	15
Local authority by laws	2	13.3	4	26.7	3	20	1	6.67	15
Vandalism of installations	0	0	2	13.3	6	40	4	26.7	15

**Source: Research data**

The table above shows the extent to which the attributes of support infrastructure have hindered the deployment of ICT systems in Kenya. Out of 15 respondents, majority of them i.e.46.67% felt that transportation was to a small extent or no extent at all hindered ICT systems in Kenya. While 20% of the respondents were neutral to this attribute. The rest i.e. 33.33% felt that this infrastructure had moderately hindered deployment of ICT systems in Kenya. Power supply responses were fairly evenly distributed among the scores that is, 26.67% of respondents felt that power supply had to a very large extent and moderate extent each hindered the deployment of ICT systems, with only 13.33% being neutral to this attribute. On the attribute of local authority by-laws, majority of respondents i.e. 33.33% felt that attribute was neutral to the implementation of ICT systems. Only 26.67% of the respondents indicated that this infrastructure attribute had to a large extent hindered deployment of ICTs systems in Kenya.

Vandalism of installation was indicated by vast majority of the respondents as having moderately hindered deployment of ICT systems, that is 40% of respondents. While 20% of the respondents were neutral to this attribute with only 13.33% of respondents indicating that the attribute to a large extent, hindered implementation of ICT systems.

#### 4.2.3b Type of infrastructure

Infrastructure	Frequency	Percent	Valid percent	Cumulative percent
Fixed telephony	3	10.0	10.0	10.0
Mobile telephony	3	10.0	10.0	20.0
IP service	6	19.0	19.0	39.0
VSAT	10	32.0	32.0	71.0
Data communication	9	29.0	29.0	100.0
Total	31	100.0	100.0	

Source: Research data

The table indicates that 32% of the respondents use VSAT systems, 29% used data communication, while 19%, 10% and 10% used IP service delivery systems, mobile telephony and fixed telephony respectively. The total above (31) is more than the sample size because some respondents use more than one ICT system/infrastructure to provide services..

#### 4.2.4 Knowledge and skills in ICT

Table 4.2.4 Knowledge and skills

Attributes	Very large extent		Large extent		Moderate extent		Small extent		No extent		Total
	F	%	F	%	F	%	F	%	F	%	
Requisite knowledge	9	60	4	26.7	2	13.33	0	0	0	0	15
Sufficiency of knowledge	9	60	4	26.7	2	13.33	0	0	0	0	15
Lack of pertinent skills	0	0	2	13.3	3	20.0	6	40	4	26.7	15
Impact of lack of skills	0	0	3	20	2	13.33	6	40	4	26.7	15
Usefulness of knowledge	7	46.7	7	46.7	1	6.67	0	0	0	0	15

Source: Research data

From the table above, 60% of the respondents considered themselves to a very large extent as having the requisite knowledge and skills to deploy ICT. Only 13.33% of the respondents considered themselves average in terms of having requisite knowledge to deploy ICT. Majority of the respondents (60%) felt that to a very large extent their knowledge and skills satisfy the requirements of their clients with only 13.33% being moderate in their rating. On the other hand, 46.67% of the respondents felt that their knowledge and skills had to a very large extent helped them in the deployment of ICT.



## 4.2.5 Capital and investment

**Table 4.2.5a Capital and investment**

Attributes	Very large extent		Large extent		Moderate extent		Small extent		No extent		Total
	F	%	F	%	F	%	F	%	F	%	
Limitation of capital	2	13.3	2	13.3	2	13.3	5	33.3	4	26.7	15
Funding by financial inst.	3	20	4	20	2	13.3	6	40	0	0	15
Adequacy of fin. resources	3	20	6	40	4	26.7	2	13.3	0	0	15
Adequacy of funds	0	0	2	13.3	2	13.3	4	26.7	7	46.7	15

**Source: Research data**

The table above shows the extent to which capital and investment have affected implementation of ICT projects. Out of 15 respondents, majority (33.33%) felt that limitation of capital had affected implementation of ICT systems to a small extent. Only 13.33% of them indicated that this attribute had to a very large extent affected implementation of ICT systems. However, 40% of the respondents indicated that they had no adequate financial resources to invest in ICT systems. In addition, majority of respondents (46.67%) felt that they did not have enough funds to carry out ICT projects.

