TeleEducation Initiatives for Sub-Saharan Africa:
The Case of The African Virtual University in Kenya

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Introduction

Africa is an enormous continent containing 53 countries (Donat, 2001). The Sub-Saharan African (SSA) region is home to 33 of the most underdeveloped and poorest countries in the world with more than 50%of Africa's 700 million people less than 20 years old. Not surprisingly, the demand for college-level education is so significant that many high school graduates are unable to find places in local universities (World Bank, 2003). In these countries, the opportunities for education are available increasingly through the African Virtual University (AVU). Career progression, coupled with higher qualifications and increase in knowledge and skills, are benefits of attending the AVU (AVU, 2008).

Africa in general and SSA in particular have received minimal attention in mainstream academic research in computer and information technologies (Mbarika, 2003/2004). This is noteworthy, since computer and information technologies are the key to transforming the delivery of education (World Bank, 2001). While there are many reasons contributing to the fact that SSA lags behind the rest of the world in terms of internet technologies and other socio-economic factors, one factor that stands out is the continent's lack of education (Mbarika, 2003/2004). Furthermore, issues of lack of access to books and up-to-date classroom materials present a dire situation for education systems in SSA.

HIV/AIDS presents another problem for the education system in Sub-Saharan Africa. According to the United Nations AIDS report for the year 2007, an estimated 1.7 million people in the SSA region became newly infected with HIV/AID; however, in adults between the ages of 15 and 49 years of age, HIV prevalence declined from 5.8% in 2001 to 5.0% in 2007. Moreover, the HIV/AIDS epidemic creates challenges for universities in many developing countries, especially in SSA where it threatens to reverse the development of gains in previous decades (Ramphele, 2004). These unfortunate trends will likely result in a decrease in education enrollment and a sharp decline in the number of those qualified to enter the skilled workforce (United Nations, 2000). In some severely stricken countries, the number of teachers dying of the disease is higher than the number of new graduates produced by teacher-training colleges (United Nations, 2000). This shortage in teachers contributes to the fact that only 3% of the populations in SSA between the ages of 18 and 25 enroll in college (Mbarika, 2003/2004). These coupled with political instability in countries like Somalia, Chard, Sudan, and the Democratic Republic of Congo further complicates and worsens the already grim education situation in the region. The gross enrollment ratio at the university level in SSA is the lowest in the world (Donat, 2001). In fact, even in cases where students qualify to join post-secondary institutions, they usually are not able to attend because universities are scarce in most SSA countries (Mbarika, 2003/2004). For example, some African countries, such as Chad, Eritrea, and Congo have only one state-owned university, limiting opportunities for very qualified students to gain post-secondary education (Mbarika, 2003/2004). Other forms and alternatives for post-secondary institutions such as private universities are costly and located sparingly throughout the urban areas. As a result of these low enrollment levels and the scarcity of universities, the bulk of students fortunate enough to attend universities—often the wealthiest or those who are fortunate enough to win scholarships—go abroad to study (Donat, 2001). The AVU is positioned to reverse this trend, as well as to facilitate delivery of educational services to a broader segment of the population.

The AVU began in 1997 as a project of the World Bank. Headquartered in Nairobi, Kenya,

Abstract [1]

Sub-Saharan Africa (SSA) lags behind the rest of the world in education. Less than 25%of qualified high school graduates in this region won't make it to the university level, mainly because most countries within the region have fewer than three universities. Furthermore, alternatives to universities, such as two-year colleges and training programs, are usually concentrated in urban areas away from the rural population. Hence, as reported in *Global Education Digest (2006)*, one out of every 16 students from the SSA region goes abroad for college. In addition, the lack of access to books, libraries, and up-to-date classroom materials presents a dire situation for post-secondary education systems in SSA. In this study we investigate the case of the African Virtual University, a wide spread TeleEducation initiative in Kenya.

Keywords:
TeleEducation, African Virtual University (AVU), Kenya, Distance Learning Technology, Sub-Saharan Africa (SSA)

the AVU is an intergovernmental organization, partnering with more than 50 institutions in over 27 countries in Africa, including Kenya, Senegal, Mauritania, Mali, and Cote d'Ivoire (AVU, 2008). In the early 1990's, approximately 56,000 students from operating AVU countries were studying abroad as a result of similar education and training opportunities lacking in their countries (Donat, 2001). This phenomenon, referred to as the "brain drain," creates a vicious cycle that places African countries even further behind other countries in terms of socioeconomic development (Wilson and Darmuzey, 2000). Thus, it is imperative that adequate measures are taken to properly address and safeguard the growth of human and economic development. The intervention of the AVU will result in increased access to quality education and improved access to quality resources, and it will promote interaction among African academics and bridge the gap between SSA and the rest of the world (Donat, 2001).

