The last mile or the lost mile?
The information and knowledge society in Africa

by

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ABSTRACT

Many developed countries today claim the status of knowledge societies as they have invested heavily in human capacity building as well as the development of efficient information infrastructure and physical infrastructure comprising of a network of roads, railways, airports and harbours. However, for many countries on the African continent the 'last mile' to the information and knowledge society has the potential to become the lost mile as there is limited capacity building in African countries. These countries cannot successfully utilise their ICT infrastructure due to a shortage in human capacity and therefore have an inability to benefit economically from the application of modern ICT. It has become imperative that information infrastructure and physical infrastructure development go hand-in-hand with aggressive investment in human capacity building and development. Africa will only bear the economic fruit of investment in information technology if it is supported by the further development of its people with regard to literacy and education. Without these there can be very little economic progress or progression towards the information and knowledge society.

Keywords: knowledge society, development, capacity building, last mile problem, physical infrastructure, ICT infrastructure, human intellectual capability

INTRODUCTION

Benefiting from the process of globalisation and becoming an information and knowledge society, has become the vision of many governments throughout the world. It is clear that becoming an information and knowledge society is much easier for developed countries that

already possess some of the prerequisite criteria, such as an efficient and effective information and communication technology (ICT) and physical infrastructure combined with high levels of literacy and education (Webster, 2002; Britz et al, 2006; Forge et al 2009). On the other hand, for the developing countries that are still in the grip of the digital divide, the goal of becoming information and knowledge societies seem nearly unattainable. This digital divide and other barriers such as the overall health and education level of citizens exclude these countries from sharing in the benefits that ICTs can bring, benefits like assistance in advancing education, broadening access to educational resources, building new skills and improving quality of education (GESCI, 2008).

Developed countries have invested heavily in human capacity building as well as the development of an effective and efficient ICT infrastructure that is supported by a well established physical infrastructure comprising of road networks, railways, airports and harbours. Through the successful integration of the ICT infrastructure with their physical infrastructure these countries have an unparalleled competitive advantage that has fostered economic growth and allowed the global expansion of their marketplace. Travelling on this golden highway to the information and knowledge society has meant economic success for many of these knowledge societies (Holmner, 2008; Forge et al, 2009).

As mentioned above, for many developing countries in Africa it is still a highway less-traveled for various reasons. In many countries there is, for example, a lack of efficient and cost effective information infrastructure development. In many cases this goes hand-in-hand with an inability to benefit economically from the application of modern ICT. Furthermore, many African countries also have an under-developed and poorly maintained physical infrastructure as well as limited or no investment opportunities in building the intellectual capacity of their people (OECD, 2005/2006). If African countries do not start to invest more in the education of their people, and in particular in applicable research and development actions, these countries will continue to fall further behind economically, as well as run the risk of being excluded from the global information and knowledge society (Britz, 2007).

It is clear that most African countries understand the socio-economic benefits of modern ICT and have accordingly given it a higher priority (World Bank, 2009). World Bank (2009) research shows that African governments have started focusing on providing affordable ICT services to

their citizens in the hope that it will help them travel the road to economic growth and international participation. Zimbabwe, to name but one such a country, is currently in the process of passing legislation that would assist them in taking additional advantage of information and communication technology. A five-year ICT plan, starting in 2010, aims to deal with issues such as cyber-security, ICT utilisation and infrastructure development, e-business and e-government, and ICT investment and partnerships (Makoni, 2010).

Notwithstanding this big international push to provide Africa with more reliable and faster access to the Internet, many African countries are still suffering from an under-developed and in many cases poorly maintained physical infrastructure (OECD, 2005/2006, Kumar & Barrett, 2007). Escribano et al (2008) indicates that this under-developed infrastructure creates immense challenges for doing business and is found to lower firm productivity by approximately 40 percent. It was argued in a previous paper (Holmner, & Britz, 2010) that it has become imperative that information infrastructure investment should go hand-in-hand with aggressive physical infrastructure development. Africa will only bear the economic fruit of investment in information technology if it is supported by the further development of its roads, railways, airports and harbours. Without these there can be very little economic progress. However, these are not the only two pillars of the information and knowledge society that need serious attention in Africa. Knowledge forms the base on which this society is founded. Britz (2007) states unequivocally that knowledge is the chief facilitator of growth and economic development that will allow people in African countries to reach their full potential and assist these countries to become information and knowledge societies.

