

East African Government Investments in Information and Communication Technologies for Education: Matching Policy to Practice

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Abstract

Information and Communication Technology (ICT) is a principal driver of economic development and social change worldwide; but technology alone can only be an enabler, not driver of development. Properly formulated policies, planning and implementation are needed to harness ICT opportunities into meaningful national development. The five countries forming the East African Community have formulated national ICT policies and (with exception of Burundi) drawn out plans for ICT integration in schools. This paper gives an overview of these policies and tries to match them with the actual practice and implementation in schools. We have analysed the gaps between the rhetoric and reality in ICT use in teaching and learning in schools in East Africa. The present paper offers a number of recommendations for policy makers, implementers and other stakeholders to maximise the returns from ICT investments in education in the 21st century.

Key words: Information and Communication Technology; Integration; Education; Policy; East Africa; Equity and Access; E-content; Teacher Education

1. Introduction

Information and Communication Technology (ICT) in its broad sense is an umbrella term used to encompass all forms of computing systems, telecommunications and networks, as well as the various services and applications associated with them. It has been argued that ICT is a principal driver of economic development and social change worldwide (Kozma, 2005; Leach, 2008). In many countries, the need for economic and social development is used to justify investments in educational reform including investments in educational ICT. Kelles-Viitanen (2005) acknowledges that ICT plays a major role in all aspects of national life: in politics, economic life, as well as in social and cultural development. ICT in developing countries is rapidly transforming the way people do business, access information and services, communicate with each other and even entertain themselves. It is thus not surprising that African governments have taken on the development and use of ICTs as a major driver of national development in the 21st century. The UN Economic and Social Council (ECOSOC) Ministerial Declaration (2000) proposed urgent and concerted actions at the national, regional and international levels in the application of ICTs for development. However, as noted by a Microsoft Corporation (2007) report on its ICT initiatives in Africa, technology alone does not drive development but merely enables it. While ICTs offer special opportunities to stimulate growth and increase innovation in every local setting, the potential of these technologies cannot be realised unless ICT resources are matched by resourcefulness; combined with other initiatives by local leaders, educators and entrepreneurs to achieve individual and institutional objectives (Microsoft Corporation, 2007). This calls for a well-formulated and implemented national strategy and policy to avail the necessary resources. Such a strategy would match ICT opportunities with resourcefulness of different players and stakeholders into meaningful national and social development.

The five countries comprising the East African Community, namely Burundi, Kenya, Rwanda, Tanzania and Uganda, have each formulated national policies to guide such implementation. With the exception of Burundi, all these countries have proceeded to formulate sector-specific policies to guide the deployment and use of ICT in education. In a recently completed literature review on developing the use of ICT to enhance teaching and learning in East African schools, we have discussed extensively the national ICT in education policy and the corresponding government initiatives (Hennessy & Onguko, forthcoming). In this paper we attempt to give an overview of these national policies, including their formulation process. We discuss both national and school-level policies, financial investments and interventions. We then characterise actual practice, delving below the surface to examine issues related to access, and levels and types of use of digital technologies in East African schools (as far as we could determine). Key stakeholders and agents of change in ICT integration are identified, including national policymakers, school leaders and academics.

2. ICT in education policy in East Africa

In this section, we trace ICT in education policy via its formulation process in East Africa. We flesh out the main milestones and highlight key thrusts of the policies as they relate to ICT use for teaching and learning in primary and secondary schools, for each of the countries.

2.1 Overview of East African ICT in education policies: Process and product

East Africa is the easterly region of the African continent lying across the equator. In 2007, the East African Community (EAC), which initially comprised Kenya, Tanzania and Uganda, was expanded to include Burundi and Rwanda. All the EAC countries have, to varying degrees, experienced both pre- and post-independence civil strife, ethnic violence and bad administration which, coupled with other external factors, have stagnated national and regional development. This stagnation has

affected the education sector as well; and with it is the loss of associated social and economic benefits. Faced with such challenges, East African countries were individually forced to embrace technology which was fast becoming an important agent for development. What followed was an emerging use of ICTs in different sectors with particular focus on personal computer use. This emergence and use of ICTs was hasty, haphazard (Waema, 2005) and in most cases without direction. The result was calling out for streamlining. Thus ICT policies in the East African Community began taking shape at the start of the millennium in response to the need for governments to offer direction in the use of these technologies.

