2002

ICT Human Resource Development in Africa: Challenges and Strategies

T.M. Waema

ABOUT THE AFRICAN TECHNOLOGY POLICY STUDIES NETWORK

The African Technology Policy Studies Network (ATPS) is a multi-disciplinary network of researchers, policymakers, actors in the private sector and other end users interested in generating, promoting and strengthening innovative science and technology policies in Africa. With a regional secretariate in Nairobi, the network operates through national chapters in 17 countries, with an expansion plan to cover the entire sub-Saharan Africa.

One of the objectives of the network is to disseminate research results to policy makers, legislators, the organized private sector, civil society, mass media and farmers' groups through ppublications, dialogue and advocacy. Among its range of publications are the Working Paper Series (WPS), Research Paper Series (RPS), Special Paper Series (SPS) and the Technopolicy Briefs.

Papers published under the ATPS Special Paper Series are those commissioned as concept papers, think pieces, leading conference papers and keynote addresses. In keeping with our knowledge brokerage function, ATPS publishes, with permission of the author(s) or journal editors, papers (published or unpublished) produced by distinguished academics/researchers for a different purpose but judged by ATPS to be of excellent quality. These papers address significant policy questions relevant to the work of ATPS and/or support the Southern voice or an African perspective. We also consider theoretical papers that advance our knowledge of science and technology policy issues.

ATPS is supported by a growing number of donors including the International Development Research Centre (IDRC), the Carnegie Corporation of New York, the Rockefeller Foundation, the World Bank, the OPEC Fund, Ford Foundation, Coca-Cola Eastern Africa, the African Development Bank, and the Royal Dutch Government.

1. Introduction

Governments worldwide recognize the role of information and communication technologies (ICTs) in national development. ICTs are key to transforming traditional economies into information and knowledge-based economies. In the vision towards an "Intelligent Island", for example, Singapore perceives ICTs as the engine for promoting development and growth, and also gaining global competitive advantage. The country developed ICT policies and strategies to increase productivity, improve infrastructure, reduce costs and attain high value-added industries. To a large degree, these policies and strategies have contributed to the phenomenal development that is associated with Singapore today.

The need to develop ICT policies stems from the challenges that many African countries are facing because of globalization and liberalization. Globalization has removed time differences and geographical boundaries between countries. Many African governments are now aware of the important role of ICTs in transforming economies in an increasingly knowledge-based global village. ICTs can address the creation of wealth, management of the HIV /AIDs epidemic, and others. Consequently, several African countries, like Egypt, Mauritius, Rwanda, and South Africa have developed comprehensive national policies and strategies to transform their nations into information/ knowledge societies. The expansion of human capacity, especially in ICT, is critical in these national policies and strategies because of the information oriented societies that are emerging globally.

In the following text, an overview of ICT human resource development (HRD)[1] in selected countries is presented, and the challenges facing most countries regarding ICT-HRD are discussed, with examples from Kenya. Recommendations on strategies that African governments should take to enhance ICT human resource development are also outlined.

---

[1] The following professions are involved in training ICT human resource development:
- · Computer Science
- · Computer engineering
- · Information technology
- · Electrical and Electronic Engineering
- · Telecommunications Engineering
- · Information Science

2.   Overview of ICT HRD in Other Countries

This overview gives a taste of what is happening in other countries and illustrates what other developing nations are doing on ICT human resource development.

India

India has one of the largest scientific manpower in the world. There are about 2 000 educational institutes that train over 60 000 students annually. ICT professionals in India were 140 000 in 1995. Private institutions conduct most ICT training programs but the Indian government offers free Internet access to the students. The government launched a pilot project named CLASS, in 1983 in schools, and it also provides computer education through TV, Internet, multimedia and formal classes to interested students. By 2000, India was earning over USD 4 billion annually through software export, and cities like Bangalore and Hyderabad have been converted into the Silicon Valley of India.