It is against this background that we decided to write this second paper. As with the first paper, we have two objectives in mind. The first is to illustrate that the well-published 'last mile' problem is in reality not related to an ICT deficit in Africa, but is related to Africa's under-investment in its human intellectual capability. This last mile traditionally refers to the final stage of connecting the user to a communication network. This has been very problematic for African countries in the past. However, the authors will show that African countries are paying attention to overcoming this technological last mile, but neglecting to invest in their countries intellectual capacity that will prevent them from taking the 'last' step towards the information and knowledge society. The second objective, which builds on the first, is to illustrate that the mere

investment in information infrastructure by African states will not bring about the desired economic growth – what is also needed is human capacity development.

With these objectives in mind the paper is structured in the following manner: In the first part we discuss the 'last mile' problem. We highlight in particular that this problem traditionally has only had an ICT infrastructure problem dimension. Flowing logically from this we focus our attention on the many new information infrastructure initiatives underway in Africa; including the new digital highway running through the continent and various mobile broadband technologies that will address the ICT 'last mile' problem. Some questions however remain: Is Africa committed in the same way to develop her human intellectual capability – or has this under-investment in education, research and development in reality become the 'lost mile'? Will it forever hamper African countries from becoming information and knowledge societies, even if the technological last mile is overcome?

The research method consisted of a qualitative review of literature combined with empirical data obtained from authoritative secondary sources, such as The World Bank and the United Nations. Literature consulted included bibliographic databases, citation indexes, journal articles, textbooks, and the internet focusing on ICT for development, local (indigenous) knowledge systems, global knowledge systems, globalisation, and the information and knowledge society. The literature review and secondary data provided the authors with the necessary understanding of the issues and debates in the area of information for development, and the study field surrounding the information and knowledge society to argue the need for human intellectual capacity in order to exploit information infrastructure fully.

THE TECHNOLOGICAL LAST MILE PROBLEM IN AFRICA

Traditionally, the 'last mile' is a communication phrase that has earlier been used in the telecommunications and technology industry to explain what technologies and processes are needed to connect the end user to a communications network (Rajakhyaksha, 2009). The phrase is often used in terms of the "last mile problem", since the final link between users and connectivity has proved to be inexplicably expensive and difficult to solve, especially in developing countries. From an information society perspective the last mile problem also poses great difficulties for countries to become part of the information and knowledge society, as an effective and efficient ICT infrastructure is one of the foremost pillars for such a society (Martin,

1995; Webster, 2002; Britz et al, 2006; Holmner, 2008; Forge et al, 2009). Furthermore, the principal vision of the information and knowledge society is founded on technological breakthroughs (UNESCO, 2005). These technological breakthroughs can thus not take place in many developing countries that are still faced with a last mile problem of getting users connected to a communication network.

An information and knowledge society should be inclusive and enable its citizens to actively partake in the sharing of knowledge (UNESCO, 2005). This notion relates to another important pillar of the information and knowledge society, namely human intellectual capability (Britz *et al*, 2006). The development of human and intellectual capital is one of the most imperative factors that aids development and economic growth. Intellectual capital is therefore one of the most important assets of an information and knowledge society. Urso et al (2009:353) elaborates further on this and states that the most significant resource the "next generation will have is the next generation itself: thus human capital". Knowledge, as represented by humans as intellectual capital, has always aided the economic development of a country and today countries are even more reliant on the creation, sharing and utilisation of knowledge (Urso et al, 2009). However, this capital cannot be utilised for economic growth and shared if the people in the country do not have access to an effective and efficient ICT infrastructure. This technological 'last mile' problem will thus hamper economic growth of a country as well as the sharing of knowledge and as James (2009) aptly states: "Knowledge sharing is power". This notion of knowledge sharing also relates to the second part of this paper since Africa has to ensure that there actually is knowledge to share through the investment in education, research and development (Britz, 2007).

As harnessing science and the power of ICTs can, both directly and indirectly, contribute substantially to realizing every one of the Millennium Development Goals, (UNESCO, 2009) it is imperative for solutions to be found for Africa to address this ICT related 'last mile' problem.

