Does investments in ICT impact Trade in Africa? A trend analysis of trade flows in Africa.

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ABSTRACT

The past few decades have witnessed a growth in the use of information communication technology (ICT) infrastructure as a catalyst for development in many countries. The growth in the worldwide ICT has resulted in globalization, enabling integration of financial markets among different countries in small geographical regions. This has led to intra-regional cooperation and trade. Trade is one of the cornerstones of economic development. It creates a larger regional economy from small and unequal national economies thereby promoting growth and sustainable development. The importance of intra-regional trade is to stimulate production capacity and competitiveness through exposing the domestic industries to intra-regional competition. This facilitates the regions' ability to compete in international markets.

In Africa, global and intra-regional trade has declined since 1970. In this study, the trend analysis of trade flows in Africa was explored. The analysis implies that the low level of trade was influenced by colonial legacy and that the lack of adequate ICT infrastructure is also one of the strong opposing factors to intra-African trade flows.

Keywords: Africa, ICT, Intra-regional trade, Regional integration and development

1.0 INTRODUCTION

The past few decades have witnessed a growth in the use of information communication technology (ICT) infrastructure as a catalyst for development in many countries (Mbarika, 2002). The impact of ICT investments on economic development has been receiving attention among ICT stakeholders as a result of convergence in information communication technology, the growing proliferation of the Internet, and the growth in worldwide mobile telecommunication technologies. International organizations such as ITU, World Bank and IMF, among others have indicated that ICT is a potential tool for economic development (Morawscrynski & Ngwenyama, 2007). Several countries have formulated national ICT policies and invested huge amounts of money into their ICT sectors to aid economic development. The growth in the worldwide ICT market has resulted in globalization, enabling integration of financial markets among different countries in small geographical regions. This in turn has led to intra-regional cooperation and trade. This is most evident in Europe, Asia and North America (Christodoulopoulou, Garofalakis, & Koskeris, 2006).

In Africa, global and intra-regional trade has declined since 1970.Trade is one of the cornerstones of economic development. It creates a larger regional economy from small and unequal national economies thereby promoting growth and sustainable development(IMF, 2008).The importance of intra-regional trade is to stimulate production capacity and competitiveness through exposing the domestic industries to intra-regional competition(WTO, 2008).This facilitate the regions' ability to compete in international markets. The recent commodity boom in some of the sub-Saharan African countries has been improving the trade prospects of the region. Africa is well endowed with natural resources, yet the region is performing below its trade and export potential.

This study aims to investigate and assess the impact of ICT investments on trade in Africa. The attempt is to explore how investments in ICT at macro level can be used to promote intra-regional trade that will help towards regional integration and development. It has been observed that macro level investments in ICT consist of four dimensions -: hardware, software, internal spending and telecommunication investment (WITSA, 2008) and the components of trade are import and export flows (WTO, 2010).The interest is to analyse the relationships between different dimensions of ICT investment and the components of trade. Therefore, our central research question focus on how do investments in ICT impact formal intra-regional trade in African countries while the specific research questions are as follows:

(1) What are the impacts of ICT investments on trade and development in African countries? (2) Which aspects of ICT investment are efficient in promoting intra-regional trade in Africa?

This is an exploratory research. Therefore, in this article, we first provide the trend analysis of trade flows in Africa: This explores the trade flow patterns and possible causes. Our further study would elaborate on the concepts of ICT investments and trade by using neoclassical growth accounting as established by Robert Solow 1957 as our theoretical framework.(Oliner & Sinchel, 2002, Raa & Mohnen,2002; Colecchia & Schreyer, 2002; Tom lee et al., 2005; Samoilenko, 2008; Samoilenko & Osei-Bryson, 2008a; Bollou & Ngwenyama, 2008; Samoilenko & Osei- Bryson, 2010). The framework is a measure of productivity growth. It indicates that increase in the output performance of a production system (economy i.e. trade) is considered to result from knowledge and technology change (ICT investments) through improved practices (Bollou & Ngwenyama, 2008). The objective of using neoclassical production functions of growth accounting is to decompose the rate of growth of economy (trade) into the contributions from different inputs (ICT investments).

The remainder of this article is organised as follows: Section two discusses the literature review. Section three provides the trends and patterns of trade flows in Africa while Section four presents the impact of ICT on trade flows in Africa. Section five provides further study and data analysis procedure. In section six, expected contributions of the study were presented. Section seven provides the limitations.

2.0 LITERATURE REVIEW

Information and communication technologies (ICTs) have brought communication and access to information to the forefront of development. People are forming new social networks, learning and sharing knowledge together across geographical boundaries (Vriendt, Laine, Lerouge, Xu, & Alcatel, 2002).

The growth in the ICT sector is bringing digital opportunities to constituencies, yet the general impact of increases in ICT spending on development is difficult to capture, as a result of variations in different structures of returns from ICT investments among countries (Kim, Kang, Sanders & Lee, 2008).

The opinions on the impact of ICT on development are in two categories: Firstly, ICT when adopted has the potential to empower communities and countries. Secondly, the ICT revolution can lead to imbalances and inequalities that may occur through ICT access and adoption (UNDP, 2003).