**Table 4.2.5b Source of financing**

Source of finance	Frequency	Percent	Valid percent	Cumulative percent
Equity	3	15.79	15.79	15.79
Debt	3	15.79	15.79	31.58
Grants	0	0.00	0.00	31.58
Internal sources	13	68.42	68.42	100.0
Total	19	100.00	100.0	

**Source: Research data**

The research established that while some network operators obtained finances from a single source, others obtained from various sources. From the above table, internal sources emerged as the major source of financing investments to network operators contributing about 68.42%. Others, though minimal were equity and debt with 15.79% each. The network operators interviewed did not regard grants as a source of finance. The total above (19) is more than the sample size because some respondents used more than one form of financing.

## 4.2.6 Affordability

**Table 4.2.6**

Attributes	Very large extent		Large extent		Moderate extent		Small extent		No extent		Total
	F	%	F	%	F	%	F	%	F	%	
Fixed telephone	5	38.5	5	38.5	2	15.39	1	7.69	0	0	13
Mobile call	1	9	2	18	5	46	2	18	1	9	11
E-mail	2	20	2	20	2	20	2	20	2	20	10
Internet	3	27	0	0	3	27	4	37	1	9	11
Leased line	0	0	1	10	4	40	2	20	3	30	10
VSAT connection	1	10	0	0	5	50	2	20	2	20	10

**Source: Research data**

The table above shows that majority of respondents (38.46%) felt that fixed telephone was to a very large extent affordable to consumers. Only 15.39% of respondents indicated that fixed telephone was not affordable. However, majority of respondents (46%) felt that mobile call was moderately affordable with only a minority (9%) indicating that it was not affordable.

Internet was considered by vast majority (37%) as being to a very small extent affordable.

Leased line and VSAT connection were indicated by majority as being moderately affordable, that is 40% and 50% of the respondents respectively.

On the overall, majority of respondents (58%) felt that their services would have been used more had the price been lower. The totals are less than the sample size (15) because some attributes were not applicable to some respondents hence they did not rate them.

It is important to note that this the service providers view of the affordability of their services; the consumers of these services may have a different view.

### 4.3.0 Importance of factors affecting implementation of ICT

**Table 4.3.1 Importance of factors affecting implementation of ICT**

Factor	Extremely important		Very important		Somewhat important		Not very important		Not all important		Total
	F	%	F	%	F	%	F	%	F	%	
Investment in ICT	10	66.67	5	33.33	0	0	0	0	0	0	15
ICT policy	8	53.33	6	40	1	6.67	0	0	0	0	15
Knowledge and skills	9	60	6	40	0	0	0	0	0	0	15
Infrastructure	9	60	6	40	0	0	0	0	0	0	15
Affordability of service	8	53.33	5	33.33	1	6.67	0	0	0	0	15

**Source: Research data**

The table above indicates the importance of the factors affecting implementation of ICT. Out of 15 respondents majority (66.67%) rated investment in ICT as the most important factor affecting ICT implementation. They were followed by infrastructure (60%) and knowledge and skills (60%) and finally affordability of service (53.33%) and ICT policy (53.33%).

The above factors were ranked in terms of their importance in realizing faster implementation of ICT as summarized by the table below.

**Table 4.3.2 Importance of factors in realizing faster implementation of ICT**

Factor	Extremely important		Very important		Somewhat important		Not very important		Not at all important		Total
	F	%	F	%	F	%	F	%	F	%	
Increase Investment in ICT	10	66.67	4	26.67	1	6.67	0	0	0	0	15
ICT policy	11	73.33	3	20	1	6.67	0	0	0	0	15
Increase Knowledge & skills	7	46.67	7	46.67	1	6.67	0	0	0	0	15
Improve Infrastructure	9	60	6	40	0	0	0	0	0	0	15

**Source: Research data**

The table above shows the importance of the factors in realizing faster implementation of ICT. Majority of respondents (73.33%) indicated that ICT policy was extremely important factor in realizing faster implementation of ICT. It was followed by increase in investment in ICT (66.67%), improvement in infrastructure (60%) and increase in knowledge and skills in ICT (46.67%).