African countries urgently need quality higher education to expand their economies, increase life-long learning, improve pedagogy, combat "brain drain," and increase access to quality education for disadvantaged groups (World Bank, 2001). In the following section, we examine the motivation of this study on the AVU and attempt a focused literature review of TeleEducation in the African context. Included is recent progress in Africa as it relates to educational opportunities and socioeconomic development.

Research Motivation

The call for higher education in Africa is imminent as investors and businesses require educated Africans to support new commerce. SSA is a land rich in business potential (Light, 1999). Long known as a continent prosperous in natural resources, including oil, gas, and mining, Africa is also a vacation paradise with biodiversity ranging from tropical jungles to snow capped volcanoes to beautiful beaches awaiting many more ecotourism businesses (Mbarika, 2002; Mbendi, 2005). However, the lack of sound education and training poses a major obstacle to the business and investment potential that are ideal for tapping the vast resources of Africa (Light, 1999).

Barriers to education in SSA universities begin with the lack of space for secondary school graduates and the high competition for admission. The majority of African countries have only a single university, most likely located exclusively in urban cities. As a consequence, accommodating students becomes a daunting task, and the quality of education gained from the few and crowded universities is often poor. The need to deliver a sound education for all students requires maintaining a balance between cost efficiency, which results from a very large number of students, and cost effectiveness, which is achieved by exploring opportunities that can lead to success by designing high quality courses with user friendly learner support. (Tony, 2005).

Most university campuses were built in the 1950s and 60s and are deteriorating because of poor maintenance and lack of funds. Therefore, funding from external organizations to refurbish these universities would be ideal, especially if the responsible authorities and professors who are educated and exposed seek the necessary funds from such funding organizations. To add to the dismal physical state of SSA universities, governments are unable to repair and/or build schools rapidly enough to handle the increase in the population (Leary and Berge, 2008). Additionally, university libraries are often poorly stocked; they rarely have modern journals, and students lack access to online data bases.

Furthermore, the HIV/AIDS pandemic is responsible for many fatalities among school teachers. A current United Nations report shows that the SSA region accounts for a dreadful 67&of total HIV/AIDS cases in the world (UNAIDS, 2008). These statistics are noteworthy since most of those infected with HIV/AIDS are in the working age groups of the education sector in SSA. The unmet need for antiretroviral treatment in the region coupled with lack of access to health care cultivates the bleak situation. Such a frightening predicament calls for academic research strategies that address the education dilemma in SSA countries such as Kenya. TeleEducation, through its efficient multidimensional strategies, has made some commendable advances in approaching this dilemma, such as the use of Tele-medicine.

TeleEducation is vital for underdeveloped and developing countries and serves as a means to provide students with various learning experiences and opportunities like those available to students in developed countries (Roy & Chhabra, 2007). It offers great opportunities for learning, where students can actively and independently access research resources rather than routinely receiving knowledge from lecturers. Therefore, AVU offers great opportunities for these countries. Such opportunities are monumental because of four main factors:

(i) A large pool of tertiary school-aged graduates who cannot enroll in traditional higher education due to limited capacity: with the gross enrollment at the university level in SSA, students end up paying the price when applying to other universities of higher standards like those in the U.S. With the poor quality of the education they have obtained, they cannot compete with other students in different universities outside of the SSA.

(ii) Growing willingness to pay for education and trainingt the high demand for enrollment in higher education courses makes it evident that students are willing to pay for education. Students are realizing the importance of education as set forth by their society, as well as societies outside Africa. As investors enter Africa and tourism becomes more lucrative, students with higher education will be better prepared for employment in these areas.

(iii) The scarcity of skilled labor and the major training problems faced by corporations and other professional organizations: The scarcity of skilled labor is essentially caused by a lack of educated people due to their inability to enroll in higher education courses.

(iv) A growing divide between Africa and the developed world (Donat, 2001): Given the very high cost associated with maintaining a sound academic infrastructure, the high cost of tuition and fees, and access to information databases makes it very difficult for individual countries in Sub-Saharan Africa to bridge the gap between them and the developed nations (Donat, 2001).