In view of these standpoints, this study will investigate the role that ICT investments play towards improving trade flows between countries. In an attempt to examine the relationship between ICT and trade, it is imperative to understand the meaning of ICT in broad terms. ICT can be perceived in terms of a people-centric perspective, i.e. an initiative of people seeking ***information*** and ***communicating*** it to people who appreciate its value *(Figure 1a)*. This becomes ***knowledge***, which can be of value to human development. The ***technology*** serves as a channel to disseminate the knowledge. ICTs are a means by which people disseminate information through a combination of complementary technologies (UNDP, 2003; ITU, 2007a). This view highlights the central role of people as agents for ICT and development (UNDP, 2003). This study conceptualizes ICT in terms of this people-centric perspective. The study will investigate the impact of how increased investments in people and technology will disseminate knowledge for development.
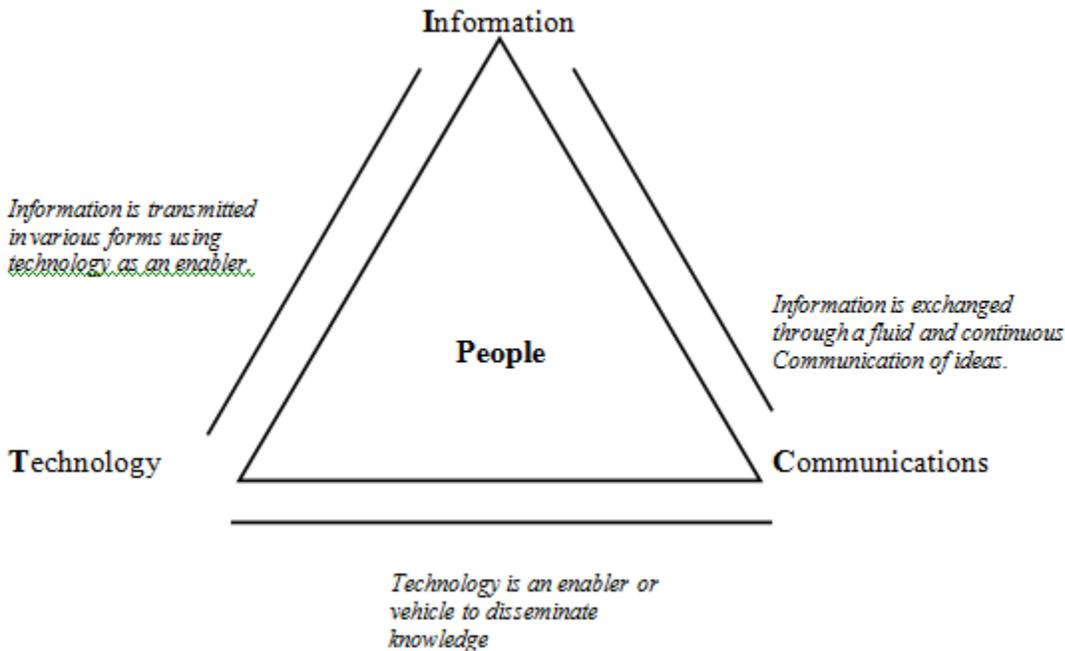
Figure 1a: People Centric Perspective View of ICT (Source: ICT for Development, UNDP, 2003).

2.1 ICT Investments

The rapid increase in ICT deployment as an engine for social and economic development has led to growth in the worldwide ICT market (ITU, 2008). The spending on information and communication technology is presently an important element of the world economy as it favours the improvement in global economies by easing the ups and downs of the economic cycles (ITU, 2008). Spending on ICT at the individual country level improves the quality of life through access to information and the exchange of ideas in both developed and developing economies (ITU, 2007).While these ICT investments are visible in all countries, the focus of ICT investment differs from country to country (Kim et al., 2008).

ICT investments are referred to as second-order investments (Servon, 2002; Morawczynski and Ngwenyama, 2007). Second-order investments are types of investments that are allocated to create opportunities for people to improve the conditions of poverty and marginalization while first-order investments are resources that are allocated towards the immediate needs of the individual such as provision of food, clothing, housing, education and health (Morawczynski & Ngwenyama, 2007).

ICT investments have been expressed in various categories according to many scholars and organizations. ICT investments are categorized into three components according to Kaiser (2003) as (I) expenditure in physical ICT capital such as hardware, software and telecommunication equipment (ii) expenditure for ICT personnel such as workers and ICT professionals (iii) expenditure for non specified items.

ICT investments are also considered as computers, software, telecommunications equipment and semiconductor (chips) investments (Oulton, 2003). The International Telecommunication Union (ITU) also describes investment in ICT as the total telecommunication spending while World Information Technology and Services Alliance (WITSA) describes ICT investment as the total value of information technology spending and telecommunication equipment and services. Information technology (IT) investment is the total annual spending on the combination of hardware for office machines, data processing equipment, data communication, software and services (WITSA, 2008).

Telecommunication investment is the total annual investment in telecommunication. It is referred to as the annual capital expenditure in telecommunication that includes fixed, mobile and other services (ITU, 2007). ICT investments can be thought of as having four dimensions- hardware, software, telecommunications and internal spending (WITSA, 2008).