#### 4.4.0 Descriptive statistics on the factors

The researcher also estimated the statistics comprising of mean, maximum, minimum and total sum of the factors influencing implementation of ICT tested by the questionnaire. The summary is presented in the table below.

**Table 4.4.1: Descriptive statistics**

Factor/Attribute	N	Min	Max	Sum	Mean	Grand Means	Rank
<b>I. Government policy</b>							
1. ICT policy facilitation	15	1	3	38	2.533		
2. Effect of ICT policy	15	2	5	59	3.933		
3. Government efforts	15	2	4	39	2.60		
4. Liberalization	15	3	5	65	4.33	3.349	2
<b>II. Infrastructure</b>							
1. Transportation	15	1	3	33	2.20		
2. Power supply	15	1	5	53	3.533		
3. Local authority laws	15	1	5	40	2.67		
4. Vandalism	15	1	4	37	2.467	2.7175	6
<b>III. Knowledge &amp; Skills</b>							
1. Requisite knowledge	15	3	5	69	4.60		
2. Sufficiency of skills	15	3	5	69	4.60		
3. Lack of pertinent skills	15	1	4	28	1.867		
4. Impact of lack of skills	15	1	4	40	2.667		
5. Usefulness of skills	15	4	5	67	4.47	3.6408	1
<b>IV. Capital &amp; Investment</b>							
1. Limitation of capital	15	1	5	39	2.60		
2. Willingness of fin. Inst.	15	2	5	50	3.333		
3. Adequacy of resources	15	2	5	53	3.533		
4. Sufficiency of funds	15	1	4	31	2.067	2.8833	4
<b>V. Affordability</b>							
1. Fixed telephone	13	2	5	39	4.10		
2. Mobile call	11	1	5	33	3.3		
3. E-mail	10	1	5	30	3.0		
4. Internet	11	1	5	33	3.3		
5. Leased line	10	1	4	21	2.1		
6. VSAT connection	10	1	5	26	2.6	3.067	3
<b>VI. Regulation</b>							
1. Regulatory regime	15		4	39	2.60		
2. Regulatory framework	15	1	5	58	3.867		
3. Convergence of service	15	2	4	34	2.267		
4. Independence of licen.	15	1	4	44	2.933		
5. Even playing field	15	1	3	3	2.067	2.7835	5

Source: Research data

The table above shows that the factors that influence implementation of ICT from the highest mean are knowledge and skills in ICT, government policy, affordability, capital and investment, regulation and infrastructure in that order. According to the table above, knowledge and skills in ICT has the highest mean of 3.6408. The least mean goes to infrastructure, which has a mean of 2.7175

#### 4.5.0 Summary of Factor Rankings

This section is a summary of how the network operators rated the factors influencing implementation of ICT in terms of their importance.

**Table 4.5.1 Ranking of factors tested by the study**

Factor	N	Min	Max	Sum	Mean	Ranking
Investment in ICT	15	4	5	70	4.667	1
ICT policy	15	3	5	65	4.333	4
Knowledge and skills in ICT	15	4	5	68	4.533	3
Infrastructure	15	4	5	70	4.667	1
Affordability of the service	15	3	5	62	4.13	5

**Source: Research data**

Table 4.5.1 above shows that infrastructure and investment in ICT were rated as the number one factors followed by knowledge and skills in ICT, ICT policy and then affordability of the service in that order.

#### 4.5.1 Investment in ICT

This proved to be among the most important factors with a mean of 4.667, which falls under the extremely important category. 66.67% of the respondents agree on the importance of investment in ICT as being a strong determinant of ICT implementation.

#### 4.5.2 Infrastructure

This factor score a mean of 4.667 indicating that it is a prevalent factor as is evidenced by the fact that 60% of the sample indicated this as an extremely important determinant of ICT implementation.