Malaysia

Malaysia has given topmost priority to ICT education and the annual enrolment of IT students in universities is expected to increase by 15-20 per cent. About 1500 IT students graduated in 1998 and by 2001, a multimedia university had also been set up to train 4000 students annually. Malaysia has established a special ICT city named Cyberjaya and also launched a multimedia corridor. The private sector conducts nearly 75 per cent of the training. To encourage the private sectors to meet the national IT training requirements, the government grants tax and custom exemption on the import of multimedia equipment as incentives.

Singapore

In 1997, the Singapore government commissioned an IT education master plan stressing the need to fully integrate the subject into the education curricula. It has set ambitious targets such as:
- hands-on training on computers for 30 per cent of the student's curricula time
- computer to student ratio of 2:1
- use of IT to plan, teach and asses academic lessons
- an investment of USD 2 billion to implement the six-year master plan
- computer grants for teachers

Egypt

By 2000, Egypt had 5000 IT specialists, skilled in programming, systems engineering, among other areas. The country's national plan for telecommunication and information states in part that: "Human resources are considered the most important component in the communication and information industry." Egypt thus plans to increase software exports to USD 500 million in five years. To achieve this goal, the country will require 30 000 ICT specialists and the plan proposes to establish a National Institute of Information Technology capable of graduating 5000 students annually. Over 70 per cent of the schools are equipped with computers and about 20 per cent have telephone lines and Internet connectivity. The Ministry of Education funds Intranets in schools.

3.   Challenges

One of the greatest challenges is the degree of disparity in infrastructure, especially power and telecommunications that exists between rural and urban areas in many African countries. In addition, many school-going children are deprived of the opportunity to attain primary education due to extreme poverty. Parents cannot afford to send them to schools.

Quality control

Education and training on ICT imparted so far have been marked by unplanned growth. Most programs are offered by private sectors that are usually skills oriented. Many non-formal education sectors are involved in human resource development but the quality, curricula and effectiveness of their programs are questionable.

In Kenya, for example, lack of standards is exemplified by disparities in the duration of similar programmes offered by different institutions. Starehe Boys Centre, for instance, takes two years to complete the KNEC Diploma in Computer Studies because of the strict academic regime that allows for only three weeks recess in a year, and a full day's teaching, compared to polytechnics where the same programme takes three years. There are also dissimilarities in entry requirements for like programmes. Different institutions offering the Institute for Management of Information Systems (IMIS) Diploma have different entry requirements. Despite the disparities, most of these institutions have a high pass rate.

Finally, there are no standards in certificates and diplomas awarded for ICT training programs, with institutions offering their own diplomas and certificates for programmes that vary in content and duration.

Inadequate trained ICT staff

Many countries, globally, lack adequate human capacity in ICT, and this is even more critical in African countries. In Kenya, for example, most of the high-end ICT training take place in public institutions, but these institutions lose staff to the private sector who offer better salaries. The consequence of the high staff turnover is over-reliance on part-time and less qualified lecturers with its attendant quality implications.

There is demand for skilled software developers, system engineers, communication and network engineers, data managers, data supervisors, computer teachers, skilled computer operators, among other specialists. Lack of teachers that are skilled in computer education is critical; schools

employ poorly trained ICT staff.

Inadequate ICT literacy

Majority of tertiary level education graduates in most disciplines lack ICT skills and most institutions have not launched ICT literacy programs. At the University of Nairobi, ICT literacy courses for all students have not been started largely because of lack of adequate staff to deal with the large number of students (about 20 000) and inadequate computing infrastructure, especially computer laboratories, amongst other reasons. Countries should have policies that encourage all workers to be computer literate. The literacy program should be launched as a national campaign once the infrastructure is established. Low cost personal computers (PCs), low cost Internet connection and telephone lines are the basic requirements for such programs. To carry out the literacy drive, a large number of ICT trainers and teachers are needed.

Insufficient funding and high costs of ICT products and services

Duties and taxes are levied on ICT products while value added tax (VAT) is levied on ICT services, making both expensive. Although many governments raise revenue through taxes on ICT, the investment on ICT-HRD is almost non-existent in most countries. The cost of ICT training gets high, particularly at technician and artisan/craft levels in private institutions. At the same time, many public tertiary institutions charge market rates for all forms of training, including ICT, thus making the training unaffordable to most people.

