

# THE IMPACT OF ICTs ON MDGs: CONTEXT FOR DIFFUSION AND ADOPTION OF ICT INNOVATIONS IN EAST AND SOUTHERN AFRICA

**Prof. Gabriel Kabanda**

Zimbabwe Open University

7<sup>th</sup> Floor Stanley House, Corner First Street/ J. Moyo Avenue

P.O. Box MP 1119, Harare, ZIMBABWE

Tel: 263-4-251873/793008-9

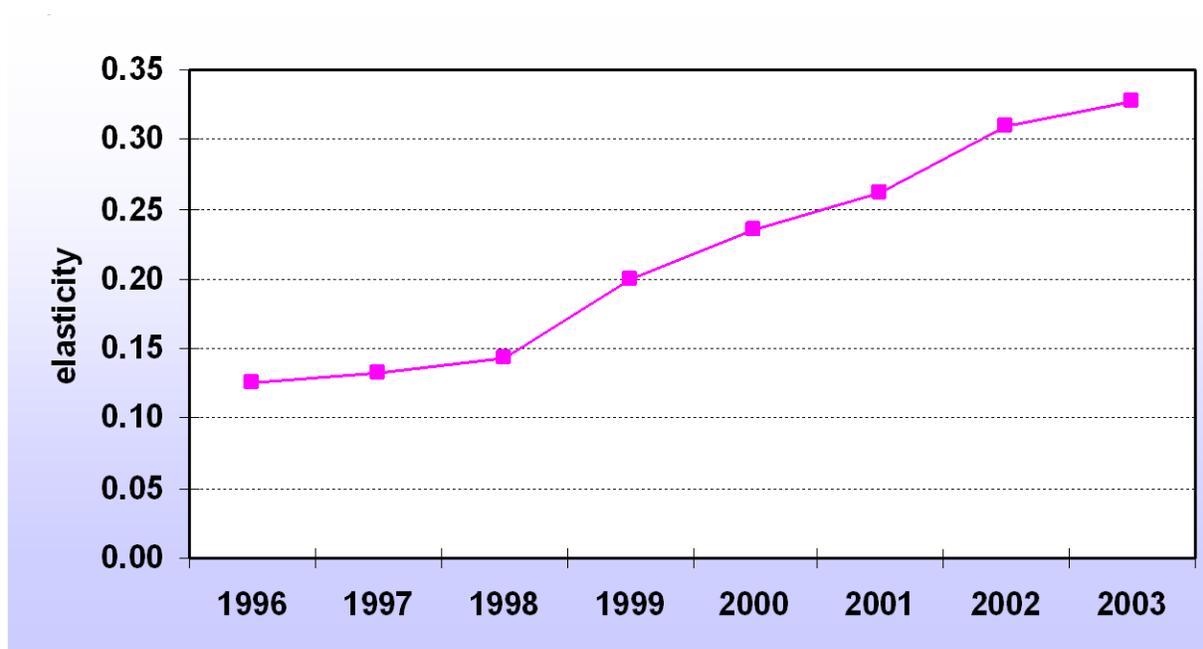
Email: [gabrielkabanda@gmail.com](mailto:gabrielkabanda@gmail.com) / [kabandag@zou.ac.zw](mailto:kabandag@zou.ac.zw) / [gabrielkaba@yahoo.com](mailto:gabrielkaba@yahoo.com)

## 1. Introduction

The major problem of underdevelopment in Africa characterized by the huge challenge to achieve the millennium development goals (MDGs) is on knowledge empowerment supported by information and communication technologies (ICTs). Information has become a strategic resource, a commodity and foundation of every activity. The emergence and convergence of information and communication technologies (ICTs) has remained at the centre of global socio-economic transformations. If implemented properly and carefully, these technologies could reduce or eliminate the imbalance between rich and poor, and the powerful and marginalized.

The productive capacity of a country is determined by the quantity and quality of its factors of production. **Infodensity** is the sum of all ICT stocks, mainly in the form of capital and labour. According to UNCTAD (2006), 1% increase in infodensity resulted on average in 0.3% increase in per capita GDP. The increase in infodensity over time is illustrated below in Figure 1.

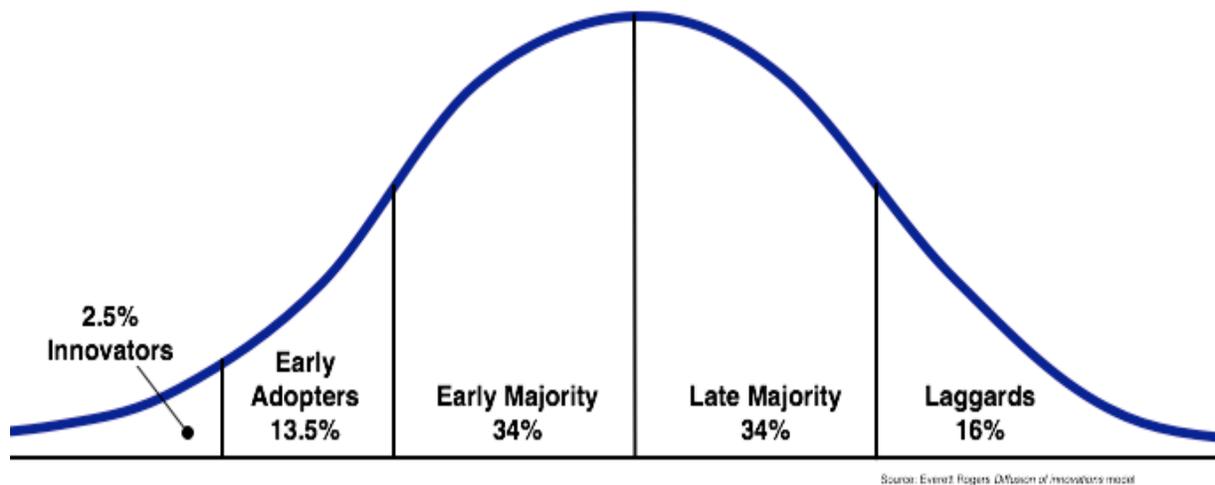
**Figure 1: Infodensity and increase in per capita GDP (UNCTAD, 2006)**



Baliamoune-Lutz (2003) conducted research using data from developing countries and examined the links between ICT diffusion and per capita income, trade and financial indicators, education, and freedom indicators. Internet hosts, internet users, personal computers and mobile phones represent indicators of ICT. It is important to assess the adoption and diffusion of ICTs in key sectors of the economies of Southern and East African countries, and to collate basic information about the actual and potential applications of ICTs in order to have a clear understanding of the specific policy environments and sustainable capacity requirements. Some researchers argue that the transfer of ICTs to developing countries may not contribute to economic development the same way it did in industrial countries, and that it may be best to localize technology and focus on its use in education (Baliamoune-Lutz, 2003) and sustainable development of economic growth.

Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication in that the messages are concerned with new ideas (Rogers, 2003:5). Innovations diffuse through a social system explained by the diffusion of innovation theory (Rogers, 2003). Diffusion of innovation is a theory that analyses as well as explains the adaptation of a new innovation. The purpose of this theory to the research is to provide a conceptual paradigm for understanding the process of diffusion and social change associated with ICTs. African countries are largely end consumers of technology and fall among the late majority (34%) and laggards (16%) with respect to ICT innovations. This is illustrated by the chart shown below as Figure 2.

**Figure 2: Rogers' bell curve**



Innovations that are perceived by individuals as having greater relative advantage, compatibility, trialability, observability, and less complexity will be adopted more rapidly than other innovations (Rogers, 1995).

The **major developmental problem** being faced by East and Southern African countries, which is the subject of focus for this paper, is multi-faceted and includes the following symptoms:

1. Many donor-driven initiatives, that excluded both policy-formulation frameworks and sustainable capacity-building, have not brought about meaningful development in these African countries.
2. The government policies, donor interest and community development needs are totally divergent with respect to priority areas for development.
3. Africa needs to break the underdevelopment, poverty and illiterate cycles in the long term and exploit the resources available to create wealth. Extensive investment in technology and human capital development as a vehicle to exploit the vast mineral and natural resources has not been given sufficient attention.
4. Poverty reduction requires a sustainable solution that increases production capacity at individual, institutional, community and national levels. The impact of ICTs on MDGs and generally economic growth needs a detailed assessment.

Some researchers argue that the transfer of ICTs to developing countries may not contribute to economic development the same way it did in industrial countries, and that it may be best to localize technology and focus on its use in education (Baliamoune-Lutz, 2003) and sustainable development of economic growth. The correlation between ICT use and economic growth is interrogated and the issue of the direction of causality is investigated. The **specific objectives of the research** are:

- to assess the impact of ICTs on MDGs;
- to ascertain the ICT impact on economic growth, and determine the pattern for diffusion and adoption of ICT innovations in East and Southern Africa; and
- to recommend a development model or a framework for economic growth for these African countries.

## 2. Literature review

The relevance and impact of ICTs to the MDGs, according to the International Telecommunication Union study (ITU, 2010), are tabulated below ([http://www.itu.int/ITU-D/ict/publications/wtdr\\_03/material/ICTs\\_MDGs.pdf](http://www.itu.int/ITU-D/ict/publications/wtdr_03/material/ICTs_MDGs.pdf)).