According to Farrell and Isaacs (2007), initial ICT policies were comprehensive and included all the sub-sectors of the education system. However, formation of the policies has been a long and complicated process. The outcomes have not always equated to implementation and results on the ground, but have to some extent set up mechanisms to specifically attract donors (Farrell & Isaacs, 2007). A case in point can be shown by the support by resourceful donor partners such as USAID, the Carnegie Corporation and the International Telecommunications Union (ITU) for the Africa Information Society Initiative (AISI) in promoting ICT policy formation in Africa (Etta & Parvyn-Wamahiu, 2003). AISI, an action framework to build Africa's information and communications infrastructure, was adopted by Ministers of Economic and Social Development and Planning and endorsed by the then Organisation of African Unity (OAU) in 1996. This initiative has helped many countries in Africa to complete elaborate national information and communication infrastructure plans. We now move to briefly discuss the policy formulation process and the key aspects of ICT in education policies for each of the EAC countries.

2.1.1 Kenya ICT policy

The earliest attempt at ICT policy formulation in Kenya dates back to the 1980s, but the process remained incomplete by 2000 (Nduati & Bowman, 2005). The formation of ICT policy in Kenyan education has its roots in the Ministry of Research of the time. The motivation was to develop national policy guidelines for the development of ICTs in the country in order to address the then prevailing haphazard growth of the sector. This was complemented by the readiness of donor agencies, including UNESCO, in funding the current policy-making process. A national ICT policy for Kenya was consequently adopted in January 2006 after many failed attempts in preceding years (Kariuki, 2009; Waema, 2005). The policy is based on four guiding principles: infrastructure development, human resource development, stakeholder participation and an appropriate policy and regulatory framework. On human resource development, the policy underscores the need to strengthen and streamline ICT training through (among others):

- Promoting ICT in education at primary, secondary, tertiary and community levels by developing ICT curricula and ensuring that teachers/trainers possess the requisite skills;
- Setting up a framework for evaluating and certifying ICT training programmes (Kenya Ministry of Information and Communications, 2006).

The national ICT strategy for education and training was expressed in the policy document for ICT in education (Kenya Ministry of Education, 2006). The policy emphasises the need for Public Private Partnership (PPP) in addressing key development challenges in the country. Among the stated strategic objectives is the need to equip educational institutions with digital equipment for secondary and primary schools. It also lays the framework for e-learning that is considered crucial for the development and utilisation of ICT. Need is expressed to provide affordable infrastructure that facilitates dissemination of knowledge and skill through e-learning platforms; and to promote the development of content to address the educational needs of primary, secondary and tertiary institutions. The e-learning framework further seeks to facilitate sharing of e-learning resources between institutions, exploit e-learning opportunities to offer Kenyan education programmes for

export, and to promote the development of an integrated e-learning curriculum to support ICT in education (Kenya Ministry of Education, 2006; Kenya Ministry of Information and Communications, 2006).

The expected outcome of these measures, according to the national ICT strategy for education and training, was to improve equipping of educational institutions with digital infrastructure in up to 80% of secondary schools and up to at least 10% of primary schools. The strategy also underscored the need for access and equity by establishing mechanisms to support infrastructural development in remote areas, implementation of policy provisions that are favourable to special needs groups, and making budgetary provisions for adequate supply of ICT equipment and facilities (Kenya Ministry of Education, 2006).

2.1.2 Tanzania ICT policy

The process of policy formation in Kenya could be likened to Tanzania, where the need to develop an ICT policy led to the formation of a grouping called the eThinkTank, a forum supported by the United Nations Development Program (UNDP). The eThinkTank's stated objective was to 'present the public and Government with ideas and suggestions to help move the country into the information age' (Tanzania Ministry of Education and Culture (MoEC), 2001). The eThinkTank also intended to help harmonise the current ICT policy and regulatory environment with that of neighbouring states and partner countries. The consultative process culminated in the formulation of the national ICT policy in 2003.