In Kenya, the government is still one of the key agencies that fund ICT human resource development. At a national level, lack of adequate funding in ICT training is associated with lack of knowledge of the potential of ICT in national development.

In public sectors of most countries, lack of funding for ICT training has led to over-reliance on external donor funding although this funding has diminished considerably because it has had its own problems, including the fact that it tends to be one-off. More often, it may not be in line with one's priorities besides the question of sustainability. There have been questions about expatriates who are not real experts.

At the firm level, organizations lack adequate funding for ICTs and ICT training. In most cases, they are more prepared to recruit staff that are already trained rather than less qualified persons who they can train, possibly due to inadequate funds or lack of awareness on the strategic importance of well-trained manpower. Organizations may also shy away from investing in ICT personnel because of the high staff turnover in the industry.

Inappropriate curricula

Curricula for training information technology professionals in African countries face the following problems:
- Most curricula are oriented towards teaching the technical aspects of the technology and ignore the social and organizational aspects of ICT. Consequently, graduates lack

organizational and management skills and are, therefore, inadequately prepared to deal with the complexity of analysis, design and implementation of ICT in organizations.

·   Most programmes for training ICT professionals are copied from economically developed countries with little modification to reflect the realities of industrial and development goals in individual countries. These training programmes need to be adapted to the local environment to reflect, among other things, the application environment, availability of resources and capabilities of existing training institutions.

·   Most curricula are rarely modified. In some situations, they are still geared towards producing people with specific skills that do not match the demand of the industry or reflect changes in technology. Training curricula and programmes for ICT professionals should change in anticipation of changes in ICT and the industry and in response to them. The programs should be dynamic enough to accommodate emerging concepts, such as the Internet technology.

·   In most institutions, adequate and relevant computing facilities and infrastructure, such as literature, audio-visual aids, and others do not support the curricula. Inadequate laboratory facilities lead to emphasis on theory at the expense of practice and experimentation.

Low salaries for teaching profession

Low salaries in the profession means that teachers' training institutes cannot attract quality candidates. In Kenya, for example, teaching is the profession of last resort for most candidates. Even those who are attracted to teaching have to resort to other methods to earn additional income, compromising the quality of their work.

4.   Strategies for African Governments

Following are some strategies that African governments must take to enhance human capacity in ICT.

Structure for ICT policy development and implementation

It is important for governments to set up national entities that champion the development and implementation of ICT policies and strategies. It may be advisable, where resources are scarce, to use an existing entity because it takes time for a new one to develop adequate resources for the task at hand. The entity must have adequate resources. It should reflect a public/private sector and sector/community partnership, and also have political accountability, and a legal and fiscal status. The entity should maintain contact with the full range of stakeholders and be politically robust and well embedded, and also strategically located close to the central policy making arm of the government. Its establishment should be based on political consensus, a very important asset in ensuring continuity beyond five-year political plans.

The entity could have a three-tier set up consisting of:
· a forum where all stakeholders are represented and consensus views developed
· a small working unit of technical people (not just ICT technicians) and trouble-shooters who can monitor the strategy and ensure that it is dynamic, by providing stimuli
· a linking mechanism with the government information strategies and the governance process

This national entity would be responsible for:
· preparing a vision statement that will energise the people, creating faith in them that ICT vitally aids personal and national growth
· formulating the ICT policy and master plan and keeping these policies and strategies updated to enable developing countries emerge as ICT giants in the 21st Century
· developing an appropriate management programme
· advising on the strategy's long-term sustainable implementation and resources
· developing a national capacity building approach covering legal, institutional development, human resources development and community awareness
· incorporating a legal framework that is flexible and can easily adapt to change
· negotiatiating with global partners (telecommunications operators and investment and venture capital)

An example of this entity would be a National Information and Communication Technology Council (NICTC). Such a council would be the apex body for providing broad guidelines and directives for human resource development in ICT. The body should be constituted under the Office of the President or Prime Minister, depending on the political structure. Various experts, ministries, universities, industries, professional organizations, training institutes, business sectors and other relevant agencies are envisaged to represent the council. In Kenya, a cabinet paper has been prepared to set up a NCICT.