OVERCOMING THE 'LAST MILE' PROBLEM: GETTING AFRICA CONNECTED

Developed countries such as Sweden, Demark, and the United States (US), have a competitive edge in the global marketplace due to their early adoption and investment in modern ICT, supported by an existing and well-developed economic infrastructure. The Networked Readiness Index (NRI) of 2009-2010 lists these countries in the top 10 with regard to ICT

network readiness. These countries have thus overcome the 'last mile' problem as the end users in these countries are connected to a communication network. Other countries that make up the top 10 (in order) are: Singapore, Switzerland, Finland, Canada, Hong Kong, Netherlands and Norway (World Economic Forum, 2010). Unfortunately, no African country has been able to achieve a top ten position on this list, and the first African country listed on this list is Tunisia in the number 39 position. This demonstrates an inadequate network readiness of African countries who are still experiencing the last mile problem. To ensure global economic competitiveness it has therefore become imperative for African countries to not only invest in modern ICT, but also to understand the economic applications thereof. Unfortunately many African countries still have to overcome the 'last mile' problem and of the bottom 15 of 133 countries surveyed for ICT networked readiness, eight are from Africa. These are Malawi, Tanzania, Madagascar, Ethiopia, Cameroon, Burundi, Zimbabwe and Chad (World Economic Forum, 2010).

Fortunately, as discussed in previous research (Holmner & Britz, 2010), many other African countries have indeed woken up to the ICT call and have paid attention to solving the 'last mile' problem. There has been exponential growth in the development of Africa's ICT infrastructure and connectivity to the internet, due to large monetary aid from, amongst others, the World Bank, the G8 countries as well as the United Nations. As mentioned, Africa has also leapfrogged into mobile technology. The continent has emerged as a leader in the economic application thereof. Mobile technologies have radically changed not only the way in which people communicate but also how they do their work in Africa. It has made life easier, safer and to a certain extent, more prosperous (Sullivan, 2006; The Economist, 2009).

Numerous technologies have helped to bridge and solve the 'last mile' problem in Africa, of which the provision of broadband is one of the most important. According to Ajai Chowdhry co-founder of HCL Infosystems Ltd, and co-chair of the World Economic Forum (WEF) in Dar es Salaam, Tanzania last May, broadband should be made available right down to every village in Africa then you will see the continent be transformed (McKenzie, 2010). Some of these broadband technologies include:

- Provision of Wired broadband

  Broadband connectivity can be delivered to Africa in a variety of forms, for example wired broadband applications or wireless broadband applications. With regard to access to wired

broadband, NEPAD has established the NEPAD Broadband ICT Network (NBIN) initiative which aspires to make certain that most countries on the African continent have access to at least two independent international fibre cable links. This programme endeavours to connect all African countries to each another as well as to ensure worldwide connections through broadband fibre-optic submarine cables (NEPAD, 2009).

- Provision of Wireless broadband

  When it comes to the provision of wireless broadband, there are numerous options available in Africa of which WiMax and Satellite connection are the two most widely used technologies. WiMax stands for Worldwide Interoperability for Microwave Access and is an up and coming telecommunications delivery platform that can offer high-speed mobile wireless data over extended distances. Ghana has experienced an increase in Internet usage between 2000 and 2007 due to the roll-out of WiMax in mid 2006, starting with the capital city of Accra. Mobile WiMax has a further advantage in that it has the ability to be deployed in areas where there is no existing wired broadband and other telecommunications infrastructure such as cable broadband and DSL (SIPA, 2007).

  With regards to satellite broadband connections, Nigeria was the first country in Africa to have a satellite with four frequency bands which enabled the country to improve the business climate and indirectly improve poverty (Adelaja & Scott, 2007). The first thing that many travellers in Africa see in cities such as Kigali, Nairobi, Lagos, Dar es Salaam, Cairo, Kampala and many more is the proliferation of VSAT antennas on the skylines. VSAT is an acronym for Very Small Aperture Terminal which is a two-way satellite ground station antenna with a very small dish antenna. Satellite providers in Africa using this technology include: AfriConnect, BlueSky, Easycom, 3DTechnologies, Bytesyste-Africa, Ipwireless, Intercel, etc. When reading the webpage of African Satellite Internet Service Providers, it becomes clear that these satellite providers provide satellite internet services to the following African countries: Tanzania, Ghana, Zambia, South Africa, Kenya, Algeria, Tunisai, Libya, Malawi, Moszambique, Cameroon, DRC Gongo, Guinea and Madagascar (www.satsig.net). Satellite communication is therefore alive and well in Africa (Mbendi, 2010).

These initiatives indicate that Africa is starting to overcome the technological 'last mile' and is embarking on the digital highway. These efforts, if successfully applied, will not only narrow

the digital divide but can also help to reduce the continent's levels of poverty. However, as discussed in our previous research (Holmner & Britz, 2010) this highway is not without its potholes and tollgates and there are still some significant challenges and bottlenecks. Even with the above-mentioned access to wired and wireless broadband, Africa still lags behind other regions of the world in Internet access (ITU, 2009). Access to the internet on the continent is unevenly distributed and the provision of broadband connectivity is relatively slow with a low penetration rate. This is mainly due to high prices combined with limited availability. An appropriate information policy and regulatory framework is also still lacking.