TeleEducation represents the quintessential instrument for sharing resources with larger numbers of people at affordable prices (Baranshamaje, 1995). A prime example of TeleEducation at its best is the availability of digital libraries, which allow anyone with proper access to search an extensive database full of journals and articles, accessible in digital format. Digital libraries are an economically viable means for supporting TeleEducation since a great amount of money is saved by keeping all available resources and information in a central repository, eliminating the need to purchase and store multiple copies of library items in various universities. Digital libraries are valuable components of TeleEducation that enable students and faculty to access large online databases (Mbarika, 2003/2004). For example, UMI-ProQuest is a high-quality online research service that provides access to over 1100 journal and magazine abstracts and full-text articles spanning over the past ten years (Mbarika, 2003/2004). Database access is especially important for colleges and universities within the SSA region, which suffer from slim budgets for acquiring books and other library resources, broken-down library equipment, and out-of-date or looted library resources (Darkwa and Mazibuko, 2000).

Another major advantage of TeleEducation is that it requires minimal capital investments and operating costs (Mbarika, 2003/2004) that are affordable for countries in SSA with limited education budgets. Instructional modes used by TeleEducation often include correspondence courses, radio, television, satellite, Internet, telephone, video conferencing, and virtual universities as some of the ways to provide distance education (Ruth and Shi, 2001). Although correspondence courses and radio are among the lowest cost alternatives for delivering instruction, they are limited by the fact that they do not enable synchronous interactions. AVU uses primarily synchronous satellite transmission and broadcasts video to 55 learning centers in 27 African countries (Leary and Berge, 2007). A benefit of AVU's synchronous satellite transmission is that it allows students to ask questions via telephone (Leary and Berge, 2007). Students are given the opportunity to interact with professors from world-renowned educational institutions across North America, Australia, and Europe without leaving Africa.

To make a difference in the socio-economic growth and the quality of labor in SSA, the best education possible must be made available to the citizens. TeleEducation serves as an enabler of such growth by providing educational opportunities for those in rural areas and for the underprivileged.

Literature Review

Higher education in developing countries is inadequate and falling further behind (World Bank, 2000). Demand for higher education is rising rapidly, compounding the challenges for countries that hope to improve quality, reduce public cost, and increase access to all strata (World Bank, 2000). Furthermore, without swift action, developing countries will be incapable of competing in the knowledge economy (World Bank, 2000).

A major obstacle to expanded access to education is the problem of providing enough teachers, schools, and classroom materials to meet children's needs, especially in remote rural areas. In Kenya, the percentage of secondary school graduates that attend college is 17.5&, with more men attending than women and a high dropout rate among the former

group (Tschang & Senta, 2001). Although the educational system in Kenya has grown, today it still lags behind the standards known in the rest of the world.

In the countries of Sub-Saharan Africa, the average tertiary expenditure per student was already 422& of GNP per capita in 1995 as opposed to 26%in high-income countries (Donat, 2001). With regard to this alarming situation, it is advocated that TeleEducation could play a vital role in improving the educational rankings of SSA countries. TeleEducation involves the use of educational technologies (especially Internet-based) to provide instruction to geographically dispersed teachers and students (Mbarika, 2003/2004).

The digital age has brought the potential to support economic development in some of the poorer and more rural areas of the world, including Kenya. Through distance education, more learners can be reached and services extended at a reduced cost (Ibrahim, 2007). Hence, technology can be effectively applied to education by providing life-long learning, improving the quality of the learning process, and increasing efficiency in the management and administration of the education process (Twinomugisha, 2003). Information and Communication Technologies (ICTs) can provide new and innovative means to bring educational opportunities to greater numbers of people of all ages, especially those who have been excluded historically, such as populations in rural areas, women facing social barriers, patients, hospitals, and clinics that lack qualified doctors, and students with disabilities. ICTs overcome distance barriers and foster education (Ibrahim, 2007). It is also quite clear that technology is directly linked to development (Twinomugisha, 2003).

A case study at the University of Pretoria in South Africa (with 24,000 part-time and distance learning students), examines a process based quality system for web learning that was designed and developed (Kinuthia & Dagada, 2008). This system and self-evaluation exercise along with synthesis of the literature led to a taxonomy of critical success factors that enhance the quality of web-supported learning opportunities in a blended learning environment in higher education (Fresen, 2007). Many of the factors are well established in the literature (e.g., better communication channels between students and lecturers and improved instructional design). The authors also identified underlying factors that form the foundation of success: ICT infrastructure, the information and computer literacy of students, the positive attitude of lecturers, and the quality of the institutional learning management system, to name a few. Their case study attempted to diminish the gap between low quality assurance and online learning practices.