Figure1 (b) below shows how the view of ICT investments takes into account investments in people (i.e., through internal spending aspects of ICT investment). It is hence in keeping with people-centric view of ICTs.
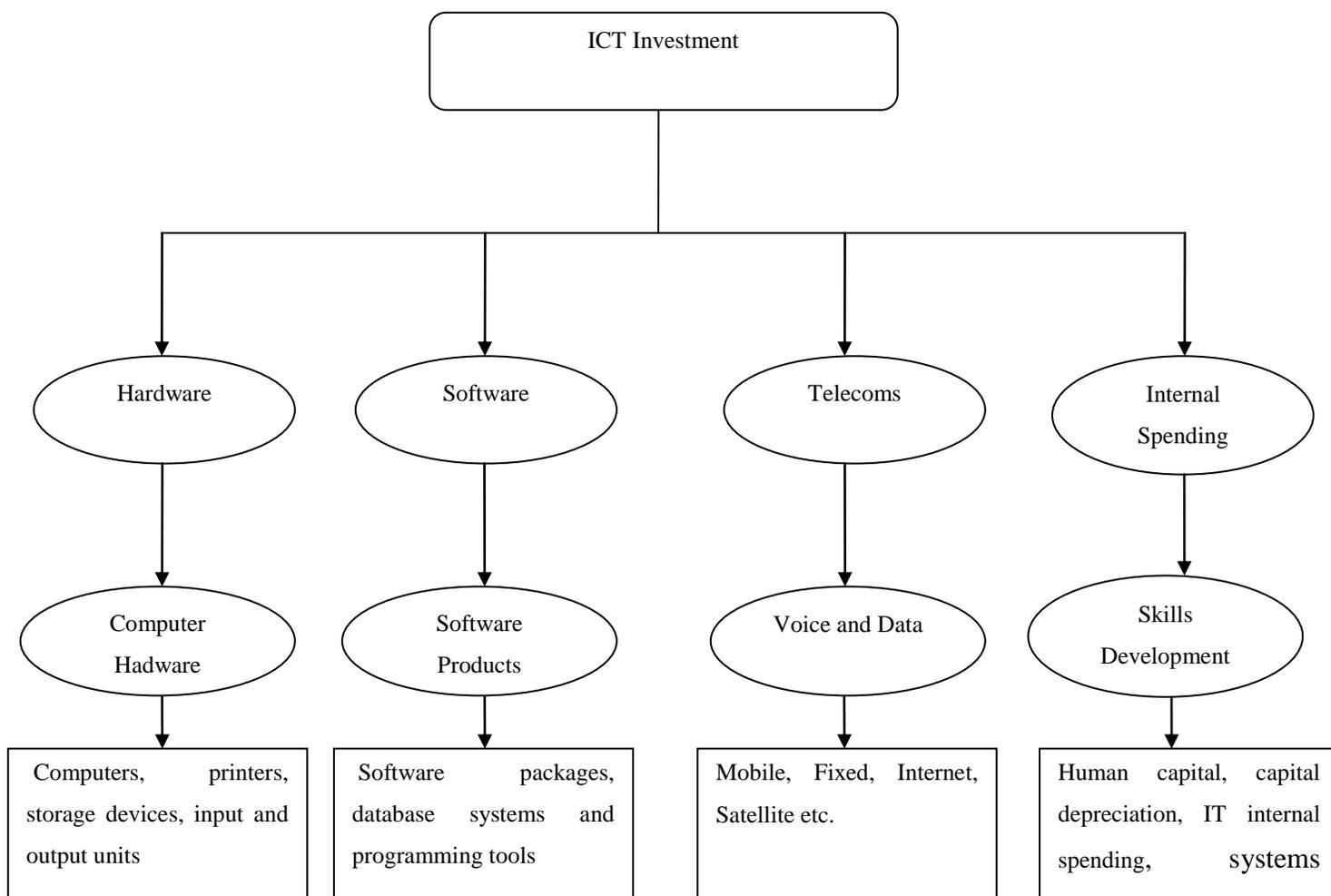
Figure 1b: People Centric View of ICT Investment (Source: WITSA, 2008).

ICT investments have grown substantially in both developed and developing countries, in some cases surpassing GDP or population growth rates. ICT and productivity growth in England contributed 1/5 % to GDP growth during the period 1989 to 1998 (Oulton, 2004). South America, Asia and Eastern Europe have been the fastest growing ICT investment markets with annual growth rates of 14.5%, 13.6% and 9.5% respectively between 1992 to 1997 (WITSA, 2008). African countries have also responded to increased investment in ICT infrastructure since 1995 (Bollou, 2006; Ngwenyama & Morawscyski, 2007).

Worldwide ICT spending accounted for $1.8 trillion in 1997; this is 6% of the aggregate global GDP and 40% larger than in 1992. The growing rate was 27% faster than the overall GDP which had been 5.5% annually (WITSA, 1998). An average growth increase in total factor productivity (TFP) of 1/3 % per annum based on ICT investments in industrial countries during 1995 to 2000 was estimated (Lam & Lam, 2005).The United States ICT investment recorded TFP of ½ % per annum during this period. It was also demonstrated in African countries that ICT investments increased TFP (Bollou & Ngwenyama, 2008).

The cumulative annual growth rate of investment in ICT in developed countries was 6 percent and 12 percent in developing countries between 1993 to 2001 (Zhen-Wei Qiang et al., 2004).The global annual growth rate of ICT investments peaked in 2004 at 12.3 % following a slowdown in 2002. ICT growth was moderated to 7.9 % in 2006 (WITSA, 2008).

There was a transition in global ICT investment in 2007. The economic recession in the US and other developed countries affected the ICT sectors. ICT investments during the period of 2007 to 2008 grew by 10.3% at considerably above economic growth rates in many countries (WITSA, 2008).The increase in ICT spending will enhance ICT production and use thereby contributing to economic growth (WITSA, 2008).

The increased global ICT penetration will support growth in ICT investments by 2011(WITSA, 2008).The demand for ICT products will decrease in developed countries due to slowing economies and the weak US dollar will encourage the exportation of ICT goods from US to emerging economies (WITSA, 2008). The total global ICT investments will be $ 4.4 trillion in 2011 compared to $2.1 trillion recorded in 2001 at a compound annual growth rate of 7.7% (WITSA, 2008). It is clear that ICT investment is an important element of the global economy. The ICT sectors are contributing significantly to the overall economic health of the global

economy. The positive impact of ICT investments on global economic growth in developed and developing nations has been established in most literature. However, the focus of this study is to investigate how investments in ICT contribute to intra- regional trade and development in African countries.