MDGs	Impact of ICTs
MDG 1: Eradicate extreme poverty and hunger	<ul style="list-style-type: none"> <li>• ICTs provide increased access to market information and reduce transaction costs for poor farmers and traders. ICTs create employment and increase wealth. Tele-work</li> </ul>

	<p>allows gainful work from home.</p> <ul style="list-style-type: none"> <li>• ICTs increase skills and productivity resulting in increased incomes.</li> </ul>
MDG 2 : Achieve universal primary education	<ul style="list-style-type: none"> <li>• ICTs increase supply of trained teachers though ICT-enhanced distance training. Distance learning helps in educational and literacy programmes in rural and remote areas.</li> </ul>
MDG 3 : Promote gender equality and empower women	<ul style="list-style-type: none"> <li>• ICTs deliver educational and literacy programmes specifically targeted to poor girls and women. Studies show females outnumber males in e-learning programmes. ICTs also empower women to work from home.</li> </ul>
MDG 4,5,6 : Health (child mortality, maternal health – reduce by 2/3 and 3/4, HIV/AIDS, malaria, etc. - halt and reverse)	<ul style="list-style-type: none"> <li>• ICTs increase access of rural caregivers to specialist support and remote diagnosis.</li> <li>• ICTs enhance delivery of basic and in-service training for health workers.</li> <li>• ICTs increase monitoring and information-sharing on disease and famine.</li> </ul>
MDG 7 : Ensure environmental stability	<ul style="list-style-type: none"> <li>• Remote sensing technologies and communication networks permit more effective monitoring, resource management, and mitigation of environmental risks. Steelwork obviates the need to travel, saves energy and reduces pollution.</li> </ul>
MDG 8: Global partnership for development	<ul style="list-style-type: none"> <li>• ICTs are extensively used in communication and nurturing of collaborative partnerships.</li> <li>• The regional collaboration strategy supported by ICTs covers: <ul style="list-style-type: none"> <li>○ humanware /social issues</li> <li>○ software-oriented technologies</li> <li>○ hardware-oriented technologies</li> <li>○ email styles and problems</li> <li>○ multimedia mail</li> <li>○ shared applications</li> </ul> </li> </ul>

Therefore, ICTs impact on all the MDGs in different ways. The fast track to the achievement of MDGs lies mainly in the ability to effectively manage the diffusion and adoption of ICTs for development.

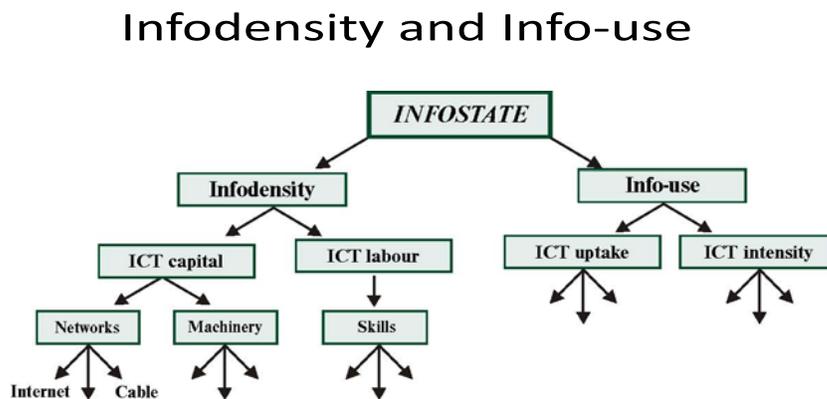
Debates have helped to uncover ways how information and communication technologies (ICTs) can help to alleviate poverty in low-income countries (Heeks, 1999). Advances in communication technologies have enabled many countries to improve the lives of their citizens through improved health, education and public service systems, and economies (Kekana, 2002). A knowledge economy requires:

- widespread access to communication networks;
- the existence of an educated labour force and consumers (human capital); and
- the availability of institutions that promote knowledge creation and dissemination.

A holistic approach to the information economy is required which provides information skills, communication skills and assistance with improving organic-, literate- and intermediate technology-based systems as well as the more obvious ICT-focused areas. A study conducted by Moradi and Kebryaee (2010) explored the impacts of ICT investment on economic growth in a cross-section of 48 Islamic countries using the data over the period 1995-2005. Panel data analysis was carried out to examine the factors affecting economic growth where the standard Solow growth model was extended to take into account the technological progress, embodied in the form of ICT investment and human capital in order to take the speed of convergence into consideration. The findings showed that the main engines of economic growth are ICT capital, non-ICT capital and human capital in a sample of 48 Islamic countries (Moradi & Kebryaee, 2010), where inflation was noted to have a negative impact on economic growth. ICT investment was found to have a stronger influence on economic growth in the sub-sample of 24 countries that have a relatively higher ICT opportunity index. Moreover, non-ICT investment was found to positively affect economic growth. However, neither openness nor population growth seems to have significant impact on economic growth, although the speed of convergence in both sub-samples was about the same (Moradi & Kebryaee, 2010).

A global set of indicators (*infostate*) showing how the availability of ICTs and access to networks can be a misleading indicator if it neglects people's skills, and if ICT networks and skills combined (*infodensity*) are not matched with a measurement of what individuals, business and countries actually do with such technologies (*info-use*), is worth further investigation in this study. This approach offers important perspectives into the central role that e-policies and knowledge have started to play in determining how countries will fare in the global competition to benefit from the information revolution and move away from poverty (Sciadas, 2003). A close correlation exists between infostates and per capita GDP. An initial study reveals that for every point increase in infodensity, per capita, GDP increases anywhere between \$136 and \$164 (Sciadas, 2003). The interrelationships between infostate, infodensity and info-use are illustrated in Figure 3 (Sciadas, 2003:10).

**Figure 3: Infodensity versus info-use**



As a result of the convergence of information, telecommunications, broadcasting and computers, the information and communication technologies (ICTs) sector now embraces a large range of industries and services. The potential of ICTs to transform development is now receiving greater attention worldwide. If ICTs are appropriately deployed, they have the potential to combat rural and urban poverty and foster sustainable development (Samiullah & Rao, 2000). Generally, investment in the development of the ICT infrastructure will result in improved economic efficiency and competitiveness; more efficient and effective education; healthcare and public administration; opportunities to exploit low factor costs in international markets; opportunities to increase social capital; and opportunities to bypass failing domestic institutions.

The African ICT environment and infrastructure faces tremendous challenges, as evidenced by a synopsis conducted for ICT indicators for Africa (Kabanda, 2008) which shows the following with regard to Africa:

- ⇒ Africa has the lowest growth in teledensity of any developing region in the world.
- ⇒ It houses 12% of the world population, but 3% of world's main telephone landlines.
- ⇒ The average level of income is the lowest in Africa, but the cost of installing telephone landlines is the highest due to the huge costs of civil works involved stretching over very long distances or in areas with a large geographical dispersion.
- ⇒ It has the highest profit per telephone landline and a long waiting period for telephone lines.
- ⇒ Internet connectivity makes up 1.5% of the world-wide connectivity.

Mobile phones may not just help create jobs and provide new sources of revenue for the state, but can also contribute to economic growth by widening markets, creating

better information flow, lowering transaction costs, and becoming a substitute for costly transportation that is lacking in rural Africa (Kyem & LeMaire, 2006). The rate of growth of cellphones in Africa has outpaced the growth rate of mainlines. The increase in mobile phone growth versus mainlines is phenomenal. The number of mobile subscriptions worldwide now exceeds five billion, ie more people today have access to a cell phone than to a clean toilet.

### **3. Methodology**

The research methodology describes ways of obtaining and analysing data to reach conclusions, thus building up empirical evidence to back up these conclusions. The methodology used was largely qualitative with regard to technology capacity needs assessment that covered six countries (South Africa, Kenya, Tanzania, Botswana, Zambia and Zimbabwe), and also quantitative with regard to GDP and infodensity covering 18 countries in East and Southern Africa. The 18 countries covered by the qualitative study are South Africa, Angola, Botswana, Burundi, D.R.C, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Rwanda, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe.

The **quantitative approach** involved the use of surveys and interviews regarding GDP and infodensity. The survey method used is good for comparative analysis, supplies a great deal of data in a relatively short space of time and is cost-effective. GDP and infodensity data was collected for 18 African countries to ascertain the link between ICT's diffusion and GDP density per country. Data was collected on **nominal gross domestic product** (GDP) of selected East and Southern African countries, ie the market-value of all final goods and services from a nation in a given year. The GDP dollar values presented here were obtained from the IMF (<http://www.imf.org/external/pubs/ft/weo/2009/02.weodata/index.aspx>) and are calculated at market or government official exchange rates by the International Monetary Fund (IMF). Values for 2009 and some of the 2008 values are estimates. The methodology for collecting data on infodensity is supported by secondary data covering East and Southern African countries. The GDP of Africa was 2.5% of the total GDP of the world in 2008, and was estimated to be 2.3% of the world GDP in 2009. Therefore:

**$GDP\ Density = GDP\ per\ capita * Number\ of\ people\ per\ square\ kilometre$**

Data on infodensity was obtained from the International Telecommunications Union (ITU, 2010).