ICT human capacity development

In resource scarce countries, like in Africa, human resource is the main factor for economic prosperity and it could be a real asset in the digital age, so each nation should accord investing in human capacity development, especially in ICT, high priority. Efforts to expand capacity for ICT education and training also attract young students into the profession and will help build indigenous capacity in ICT. The abundance of ICT professionals in Africa may, with the right policy instruments, attract foreign investment for the industry as it has done in several Asian countries. There are prospects of exporting software to other countries hence software development should be carried out to create self-employment and to earn foreign currency for national development.

The anticipated global ICT industry is worth over USD 50 trillion by 2008. This means that there will be a huge demand for ICT manpower in the coming years. Developing countries should be positioned to take a significant share of this global market by developing ICT human resources by initiating the following programs:

- · **Capacity building:** Expanding capacity in existing institutions and building capacity in new institutions without compromising quality.
- · **Electronic distance education.** With the availability of high technology, it has been possible to offer distance education via Intranet and Internet. Internet application like tele-learning has been introduced in several countries, bringing education to the doorstep of people in various fields. Each district can be linked with central V-SAT. Using Intranet or metropolitan area network system, computers may be used as televisions for tele-teaching, tele-learning and demonstration of different of educational packages.
- · **Private sector involvement.** The private sector will have to be more involved in ICT-HRD. Governments need to come up with incentives, such as tax holidays for those providing ICT services, zero-rating importation of teaching equipment and materials, among others that will enable the private sector to invest more in ICT human capacity development.
- · **Training of teachers.** If governments in Africa are to succeed in using computers for learning, teachers will first have to be convinced of the value of using ICT. Moreover, they will have to become adequately ICT literate to integrate the new approaches into their teaching methods. Learners cannot be expected to become adept at the new technologies if the teachers do not fully appreciate the potential of these technologies. The policy, therefore, will focus on forming the next generation of teachers and training the current ones.

However, the expansion in ICT human capacity will only be effective within the framework of a

national ICT policy and strategy. The education sector component of the national ICT policy and strategy should evolve in tandem with changes in education, technology and society and also promote opportunities for all citizens to benefit from the ICT revolution by ensuring access for all to existing and future education systems.

ICT literacy for all

While developing the human capital we should take into account that ICT is centred on people with appropriate skills and knowledge. The basic building block of ICT industry is the skilled and semi-skilled manpower. ICT industry that caters for internal and external markets needs a large number of skilled and semi-skilled manpower that comes basically from the three sectors of education, namely, schools, learning institutions, and other training institutions.

Appropriate basic education is the first building block for a strong manpower and it is imperative that people are empowered with appropriate basic education to achieve better life in the digital age. Governments should make ICT training compulsory in all schools to enable each country to have the human capacity to exploit and develop new technologies that meet national development requirements.

In Kenya, many eminent persons from the public and private sectors have, in the recent past, made pronouncements on the need for a national curricula for primary and secondary schools. At the same time, the Institute of Computer Science, University of Nairobi, for example, has developed modular certificate and advanced certificate courses in computing studies. These academic courses were developed to meet the following needs:
- provide information technology literacy skills to a cross-section of target audience
- build a foundation for a career in ICT
- standardize computing education, at certificate level
- open up ICT technology education to a wider cross-section of Kenyans

 In schools, the motivation was lack of a relevant and up-to- date curricula.
One of the target audiences for these courses is the student in school (right from pre-unit to secondary school), and the training would be undertaken alongside the school curricula. Another target audience is the employee who needs ICT literacy skills (from post-secondary school to retirement age). For this group, the courses would need to be taken in ICT training colleges accredited by the university.