### 4.5.3 Knowledge and skills in ICT

Of significance but of less bearing than the above two is the knowledge and skills in ICT. 46.67% of the respondents saw this factor as merely important. The rest who formed a minority considered it an extremely important factor in the implementation of ICT. Thus knowledge and skills in ICT carried more weight as an important factor having a mean of 4.533.

### 4.5.4 ICT policy

73.33% of the respondents were in agreement that the above factor was extremely vital in the implementation of ICT. However, all the rest thought it was very important with the exception of one network operator, who considered this as somewhat important factor. Thus this factor scored a mean of 4.333

### 4.5.5 Affordability

This scored a mean of 4.133 indicating that it was on the higher side of being somewhat important or not important that is, it is approaching *important* level. 53.33% of the respondents considered it an extremely important factor with the rest being evenly balanced across the likert scale. This explains why it has a low mean and yet a high percentage considered this factor extremely important.

## CHAPTER FIVE

### 5.0 SUMMARY OF THE FINDINGS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

#### 5.1 Summary of the findings and conclusions

##### 5.1.1 Summary of the findings

This study set out to find out how government policy, infrastructure, knowledge and skills, availability of capital /investment and affordability of ICT by network operators in Kenya.

The study found out that the investment in ICT along with infrastructure play a very important role in the implementation of ICT. As a matter of fact, most network operators unanimously agree that these were the two most important factors. There was no great discrepancy between the mean scores and the actual scores that the above two factors scored individually among the network operators (See table 4.5.1).

Knowledge and skills in ICT was next in line in terms of importance. As noted in the literature review, the role of human capital in economic growth has been widely acknowledged as evidenced by various empirical studies (Benhabib and Spiegel, 1994, Bessanini and Scarpetta, 2001b).

For the ICT policy, the researcher found out that with the exception of one network operator, all the network operators considered this factor as very important.

The affordability of ICT infrastructure does influence the implement of ICT. This scored a mean of 4.133

##### 5.1.2 Conclusion

The findings of the study support the assertion by Schumpeter (1912) that a developed financial sector is important to economic growth. This study ranked investment in ICT as number one variable which influences implementation in ICT.

The study also supports observation by Gilles and Mitchell (2002), that makers of public policy have a responsibility to develop and maintain an enabling environment that encourages investment by private organizations and businesses in ICT infrastructure.

This study ranked knowledge and skills in ICT as number two factor. According to the study, lack of pertinent skills to implement ICT was rated among the number one attributes that influence ICT implementation. This therefore supported the study by ITU (2002), that education is important factors influencing implementation of ICT.

## **5.2 Limitations of the study**

The outcome cannot be generalized to network operators operating in other economies and regions since the study was limited to network operators in Kenya given its unique features.

The study was a survey. The use of predetermined questions may have forced respondents to respond to questions even without properly understanding them. As a matter of fact, some respondents did not provide answers to all questions asked and this could have influenced the final result.

The study was limited by time and resource. This could have affected the response rate owing to the fact that the study was designed to be a census. The researcher had intended to study the whole population of network operators; however this was not achieved due to lack of cooperation by some network operators. This could have slightly tilted the results of the study. Since 16.67% of the total population was not studied, there may be some difficulties in generalizing the results of this study.



### **5.3 Recommendations**

From the results of the study, it has emerged that there are a number of factors that influence implementation of ICT in Kenya, investment in ICT and infrastructure being the most important factors. Thus clear pointers, in terms of policy emerge. Firstly, the full liberalization policy currently in force should be accelerated to fully liberalize ICT sector so that other players enter the market with the necessary investment that will result in an increased diffusion and use of the ICTs.

Secondly, for any meaningful investment in the Kenyan ICT sector to take place, conducive environment for investors is necessary. Thus in order to reap benefits that come with ICT, the policy and regulatory environment has to be right and enabling.

The policies should increasingly move towards enabling multiple providers of ICT in order to break hitherto monopolies and at the same time drive down prices of ICT services by attracting more investment in the sector and achieving economies of scale.

Thirdly, complimentary infrastructure particularly power supply is as critical as investment in the extent to which it affects/influences the implementation of ICT. This requires deliberate effort in order to ensure speedy diffusion of ICT and its eventual contribution to economic development.