The overall ICT policy mission is to enhance national economic growth and social progress through ICT in all sectors (Tanzania Ministry of Communications and Transport, 2003). The policy aims at expanding and developing the teaching of ICT at all formal and informal levels of the national education system and using ICT to improve the quality of education and training in all areas including distance learning. The policy proposes to develop and deploy a nationwide e-education system that interconnects schools and higher education/training facilities across the country with each other (Tanzania Ministry of Communications and Transport, 2003, pp. 13-14). In 2007 the Tanzanian Ministry of Education, having acknowledged the importance of ICT, presided over the formulation of a more specific policy to guide the integration of ICT in basic education (Tanzania Ministry of Education and Vocational Training, 2007). Basic education refers to teacher education, secondary, primary and pre-primary, as well as non-formal and adult education. The policy hopes to achieve the country's educational policies and programmes which emphasise the acquisition and appropriate use of skills by integrating ICT.

The Tanzania ICT Policy for Basic Education (Tanzania Ministry of Education and Vocational Training, 2007) acknowledged that very few schools had access to ICT infrastructure, and those that did were primarily urban. The aim was to ensure the establishment of the necessary infrastructure to facilitate the adoption of ICT within the education system. This infrastructure includes access to computers and the internet, digital equipment, telecommunications, radio and television. National coverage is envisaged by 2015. Implementation will involve a PPP approach to the financing of ICT in education. Notable in the framework is the inclusion of an ICT curriculum for both primary and secondary schools. It should be noted that Kenya and Uganda only mentioned an ICT curriculum for secondary schools. The use of ICT as a pedagogical tool for teaching and learning, and for the professional development of teachers, administrators and managers, is given prominence. The development of local content for basic education and facilitating the use of ICT resources in schools and colleges by the neighbouring community is also a priority. As a statement of intention, the policy is evidently comprehensive as it considers issues of infrastructure, curriculum and content, training and capacity development, planning procurement and administration, management, support and sustainability, and monitoring and evaluation (Hare,

2007a). The implementation of such ambitious intentions is, as we observe later, the cause for concern.

2.1.3 Uganda ICT policy

In Uganda the national ICT policy development process was initiated in 1998 by the Uganda National Council of Science and Technology (UNCST) (Torach, Okello & Amuriat, n.d.). In 2002 the UNCST submitted a draft national ICT policy framework to the cabinet which was approved the following year (Uganda Ministry of Works, Housing and Communications, 2003). The policy recognised that Uganda would need to embrace the goal of lifelong education for all (Farrell, 2007a). The policy highlighted the need for literacy improvement and human resource capacity building. Among the strategies for attaining this objective was to integrate ICT in mainstream educational curricula as well as other literacy programmes and provide for equitable access by pupils and/or students at all levels (Uganda Ministry of Works, Housing and Communications, 2003). An educational sector ICT policy was formulated in 2005 aimed at rationalising and harmonising ICT-related programmes within the educational sector that had been identified as uncoordinated and fragmented (Uganda Ministry of Education and Sports, 2005).

The educational sector ICT policy underscored the need for investing from primary to tertiary level. It recognised that ICT programmes had been initiated at secondary and tertiary institution level, but at a very limited scale compared to the demand for such services. The policy defines variable focus in ICT investment at the different educational levels. At primary school level, the policy aims at encouraging those that have acquired technology to use it, either by producing teaching materials or by using technology with students. This is in addition to computer awareness programmes at primary teacher-training level. These programmes enable newly qualified teachers to get equipped to make use of ICT as it becomes available. At secondary level the policy advocates for a more direct government role, aimed at ensuring that teachers are equipped to make use of ICT in their lesson preparation and teaching practice. Additionally, a specific subject based on ICT applications has been provided for schools that have sufficient equipment. The policy recognises the need to mitigate the likely expansion of a digital divide between wealthy urban schools and poor rural schools. To this effect, the strategy proposes the provision of some equipment targeted at a number of poor rural schools depending on resource availability (Uganda Ministry of Education and Sports, 2005). Generally, the policy proposes that the key focus in government investments should not be on the provision of equipment, but on teachers, trainers, lecturers and on the curriculum that they are expected to follow. This is prudent given the limited public purse. Government, however, should not abdicate its role of spear-heading efforts to ensure access to ICT facilities by all schools. For ICT integration, well trained teachers and suitable curricula are not of much use without access to ICT facilities.