Cost of ICT

The cost of ICT products and services can be reduced through:
- **Instruments to encourage private sector participation.** These include bank loans with low interest rates for the education sector and zero rating duties and taxes for ICT products and services in education. This will enable the private sector to be actively involved in ICT human capacity development and also offer other ICT services.
- **Reduce telecommunication tariffs.** A precondition for the scholarly and integrated use of new technologies is the availability of adequate and suitable ICT infrastructure, including multimedia computers, peripheral equipment, software and telecommunications

connections. Of concern is the high recurrent cost of communication due to high telecommunication tariffs in most countries. There is, therefore, need to have special telecommunication tariffs for the education sector to spur growth in the ICT sector.

In addition to reducing costs of ICT products and services, governments should invest directly in ICT human resource development. It is true that the investment made in education may not yield immediate observable dividends. Balancing investment in ICT-HRD with other pressing matters is a key issue to be addressed.

Quality programmes and content

The ICT programmes and content should be of quality and characterised by the following:
- **Appropriate mix of staff complement.** This is largely due to the growing multi-disciplinarity nature of ICT. In computer science, for example, a staff complement of 'traditional' computer scientists is a recipe for disaster in training ICT manpower.
- **Dynamic curricula/programmes.** Training curricula and programmes for ICT professionals should change in anticipation of changes in technology, industrial requirements, and others, and also in response to these changes.
- **Adequate supporting resources and facilities.** There is need to have adequate support resources (human, capital, etc.) and facilities (computers, literature, etc.) to improve the quality of training.

Standards for quality training

The stakeholders need to look for methods to regulate the quality of training institutions. Following are some recommendations:
- developing standards in ICT training including guidelines on trainee entry requirements for the various courses at different levels, on qualifications of trainers for the various courses, on staff/student ratios, and on adequacy of the host on training resources, such as computers and literature
- involving professionals in the development of the standards
- setting up mechanisms to ensure adherence to the standards

establishing dynamism in standardization to ensure that standards reflect changes in expected quality

5.   Conclusion

The impact of ICT revolution throughout the world can neither be doubted nor ignored. However, ICT is not an end in itself but a means to bring prosperity to modern times. We should realize that mere introduction of ICT will not help our societies. Without the paradigm shift in every level of each nation, our societies cannot exploit full potential of ICT.

Other Publications in the ATPS Special Paper Series

Special Paper Series 1
Globalization and Technology: Africa's Participation and Perspectives: Concept Paper and Research Agenda by Melvin Ayogu &Osita Ogbu (*2002)*

Special Paper Series 2
Globalization, Markets for Technology and the Relevance of Innovation Policies in Developing Economies by Sunil Mani (*2002)*

Special Paper Series 3
Biotechnology in sub-Saharan Africa: Towards a Policy Research Agenda by
John Mugabe (2000)

Special Paper Series 4
The Impact of Globalization in sub-Saharan Africa Countries by Mwindaace N. Siamwiza (*2002)*

Special Paper Series 5
A Blueprint for Developing National ICT Policy in Africa by Clement Dzidonu*2002*

Special Paper Series 6
Impact of Foreign Direct Investment (FDI) on Technology Transfer in Africa by Moses M. Ikiara (2002)

Special Paper Series 7
Pursuing Technology Policy Research in sub-Saharan Africa: Reflections on the Dimensions, Applications and Implications of a Methodological Framework by M.H. Khalil-Tammy *(2002)*

Special Paper Series 8
African Response to the Information Communication Technology Revolution by G. Olalere Ajayi *(2002)*

Special Paper Series 9
Information and Communication Technologies (ICTs): Poverty Alleviation and Universal Access Policies by Andrew Dymond & Sonja Oestmann *(2002)*

Dr. T. M. Waema is a Lecturer at the Institute of Computer Science, University of Nairobi, Kenya.

For more information this series and ATPS Contact:

The Executive Director
The African Technology Policy Studies Network
3rd Floor, The Chancery, Valley Road
P.O. Box 10081 00100 General Post Office
Nairobi, Kenya

Tel: +254-2-2714168/092/498
Fax: +254-2-2714028