### **5.4 Suggestions for further research**

The study concentrated on the factors that influence the implementation of ICT by the network operators in Kenya. It forms a foundation for further researches in this area. Further studies should include:

1. The scope of this study should be widened to cover other countries and specially East Africa in order to see whether the said factors affect successful implementation of ICT the same way;
2. An exploratory study can also be conducted to establish regulatory barriers that hinder successful implementation of ICTs in Kenya;
3. This study concentrated on the factors that influence implementation of ICTs, such as investment in ICT. A study could be done to examine the extent to which modes of financing affect implementation of ICTs among the network operators;
4. Another study could be done to establish the relationship between demographic factors such as size, ownership and so on of the network operators and the factors affecting the implementation of ICTs in Kenya.

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# APPENDICES

## Appendix 1: Letter to the respondents

**T. A. Senaji**  
**c/o University of Nairobi**  
**Faculty of Commerce**  
**P.O. Box 30197**  
**Nairobi**

**To:**

**Respondent**

Dear Sir/Madam,

### **QUESTIONNAIRE ON FACTORS AFFECTING IMPLEMENTATION OF INFORMATION AND COMMUNICATION TECHNOLOGY, ICT BY NETWORK OPERATORS IN KENYA**

I am an MBA student in the University of Nairobi interested in learning more about the factors that affect the implementation of ICT by network operators in Kenya

To do this, means going to someone such as yourself who knows about the Internet Industry in Kenya, having been an active player.

Your help with the few questions that are attached will take a few minutes and will make an invaluable contribution to this study.

I confirm that your reply will be treated in strict confidence and will be available only to my research staff and me. Any publication will be for statistical totals, for a group of companies.

Your assistance will be greatly appreciated and will help us to know more about the relative importance of the factors that affect implementation of ICT by network operators in Kenya.

Yours faithfully,

**Thomas Senaji**  
Researcher

**Dr. John Yabs**  
Supervisor

## **Appendix 2: List of respondents**

### **Public Fixed Switched Telephone Network Operators**

1. Telkom Kenya Ltd

### **Mobile Phone Operators**

1. Safaricom Limited
2. Celtel Kenya

### **Commercial VSAT Operators**

1. Telkom Kenya Limited
2. Gilat Alldan (Africa Limited)
3. AFSAT Communications Kenya Ltd

### **Internet Backbone Operators**

1. Telkom Kenya Limited
2. Jamii Telecommunications Ltd

### **Public Data Network Operators**

1. Telkom Kenya Limited
2. Simbanet Com Ltd
3. Open Systems Limited
4. Broadband Access Limited
5. Pegrume Limited
6. Satallite Data Networks Limited
7. Microage Ltd



## **Appendix 3: Population comprising all ICT Network Operators in Kenya**

### **Public Fixed Switched Telephone Network Operators**

1. Telkom Kenya Ltd
2. Bell Western Communications Ltd

### **Mobile Phone Operators**

1. Safaricom Limited
2. Celtel Kenya

### **Commercial VSAT Operators**

1. Telkom Kenya Limited
2. Gilat Alldcan (Africa Limited)
3. AFSAT Communications Kenya Ltd

### **Internet Backbone Operators**

1. Telkom Kenya Limited
2. Jamii Telecommunications Ltd
3. Kenya Data Networks

### **Public Data Network Operators**

1. Telkom Kenya Limited
2. Kenya Data Networks
3. Simbanet Com Ltd
4. Open Systems Limited
5. Broadband Access Limited
6. Pegrume Limited
7. Satallite Data Networks Limited
8. Microage Ltd

## Appendix 4: Questionnaire aimed at answering the objectives of the study

### Part A: General Information

1. Name of respondent: \_\_\_\_\_

Organisation (optional): \_\_\_\_\_

Address: \_\_\_\_\_

Date: \_\_\_\_\_

2. For how long have you been in operation? \_\_\_\_\_ years

3. Do your operations cover the whole of Kenya? YES [ ] NO [ ]; If NO, in which towns do you operate? (Please list all)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Part B: Factors Affecting ICT Implementation by Network Operators