Solid progress has however been made in the construction of the digital highway and there is adequate reason to be positive and optimistic about Africa's digital future.

AFRICA'S 'LOST MILE': HUMAN INTELLECTUAL CAPACITY AND KNOWLEDGE SHARING IN AFRICA

One of the big bottlenecks on this digital highway is, as indicated earlier, the lack of investment in human intellectual capacity. Even if the ICT 'last mile' problem is overcome, the question still remains whether Africa will be able to utilise this highway effectively for knowledge sharing, as Africa is truly knowledge poor (Britz, 2007). This question will now be explored. We start by discussing the need for investment in literacy and education, as a prerequisite to successfully become an information and knowledge society. Following from this we discuss some of the current African statistics with regard to human intellectual capacity as well as progress that Africa has made regarding the investment in her people over the last decade.

Within an information and knowledge society, effective education and training systems are vital to ensure economic competitiveness and social inclusion. This sentiment was endorsed by the WSIS in their declaration of principles, in which they recognise that education, knowledge, information, and communication are at the heart of human progress and their vision of a people-centred, inclusive and development-oriented information society (WSIS, 2003). Furthermore, education is, essentially, a fundamental human right, stipulated in Article 26 of the *Universal Declaration of Human Rights* (United Nations, 1948), which states that: "elementary education shall be free and compulsory, and that higher levels of education will be equally available on the basis of merit."

Seen from a development perspective, this undertaking was also re-iterated in 2000 by the *Dakar Framework for Action*, which was adopted by the World Education Forum in Dakar, Senegal.   In Article 6 of this framework, education is seen as, "the key to sustainable development and peace and stability within and among countries, and thus an indispensable means for effective participation in the societies and economies of the twenty-first century, which are affected by rapid globalisation." Thus, education is the indispensable means for investing in human intellectual capacity and for ensuring effective participation in the information and knowledge society.

Due to the efficient digital highway discussed above, information and knowledge is changing at a very fast pace. It is created and becomes obsolete at an even faster tempo (Nassimbeni & De Jager, 2000). Students in African countries need to acquire the skills to deal with these constant changes in knowledge, and for that they require literacy and education. According to Friedman (2005) an information and knowledge society will produce more highly skilled people by making primary and high school education mandatory. This will further address one of the eight millennium development goals of the Millennium Plan, namely universal elementary education (UNDP, 2003). Friedman (2005) goes further, stating that a tertiary education will become more and more critical the flatter the world gets, empowering more people to get a bigger slice of the complex economic pie. This argument is supported by Lor & Britz (2005) who are of the opinion that skilled people are a pre-condition for progression towards the information and knowledge society. How skilled are people on the African continent? According to the African Union (AU), Africa is still deficient in the utilisation of intellectual capabilities to deal with the continent's own challenges in a scientific manner (CfA, 2005). One way that this can be corrected is though the investment in education in African nations. There is no doubt that education has a momentous role to play in the development of skilled people on the African continent. Whether this development is with regard to industrialization, economic and social advancement, or cultural sophistication, education is the key (Onyango, 2009). However, many African countries are not investing as much as developed countries in the education of their people. When looking at the same eight African countries that are in the bottom 15 of 133 countries in the ICT Networked Readiness survey, this disparity in the amount of investment in education, is clear; Table 1 shows that all eight these African countries are investing a good deal less on education compared to the OECD average.

Table 1: African expenditure on education compared to the OECD average (United Nations, 2009; OECD, 2009)

Country / Region	Public expenditure on education 1999 – 2008 (% of GDP)
Malawi	4.2%
Tanzania	2.2% [1]
Madagascar	2.9%
Ethiopia	5.5%
Cameroon	3.9%
Burundi	5.1%
Zimbabwe	4.6%
Chad	1.9%
OECD	6.1%

As can be seen from Table 1, only four of the eight African countries, Burundi, Ethiopia, Malawi and Zimbabwe, are spending more than 4% of their GDP on education. Furthermore it is imperative to look at the literacy rates within these countries as knowledge sharing cannot be successful if the citizens within these countries cannot understand the information being distributed through an efficient digital highway discussed earlier. According to the UNESCO Institute for Statistics, (2007b), the average literacy rate for the world for the period 1995 – 2005, is 82.4%, for youths (15 years to 24 years) and adults (15 years +). The lowest literacy rate can be found in Burkina Faso, which only has an adult literacy rate of 12.8%. The countries with the highest literacy rates (99% and higher) include countries such as the United States, Norway, Hungary, Slovakia, Armenia and the Russian Federation, to mention a few.