2.1.4 Burundi ICT policy

Notwithstanding Burundi's 1993 political crisis¹ which had a devastating effect on education, the national ICT for development policy was adopted in 2007. The policy was expected to focus on the adoption and use of ICT to achieve its six strategic objectives: capacity building, enhancement of a legal and regulatory environment, promotion of a base infrastructure, promotion of good governance, promotion and encouragement of private investment, and the promotion of the development of content and applications (Hare, 2007b). The country has no specific policy for ICT use within the education sector, despite recognising ICT as an enabler of education. This means that ICT initiatives are not a core part of the government development plans, and therefore lack focus,

¹ In 1993, Burundi's first democratically elected head of state was assassinated, setting the scene for years of Hutu/Tutsi ethnic violence in which an estimated 300,000 people, most of them civilians, were killed. (BBC News: http://news.bbc.co.uk/2/hi/africa/country_profiles/1068873.stm#facts).

resources and a nationalistic outlook (Hare, 2007b; Novatech, 2008). Consistent with the infoDev report (Hare, 2007b), we found no documentation to indicate ICT use in public secondary schools. According to the report, there is also lack of awareness, coupled with lack of trained teachers with ICT knowledge, which has contributed to a lack of interest and lethargy in adopting ICT in the classroom. In addition, ICT has not been identified as a priority area in education hence the resources available are channelled towards the sector development programme, a large project dealing with fundamental issues such as the construction of classrooms and buying of textbooks (Hare, 2007b). Due to the absence of a specific policy on ICT in education, Burundi is excluded from the further discussion.

2.1.5 Rwanda ICT policy

Rwanda is a landlocked country with a painful history of conflict and one of the poorest nations of the world. The country accepted ICT as central to its Vision 2020 (Farrell, 2007b) and is one of the core pillars of the country's National Information and Communications Infrastructure (NICI) Policy and Plan, adopted in 2000. It is expected that the country will achieve middle-income status by 2020 based on an information-rich, knowledge-based society and economy, achieved by modernising its key sectors using ICT. This vision, developed through a national consultative process that began in 1998, was the basis for Rwanda's formulation of the ICT policy (Were, Rubagiza, Denley & Sutherland, 2007). The policy is being implemented in planned phases that cover five years, referred to as the National Information and Communications Infrastructure (NICI) plans. Phase 1 began in 2001 and concluded in 2005. Phase 2 covers the period from 2006-2010 (Rwanda Government, 2006). These plans are based on the Vision for Rwanda (VfR) mission strategies which in the case of ICT are to:

- Transform Rwanda into an ICT-literate nation;
- Transform the educational system using ICT with the aim of improving accessibility, quality and relevance to the developmental needs of Rwanda;
- Improve the human resource development capacity of Rwanda to meet the changing demands of the economy.

The policy sets out the development of special education initiatives for academic exchanges and twinning, implementation of the SMART schools concept where technology platforms are used for distance education, and penetration of ICT into rural schools (Farrell, 2007b). The NICI plans have clearly elaborated activities relating to the integration of ICT in education. The NICI 2010 plan involves seven policy action items. Three of these have a direct bearing on primary and secondary education: Use of ICTs for formal education, improvement of formal education in ICT, and helping educational institutions improve their business processes. All plans have specific timelines. The policy mentions introduction of teacher-led development of e-learning content and a translation of educational software into the local Kinyarwanda language as strategies for availing quality and relevant teaching and learning to all learners. The development of programmes to promote the acquisition of computer equipment by educational institutions and a national SchoolNet to provide access to the internet for schools is also included within the policy. This will further enhance the access to quality and relevant learning.