#### 1. Government Policy

You are requested to assess to provide an assessment of the extent to which Government policy affects your efforts to implement ICT in Kenya by providing your opinion on each question on a scale of 1 to 5 as illustrated; where 1=No Extent and 5=Very Large Extent

##### 1.1 Policy

No Extent	Small Extent	Moderate Extent	Large Extent	Very Large Extent
(1)	(2)	(3)	(4)	(5)

- (ii) To what extent do you think the Kenyan ICT policy has facilitated your implementation of ICTs?
- (iii) To what extent do you feel the ICT policy has slowed down your implementation of ICTs?
- (iv) To what extent do you feel the Government has made deliberate efforts to promote ICT implementation?
- (v) To what extent do you feel a fully liberalised ICT sector is good for implementation of ICTs?

## 1.2 Regulation

You are requested to assess the regulatory regime in as far as it affects your efforts to implement ICT in Kenya. Please rate the following factors on a scale of 1 to 5 as indicated.

No Extent (1)	Small Extent (2)	Moderate Extent (3)	Large Extent (4)	Very Large Extent (5)

- (i) To what extent do you feel that the regulatory regime is conducive to speedy diffusion of ICT?
- (ii) To what extent do you feel that the regulatory framework has not assisted in speedy diffusion of ICTs?
- (iii) To what extent do you feel the regulatory regime has embraced convergence of services and media over the same delivery platform?
- (iv) To what extent are the licenses to network operators independent of the technology used to deliver those services?
- (v) To what extent do you feel that there is even playing ground among operators in ICT sector in Kenya?

## 2. Infrastructure

You are requested to provide an assessment of the infrastructure available in Kenya which supports implementation of ICT services on a scale of 1 to 5 as illustrated below:

- (i) What type of infrastructure do you have for provision of ICT services? Check all that apply.

Infrastructure / System	Fixed Telephony	Mobile Telephony	IP Service	VSAT	Data Communication

- (ii) To what extent have the following factors hindered the deployment of your ICT systems in Kenya?

Factor	No Extent (1)	Small Extent (2)	Moderate Extent (3)	Large Extent (4)	Very Large Extent (5)
Transportation					
Power supply					
Local authority by-laws					
Vandalism of installations					

### 3. Knowledge and Skills

It is useful for this study to know how your knowledge and skills have impacted your implementation of ICT in Kenya; please provide response to the following questions on a scale of 1=No Extent to 5=Very Large Extent.

- (i) To what extent do you consider yourselves as having the requisite knowledge and skills to deploy ICT?
- (ii) To what extent do you feel your knowledge and skills satisfy the requirements of your clients?
- (iii) To what extent do you lack pertinent skills to implement ICT?
- (iv) To what extent does the lack of skill impact on your delivery of service to your customers?
- (v) To what extent has your knowledge and skills helped you in the deployment of ICT?

### 4 Capital and Investment

It is of importance to this study to know how ICT projects are financed and whether you have adequate resources to invest in your ICT projects.

i) Please, indicate how your ICT programs are financed?

Equity	Debt	Grants	Internal sources	other

It is of importance for this study to the role of investment in the implementation of the ICT in your organisation. On a scale of 1 to 5 please provide responses to the following questions:

<b>No</b>	<b>Small</b>	<b>Moderate</b>	<b>Large</b>	<b>Very Large</b>
<b>Extent</b>	<b>Extent</b>	<b>Extent</b>	<b>Extent</b>	<b>Extent</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>

- (ii) To what extent has limitation of capital affected your implementation of ICT systems?
- (iii) To what extent are the financing institutions willing to fund your projects?
- (iv) To what extent do you feel that you have adequate financial resources to invest in your ICT projects?
- (v) To what extent is the following statement true of your organisation “we do not have enough funds to carry out our ICT projects”.

**5. Affordability**

- (i) To what extent do you feel the following ICT services are affordable to the consumers of your services?