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[1] 1999 – CIA World fact book

As can be seen in Table 2 the total youth illiteracy rates in many of these African countries are below that of developed countries such as the US and Norway, although at first glance they do not appear all that low. Unfortunately illiteracy rates like these create a mirage of literacy since they are not a true measure of what people can actually do with literacy and whether these citizens can truly understand the information they are confronted with (United Nations, 2008). Citizens of these countries are in many cases not in a position to exploit information, in other words, they cannot create, locate, use, and distribute global information to transform it into usable content (Holmner, 2008). In order to make use of existing global knowledge, communities need sophisticated skills that enable them to analyse, translate, and synthesise global knowledge (IKWW, 2002). The lack of these skills combined with the low investment in education results in a lack of human intellectual capacity in these countries. This makes it very difficult for African countries to utilise all the ICT initiatives and technologies that will help ensure economic competitiveness and social inclusion.

Table 2: African countries youth illiteracy (15 – 24 years) rates: 2005 – 2008 (African Economic Outlook, 2009)

Country	Total youth illiteracy rate (%)	Male (%)	Female (%)
Malawi	25.5	16.8	34.3
Tanzania	6.9	5.4	8.4
Madagascar	16.6	14.0	19.3
Ethiopia	39.0	34.2	43.7
Cameroon	7.2	6.2	8.3
Burundi	30.6	30.8	30.3
Zimbabwe	1.8	0.7	2.9
Chad	25.6	20.8	30.3

Numerous initiatives are in place to to decrease these illiteracy rates on the African continent. These initiatives aim to improve literacy rates, especially female literacy rates. These initiatives show a commitment by the countries in Africa to seriously improve their investment in human intellectual capacity. Through these and other initiatives, Africa is trying to find and utilise the 'lost mile' to the information and knowledge society. The most notable initiatives and programs are:

- UNESCO has implemented the LIFE (Literacy Initiative for Empowerment) project. LIFE will be implemented in 35 countries, where either the literacy rate is lower than 50% or there is a population of more than 10 million citizens without literacy competencies. It will be implemented, over a 10-year period, starting in 2006, and ending in 2011 with the evaluation and assessment of the project. Since 2003, the United Nations has made the needs of adults and the goal that people worldwide should be able to use literacy to communicate, a decade-long effort. For this reason the theme for the United Nations Literacy Decade (2003-2012) is, "Literacy for all: voice for all, learning for all." Unfortunately, literacy is still a dream that is unattainable to many. According to UNESCO, more than 780 million of the world's adults are still regarded as being illiterate and cannot read, or even write, their own names (UNESCO, 2006)

- Through the Africa Education Initiative, USAID hopes to enhance access to literacy and quality education through supporting the tuition of new teachers as well as by providing textbooks and scholarships for the youth. The President's Africa Education Initiative (AEI) focuses on escalating access to basic education of high quality in 39 sub-Saharan countries (USAID, 2008).

- The Secondary Education in Africa (SEIA) initiative of the Africa Human Development Department of the World Bank. SEIA has provided eight studies focused on secondary education in Africa, a reassessment of educational trends in industrialized countries, as well as three regional education and training conferences (Kampala 2003, Dakar 2004, and Accra 2007). Furthermore SEIA aims to encourage discourse among African countries and the global international donor society on the choices available for expanding African education and training systems (World Bank, 2010).

- The World Literacy Initiative is a 501 (c)(3) private, non-profit, non-governmental organization (NGO) that is situated in Atlanta, Georgia in the United States. Its primary

mission is towards improving literacy and basic education throughout the developing world, especially throughout sub-Saharan Africa (World Literacy Initiative, 2010).

Apart from these literacy initiatives mentioned above, there are also various projects and initiatives aimed at intellectual capacity and skills development in Africa. For example:

- Nathan Associates' Southern Africa Trade Facilitation and Capacity Building project. This project is aimed at capacity building of ten African countries, namely Zambia, Angola, Tanzania, Botswana, Swaziland, Lesotho, South Africa, Malawi, Namibia and Mozambique. This project has resulted in the publication of "Inside Southern Africa Trade", a journal aimed at sharing knowledge concerning African trade issues (Nathan Associates Inc, 2010).