**Qualitative research** was used to deepen our understanding of the link between diffusion of ICTs and economic growth. It is good to note that the Tripartite Summit signed in October 2008 provided a political framework for the alignment of various policies, initiatives, infrastructure, institutional arrangements and cooperation from the Common Market for East and Southern Africa (COMESA), East African Community (EAC) and the Southern Africa Development Community (SADC) member states.

The technology capacity needs assessment was conducted in institutions and regional bodies in Kenya, Tanzania, South Africa, Botswana, Zambia and Zimbabwe for the period December 2008 to December 2009. Data was collected from government officials, heads of institutions/organizations and experts in various organisations in East and Southern African countries. The capacity needs assessment was conducted in terms of the systems level, the entity level and individual human capital development needs. Capacity needs assessment included both the human capital development and social capital aspects in order to achieve sustainable information and communication technology capacity development. Human capital development is central to capacity needs. A training need exists when there is a gap between what is required of a person to perform their work competently and what they actual know. Interviews were conducted for the organizations and a questionnaire administered in the form of a capacity needs assessment questionnaire. Secondary data was also compiled and analysed. The following data collection techniques were used in this study:

- Formal meetings and focus group discussions
- Face-to-face oral interviews
- Questionnaires on capacity needs assessment
- Secondary data and records observation

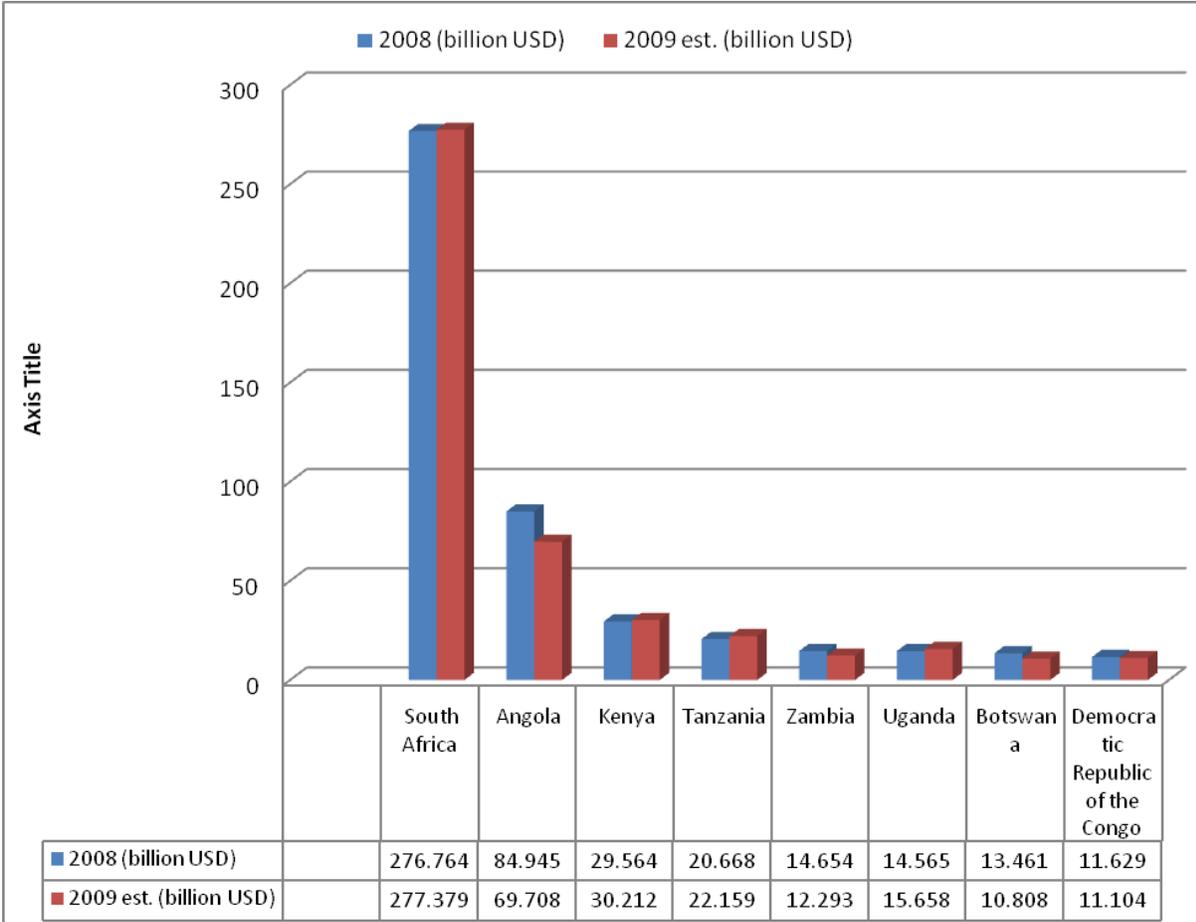
The face-to-face interviews allowed for the sharing of in-depth knowledge, helped to develop a bigger picture of ICTs for development and promoted networking. Focus group discussions were held with selected regulatory, training and research institutions to pick up grassroots input and in developing ideas, while sharing latent knowledge spontaneously on technological capacity needs assessment. Site visits were conducted in selected organizations and institutions. A structured questionnaire, the capacity needs assessment questionnaire, was administered in the same institutions in order to solicit detailed information in support of the interviews and focus group discussions.

## **4. ANALYSIS OF RESULTS**

### **4.1 GDP FOR SOUTHERN AND EAST AFRICA COUNTRIES**

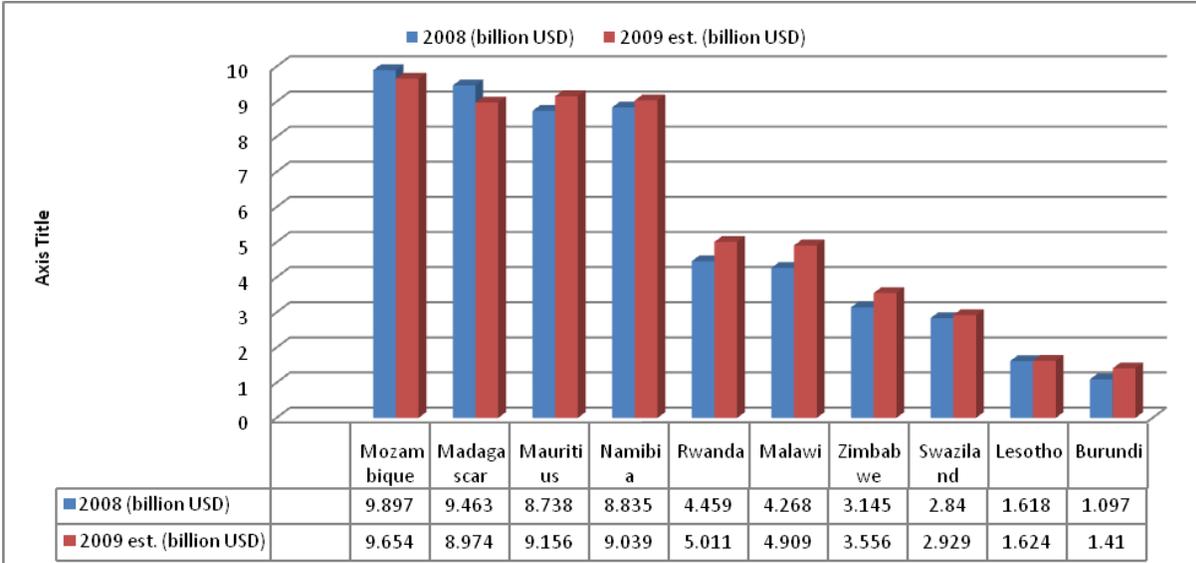
The world nominal GDP per capita for the year 2008 was US\$60,917.477 and for 2009 it was \$57,228.373. However, the total for Africa was only \$1,282.373 (2.11%) in 2008 and \$1,184.891 (2.07%) in 2009. The nominal GDP per capita for the 18 African countries in East and Southern Africa is shown below, with Figure 3 showing the top eight countries only. Notably South Africa leads all the countries by far, followed by Angola and then Kenya. The lower end in this group is made up by Uganda, Botswana and the DRC.