2.2 Dimensions of ICT Investment

This study will follow the comprehensive description of ICT investments by WITSA (2008) in order to gain a deeper understanding of the impact of ICT investments. The four dimensions of ICT investment are expanded on next.

2.2.1 Software Investment

Software spending is the total value of all the purchased software products including software packages, database systems, application tools, and utility software and programming tools in a country (WITSA, 2008). Software investments are growing rapidly and this is reflected in the large volume of software expenditure across the globe as many organizations and countries are investing strategically in software assets to gain a competitive advantage in the market place (Withey, 1996; Jorgenson, 2001).

The global information age has enabled the incorporation of high speed and low cost information technology components that provide new functions and offer value creation in the business processes. Software embodies these new value functions. For example, in the past few decades, India has remained as a major exporter of software in the international economy and the software industry remained a major export earner for the country (Arora & Athreye, 2002).

This is also evidenced when the world wide software expenditure was estimated to be more than US$ 800 billion annually (Boehm & Sullian, 2000).Software investments were classified into three different types-:pre-packaged, customised and own-account software. Pre-packaged software is licensed software that is sold in standard packages or electronic files. Customised software is a specific application software that consist of analysis, programming and design for user customization while own-account software is a software that is sold for dedicated application (Jorgenson, 2001).

2.2.2 Computer Hardware Investment

Computer hardware investment is the total computer hardware spending in a country.This includes purchased or leased computers, storage devices, memory upgrades, printers, monitors, scanners, input-output devices, terminals, and other peripherals from external agents (Kim et al., 2008 ; WITSA, 2008). The investments in hardware and software are interwoven as hardware infrastructure in terms of computers, servers and networks permits the exploitation of software investments (Armour, 2001). At country and organization levels, the impact of the computer oriented environment cannot be over emphasized. The world is changing and the use of computers in everyday activities is a global trend. This concept is true in every activity particularly in education, government and communities (Bocij, Chaffey, Greasily & Hickie, 2006).

The link between computers and other hardware devices such as printers, scanners, speakers and storage devices can be referred to as a computer network. These links allow computer devices and others to be shared more cost effectively. Computer hardware networks are based on local and wide area networks (Bocij et al., 2006). The local area network (LAN) is structured within a workgroup for a single office whereas a wide area network (WAN) is constructed for national and international workgroup such as the internet.

Computer hardware networks are providing organizations with computer-based information systems that improve their capability for response in a dynamic environment. Organizations and countries can operate effectively with the use of computers to provide better planning and forecasting, and to diminish the effect of potential problems. Computer hardware networks provide the interaction of data between people working in different departments of organization. Network serves as a regular and reliable means of data transfer among people (Bocij et al., 2006).

The increased hardware computerized systems and data transfer in the organizations have led to growing market for storage network in countries (Gibson & Meter, 2000). The computer storage networks are technology that optimizes the processing and storage of data (Wang, 2006). A computer storage network connects several network servers to a centralized group of disk storage

to maximize the computing power and storage virtualization to all users. These reduce cost, perceived complexity and ensure responsiveness and accessibility of data (Wang, 2006).

2.2.3 Internal Spending

This aspect describes the amount of internal software customization, capital depreciation, human capital development and IT related internal spending such as outsourced domestic and offshore IT consulting, computer systems integration, network systems integration, web hosting, computer disaster recovery, office automation, facilities management, equipment maintenance and other expenses that cannot be attached to a vendor (WITSA, 2008; Kim et al, 2008).

Internal spending refers to the amount spent on the quality of available human capital, skills and equipped workforce to achieve ICT innovation and productivity (OECD, 2004).It is the amount invested in human resource strategy to develop the necessary IT worker skills (Gera & Wulong, 2004; Giuri, Torrisi & Zinovyeva, 2008). This can be attributed to the investments in R&D portfolio, for process and product innovation (Lambertini, 2003).

2.2.4 Telecommunication Investment

Telecommunication investment is the amount invested on voice and data communications services in a country. Samoilenko & Osei-Bryson (2008a) refer to ICT investments as the total annual investments in telecommunication and human capital in the form of full-time telecommunication staff. Examples of telecommunication services are local and long distance wire- line telecommunication, wireless communication, paging, satellite communication, private line services and Internet. Examples of telecommunication equipment are wide area network (WAN) equipment, LAN equipment, modems, telephone handsets, IPPBXs, multiplexers and telephone answering machines(WITSA, 2008).

Investments in telecommunications bring together the expenditures by businesses, households, government and educational institutions on the public network equipment, private network and telecommunication services (ITU, 2007). The 1990s experienced a massive investment in the

telecommunication sector with the opening of competitive markets in the sector (Bollou, 2006). Telecommunication investments remain the largest aspect of ICT investments (WITSA, 2008).

2.3 Trade and Regional Integration in Africa

Trade is the exchange of goods and services between parties located within a given country. Trade exists as a result of specialization and division of labour. Trade occurs between regions because different regions have comparative advantages in the production of some tradable commodity (Christodoulou et al., 2006; WTO, 2008). Trade is one of the most important factors of globalization that offer the opportunities to improve the life of the people (Kabamba, 2008).There are two types of formal trade: Bilateral and Multi-lateral trade. Bilateral trade is the type of trade that exists between two traders while multilateral trade occurs between two or more traders(WTO, 2008).Trade per capita is estimated as an economy's total trade of goods and commercial services (exports + imports) divided by the population' (WTO, 2008). Trade to GDP ratio is estimated as an economy's total trade of goods and commercial services (exports + imports) divided by GDP (WTO, 2008).