In India, the advancement in telecommunication allows medical knowledge and skill to be exchanged across geographically dispersed academic medical centers of excellence with medical colleges and institutes to provide practice distance learning (Mahapatra, et al., 2009). TeleEducation in health science has been greatly adopted. In 2001, the first distance medical TeleEducation program, the Sanjay Gandhi Postgraduate Institute, began networking with Sriram Chandra Bhanj Medical College. By 2009, modules such as telesurgical conferences, teleconsultations, and teleradiology had been implemented. The network operates through ISDN, satellite communication links, and high bandwidth. Between 2001 and 2009 there were 1,303 TeleEducation sessions.

A Brazilian case study of a TeleEducation leprosy course found improvement in health teams that took the distance education course (Paixao et al., 2009). Considering the 3,000% increase in the number of health teams created, TeleEducation was found to be a suitable solution by providing simultaneous training, wide coverage, and low operational cost.

The higher education system in SSA is the least developed in the world (Ibrahim, 2007). Over the post-independence decades, government leaders have attempted repeatedly to solve the problems plaguing the education system. In Kenya, various solutions have been tried to mitigate difficulties and enhance the output of the educational system and its benefits for the country. One solution was the creation of other public universities, for a total of six public universities today. Another proposal was to embrace private ventures in university education; 18 of such institutions are operational today with various levels of performance (Oketch, 2003). A few other approaches dealt with controlling cost and consisted of cost reduction strategies and means-tested loans systems (ICHEFAP, 2002).

While some significant results have been achieved in all these areas of management, the educational system in Kenya remains unable to successfully confront such obstacles as demographic growth, the economic crisis facing the country, and the "brain-drain" caused by a set of socioeconomic and political factors. This situation has produced a major decline in the quality of education since the 1980s. This spreading

crisis has caused many Kenyan students to leave their country to study and work abroad. The last straw is the HIV-AIDS epidemic and its heavy toll on teachers and educators, further limiting the resources available for university education.

Clearly a response to the challenges facing the higher education system in Africa, the AVU at Kenyatta University has established more than 50 learning centers and partnerships with 27 countries (Juma, 2006). Until a few years ago, the possibility of TeleEducation in Kenya was not realistic but with newly implemented technology and the help of external funding, Kenya is carving a path for distance education.

History of African Virtual University

The African Virtual University (AVU) was an initiative of the World Bank under the supervision of Mr. Etienne Baranshamje with the assistance of Dr. Rex Kruge and Dr. Bob Kavanagh. AVU started in Africa in Uganda, where the founding members first visited some staff at the Makerere University, Polytechnic in Kampala, and the Martyrs and Nkosi University. After the visit, they saw the great need for this project to be extended to other African countries (Kavanagh, 2001). Currently, the African Virtual University is headquartered in Nairobi, Kenya and is a prime example of a successful TeleEducation project in SSA. AVU is part of a network of African Universities striving to increase access to affordable tertiary education in Africa (IIEP, 2007). In 1996, the feasibility study of a Virtual University in SSA was initially funded by a $250,000 grant from InfoDev, a World Bank program. This study involved defining AVU's business plan, technological choices, and study programs for a start-up-phase, as well as making arrangements with suppliers, institutions, and other African countries.

The project was picked up later that year by other donor agencies and countries and the European Union, and was implemented in February of 1997. Approximately $200,000 in grant funding was distributed to 6 different countries in SSA for 12 universities to purchase satellite terminals and basic equipment for the implementation of AVU. Other collaborative and funding agencies include the Canadian International Development Agency (CIDA), the Australian Agency for International Development (AusAid), UNESCO, the Department for International Development (DfID), and the African Development Bank (AfDB), as well as the Massachusetts Institute of Technology (MIT)

(Rasungu, 2009)

Upon opening in 1997, AVU was aimed at providing "a university without walls that uses modern ICTs to give the countries of SSA direct access to some of the highest-quality academic faculty and learning resources throughout the world" (Barjis, 2003). After the initial "proof-of-concept" and "transition" phases, the AVU has reached maturity level, as demonstrated by its 34 member campuses in 17 countries using French, English, and Portuguese as educational languages. Since a partnership was signed with the Royal Melbourne Institute of Technology, the AVU has become more of a traditional university, graduating its first batch in electric and computer engineering, far from the language courses and professional training programs of its inception years. The project itself has undergone many adjustments along the way, essentially due to technical and financial considerations, but the original objectives have persisted, including:

To use modern telecommunication technology (especially satellite TV technology) in diverse countries in Africa to demonstrate that it can be used effectively as a teaching medium.