**Figure 4: Nominal GDP per capita for the period 2008-2009 for the top 8 countries**



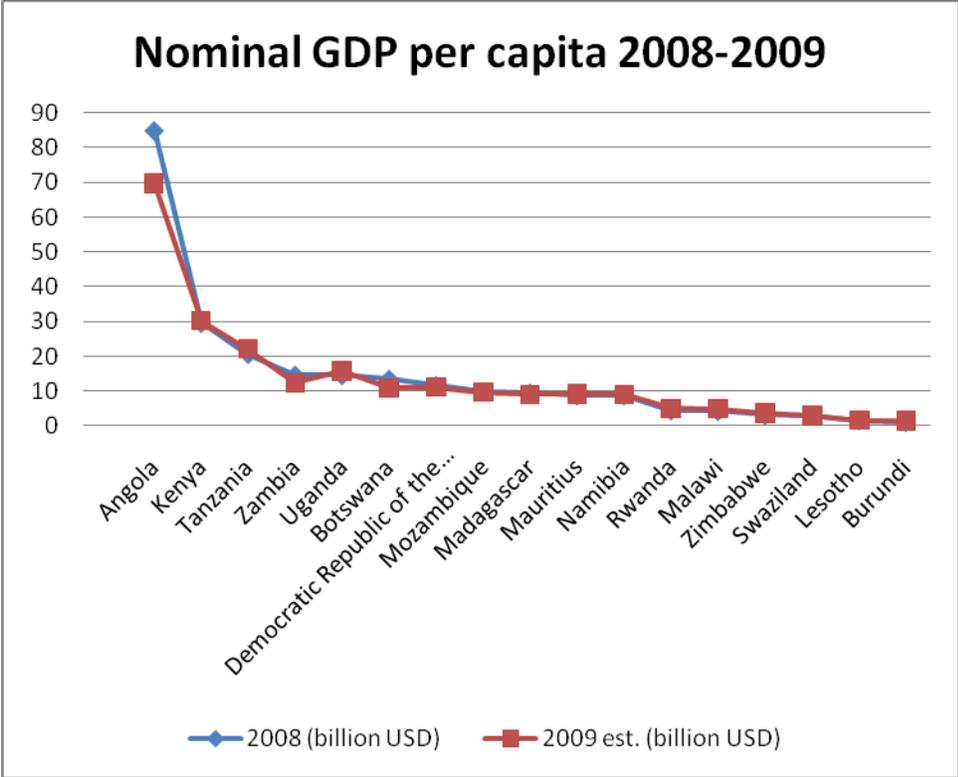
The diagram below (Figure 5) shows nominal GDP per capita for the period 2008-2009 for the bottom ten countries. At the head of these countries are Mozambique, Madagascar and Mauritius in that order. The lowest three in this group are Swaziland, Lesotho and Burundi.

**Figure 5: Nominal GDP per capita for the period 2008-2009 for the least 10 countries**



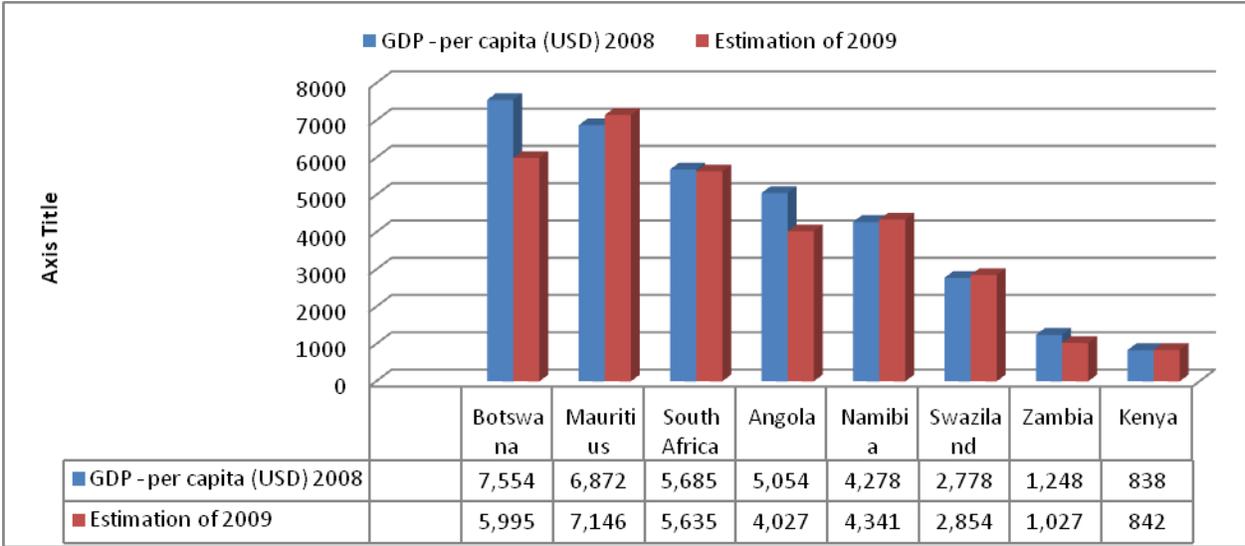
The nominal GDP per capita excluding South Africa is shown in Figure 6 below. Besides South Africa, Angola leads followed by Kenya.

**Figure 6: Nominal GDP per capita for 2008-2009 excluding South Africa**



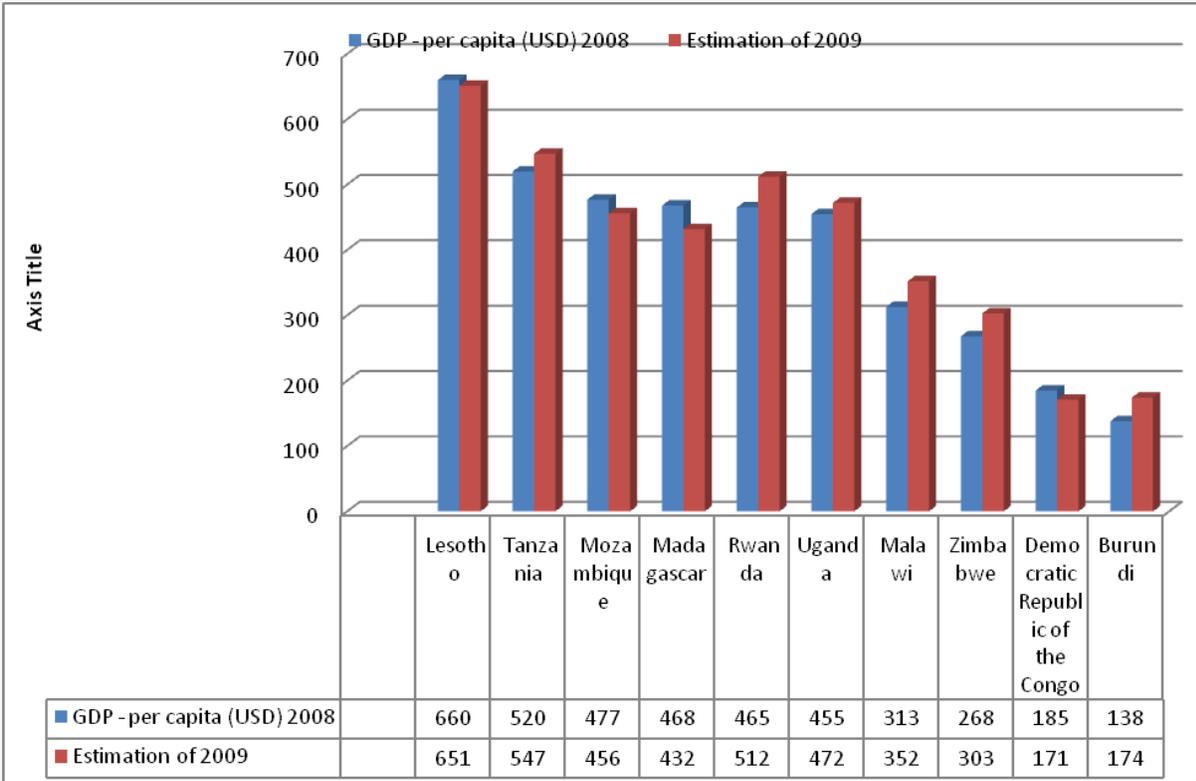
The GDP per person of the 18 African countries for the period 2008 to 2009, converted to US dollars through estimated IMF exchange rates, is shown below (Figure 7), showing the top eight countries only. Botswana, Mauritius and South Africa are the top three in that order, while Swaziland, Zambia and Kenya are the last three among the top eight countries with respect to the GDP per person.

**Figure 7: GDP per person for the period 2008-2009 of the top eight countries**



Similarly, the last ten countries with regard to GDP values are shown in Figure 8 below. The leading country in this group is Lesotho whilst Burundi is the last one.

**Figure 8: GDP per person for the period 2008-2009 of the lowest 10 countries**



Source: [World Economic Outlook Database for October 2009](#)

The ratio of GDP per person/nominal GDP per capita was analysed for the 18 African countries for the period 2008-2009 and the results are shown in Figure 9 below.