- The African Capacity Building Foundation (ACBF) was established in 1991 as a response to Africa's relentless capacity needs as well as the challenge of investing in indigenous human capital in Sub-Saharan Africa. This foundation has already funded 233 capacity building projects in 44 African countries, as well as the establishment of 27 independent think tanks across Africa (Speer, 2010).

- The African Leadership Capacity Development project implements capacity development programs in Africa that supplies information, training, education, and strong support networks to the youth of Africa. This project aims to create a global network of professionals, intellectuals and scholars that are African as well as non-African. This network will facilitate discussion and the dissemination of ideas that can assist in the harnessing of Africa's intellectual capacity (The African Leadership and Progress Network, n.d.)

It is hoped that through initiatives like these and numerous other programs on African regional level, the human capacity of people living on the African continent will be improved. Through the education of Africa's children we will ensure that the next generation will be able to effectively generate and utilise knowledge that will foster economic growth and development (Britz, 2007).

CONCLUSION AND THE ROAD AHEAD

The information and knowledge society, which is characterised by globalisation and advanced capitalism driven by ICTs, has led to numerous advantages such as advancing education,

broadening access to educational resources, building new skills and improving quality of education. These advantages however cannot be shared by many countries on the African continent, as they are not equipped with a sophisticated and well developed information infrastructure, and as we have argued, cannot economically benefit from knowledge sharing through the utilisation of such a digital highway as many African countries have limited intellectual capacity.

Africa is on the right track regarding her economic understanding and subsequent commitment to the development of both the information as well as physical infrastructures. Based on our interpretation of the available data concerning African countries' intellectual capacity, it is however a question of whether Africa will get 'lost' on the intellectual capacity leg of the last mile. As has been pointed out in this article as well as in our previous research, many African governments are focusing on and prioritising ICT development. Most of these initiatives are well funded by international role players and it is predicted that Africa will soon have much wider access to broadband through technologies such as WiMax and Satellite broadband. Overcoming the digital last mile as we have pointed out is a reality and there is enough reason to be optimistic about Africa's digital future. This is however not the same with regards to the investment in Africa's intellectual capacity. It was shown through statistics in this article that the same financial commitment in human intellectual capacity building by developed OECD countries is not evident in countries on the African continent. This has resulted in many African countries living in absolute knowledge poverty. As discussed many African countries are however committed to improve this situation through initiatives that aim to improve for example literacy rates, especially female literacy rates.

Being digitally connected has already contributed significantly to socio-economic development in Africa – and will continue to do so in the future. It is however not enough and will not bring the full benefits of the information and knowledge society. What is also needed is an increase in investment in human intellectual capacity. This will not only link African countries more effectively but will also facilitate knowledge sharing with the rest of the world. Many funding organisations such as The World Bank and USAID have initiated intellectual capacity building projects and it is hoped that through projects like these, Africa will be able to find and utilise the 'lost' mile to the information and knowledge society, and benefit from all the advantages associated with it.

REFERENCES

Adelaja, A. & Scott, C. 2007. Satellite launches boost African communications. [Online]. Available WWW: http://www.scidev.net/en/news/satellite-launches-boost-african-communications.html (Accessed 6 August 2010).

African Economic Outlook. 2009. *Data & Statistics*. [Online]. Available WWW: http://www.africaneconomicoutlook.org/en/data-statistics/ (Accessed 9 August, 2010).

African Union. 2009. *The AU/NEPAD AFRICAN ACTION PLAN 2010 – 2015. Advancing regional & continental integration in Africa*. [Online]. Available WWW: http://www.africapartnershipforum.org/dataoecd/27/33/44326724.pdf (Accessed 20 January 2010).

Britz, J.J. 2007. The joy of sharing knowledge - but what if there is no knowledge to share?: a critical reflection on human capacity building in Africa, *International Review of Information Ethics*, 7 (web based publication). [Online]. Available WWW: http://www.i-r-i-e.net/inhalt/007/02-britz.pdf (Accessed 9 August 2010).

Britz, J. J., Lor, P. J., Coetzee, E. M. I. & Bester, B. C. 2006. Africa as a knowledge society: a reality check. *International Information and Library Review* 38:25-40.

Butler, R. 2005. Cell phones may safe Africa. *Mongabay.com*, July 11 2005. [Online]. Available WWW: http://news.mongabay.com/2005/0712-rhett_butler.html (Accessed 2 September 2006).

Commission for African Report (CfA). 2005. [Online]. Available WWW: http://www.commissionforafrica.org/english/report/introduction.html. Accessed 19 October 2005 (Accessed 16 August 2006).