To prove that such a project can be successfully implemented in various African countries, each with its own government and culture.

To prove that such a project can generate enough economy to sustain itself after the discontinuation of donor funding.

To upgrade the quality of teaching in African countries in mathematics and science, subjects that are very much needed to get the economies going.

To prove that diverse communities can easily adapt to modern technology.

To increase the participation of women in science and engineering.

Since the beginning, AVU has been seen as a three-phase project. In 1997, the first prototype service phase was implemented at Kenyatta University. This phase established a network with other universities and vice chancellors within SSA. The network quickly enabled Kenyatta University to tap into more technology resources for the teachers and students. The network is connected to universities worldwide via satellite to obtain courses provided by the US, Ireland, Canada, and facilities of the World Bank (Juma, 2003).

Three years later, the second phase was implemented, offering complete undergraduate degree programs from leading universities. In

phase two, the aim of AVU was to create more partnerships, and to assess AVU's needs for sustaining access to affordable education at a tertiary level for Africa (Juma, 2003). Phase two was a successful prototype, thus making more resources available to students in Kenya.

The third phase was implemented to give a higher education to the teachers and students. For students, it offers four-year degree programs in science and engineering curricula in English and French. AVU also established an ambitious teacher education project that involves ten African countries in partnership with the African Development Bank (AfDB) and the New Partnership for Africa's Development (NE-PAD) and focuses on mathematics and science education (Ferrell and Isaacs, 2007).

A 2006 survey report of ICT and education in Africa deems that a new phase, coined "projects to policies," has begun in ICT education (Ferrell and Isaacs 2007). Projects to policies signifies that a shift from donor-supported, NGO-led, small-scale, pilot projects towards a new phase of systemic integration informed by national government policies has taken place. As more national governments realize the total contribution of ICT in national development efforts, more policies will be created to further the growth and societal impacts. The Prime Minister Meles Zenawi of Ethiopia, speaking to an ICT conference in Addis Ababa in 2005, commented: *"We were convinced that we should invest every penny we have on securing the next meal for our people. We did not believe serious investment in ICT had anything to do with facing the challenges of poverty that kills. Now I think we know better. We recognize that it is a vital and essential tool for fighting poverty—for beating poverty that kills—and ensuring our survival"* (Ferrell and Isaacs, 2007, p. 4).

AVU Model

Normally, an AVU classroom has between 25 and 30 students, sitting at their desks watching the broadcast on large screen projectors, television monitors, or computers (Barjis, 2003). AVU students have the opportunity for real-time interaction with the instructor using phone lines or e-mail (Barjis, 2003). In order for this type of real-time, synchronous interaction to take place, a few critical conditions need to be met. First, instructors in various European and American countries present lectures and seminars in front of video cameras. The video is then relayed via ISDN lines, satellite, or fiber optics to an uplink station in Clarksburg, Mary-

land, which then beams the footage via satellite to different African sites that are equipped with the necessary satellite dish (as illustrated in Figure 1).
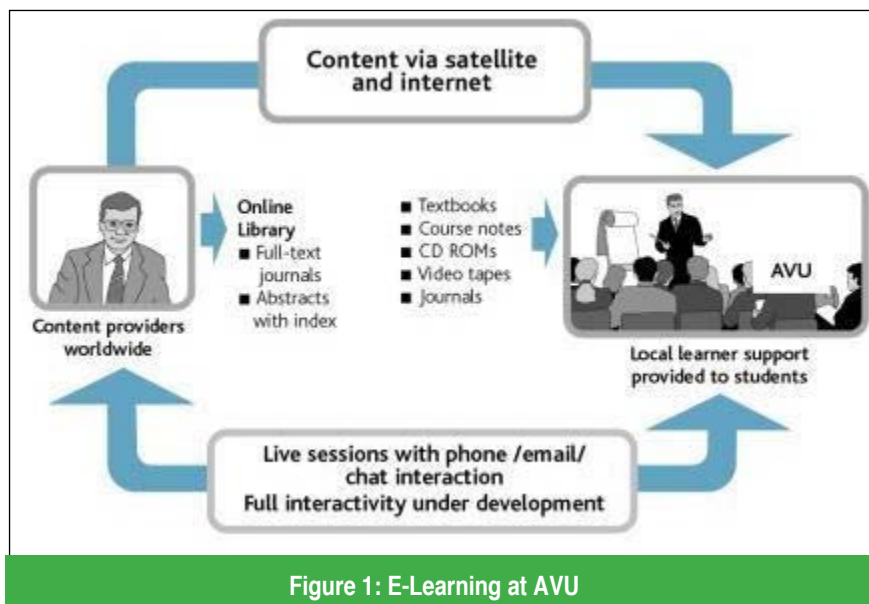