**Figure 9: GDP per person/nominal GDP per capita**



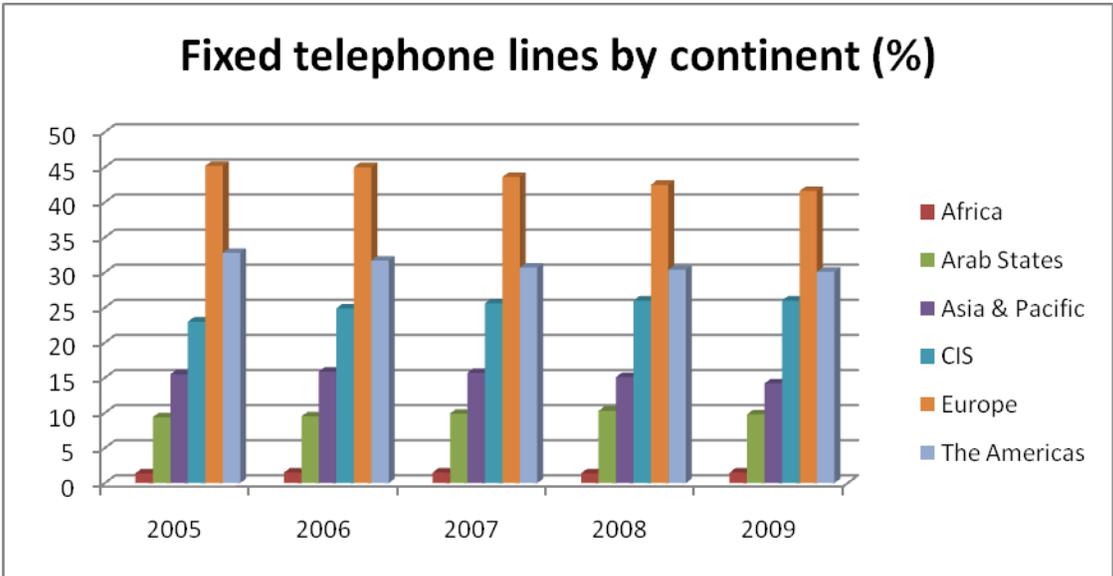
The strongest economies showing economic growth are South Africa, Angola, Kenya, Tanzania, Zambia, Uganda, Botswana, the DRC, Mozambique, Madagascar, Mauritius, Namibia, Rwanda, Malawi, Zimbabwe, Swaziland, Lesotho and Burundi, in that order.

#### **4.2 INFODENSITY FOR SOUTHERN AND EAST AFRICA COUNTRIES**

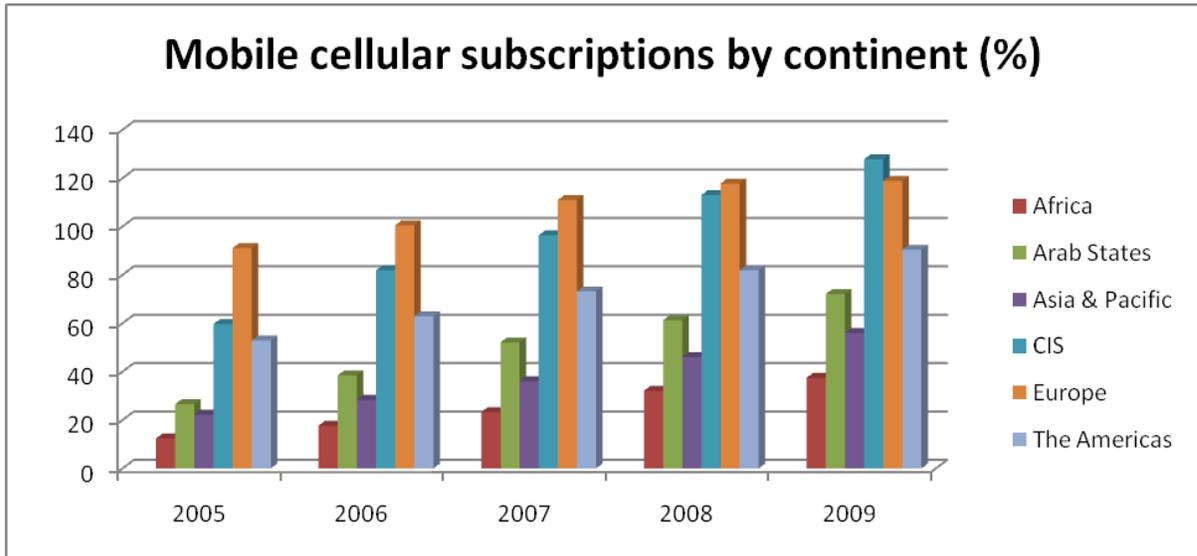
There is a close correlation between the country's infostate and GDP per capita. For every point increase in infodensity, GDP per capita increases by an approximate US\$150, rendering widespread, affordable access to information services an absolute imperative. The last decade has seen continual growth in infrastructure development and service uptake. Over the last five years, the ITU reports that developed and developing countries have increased ICT levels by more than 30%. However, notwithstanding the rapid expansion, to date access and adoption of internet services is

highly unequal across and within countries. Emerging countries face considerable challenges in broad-basing internet utilization for their growth and development on account of inadequate fixed-line infrastructure, and lack of supporting infrastructure, including electricity and steep prices of personal computers. An approximate 75% of the world populace, a large segment of which lives in emerging markets, consequentially have limited or no access to the internet. Data on infodensity was obtained from the International Telecommunications Union (ITU, 2010) and the analysis is shown below (Figures 10-14). The fixed teledensity by continent is shown in Figure 10, while the mobile cellular subscriptions (%) is shown in Figure 14. Both charts show that Africa has the lowest penetration ratio for fixed teledensity and mobile cellular subscriptions, respectively.

**Figure 10: Fixed teledensity by continent (%)**

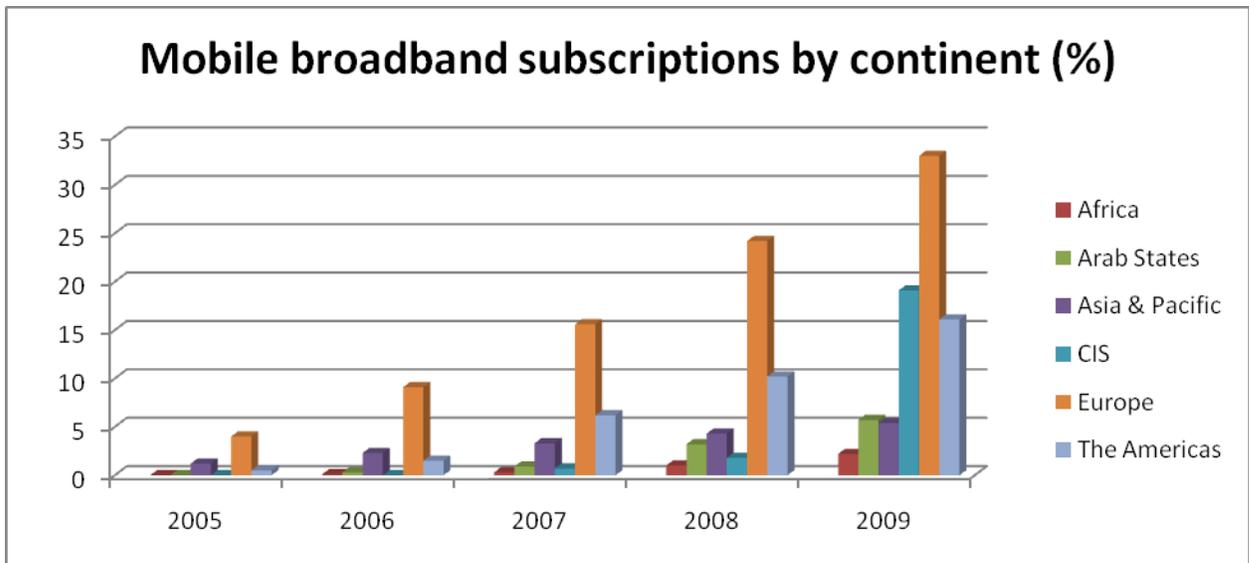


**Figure 11: Mobile cellular subscriptions by continent (%)**

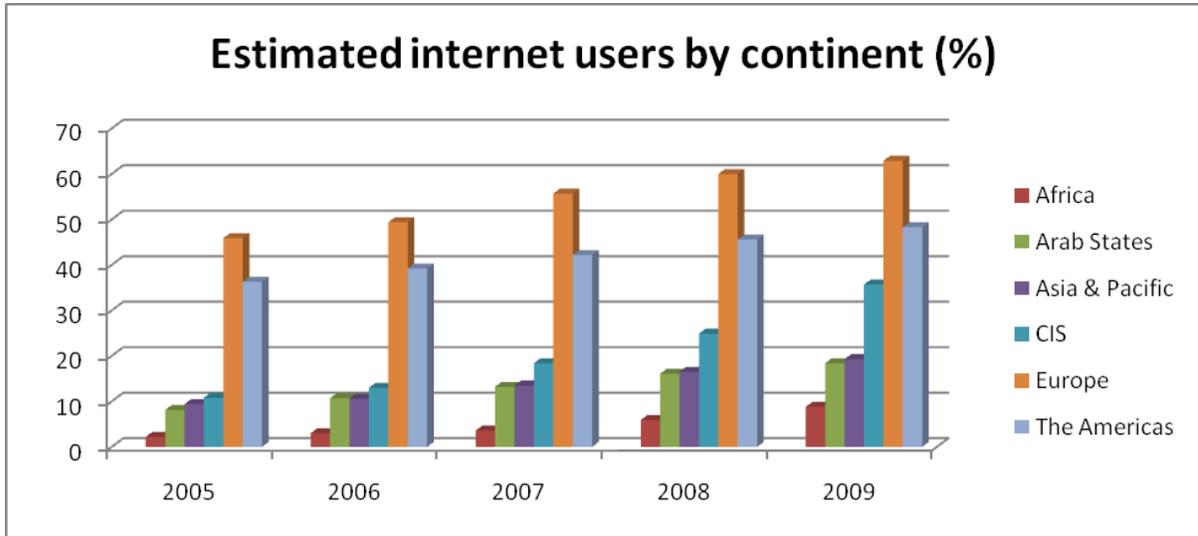


The mobile broadband subscriptions by continent are shown in Figure 12 below. Europe leads all other continents while Africa remains at the bottom end, with at most 2%. The same picture is reflected with regard to internet users (Figure 13). The fixed broadband subscriptions (Figure 14) show an even wider gap between Africa and other continents.