In sub-Saharan Africa, there has been a long history of trade and regional integration since the wave of independence in 1960s. Several African leaders and policy makers have agreed to the importance of trade and regional integration. These agreements have yielded few results. It has not increased trade within the region or between the countries of the region (Radelet, 1999).

The intra-regional trade among the African countries has declined since 1970 as a result of economic instability, high tariff structures, poor business environment, small domestic markets and high indirect costs (IMF, 2008). Intra-African exports represented 8.7 percent of the region's total exports while intra-African imports represented 9.6 percent of total imports between 2004 and 2006(UNCTAD, 2009). This proportion of intra-regional trade was below the other regions of the world (UNCTAD, 2009).

Intra-regional trade is one of the cornerstones of economic development. It creates a larger regional economy from small and unequal national economies thereby promoting growth and sustainable development (IMF, 2008).The importance of intra-regional trade is to stimulate the production capacity and competitiveness through exposing the domestic industries to intra-

regional competition. This will facilitate the regions' ability to compete in international markets. The lack of ICT infrastructures poses as a significant barrier to a countries' ability to participate in ICT-enabled trade and regional outsourcing (Christodoulopoulou et al., 2006; UNCTAD, 2009).

Though, the proportion of intra-African trade has stabilized at about 10 percent in the early 2000. There was a decline in this figure towards the end of the period. The declined in this proportion was due to the fact that Africa's trade with the rest of the world increased much faster than intra-African trade (UNCTAD, 2009). For example, the intra-African trade between 1999 and 2006 increased by 13.64 percent on average while Africa's trade with US and china was 27.57 and 60.85 percent respectively (UNCTAD, 2009).The recent commodity boom in some sub-Saharan African countries has been improving the trade prospects of the region. African countries are well endowed with natural resources, yet the region is performing below its trade and export potential (IMF, 2008).

2.4 ICT Investments and Trade in Africa.

Over the past few years, international organizations such as ITU, IMF, World Bank and UN have been clamoring for investments in ICT for development in many countries. ICT spending has been used to foster economic and regional trade in both developed nation such as United States, and developing nations like South Korea, Malaysia and Singapore (Mansell, 1999; Wang, 1999; Avgerou, 1998; Ngwenyama et al., 2006).

The comparative study conducted in United States and nine OECD countries shows the contribution of ICT to economic growth (Colecchia, & Schreyer, 2002; Kuppusamy & Santhapparaj 2005). Several other studies have established the overall impact of ICT investments to trade and economic growth in developed countries (Lichtenberg 1995, Brynjolffson & Hitt, 1995, Lehr & Lichtenberg 1999 and Loveman, 1994; Manalo & Camacho, 2007). Trade is one of the cornerstones of economic development that promote growth and regional integration (IMF, 2008).Figure 2 below shows model of ICT investments and trade.
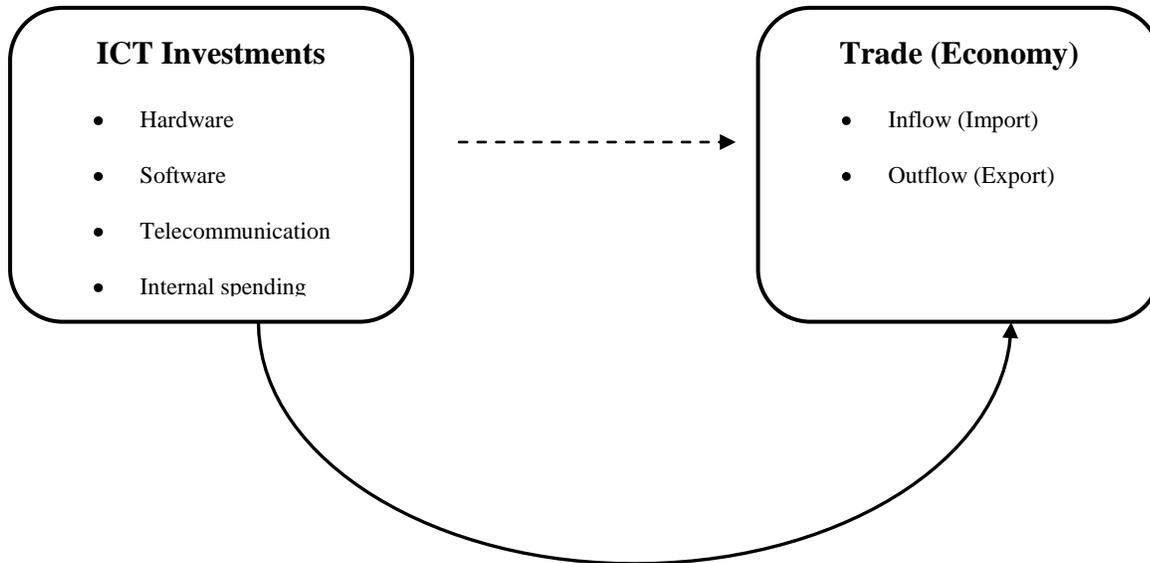
Figure 2: General Model for ICT investments and Trade (Colecchia & Schreyer, 2002).

There has been connection between trade and investments in technology (ICT) for development in both developed and developing countries (OECD, 2009).Despite this strong correlation between ICT investments and regional trade, there is low level of intra-regional development in Africa and little research existed in regard to this. This study is motivated by the following factors:

(a) The importance of ICT in aiding regional trade integration and economic development (Rodnik, 1998;Coe & Hoffmaister, 1999; Christodoulopoulou et al., 2006; IMF, 2008; Demirkan et al., 2009;UNCTAD, 2009; NEPAD ,2010; WTO,2008).