Escribano, A., Guasch, J. L. and Pena, J. 2008. *Impact of Infrastructure Constraints on Firm Productivity in Africa.* AICD, Working Paper, World Bank, Washington, D.C.

Forge, S. et al. 2009. *A Green Knowledge Society. An ICT policy agenda to 2015 for Europe's future knowledge society*. [Online]. Available WWW: http://ec.europa.eu/information_society/eeurope/i2010/docs/i2010_high_level_group/green_knowledge_society.pdf (Accessed, 4 August, 2010).

Friedman, T. S. 2005. *The world is flat: a brief history of the twenty first century*. New York: Farrar, Straus Giroux.

GESCI. 2008. Building a knowledge society for all. [Online]. Available WWW: http://www.gesci.org/assets/files/GeSCI%20Literature.pdf (Accessed, 4 August, 2010).

Holmner, M. 2008. *A critical analysis of information and knowledge societies with specific reference to the interaction between local and global knowledge systems.* Unpublished doctoral thesis. University of Pretoria. [Online] Available from UPeTD: http://upetd.up.ac.za/thesis/available/ (Accessed 2 Augustus, 2010).

Holmner, M. & Britz, J. 2010. *The Road Less Traveled: A Critical Reflection On Infrastructure Development In Africa From A Perspective Of The New Economics Of Information*. Unpublished Article.

IKWW. 2002. *Indigenous knowledge worldwide: linking global and indigenous knowledge*. Den Haag: Nuffic.

ITU. 2009. *Information Society Statistical Profiles 2009 – Africa*. [Online]. Available WWW: http://www.itu.int/ITU-D/ict/material/ISSP09-AFR_final-en.pdf (Accessed 18 March 2010).

James, J. 2009. Sharing Mechanisms for Information Technology in Developing Countries, Social Capital and Quality of Life. *Soc Indic Res*, 94:43–59.

Kumar, A. & Barrett, F. 2007. *Stuck in Traffic: Urban Transport in Africa*. AICD, Background Paper, World Bank, Washington, D.C.

Lor, P.J. & Britz, J.J. 2005. Knowledge production from an African perspective: International information flows and intellectual property. *International Information and Library Review*, 37(2): 61–76.

Makoni, M. 2010. *Zimbabwe aims for 'knowledge society' with ICT bill.* [Online]. Available WWW: http://www.scidev.net/en/news/zimbabwe-aims-for-knowledge-society-with-ict-bill.html (Accessed 4 August, 2010).

Martin, W. J. 1995. *The information society*. London: Aslib.

Mbendi. 2010. *Computers and Communications in Africa - Satellite communication systems in Africa.* [Online]. Available WWW: http://www.mbendi.com/indy/cotl/af/p0085.htm#4

 (Accessed 6 August 2010).

McKenzie, D. 2020. *Why broadband, not roads, will transform Africa*. [Online]. Available WWW: http://edition.cnn.com/2010/WORLD/africa/08/06/ajai.chowdhry.africa/index.html?wom=false#fbid=j-Fh5vG81kB&wom=true (Accessed 9 August, 2010).

Nassimbeni, M & De Jager, K. 2000.Training for access to global information. *Library Management* 21(4):192-196.

Nathan Associates Inc. 2010. *Southern Africa Trande Facilitation and Capacity Building*. Available WWW: http://www.nathaninc.com/projects-and-cases/southern-africa-trade-facilitation-and-capacity-building-2004-2010 (Accessed 2 November, 2010).

NEPAD. 2009. *NEPAD ICT Broadband Infrastructure Network.* Available WWW: http://www.eafricacommission.org/projects/126/nepad-ict-broadband-infrastructure-network (Accessed 4 August, 2010).

OECD. 2005. *African economic outlook*. Paris: OECD Development Centre, African Development Bank**.**

OECD. 2006. *African economic outlook*. Paris: OECD Development Centre, African Development Bank**.**

OECD. 2009. *Education at a Glance 2009: OECD Indicators.* [Online]. Available WWW: http://www.oecd.org/document/24/0,3343,en_2649_39263238_43586328_1_1_1_1,00.html (Accessed 8 August, 2010).

Onyango, D. 2009. *The Critical Role of Education in Africa: Social and Economic Advancement hindered*. [Online]. Available WWW: http://www.orato.com/world-affairs/the-critical-role-of-education-africa (Accessed 9 August, 2010).