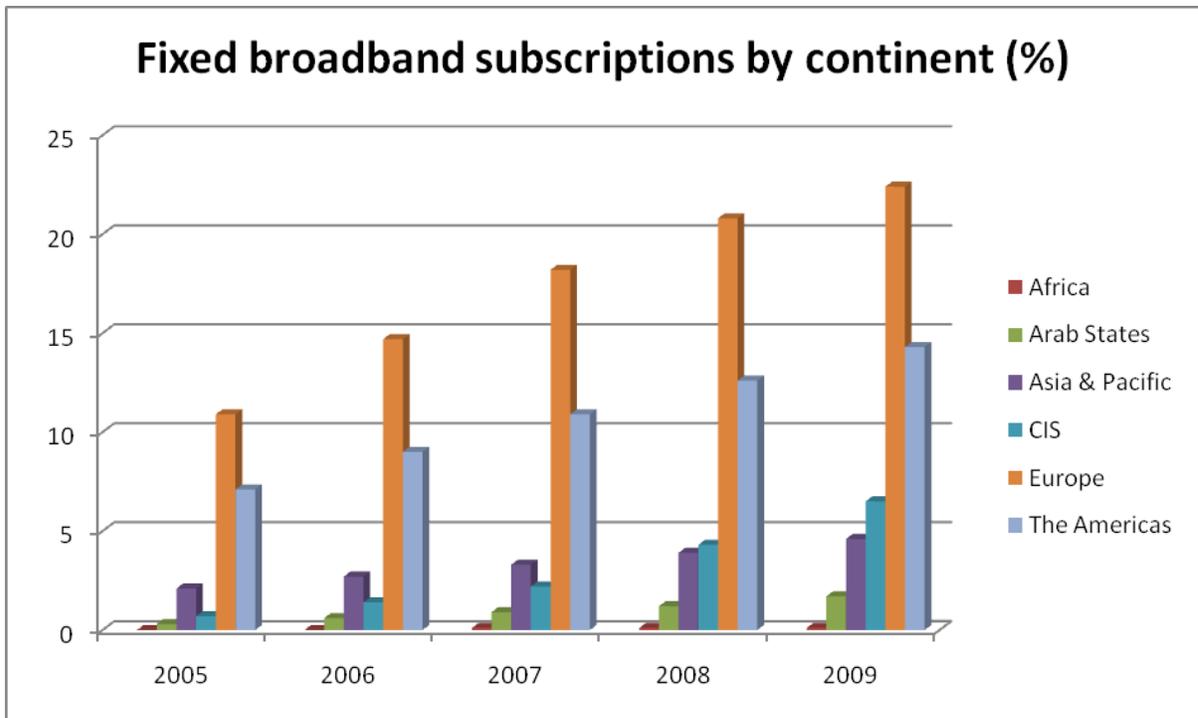
**Figure 12: Mobile broadband subscriptions (%)**



**Figure 13: Internet users by continent (%)**

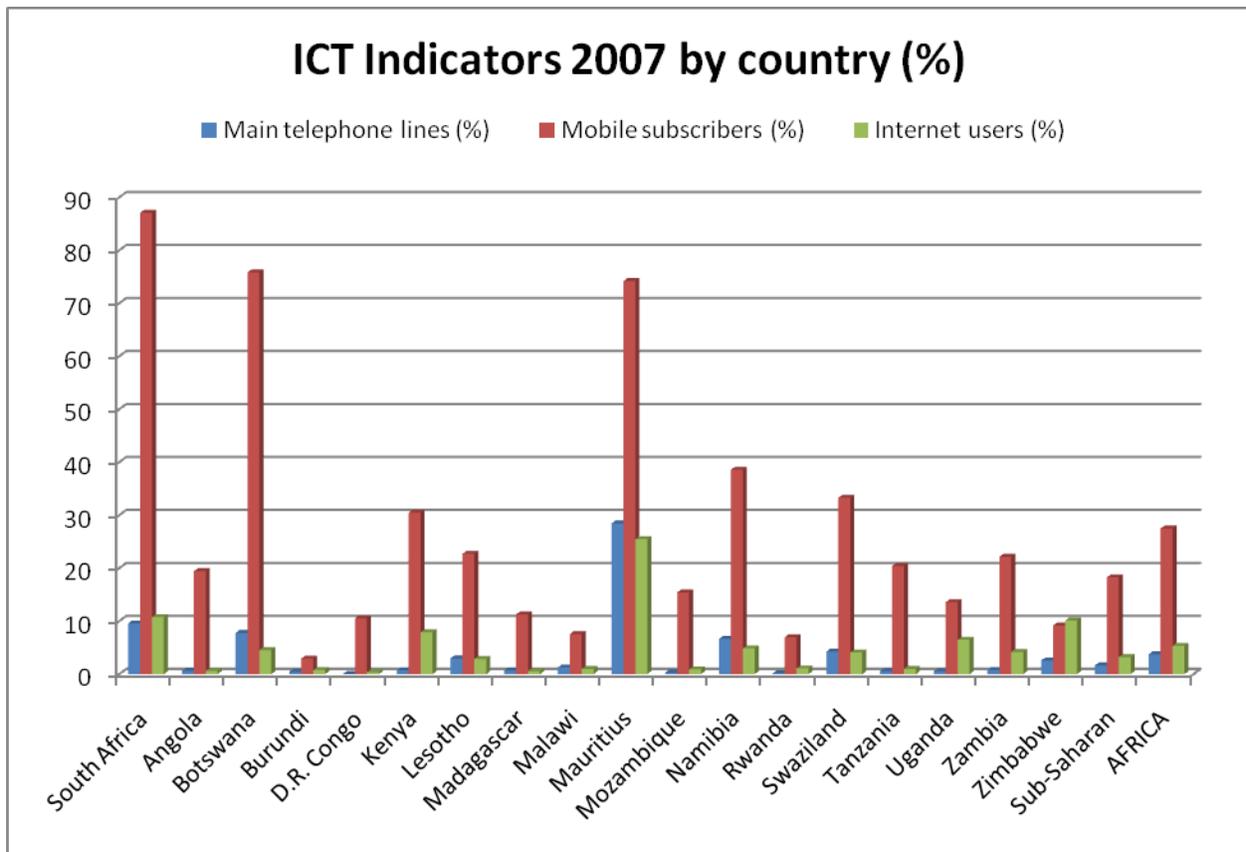


**Figure 14: Fixed broadband subscriptions by continent (%)**



The ICT indicators by country for the 18 East and Southern African countries are shown on Figure 15. South Africa has the highest number of mobile subscribers followed by Botswana and Mauritius. However, Mauritius has the highest density for main telephone lines and internet users.

**Figure 15: East and Southern Africa ICT indicators for 2007**



A summary of the statistics on infodensity as measured by the ICT indicators and the GDP per capita for the 18 countries in East and Southern Africa is shown on Table 1 below. The mean for the 18 East and Southern African countries with respect to main telephone density is 3.8%, for mobile subscribers it is 27.87%, and for internet use it is at 4.87%.

**Table 1: Descriptive statistics for East and Southern Africa**

	N	Minimum	Maximum	Mean	Std. Deviation
Main telephone lines (%)	18	0%	28%	3.80%	6.791%
Mobile subscribers (%)	18	3%	87%	27.87%	25.490%
Internet users (%)	18	0%	25%	4.87%	6.124%
GDP per capita 2008 (US\$)	18	138	7,554	2,125.33	2,554.349
GDP per capita 2009 (US\$)	18	\$171	\$7,146	\$1,996.50	\$2,349.695
Valid N (listwise)	18				

A one-sample T-test for the same data for the 18 East and Southern African countries is shown in Table 2 below. The 95% confidence interval for the lower and upper levels is also shown in Table 2.