Figure 1: E-Learning at AVU

As displayed in Figure 1, there are several ways data can be transferred to Kenyatta and AVU institutions. The first is an Integrated Services Digital Network (ISDN) connection via LAN lines. This option is most cost effective, but has the least reliability and bandwidth availability. A student or instructor must dial in order to connect with another user. Additionally, both sides must be free of all activity, or else a poor connection or no connection will result. Even with the best possible connection through this medium, there is a great amount of lag time in communication.

The next option is a satellite connection. Something of this caliber is much more expensive, but more stable and much faster than ISDN. To achieve a connection via satellite, the user would need to be at an uplink center where the data could be transmitted via satellite to a satellite in orbit in space. Finally, the receiving site would need a satellite capable of obtaining and transforming the video back into data form for viewing purposes. With hardly any lag time, this option would be the perfect selection if not for its high price and potential for unintended downtime due to bad weather.

Finally, the best option, but also the most expensive, is to relay the video via fiber optic cables. Fiber optic cables are glass lines through which light is manipulated to represent data. Because the data is transmitted as light traveling through glass, it demands less band-

width and the transmission is more reliable. However, the hardware and installation costs are extremely expensive.

AVU uses a compressed digital video up-link to connect to other institutions via one high quality channel. The use of digital high-quality compressed video gives cost-effective resources to the institutions. However, there are a limited number of earth stations in Kenya, which makes it hard to network to certain places in Kenya. The earth stations that do exist consist of the following:

- Outdoor satellite: a dish that connects the AVU networks (similar to a Direct TV satellite used to watch over 100 channels).
- Classroom equipment: devices (cables line, hubs, and routers) used to connect to a satellite, TV monitor, video recorder, etc.
- Digital decoder: a device used to separate the signal from the video. Audio and data-output devices are used to produce sound and retrieve data through a computer.
- Video recorder: a device used to record a session over the AVU network and a television monitor—used to display the session.

Kenyatta University is one of six major public universities in Kenya. As an income- generating AVU site, Kenyatta University sponsors the equipment for the benefit of students and teachers in Kenya. With funding from Kenyatta University through paying students and executives as described below in the Sources of Funding section, AVU enables a student in Kenya to pose a question to a professor in Paris that can be heard and commented upon by students in Benin. The possibilities are infinite in this type of setting. To continue the upward trend, AVU directors hope to be able to broadcast lectures and seminars directly through African TV stations, making education more accessible to Kenya and the rest of the continent. AVU classrooms have low overall costs and provide a quality education to students in rural areas from expert instructors from around the world.

Students currently take their courses at AVU learning centers where on-site moderators guide students through the material and act as assistants to course instructors. Each AVU learning center is equipped with Internet access and at least 50 computers. Kenyatta University offers AVU students access to a Digital Library. The digital library currently consists of approximately 4,000 full-text online journals and 8,000 e-books stored in a repository. This service is free to all students that have paid their tuition and have access to the Internet. Students also have access to email. More than 10,000 free e-mail accounts have been opened and can be accessed through the AVU website. The AVU learning centers are facilitating the educational and technological advancement of students.

Online discussion forums provide an open learning environment that facilitates interactions between students and instructors. WebCT, is the software used to deliver AVU materials around the world (African Virtual University, 2007). The centers allow people globally to interact in one giant classroom. Although the infrastructure and technology is in place, internet and computer speeds still vary in Kenya. Consequently, the websites and files that are made available to students have to be either in compressed format or simple enough for the current networks to handle them. Other examples of TeleEducation programs as outlined in the literature review have similar infrastructure models. Satellite, ISDN, and high bandwidths are major components in today's TeleEducation infrastructures.

Sources of Funding

Kenyatta University makes US $80,000 in profit per year from the AVU Learning Center tuition, executive seminars, and business center (Cyranek, 2000). The profit is derived from students, faculty members, and workers that pay to use the AVU Learning Center facility and technology. Costs for AVU services are indicted below:

- US $50 for a 2-week course that meets for 2 hours a day.
- US $200 for a 2-month course that meets for 8 hours a day.
- US $1200 for a 9-month pre-university course.
- US $40 a day for an executive seminar.
- US $1 per page for each facsimile and email.
- US $25 a month for digital library usage.