<b>Factor</b>	<b>No</b>	<b>Small</b>	<b>Moderate</b>	<b>Large</b>	<b>Very Large</b>	<b>N/A</b>
	<b>Extent</b>	<b>Extent</b>	<b>Extent</b>	<b>Extent</b>	<b>Extent</b>	
	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	
Fixed telephone						
Mobile call						
e-mail						
Internet						
Leased line						
VSAT connection						

- (ii) To what extent do you feel that your services would have been used more had the price been lower? Indicate on a scale of 1 to 5 where 1=No Extent and 5=Very Large Extent

**6. Importance of the factors affecting implementation of ICT by network operators**

(i) In your view, how important do you feel the following factors are important to the implementation of ICT by your organisation?

Factor	Extremely Important (5)	Very Important (4)	Somewhat Important (3)	Not Very Important (2)	Not at all Important (1)
Investment in ICT					
ICT policy					
Knowledge and skills in ICT					
Infrastructure					
Affordability of the service					

(ii) How important is it to address the following factors in order to realise faster implementation of ICT in your organisation?

Factor	Extremely Important (5)	Very Important (4)	Somewhat Important (3)	Not Very Important (2)	Not at all Important (1)
Increase investment in ICT					
ICT policy					
Increase knowledge and skills in ICT					
Improve infrastructure					

(iii) Is the Government making an effort to promote implementation of ICTs? Yes \_\_\_\_\_  
No \_\_\_\_\_

(iv) To what extent do you feel enough effort is being directed towards development of a vibrant ICT sector in Kenya?

No Extent	Small Extent	Moderate Extent	Large Extent	Very Large Extent
(1)	(2)	(3)	(4)	(5)

7. If you would like a summary of the results of this survey, please indicate

here \_\_\_\_\_

You have successfully completed the Questionnaire. Your time and responses are invaluable.

Thank you for your kind assistance.



## Appendix 5: Summary of Scores

### Appendix 5a: Government Policy Scores

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>
	3	4	4	4
	3	4	3	4
	3	3	2	5
	3	3	2	5
	1	5	2	5
	3	3	2	3
	3	5	2	5
	2	4	3	5
	2	5	3	3
	2	5	2	5
	3	2	3	4
	3	4	2	4
	2	3	2	4
	2	4	4	4
	3	5	3	5
<b>TOTAL</b>	<b>38</b>	<b>59</b>	<b>39</b>	<b>65</b>
<b>MEAN</b>	<b>2.533</b>	<b>3.933</b>	<b>2.60</b>	<b>4.33</b>

**Source: Research data**

**KEY: I -ICT policy facilitation, II-Effect of ICT policy, III-Government efforts,**

**IV-Liberalization**

5-Very large extent, 4-Large extent, 3-Moderate extent, 2-Small extent, 1-No extent

**Appendix 5b: Regulation Scores**

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>
	3	1	2	2	3
	2	4	2	4	2
	3	5	2	4	2
	4	4	2	2	3
	1	5	2	4	1
	3	3	2	1	1
	2	5	2	2	3
	2	5	2	2	2
	3	5	3	4	2
	2	4	2	3	3
	3	2	4	4	2
	2	4	2	3	2
	2	5	2	4	2
	3	4	2	3	3
	4	2	3	2	1
<b>TOTAL</b>	<b>39</b>	<b>58</b>	<b>34</b>	<b>44</b>	<b>31</b>
<b>MEAN</b>	<b>2.60</b>	<b>3.867</b>	<b>2.267</b>	<b>2.933</b>	<b>2.067</b>

**Source: Research data**

**KEY: I-Regulatory regime, II-Regulatory framework, III-Convergence of services, IV-Independence of licenses, V-Even playing field**

**Appendix 5c: Infrastructure Scores**

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>
	2	1	1	1
	3	5	3	3
	2	4	3	1
	3	5	4	2
	3	5	2	2
	2	4	5	3
	2	2	1	3
	3	3	1	2
	2	3	4	4
	1	1	1	3
	2	3	4	2
	1	4	3	3
	2	5	3	3
	2	5	1	4
	3	3	4	1
<b>TOTAL</b>	<b>33</b>	<b>53</b>	<b>40</b>	<b>37</b>
<b>MEAN</b>	<b>2.20</b>	<b>3.533</b>	<b>2.67</b>	<b>2.467</b>