**Table 2: One-sample T-test for East and Southern Africa**

	Test Value = 0					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Main telephone lines (%)	2.374	17	.030	3.800%	.42%	7.18%
Mobile subscribers (%)	4.638	17	.000	27.866%	15.19%	40.54%

Internet users (%)	3.371	17	.004	4.866%	1.82%	7.91%
GDP per capita 2008 (US\$)	3.530	17	.003	2,125.333	855.09	3,395.58
GDP per capita 2009 (US\$)	3.605	17	.002	\$1,996.500	\$828.02	\$3,164.98

### **Correlation between ICT indicators and GDP per capita**

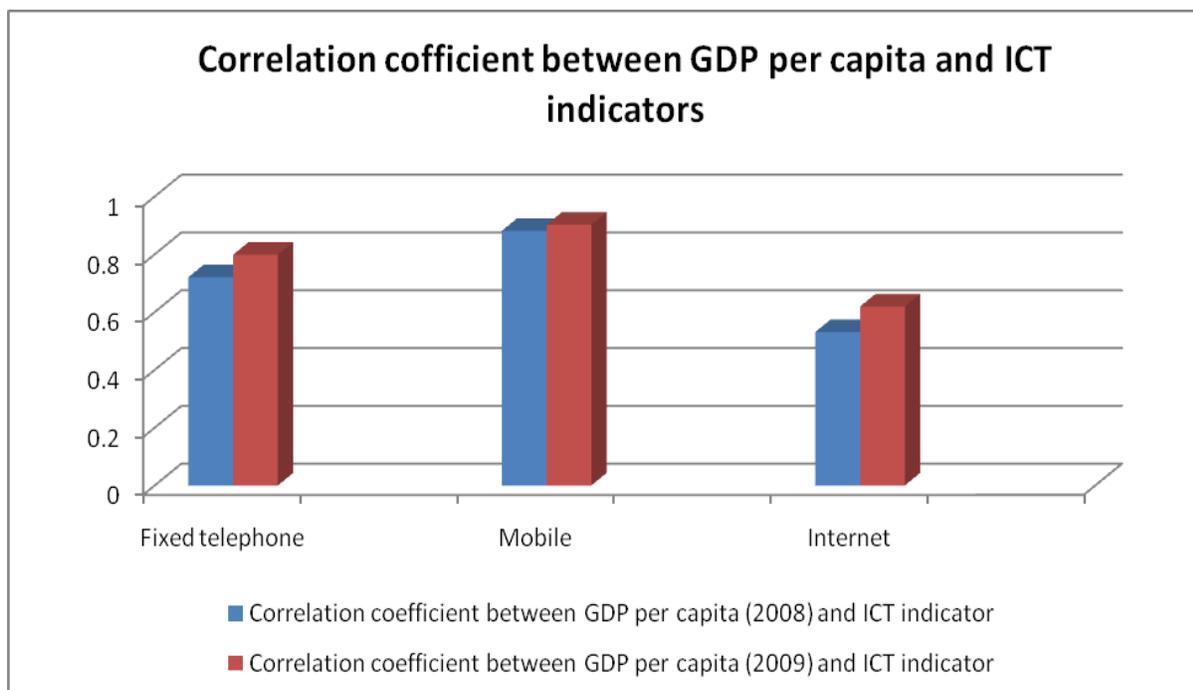
The correlation coefficients between the ICT indicators and the GDP per capita for both 2008 and 2009 are summarized in Table 3 below. The correlation coefficient between the main telephone lines (%) to the GDP per capita is 0.721 and 0.798 for the years 2008 and 2009 respectively. The mobile subscriber rate (%) is strongly correlated with the GDP per capita, showing values of 0.881 and 0.902 for the years 2008 and 2009 respectively. However, the correlation coefficient between internet use (%) and GDP per capita remains as low as 0.531 and 0.619 for the years 2008 and 2009 respectively.

**Table 3: Correlations between ICT indicators and GDP per capita**

		GDP per capita 2008 (US\$)	GDP per capita 2009 (US\$)
Main telephone lines (%)	Pearson Correlation	.721**	.798**
	Sig. (2-tailed)	.001	.000
	N	18	18
Mobile subscribers (%)	Pearson Correlation	.881**	.902**
	Sig. (2-tailed)	.000	.000
	N	18	18
Internet users (%)	Pearson Correlation	.531*	.619**
	Sig. (2-tailed)	.023	.006
	N	18	18

The correlation coefficients between the ICT indicators and the GDP per capita are shown in Figure 16 below.

**Figure 16: Correlation between ICT indicators and GDP per capita**



From the above chart (Figure 16), the correlation coefficient between GDP per capita and ICT indicators is highest with the mobile density (about 90%) and then followed by fixed telephony (about 75%), and lowest with internet penetration ratio (about 57%). Hence, the mobile density of a country in East and Southern Africa is a good measure of the relative proportion in terms of the GDP per capita.

#### 4.3 SUSTAINABLE TECHNOLOGY CAPACITY IN EAST AND SOUTHERN AFRICA

The ICT policy formulation process went through a due process in all the countries in East and Southern Africa, and its implementation is at various stages in the different countries depending on the availability of financial resources. Notable achievements have been made in ICT policies, coordination with national ICT committees, improvement of regional connectivity through coordination ministries, and access to information through the website, portals, SMEs, and so forth. ICT education and training are required to address the various e-skills opportunities identified in the public sectors. However, social capital/networks have not received much attention with respect to technological development and much work is required to establish basic e-business frameworks in all countries outside South Africa. Availability of electricity in remote parts of member countries has an adverse effect on the implementation of the telecommunications infrastructure. The convergence in ICTs is shifting the focus to infrastructure, protocols, applications and services (ERPs), and content as specific areas that need capacity-building initiatives.

ICTs affect all the MDGs. There is a strong correlation between ICTs and economic growth. The data collection techniques used in this study include formal meetings, oral interviews, questionnaires and records observation. The major components of the data collected included the identity of the institution, current capacity of the institution, current and future interventions in staff capacity development, the availability and status of the national/corporate ICT policy framework and progress towards its implementation, quality assurance philosophy and framework, and strategic programme development, management and reviews. The capacity needs of the national and regional institutions/organizations identified by the research is shown in Table 4 below. The research showed evidence of technological capacity with tremendous opportunities that can change the face of East and Southern Africa through identified public institutions in each of the countries covered by the research project. Table 4 below shows the ICT capacity needs components by country as identified by the research.

**Table 4: ICT Capacity needs components by country**

<b>Capacity Components</b>	<b>Country Regional / National Institution</b>
<i>Policy formulation and planning</i>	Kenya, South Africa, Tanzania and Zimbabwe
<i>Alignment of ICT infrastructure and facilities</i>	All countries in East and Southern Africa
<i>Legislative framework</i>	East African Community , COMESA, and SADC with support from government ministries in all countries concerned
<i>Establishing centres of excellence</i> <ul style="list-style-type: none"> <li>• <i>Centres of specialization</i></li> <li>• <i>Internationalization</i></li> <li>• <i>Professorial chairs</i></li> <li>• <i>Adjunct professors</i></li> </ul>	South Africa, Tanzania, and Zimbabwe through the universities/colleges
<i>Human capital development and institutional capacity:</i> <ul style="list-style-type: none"> <li>• <i>Staff development programmes</i></li> <li>• <i>Professional continuous development</i></li> </ul>	All countries in East and Southern Africa through the universities

<ul style="list-style-type: none"> <li>• Workshops/seminars/conferences</li> <li>• Digital libraries</li> </ul>	
<i>E-skills development &amp; ICT training</i> <ul style="list-style-type: none"> <li>• Short term</li> <li>• Long term</li> <li>• Open and distance learning</li> <li>• Professional continuous development</li> </ul>	Government ministries and universities in all countries in Southern Africa
<i>Collaborative framework &amp; research leadership</i> <ul style="list-style-type: none"> <li>• Collaborative networks</li> <li>• Research leadership training/mentoring</li> </ul>	South Africa, Botswana and Tanzania

All the six African countries covered by the qualitative research have national ICT policy frameworks which are in different phases of implementation due to challenges in the availability of financial resources. The common strategic areas of focus for meaningful ICT development in East and Southern Africa are summarised in Table 5 below and these form a basis for the goals and specific objectives for implementation (Government of Zimbabwe Ministry of ICT Strategic Plan 2010-2014, 2010).

**Table 5: Key areas for ICT development**

<b>KEY AREA FOR ICT DEVELOPMENT</b>
1. <b>Infrastructure establishment and development</b> , eg connectivity, fibre, VSAT, wireless, wireline, VoIP
2. <b>Human capital and social networks development (humanware)</b> , eg advocacy, skills, e-literacy, sustainable capacity-building, languages, curricula
3. <b>Governance</b> , eg policy frameworks, ICT bill, regulatory framework, corporate governance
4. <b>E-government &amp; e-business</b> , eg government portal, e-commerce frameworks, e-learning, national payment systems
5. <b>Application development</b> , eg innovation, animation, e-development
6. <b>ICT industry, investment &amp; partnerships</b> , eg PPPs, innovative SMEs, tax incentives
7. <b>Research and development</b> , eg research, cross- and multidisciplinary collaborative projects
8. <b>Security and quality assurance frameworks</b> , eg interoperability, quality of service
9. <b>Corporate services</b> , eg internal ministry support requirements, resource

It is envisaged that the above key areas for ICT development would change the landscape for sustainable ICT development in East and Southern Africa within a period of about five years, as the government support and commitment is very high in all the six African countries visited. The political will and common determination throughout the public institutions visited need to be maintained and developed further with the required resources for ease of implementation.