The present operating budget has grown forty times over to $9.5 million, with the World Bank funds accounting for only 21% in 2004. Since then, The AVU has been operating as a financially viable and independent entity. With the yearly profits, Kenyatta University is planning to reinvest the money back into its infrastructure, buildings, and technology. Reinvestment plans are to establish an e-Learning Coordinating Center, build capacity in e-content development and multimedia productions, and create e-Learning awareness/sensitization through public lectures, workshops, seminars,

and international conferences (E-Learning Co-ordinating, 2007)

AVU now links 34 learning centers in 17 African countries via the Internet to universities in Europe, Canada, Australia, and the United States. The AVU has decreased the cost of bandwidth use from $4 per kbps to $2.5 and counting, and its reach stretches from Ghana to Mozambique, covering Benin, Burkina Faso, Nigeria, Rwanda, and Tanzania, among others.

AVU now offers courses on IT, science, foreign languages, healthcare, and engineering for over 25,000 students distributed among SSA countries. Since its opening in 1997, the university has provided students and professionals with more than 2,500 hours of interactive instruction, including 1,500 electronic full-text journals and thousands of online references (Barjis, 2003). AVU continues to grow and is creating more of its own funding to assist in its growth endeavors.

AVU incorporates some other strategies to ensure financial framework. These strategies include generating revenues through offering short courses, consulting and workshops, encouraging contribution and subscription models, project management fees, and also support from funding partners (http://www.avu.org).

Outcomes of AVU

In the year 2000, approximately 200 Kenyan teachers completed information and technology courses through AVU located at Kenyatta University. The teachers completed courses similar to Introduction to Computer Literacy, Advanced Computer Literacy, and Internet Proficiency. Such courses provided the teachers with the skills necessary for teaching students using technology. Teachers have a strong and continued interest in information and communication technology because of their growing popularity and the recent business and student demand for technology knowledge.

On November 8, 2003, Kenyatta University received a grant of $258 million from the Australia Agency for International Development (AusAID) to offer degree courses online. The grant was to enable the university to offer degree courses online due to the growing number of students and teachers using AVU as an educational resource. AVU will use this grant to update technology and equipment in a continued effort to give quality information and communication resources and training to Kenyan students. So far, Kenyatta University has trained more than 20,000 students in IT courses

alone. Graduates of Kenyatta University enter a wide range of fields including media, politics, the arts, business, research; over 70% of secondary schools and college educators in Kenya were trained at Kenyatta (Alumni and Outreach, 2007).

Besides Kenyatta University, other public and private institutions of higher education in Kenya have embraced E-learning and TeleEducation. With the development of the ICT infrastructure in the SSA, the number of e-students now stands above the ten thousand mark. AVU Enrollment has reached five of the six public universities: Egerton, Jomo, Kenyatta, Moi and Nairobi, with different levels of implementation. The AVU is in fact acting as a multiplication factor in Kenya and in the rest of SSA, with the number of universities now reaching 34 in 17 countries. With diploma and certificate programs, and a computer science degree program with a curriculum developed in partnership between The Association of Universities and Colleges of Canada (AUCC) and AVU, SSA's economy will be positively impacted with higher educated students, teachers, and adults in general working to improve business and government technology (African Virtual University, 2007).

AVU currently links 25 African campuses to classrooms and libraries worldwide. It has a digital library of more than 1,000 complete text journals and other academic materials. Additionally, it has more than 45,000 e-mail accounts and also a website that receives approximately one million hits per month. The AVU has become an exemplary example of educational training in Africa (AVU, 2007). As of 2009, there are 10 other large universities now connected to AVU. The launch phase of these ten-country distance learning facilities will last up to early 2010. This platform for higher education will continue to provide thousands of African students with access to quality education and research (Berlin, 2009). By 2009, AVU had awarded degrees to 40,000 students across Africa and trained 133 staff members. These 133 members have come from 24 universities in 17 countries (Berlin, 2009).

For something that was just an idea seven years ago, AVU has really separated itself from most TeleEducation projects and reached maturity status. In fact, the main goal in the next few years is to expand to even more countries in Africa while maintaining its financial sustainability. A few questions remain, however:

- How can the project include more local content? Until now, course content and presentations are streaming from the US, Canada, and/or Australia to Africa. This might not present a major implicit bias in hard sciences, but if the AVU were to include other areas such as humanities or law, the African perspective and context would need to be heard and represented. The present technological setup does not make room for such input.