(b) The decline in formal regional trade in Africa since the 1970s (IMF, 2008; UNCTAD, 2009).

3.0 TRENDS AND PATTERNS OF TRADE FLOWS IN AFRICA

In this section, the trends and patterns of trade flows were analyzed using trend analysis. The attempt is to collect, compare the trade flows around the world and to spot a pattern or trend and the possible causes. Despite the campaign for regional trade in Africa, the proportions of intra-regional trade remains low when compared with other regions of the world (Figure 3).There was a declined in intraregional trade from the period of 1970s to a low point in 1978. The percentage of intra-African exports was 2.9 percent of total African exports. This recovered slowly till mid-1980s and increased towards the second half of 1980s and half of 1990s.
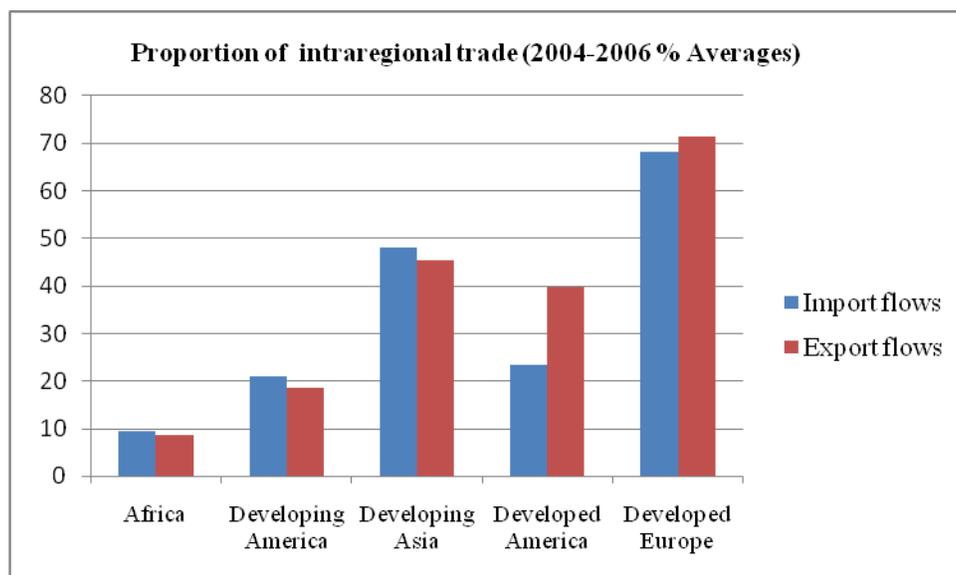

Figure 3: Proportion of Intra-African trade with other regions (Source: UNCTAD, 2008).

Several occurrences could explain the fluctuation (unstable decrease and increase) in intra-regional trade flow in Africa. The low level could be attributed to the trade links oriented towards Europe. This was inherited at independence-: most African countries had been producing commodities for colonial powers' industries. The situation as shown in the above figure is not particular to this period only. The period of 1960 till 2000 also had a lower proportion of intra-regional trade lower than 10 percent- as a result of colonial rule that was

extractive and outward oriented. African countries were not allowed to develop trade interaction among each other. The import substitution policies in 1960s and 1970s were centered on self sufficiency and not encouraging trade among African countries. There was a positive trend at the beginning of 1980s that can be explained as a result of the following factors: First, the introduction of structural adjustment programmes (SAP) by World Bank and IMF (World Bank, 1994). This opened up African economies through new business environment following the import substitution era. It also influenced more trade benefits among countries, though most, African countries were not able to fully gain from this development. A second factor is the abolition of apartheid in South Africa, which deepened the economic ties among its neighboring countries and intensified the creation of SADC, COMESA and RTA (Metzeger, 2008). Third, the liberalization of ICT policy in African countries encouraged investments in ICT infrastructure.
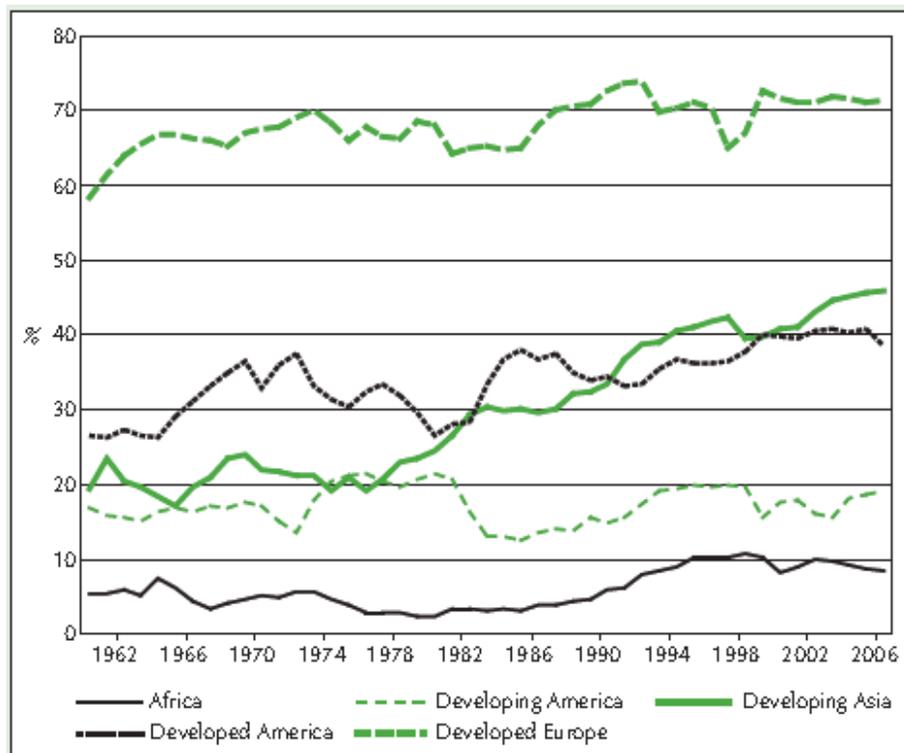

Figure 4: Trade flows in Africa and other regions (Source: UNCTAD, 2009).