**Source: Research data**

**KEY: I-Transportation, II-Power supply, III-Local authority by-laws, IV-Vandalism of installations**

**Appendix 5d: Knowledge and Skills in ICT**

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>
	5	5	1	1	5
	5	5	2	2	4
	5	5	1	1	5
	5	5	2	2	4
	5	5	2	1	5
	3	3	4	4	4
	5	5	1	2	5
	5	4	1	1	5
	5	4	3	4	4
	4	5	2	2	4
	4	5	2	2	5
	4	4	2	4	4
	5	5	1	2	5
	5	5	2	1	4
	4	4	2	1	4
TOTAL	69	69	28	40	67
MEAN	4.60	4.60	1.867	2.667	4.47

**KEY:** **I**-Requisite knowledge, **II**-Sufficiency of knowledge, **III**-Lack of pertinent skills,  
**IV**- Impact of lack of skills, **V**-Usefulness of knowledge

**Appendix 5e: Capital and Investment Scores**

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>
	1	5	4	1
	2	2	5	1
	1	5	4	4
	5	2	4	1
	1	4	5	1
	2	5	5	1
	2	4	2	3
	4	2	3	2
	3	3	3	3
	2	3	2	4
	5	4	4	2
	4	2	3	2
	1	3	4	1
	2	2	3	2
	4	4	2	3
<b>TOTAL</b>	39	50	53	31
<b>MEAN</b>	2.60	3.33	3.533	2.067

**Source: Research data**

**KEY: I-Limitation of capital, II-Funding by financial inst., III-Adequacy of financial resources, IV-Adequacy of funds**

**Appendix 5f: Affordability Scores**

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>	<i>VI</i>
	4	3	1	2	3	3
	4	3	3	2	3	2
	5	4	4	2	1	3
	5	3	5	5	4	2
	2	5	1	5	1	1
	5	1	5	1	1	5
	3	4	2	5	1	1
	4	2	3	2	3	3
	4	2	4	3	3	3
	5	3	2	3	1	3
	4	3		3		
	5					
	4					
TOTAL	41	33	30	33	21	26
MEAN	3.417	2.75	2.50	2.75	1.75	2.167

**Source: Research data**

**KEY: I-Fixed telephone, II-Mobile call, III-E-mail, IV-Internet, V-Leased line**

**VI-VSAT connection**

**Appendix 5g: Importance of factors affecting ICT implementation Scores**

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>
	5	4	5	5	4
	5	4	4	5	5
	4	5	4	5	4
	5	4	4	4	4
	4	3	5	4	3
	5	5	5	4	5
	5	5	5	5	5
	5	5	4	5	4
	4	5	5	5	4
	5	4	5	5	4
	5	5	4	5	4
	4	4	5	4	5
	5	4	4	5	4
	4	3	4	4	3
	5	5	5	5	4
<b>TOTAL</b>	70	65	68	70	62
<b>MEAN</b>	4.667	4.333	4.533	4.667	4.133

**Source: Research data**

**KEY: I-Investment in ICT, II-ICT policy, III-Knowledge and skills, IV-Infrastructure,**

**V-Affordability of the service**

5-Extremely important, 4-Very important, 3-Somewhat important 2-Not very important, 1-Not at all important

**Appendix 5h: Importance of factors in terms of realizing faster implementation of ICT**

**Scores**

<i>Respondent/Factor</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>
	4	5	5	5
	5	4	4	4
	4	5	3	5
	5	5	4	4
	3	5	4	4
	5	3	3	5
	5	5	5	4
	5	5	5	5
	5	5	4	5
	4	5	5	4
	5	5	4	5
	5	4	5	5
	4	4	5	5
	5	5	4	4
	3	5	3	3
TOTAL	67	70	63	67
MEAN	4.467	4.667	4.20	4.467

**Source: Research data**

**KEY: I-Increase in investment in ICT, II-ICT policy, III-Increase in knowledge,**

**IV-Improvement in infrastructure**