- The increased participation of different countries, universities, and campuses in SSA demonstrates the success of the AVU project. However, how can these universities interact with each other, using local resources where they are available, instead of transmitting curriculum from other parts of the world? How can a horizontal model of cooperation be created given the technical constraints and financial limitations of SSA nations?

Projects like the AVU remind us how helpful technology can be for humanity and how it can make the economic growth outlook for the future, especially for countries like Kenya, a much better one. Education access is the key to advancing SSA in its health, economic, and tertiary educational efforts.

Research Implications

The possibilities for the future of education seem unlimited with AVU in countries like Kenya, where there is such a thirst for new knowledge. AVU provides exciting ways to deliver information to those with the desire to learn. Additionally, AVU has over 40%participation from women in AVU's pre-university courses at the most active learning centers (The World Bank, 2003). However, the same ICTs that are used for so much good could be a threat to university socialization. Graduating from the same program with students who live and study in different countries is an unprecedented experience. How is the educational and social experience of AVU students affected by the distance learning?

Another area for continued research is determining the impact of ICTs in the social and economic life of SSA countries. In certain cases, shy and reserved students are more likely to express themselves in electronic forms and participation levels tend to rise. Nevertheless, teachers and students must continue to interact in person and not just communicate by computer. The AVU helps facilitate this aspect by providing real-time voice communication while viewing live presentations.

An additional reason to continue researching and delineating the success of the AVU is to monitor virtual communications' and the Internet's effects on economic, social and political development. Many scientists have stated that ICTs could be leveraged in SSA countries as tools for increased economic performance, while some have mentioned them as a factor for democracy and political freedom as well. Furthermore, there has been relatively little application of ICTs in the Technical and Vocational Education and Training (TVET) and therefore TVET institutions and polytechnics in Africa are lagging behind in educational growth (Ferrell and Isaacs, 2007). The use of these new technologies in the area of technical and vocational training and its impact on economic and social development could be a further research initiative.

Furthermore, as the number of students attending AVU at Kenyatta University grows, there is an increased need to improve the digital library system. Presently, the system cannot handle a large number of people. A large number of concurrent connections may cause the system to crash or the network to slow down. Kenyatta University's profit reinvestment strategy could provide for additional funding to upgrade the networks and equipment to handle the ever-increasing flow of information through the network more quickly and reliably.

Overall, TeleEducation provides benefits to low-resource areas in need of a greater solution for higher education. Further research could explore how to reach the pool of tertiary-age students in even more rural areas of SSA. Those in more populous and advanced countries such as Kenya may have a growing willingness and ability to pay for education and training, but there may be a digital divide occurring even within Africa. TeleEducation can assist in improving the scarcity of skilled labor and training problems faced by investors, corporations and other professional organizations in need of educated Africans.

Conclusion

Ultimately, we must continue investment in ICTs, but remember that ICTs alone do not foster human development, but must also be coupled with investments in education and health care (Morawczynski and Ngwenyama, 2007). That includes involving more than the development of computer literacy skills in teacher train-

ing. Teachers need to be able to design and adapt content materials to suit student needs, to search and manage information, and to be aware of the ethics and dangers inherent in the use of ICT technologies; AVU serves as a role model example in this instance (Ferrell & Isaacs, 2007). African Virtual University could prove to be a multinational and longitudinal experiment in the use of the Internet not only for education and knowledge, but also for social and political change within the participating countries and among African students.

The students at African Virtual University will make the countries in which they live a more economical place to live by starting their own businesses and working for other businesses involving technology. Higher-skilled workers and entrepreneurs will improve their countries both technologically and economically. For example, even though Kenyatta University lags behind in its technology in comparison to the US, the university has greatly decreased the gap since they began housing AVU and profiting and reinvesting in their TeleEducation system.

There seems to be a recurring theme in the research we have conducted: Kenya is now a better place because of AVU. Kenya set out to make a difference with TeleEducation and they are achieving that goal and others related to extending educational opportunities to marginalized groups. African Virtual University is definitely a good thing, not only for places like Kenya, but also for the rest of the countries associated with AVU and for the rest of the world. As long as we keep the potential for knowledge restricted to actually physically attending a university class in Africa, something many cannot do, we hold back a country from its full potential.

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