In the year 2000, intra-African trade flow was stabilized at 10 percent with a slight decrease towards the end of the period. This occurred as a result of proportion of African's trade with the rest of the world that increased faster than intra-African trade. The intra-African trade between the years 1999 till 2006 increased by 13.6 percent, the Africa trade with United States was 27.6 percent while trade with China was 60.9 percent over the same period. From the figure 4 above, it is clear that the overall and comparative terms of intra-Africa trade shows a low level of trade within the region and globally. There existed some other factors to this occurrence such as small size of African economies, high trade cost, poor trade facilitating mechanism and poor economic policies (UNCTAD, 2009; IMF, 2008). Our interest is to assess the potential of increasing intra-African trade that will foster economic growth and development in Africa.

Dermikan et al, 2009 & UNCTAD, 2009 Studies suggest the process of reducing the barrier to intra-African trade through two approaches- Weak attraction forces and Strong opposing forces. *Weak attraction forces* is the barrier associated with individual country variation in population size, GDP, language, history while, S*trong opposing forces* is considered as high trade cost, described as the total cost incurred in getting goods to final destination. This involves soft, hard infrastructure and ICT (UNCTAD, 2009). This study will explore both weak attraction and strong opposing forces to investigate how investments in ICT will assist to reduce the trade barrier.

4.0 IMPACT OF ICT ON TRADE FLOWS IN AFRICA

Several studies on knowledge spillovers identified that knowledge acquired in one country has positive effects on other countries through trade (WTO, 2008; Dermikan et al., 2009).Diffusion of technology enhances trade flow based on the following: ICT enabled goods are more readily available for production, the technological specifications of goods developed abroad can be studied and the inherent knowledge can be acquired and trade favours interpersonal communications as a vehicle of knowledge transfer(WTO, 2008).

The lack of adequate technological infrastructure is one of the factors that caused high trade cost. The lack of ICT enabled systems caused inefficiency in border procedures such as lack of electronic systems for document lodging, lack of coordination in goods inspection, delay in duty

refunds, unstable opening times at the point of entry to mention a few. This led to inefficiency in customs procedure resulting in high cost of trade transactions (Gad, 2009; Njikeu et al., 2008).For example, the adoption of Automated System for Customs Data (ASYCUDA) in Ghana, Mozambique and Angola has reduced customs clearing time and improve the simplification of the procedure. This has generated 58 percent increase in customs revenue in Mozambique.

The availability of ICT infrastructure will help the landlocked countries in Africa to develop knowledge based economies which are less dependent on neighboring coastal countries. ICT will also promote service based trade such as electronic document processing, accounting, telephone based customer service and outsourcing among others.

5.0 FURTHER STUDY

As shown from the previous sections, the effect of investments in ICT is important in researching intra-regional trade flow. Our further study will explore ICT investments at national level so as to inform the African leaders and policy makers in decision making.

5.1 Research Approach

The underpinning approach for this future study will be partly deductive and inductive. Deductive research approach follows a conscious direction from a general law to a specific case. It involves the testing of existing theories thereby drawing logical conclusions (Chong Ho, 1994; Kovac & Spens, 2002).

Inductive research approach involves moving from specific case or several observations to general law (Kovac & Spens, 2002). Inductive reasoning do not necessarily rely on literature rather on the knowledge of the world that lead to emerging propositions and generalization in a theoretical framework(Kovac & Spens, 2002).In abduction research , the researcher aims to understand the phenomenon in a new way different from a conceptual framework (Danermark, 2001;Dubois & Gadde, 2002; Kovac & Spens, 2002). This result to specific situations that is different from the general structure of such framework. Abduction follows a process from rule to result, to case (Danermark, 2001).

Firstly, this study will employ a partially deductive approach as literature review shows that there is some logical relationship between ICT investment and trade. Secondly, the research will be inductive to further elucidate the impact of the dimensions of ICT investment on the components of regional trade. Theoretical propositions derived from the interpretation of empirical findings based on abduction derivation will ensue. Iivari & Huisman (2007), show that an empirical quantitative research method is appropriate for exploratory-theory building research.

5.2 Data Collection and Analysis

The study will use quantitative data collected from different data sources such as the ITU, WITSA, the World Bank and IMF databases. These databases are rich sources of secondary data that provide detailed current and historic information about the actual phenomenon. The ITU database provides the statistical data for the telecommunication sector for all countries (Bollou & Ngwenyama, 2008). World Bank and IMF provide general economic data and social indicators (Ngwenyama & Morawscynki, 2009). While WITSA database provides ICT data based on research of the International Data Corporation (IDC).The country level data will be collected from 1995-2007. This 12-year period experienced huge spending in ICT infrastructures in Africa (Bollou & Ngwenyama, 2008; Bollou, 2006). The following data will be collected for the countries: Trade statistics (export and import), ICT investments (hardware, software, telecommunications and internal spending).