Rajadhyaksha, A. 2009. *Rethinking the Last Mile Problem: A provisional definition for the Cultural Last Mile*. The centre for Internet & Society. [Online]. Available WWW: http://www.cis-india.org/research/cis-raw/histories/last-mile (Accessed 4 August, 2010).

SIPA. 2007. *New media and development communication.* Available WWW: http://www.columbia.edu/itc/sipa/nelson/newmediadev/WiMax%20And%20Africa.html (Accessed 4 August, 2010).

Speer, L. 2010. *African Capacity Building Champion seeks funding partners*. Available WWW: http://www.devex.com/articles/african-capacity-building-champion-seeks-funding-partners (Accessed 4 November, 2010).

Sullivan, K. 2006. *In war-torn congo, going wireless to reach home:*

for poor, cellphones bridge digital divide. [Online]. Available WWW: http://www.washingtonpost.com/wp-dyn/content/article/2006/07/08/AR2006070801063.html (Accessed 2 September 2006).

The Economist. 2009. Father of the cell phone. *The Economist*, June 2009.

The African Leadership and Progress Network. n.d. The *African Leadership Capacity Development project.* Available WWW: http://www.africanprogress.net/leadership_capacity.htm (Accessed 2 November, 2010).

UNDP. 2003. Millennium development goals: a compact among nations to end human poverty. [Online]. Available WWW: http://hdr.undp.org/en/media/hdr03_complete.pdf (Accessed 2 April, 2007).

UNESCO. 2005. *Towards Knowledge Societies. UNESCO World Report*. [Online]. Available WWW: http://unesdoc.unesco.org/images/0014/001418/141843e.pdf (Accessed 19 June 2008).

UNESCO. 2006. *Literacy Initiative for Empowerment: LIFE 2005-2015.* [Online]. Available WWW: http://unesdoc.unesco.org/images/0014/001411/141177e.pdf (Accessed 9 August, 2010).

UNESCO. 2007. *Institute for statistics.* [Online]. Available WWW: http://www.uis.unesco.org/ev.php?ID=2867_201&ID2=DO_TOPIC (Accessed 23 August, 2007).

UNESCO. 2009. Address by Mr Koïchiro Matsuura, Director-General of UNESCO,

on the occasion of the *International Conference on Broadcast Media & Climate Change Conference,* UNESCO, 4 September 2009. [Online]. Available WWW: http://unesdoc.unesco.org/images/0016/001615/161517m.pdf (Accessed, 2 August, 2010).

United Nations. 1948. *Universal declaration of human rights*. Adopted and proclaimed by General Assembly resolution 217 A (III) of 10 December 1948. [Online]. Available: http://www.un.org/Overview/rights.html (Accessed 13 August, 2007).

United Nations. 2008. *The global literacy challenge*. [Online] Available WWW: http://unesdoc.unesco.org/images/0016/001631/163170e.pdf (Accessed 12 August, 2010).

United Nations. 2009. *Department of Economic and Social Affairs, Population Division, World Population Prospects, The 2008 Revision*. [Online]. Available WWW: http://esa.un.org/unpp /index.asp?panel=2 (Accessed 1 August, 2010).

Urso, G. et al. 2009. Knowledge sharing is power. *Transit Stud Rev*, 16: 352-367.

USAID. 2008. *Sub Saharan Africa.* [Online]. Available WWW: http://www.usaid.gov/locations/sub-saharan_africa/initiatives/aei.html (Accessed 9 August, 2010).

Webster, F. 2002. *Theories of the information society*, second edition. London: Routledge.

World Bank, 2009. *Information and communications for Development. Extending Reach and Increasing Impact*. The World Bank: Washington DC.

The World Bank. 2010. *SEIA - Secondary Education in Africa.* [Online]. Available WWW:

http://go.worldbank.org/VKSZD0AZJ0 (Accessed 7 August, 2010).

World Economic Forum. 2010. The Global Information Technology Report 2009–2010. [Online] Available WWW: http://www.weforum.org/en/initiatives /gcp/Global%20Information%20Technology%20Report/index.htm (Accessed, 2 August, 2010).

World Education Forum. 2000. *The DAKAR framework for Action*. [Online]. Available WWW: http://unesdoc.unesco.org/images/0012/001211/121147e.pdf (Accessed 2 August, 2010).

World Literacy Initiative. 2010. *World literacy.* [Online]. Available WWW:

http://www.worldliteracyinitiative.org/ (Accessed 4 August, 2010).

WSIS. 2003. *Declaration of principles.* [Online]. Available: http://www.itu.int/wsis/docs/geneva/official/dop.html (Accessed 5 May, 2007).