2.2 Cross-cutting issues on ICT policy in the EAC

Several commonalities can be deduced from the formation of ICT in education policies in East Africa. Firstly, the policies were formed at the turn of the millennium or the year 2000 against a backdrop of haphazard and uncoordinated ICT developments. Around this time, many countries were formulating ways in which to try and achieve the Millennium Development Goals (MDG).

Secondly, in all cases a national ICT policy was adopted before an education-sector-specific ICT policy was formulated. In the case of Rwanda, the ICT in education strategy is embedded in the national ICT plans. Only Burundi is yet to publish an ICT in education policy document. Thirdly, although the reasons for the formation of these policies varied from one country to another, the bottom line was the eradication of poverty through the training of skilled human resources and provision of education in line with the Education for All (EFA) agenda. Fourthly, although the various governments were at the forefront in formation of these policies, the presence of donor agencies was strong, and was felt through their funding of these processes. Finally, although the formulation of these policies was comprehensive and articulate, the implementation, as discussed later in this paper, may not have been as impressive.

All the East African countries have appreciated the need for integrating ICT in both formal and informal education. There is a stated commitment to invest in ICT infrastructure in schools with deliberate plans to ensure that the digital divide between rural (poor) and urban (rich) schools does not escalate and that children with special needs are catered for as well. The policies point to a desire for a nationally coordinated effort in the creation, dissemination and sharing of e-learning content to improve the quality of teaching and learning in schools. Management and maintenance of the ICT infrastructure as well as use of ICT in school management (business processes) are also catered for in the policies. Training of teachers in ICT skills and pedagogical application of ICT are given hierarchical prominence alongside the development of relevant curricula for teaching ICT at the different levels of the school system. The role of coordinating different ICT investments in schools which were until then uncoordinated and fragmented was vested in the respective country ministries responsible for education. The use of PPP and a phased approach to investment in ICT in education by governments are some of the mechanisms set out for the achievement of policy objectives. However, while the ICT policies are indeed comprehensive statements of intention, there are gaps in policy implementation to date. We now turn to discuss the evidence available for the implementation of ICT in education policies.

3. ICT policy implementation: Evidence and gaps

3.1 Public Private Partnerships (PPP)

Governments in East Africa are incapable of solely funding ambitious ICT projects in the education sector. This has led to the fostering of PPPs to complement government efforts. There is strong evidence to show that these partnerships have been exploited: ICT initiatives based on such partnerships are the most prevalent in schools in East Africa. Notable among these are SchoolNet, One Laptop per Child (OLPC), New Partnerships for African Development (NEPAD) e-schools initiative, the Microsoft Partners in Learning Program, and Connect-ED, among others. The ICT in teacher education programme carried out by the Tanzanian government has equipped all the teacher training colleges in the country with internet-enabled computers with support from the Swedish International Development Cooperation Agency (SIDA) and other partners. These PPP initiatives have focused on equipping schools with computers and associated hardware and software, provision of internet connectivity, training of teachers and teacher educators in ICT use, and the development and selection of digitised pedagogical content. Such initiatives have led to increased access to ICT in schools, although information on their actual impact is scant. It is beyond the scope of this paper to analyse each of the initiatives in detail. However, the following discussion focuses on two large-scale models as exemplifiers.

The NEPAD e-schools initiative is run by the education ministries in close partnership with the Commonwealth of Learning and infoDev. This is supported by consortia of over 50 private sector institutions led by AMD, Cisco, HP, Microsoft and Oracle. This ambitious initiative aims to equip more than 550,000 African schools with state-of-the-art computers, curriculum-relevant learning materials and to connect the schools to the internet by 2020. It also includes the teaching of ICT