 In an attempt to deal with contrasting countries that are different in size, population and level of wealth, this study will find a scale that will minimize the bias by using percentage rather than actual number values. The objective is that the percentage will minimize the bias associated with size and level of the economic development (Samoilenko & Osei-Bryson, 2008).Interpolation and extrapolation procedure will also be employed when there is missing data. Interpolation is the process of substituting the missing value by the value of the previous or the next year (Samoilenko, Ngwenyama & Osei-Bryson, 2006). Extrapolation is the process of plotting data and adding a trend line to the resulting graph where the data points represent the extrapolated value and the trend lines shows the effect of substitution (Samoilenko, Ngwenyama & Osei-Bryson, 2006). Due to the exploratory nature of this study, we would not propose any specific

hypotheses rather the data collected would be analyzed to explore the relationship between the dimensions of ICT investment and components of trade through the following analytical techniques:

5.2.1 Data Envelopment Analysis (DEA)

Data envelopment analysis (DEA) is a non parametric technique widely used by many researchers (Samoilenko & Osei-Bryson, 2008b; Samoilenko & Osei-Bryson, 2010).DEA is a frontier analysis originated from the work of Farrell (1957) and was later amended by Charnes, Copper, and Rhodes (1978) and Banker, Charnes & Copper (1984) to form two classical DEA models known as CRS (constant return to scale) and VRS (variable return to scale) respectively (Samoilenko & Osei-Bryson, 2008b).

DEA is a method used for measuring the efficiency of a decision making unit (DMU) (Samoilenko & Osei-Bryson, 2010). This method is well known for its effectiveness in measuring the relative efficiency of organizations and countries (Bollou, 2006).The advantage of DEA is its flexibility for several models and orientations thereby offering multiple vantage points (Samoilenko & Osei-Bryson, 2008b; Samoilenko & Osei-Bryson, 2010).There are three common types of DEA orientation models: input oriented, output oriented and base oriented (Charnes, Copper, Lewin & Seiford, 1994). This research will employ DEA to evaluate the efficiency of ICT investment utilization and effectiveness in promoting trade in Africa countries.

5.2.2 Cluster Analysis (CA)

Cluster analysis (CA) is a well accepted data technique that deals with the partitioning of a set of objects into clusters to enable similarities among observations within individual clusters (Wallace, Keil & Rai, 2004).

Cluster analysis may be used to enhance the performance of predictive modeling and decision making (DM) techniques when there exist several challenging patterns in the data (Samoilenko & Osei-Bryson, 2010). It identifies a set of groups and the matching description of each group. CA can be classified into hierarchical, deterministic and fuzzy (Samoilenko & Osei-Bryson,2008b).Cluster analysis will be used in this research to determine the similarities or

differences among the selected set countries in terms of their level of investments in ICT (i.e. homogenous or heterogeneous). It will also be used to improve the performance of decision making techniques.

5.2.3 Decision Tree (DT) Modeling

Decision trees (DT) can be described as a tree-like formation depicting a given decision problem such that each leaf node is connected to a value of a dependent variable and each non leaf node is connected to the value of one of the independent variables (Samoilenko & Osei-Bryson, 2008b; Samoilenko & Osei-Bryson, 2010). The formation of DT model is referred to as DT induction. DT induction algorithm partitioned data set into different subsets. The model consists of four components-root nodes, leaf nodes, decision nodes and branches. DT is widely employed in research for the purpose of classification and prediction (Samoilenko, 2008).

The two main types of decision tree are: classification tree and regression tree. Decision tree modeling will be used in this research to determine the aspects of ICT investment that are efficient in promoting trade and to provide insight into the nature of differences between the efficient and inefficient among the countries.

5.2.4 Structural Equation Modeling (SEM)

Structural equation modeling is a type of multivariate statistical analysis that enables the researcher to solve a set of interrelated questions in a single, orderly and comprehensive way.SEM allows one to conjecture the presence of relationships between multiple unobserved variables (latent variables) such that each latent variable is associated with multiple observed variables (Samoilenko, Ngwenyama & Osei-Bryson, 2006). In SEM equations, variables may appear as response or predictor depending on the level of influence on another (i.e. either directly or in-direct) (Samoilenko, et al., 2006).These are meant to represent a causal relationship among the variables in the model (Fox, 2002). SEM is used in social science research to determine the causal relationship among variables of observational data to facilitate the translation into data analysis (Fox, 2002). SEM was selected for this study based on the following: (Crowley & Fan, 1997).

- SEM express relationship among several variables either directly observed or unobserved while other univariate techniques examine one variable at a time thereby leaving some relationship unexplained

- SEM involves a confirmatory approach to data analysis i.e. the pattern of relationship among variables are specified a priori based on theoretical expectation.

- SEM is efficient in using empirical data for testing theoretical models. Other multivariate techniques are descriptive and exploratory. This made them less efficient for model testing.

The limitations of SEM is the sample size, it is assumed that sample size should be large enough so that the assumptions should be valid (Crowley & Fan, 1997; Weston & Gore, 2006).

The two common approaches to SEM are covariance based and variance based. These two approaches can be estimated using different methods such General Least Square (GLS), Ordinary Least Squares (OLS), Maximum Likelihood Estimation (MLE), Partial Least Square (PLS) and others (Samoilenko et al., 2006).

6.0 EXPECTED CONTRIBUTIONS

The study will

- Propose a framework for supporting ICT deployment in regional countries to improve trade flows

- Investigate how to increase regional trade through ICT investment

- Propose a strategy for seizing digital opportunities in regional trade

7.0 LIMITATION OF THE STUDY

Despite the major contribution of this study, there exist some limitations; the researcher identified that the trade data for this study is limited to the formal trading among the countries understudy. And lack of availability of ICT investments data in some countries in Africa. However, this limitation is not peculiar to this study alone but is characteristic to the research in this area in general. The political issues of the countries understudy are not taken into consideration.

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