Human capital development is central to capacity development, as adequate human resources are an essential component of a nation's ability to carry out its mission. In pursuit of the broader objectives of the African Union to accelerate economic integration of the continent, with the aim to achieve economic growth, reduce poverty and attain sustainable economic development, the tripartite summit of the heads of state and government of the Common Market for East and Southern Africa (COMESA), East African Community (EAC) and the Southern Africa Development Community (SADC) met in Kampala, Uganda on 22<sup>nd</sup> October, 2008. The East African Community partner states have various advantages in terms of geographical proximity, common socio-cultural characteristics, and economic complementarities for maximizing the benefits from regional cooperation in the ICT sector. Regional cooperation in ICT does not only facilitate greater access to ICT infrastructure, but is also essential to promote trade, governance and ICT business opportunities within and beyond the region. Regional ICT special projects covers COMESA, IGART, and so forth.

ICTs have a tremendously important role to play in achieving the regional economic integration objectives of SADC, COMESA and EAC (<http://www.eac.int/treaty.htm>) which include the following:

- Promotion of sustainable growth and equitable development of partner states including the rational utilization of the region's natural resources and protection of the environment.
- Strengthening and consolidating the long standing political, economic, social, cultural and traditional ties between partner states and associations between the people of the region in promoting a people-centered mutual development.
- Enhancing and strengthening participation of the private sector and the civil society.
- Mainstreaming gender in all its programmes and enhancing the role of women in development.
- Promoting good governance including adherence to the principle of democratic rule of law, accountability, transparency, social justice, equal opportunities and gender equality.
- Promoting peace and stability within the region, and good neighbourliness among partners states.

## **5. CONCLUSION**

ICTs impact all the MDGs, especially in eradicating extreme poverty and hunger. The solution to poverty and hunger is not money but knowledge, hence the importance of human capital development national programmes focusing on sustainable social networks/capital to ensure empowerment of local communities and indigenous people. Revolutionary science and technology innovation at the lowest level of education, eg pre-school up to universities and colleges and then across all communities, is critical in the eradication of extreme poverty and hunger. Curriculum reviews for schools and universities in order to contextualize the technology diffusion and innovation within an African environment require urgent attention. Furthermore, the alignment of the infrastructure with equipment and facilities at schools, colleges and institutions that drive education for sustainable development, is equally important. ICTs are therefore key enablers in the generation and dissemination of knowledge, hence the achievement of the MDGs. In fact, ICTs contribute to economic growth as evidenced by the strong correlation between the GDP growth and ICT indicators. ICTs increase productivity through:

- better communication and networking at lower costs
- digitalization of production and distribution
- new trade opportunities through e-commerce
- access to knowledge
- increased competition

The mean for the 18 East and Southern African countries with respect to main telephone density is 3.8%, for mobile subscribers it is 27.87%, and for internet use it is at 4.87%. With the exception of South Africa, all the East and Southern African countries are among the late majority and laggards with respect to diffusion and adoption of ICT innovations, ie they are largely late end-consumers of technology that has been tried and tested in developed and some developing countries. The ICT capital comprises network infrastructure and ICT machinery and equipment. ICT and non-ICT factor inputs are combined to produce ICT and non-ICT goods and services, without a one-to-one correspondence. There is a strong correlation between ICT diffusion and high economic growth. The correlation coefficient between GDP per capita and ICT indicators is highest in terms of mobile density (about 90%), followed by fixed telephony (about 75%), and lowest in terms of internet penetration ratio (about 57%). Hence, the mobile density of a country in East and Southern Africa is a good measure of the relative proportion with the GDP per capita.

The methodology used was largely qualitative in terms of technology capacity needs assessment that covered six countries, and also quantitative in terms of GDP and infodensity covering 18 countries in East and Southern Africa. GDP and infodensity data was collected for 18 African countries to ascertain the link between ICTs diffusion and

GDP density per country. Policy-formulation frameworks and sustainable capacity-building provide a conducive environment for meaningful development in the SADC countries. Capacity needs assessment included both the human capital development and social capital aspects in order to achieve sustainable information and communication technology capacity development. Human capital development is central to capacity needs. There is a strong correlation between ICT diffusion and high economic growth. The solution to poverty and underdevelopment in African countries is knowledge and economic empowerment.

The East and Southern African countries covered by the study showed tremendous development potential, even though they are among the late majority and laggards with respect to technological innovations. The solution to poverty and underdevelopment in African countries is knowledge and economic empowerment. The recommended sustainable technology development using an African model is proposed with the following major components:

1. National human capital development programmes with a bias towards social networks/capital to ensure empowerment of local communities and indigenous people
2. Curriculum reviews for schools and universities to contextualize the technology diffusion and innovation in an African environment
3. A revolutionary science and technology innovation drive at the lowest level of education, eg pre-school up to universities and colleges, and then across all communities
4. Universitization of the entire education system where the academic leadership offered by academia and research institutions inculcates and influences the curricular of the entire education system in order to provide a meaningful contribution to knowledge
5. Alignment of the infrastructure and equipment facilities with schools, colleges, and institutions that drive education for sustainable development
6. Review of the legal framework and policy formulation mechanism with a view to rapid development initiatives
7. Establishing centres of excellence in specialised fields to provide leadership (academic, research and consultancy) on key developmental issues

## REFERENCES

- Baliamoune-Lutz Mina (2003), *An analysis of the determinants and effects of ICT diffusion in developing countries*, Information Technology for Development 10 (2003) 151–169 151, IOS Press.
- Government of Zimbabwe (2010), “*The Ministry of Information Communication Technology (MICT) Strategic Plan 2010-2014*”, Republic of Zimbabwe

- Government Printers, February, 2010.
- Heeks, R. (1999) 'Information and Communication Technologies, Poverty and Development'. Development Informatics Working Paper Series, Paper No. 5, June 1999, IDPM, Manchester. Available from: [http://www.man.ac.uk/idpm/idpm\\_dp.htm#devinf\\_wp](http://www.man.ac.uk/idpm/idpm_dp.htm#devinf_wp).
- International Telecommunications Union (2010), World Telecommunication/ICT Indicators Database: ITU, June, 2010. Available from: <http://www.itu.int/ITU-D/ict/statistics/index.html>.
- Kabanda, G. (2008), *Collaborative opportunities for ICTs development in a challenged African environment*, International Journal of Technology Management & Innovation, Volume 3, Issue 3 of 2008, pages 91-99, ISSN 0718-2724.
- Kekana, N. (2000) Information Communication and Transformation: A South African Perspective. Communication, Vol. 28 No.2, pages 54-61.
- Kyem, P.A. and LeMaire, P.K. (2006), "Transforming recent gains in the digital divide into digital opportunities: Africa and the boom in mobile phone subscription", The Electronic Journal on Information Systems in Developing Countries, EJISDC (2006) 28, Volume 5, pages 1-16.
- Moradi, M.A. and Kebryaee, M. (2010), "Impact of Information and Communication Technology on Economic Growth in Selected Islamic Countries". Available from: <http://www.ecomod.org/files/papers/987.p>.
- Rogers, E.M. (1995). Diffusion of innovations (4th edition). New York: The Free Press.
- Rogers, E.M. (2003). Diffusion of Innovations (5<sup>th</sup> Edition). New York. The Free Press.
- Samiullah, Y and S. Rao (2000) 'Role of ICTs in Urban and Rural Poverty Reduction'. Paper prepared for MoEF-TERI-UNEP Regional Workshop for Asia and Pacific on ICT and Environment, May 2000, Delhi. Available from: <http://www.teri.res.in/icteap/present/session4/sami.doc>.
- Sciadas G. (2003), "Monitoring the Digital Divide and beyond", The Orbicom project publication, in collaboration with the Canadian International Development Agency, the InfoDev Programme of the World Bank and UNESCO: Claude-Yves Charron, Canada, 2003 (ISBN 2-922651-03-7), page 10. Available from: <http://www.orbicom.uqam.ca>.
- UNCTAD (2006), The United Nations Conference on Trade and Development "The least developed countries report for 2006: developing productive capacities", Paper number UNCTAD/LDC/2006, United Nations New York and Geneva, 2006. Available from: [http://www.unctad.org/en/docs/ldc2006\\_en.pdf](http://www.unctad.org/en/docs/ldc2006_en.pdf).
- UNDP. (2001). Information communications technology for development. Essentials: Syntheses of Lessons Learned No. 5. [Online]. Available from: [http://www.undp.org/eo/documents/essentials\\_5.PDF](http://www.undp.org/eo/documents/essentials_5.PDF). Accessed on 28 September 2006.

UNESCO (2010), "Universities and the Millennium Development Goals Report 2007", Association of Universities and Colleges in Canada, WDI publication, presented at the Association of Commonwealth Universities conference, Cape Town, April 2010.

World Development Report (1998/99). The power and reach of Knowledge. [Online]. Retrieved 15 January, 2006 Available from: <http://www.worldbank.org/wdr/wdr98/ch01.pdf>. Accessed on 15 January 2006.

World Bank (2003). *Lifelong learning in the global knowledge economy: Challenges for developing countries*. Washington, DC: World Bank.

World Bank (2002). *ICT Sector Strategy Paper*. World Bank. Available from: [http://info.worldbank.org/ict/ICT\\_ssp.html](http://info.worldbank.org/ict/ICT_ssp.html)

World Development Indicators (2004). "E-Strategies: Monitoring and Evaluation Toolkit", The World Bank INF/GICT, Volume 6.1B, 3<sup>rd</sup> January, 2005. Available from: <http://www.worldbank.org/ict/>.