skills to young Africans in primary and secondary schools and provision of ICT skills to teachers to enhance teaching and learning (Farrell, Isaacs & Trucano, 2007). The project started with a pilot study project of six schools per country, in 16 countries including Kenya, Rwanda and Uganda. A monitoring and evaluation report of this phase of the project by Farrell et al. (2007) identified a number of problems that hindered or delayed implementation. Issues included a lack of both human and fiscal resources, a consequent lack of effective communication among project partners, inaccurate assumptions about ICT use in education in Africa, and lack of preparedness of some countries to participate. The lessons learnt from the pilot project are being used for a wider-scale roll out plan. Kenya, for example, is reported to have adopted the NEPAD e-schools model and started rolling out ICT to 100 schools. The rate of rollout, however is far too slow to be able to cover all schools in the stated time frame. The portable computing initiative for developing countries, known as OLPC, has a mission of 'creating educational opportunities for the world's poorest children by providing each child with a rugged, low-cost, low-power, connected laptop with content and software designed for collaborative, joyful, self-empowered learning'². With the exception of a few scattered volunteer projects, Rwanda is the only country in East Africa to have adopted this model; the aim is to equip each child in primary school with an internet-enabled laptop by 2012, starting with rural schools (Rwanda Information Technology Authority, 2007). The Rwandan government is reported to have ordered 100,000 such laptops, of which 20,000 were expected by end of August 2009; a further 10,000 computers have also been donated by the OLPC organisation (Africa Science News Service, 2009). However, the reality of managing such a huge ICT model has raised other issues, including the sustainability of the mother OLPC initiative, which is said to be overwhelmed by the reality of business, politics, logistics, and competing interests worldwide for the surging demand for low-cost educational ICT (Kraemer, Dedrick & Sharma, 2009). Such a massive investment will require close monitoring and evaluation to ensure maximum utility. Failure to set up the requisite structures for facilitating monitoring and evaluation was one of the challenges of NICI 2005 that were to be addressed in the NICI 2010 plan (Rwanda Government, 2006).

3.2 Coordination, monitoring and evaluation

The Ministries of Education in the countries discussed here are mandated by ICT education policies to coordinate, monitor and evaluate all the different ICT school initiatives. The Kenya ICT Trust Fund is an attempt at such coordination. This registered consortium, in the form of a Kenyan NGO, brings together many partners from the public, private and civil society sectors. However, to date it has not been possible to obtain reliable and up-to-date information on the activities so far performed by the Kenya ICT Trust Fund. Coordination efforts must be widely publicised for intending partners to see what has been achieved and what remains. This is necessary for improving transparency to encourage future participation, sharing of experiences learnt and best practices and for minimising likely duplication of efforts.

The Education Management Information System (EMIS) is a major ICT initiative in its own right, and also a useful mechanism in coordination. The EMIS is set up in all the East African countries and aims at providing quality education statistics in a cost-effective and sustainable manner. This is done through data capture on school facilities and pupil details. Details are coordinated at the district level and uploaded to the system for national compilation and processing. In Uganda, for example, districts have been equipped with internet-connected computers and associated peripherals and officials trained in their use (Uganda Ministry of Education and Sports, 2005). However, a drawback is that in spite of internet connectivity, the district systems are not networked with the national centre. This means that real-time data upload and comparative analysis is not possible (Uganda Ministry of Education and Sports, 2006). A similar problem was reported in Kenya where,

² <http://laptop.org/en/vision/index.shtml>

after two years, migration of data from the districts to the national platform had only been achieved in two of 70 districts due to non-interconnectivity of systems (Kenya Ministry of Education, 2008). This defeats the initial objective of EMIS which was to 'harmonise and integrate information systems to support timely collection, processing, dissemination and use of education data ... to achieve relevant and quality education' (Kenya Ministry of Education, Science and Technology, 2005, p. 75). The EMISs are currently being used for collection and analysis of predominantly demographic school data that limits application. Information on the levels of investments in ICT in schools, for example, was not readily available from the respective education ministries. Such information is useful in monitoring the progress of ICT integration in schools. There is need for research on the optimal use of EMISs for prompt provision of such information.

3.3 Curriculum and content development

All the four countries have developed a curriculum for teaching ICT skills in secondary school. Rwanda and Tanzania have also developed a curriculum for ICT in primary schools. With the exception of Rwanda, where a considerable effort has been made to improve access to ICT in rural schools, the implementation of these curricula is limited to the few urban schools that have the required facilities. This leaves the majority of teachers and students ICT-illiterate, and unable to reap the numerous benefits of ICT (Centre for Educational Technology, 2007).

A number of initiatives have been reported aimed at generating and sharing relevant e-content for use in schools. The Kenya Education Trust Network (KENET) initiative in Kenya was to establish permanent high-speed internet infrastructure in 22 institutions of higher learning and then expand to 600 secondary and primary schools within two years (Farrell, 2007c). This, if achieved, will assist in the generation and sharing of digital learning content (e-content). The Kenya Institute of Education was reported to be working on the digitisation of curriculum content for schools, although to our knowledge no update can be found on progress thus far. In Uganda, SchoolNet Uganda runs the Uganda Digital Education Resource Bank (www.uderb.org), an online repository of digital resources created or identified by Ugandan teachers and students. In Rwanda, the National SchoolNet is expected to provide access to the internet for schools and facilitate sharing of learning resources. These are steps in the right direction as they bring economies of scale to the use of e-content. Reuse and sharing of e-content greatly reduces its cost per user. What needs to be emphasised, however, is that it is undesirable to separate online content from online access. Attempts to generate appropriate e-content before addressing access issues can only serve to further disadvantage those schools and pupils that have received little or no quality teaching and learning materials in the first instance.

3.4 Teacher education and pedagogical application of ICT

It is heartening to note that all the East African countries discussed here have placed emphasis on the educational and professional development of teachers in ICT use as a key prerequisite to the integration of ICT in schools. This is strongly supported by theory and practice, as shown later in this volume by Hennessy et al. and elaborated in our literature review (Hennessy & Onguko, forthcoming). What is missing or inadequate, however, is education of teachers in the pedagogical application of ICTs in teaching and learning. It is one thing to train teachers in ICT proficiency; a prime example is Tanzania, where teachers can attain International Computer Driving Licence certification (Tanzania Ministry of Education and Vocational Training, 2007). The ability to use such skills to improve students' learning experience, however, is a different skill altogether. Secondly, the professional development of teachers in ICT needs to go in tandem with access. A teacher who obtains ICT skills may be inclined to transfer to schools that already have ICT facilities, in order to use these skills. This further disadvantages those schools without ICT access.

3.4.1 Equity and access

The principle of equity in accessing quality teaching and learning environments irrespective of economic status, gender, disability or other forms of discrimination is mentioned in the education policies of all the East African countries. Some efforts towards the realisation of such an objective have been reported. For example, the Computer for Schools – Kenya project, has extended ICT access to disadvantaged groups in society, including two children’s homes, a school for the deaf and a rehabilitation centre for street children (Farrell, 2007c). While such efforts are commendable, more concerted and better coordinated initiatives are required to address issues of equity and access to ICT-enhanced education in East Africa. Disadvantaged schools in rural areas with no access to the power-grid need specially formulated access solutions. The use of mobile phones and low-energy consuming (i.e. solar-powered) devices can help bridge the digital divide between rural and urban schools. Similarly, solutions for children with disability need to be specially formulated and adopted to the relevant context. Access for disadvantaged groups will thus need holistic solutions, rather than the one-here-one-there intervention model currently being practised in East Africa. Governments will need to issue implementation guidelines that specifically address the problem of a widening digital divide among its citizens and follow-up on these to ensure that they are being carried out.

3.4.2 Management and maintenance of ICT resources

Proper guidelines related to the management and maintenance of ICT infrastructure, including the provision for sustainability, are integral to the success of ICT in East African education. ICT investments are very costly especially when one weighs in the opportunity cost of other needed infrastructure like school buildings. The teacher training initiatives in trouble-shooting and basic maintenance of computers, which have been referred to earlier, are therefore commendable. However, such efforts need to be matched with actual data showing the functionality status of different equipment and what has been done (or needs to be done) to maintain them. Replacement and routine maintenance plans also need to be drawn out and shared with stakeholders in advance. Interestingly, the ICT infrastructure can itself be used to provide such a management and maintenance system. Research into expanding the existing EMISs to perform such function would be useful.

4. Conclusion and recommendations

This paper has given an overview of the policies guiding the integration of ICT in primary and secondary schools in East Africa. There has also been reference to teacher training colleges as well; in as far as they impact on the skills of teachers at the primary and secondary school level. We have traced the formulation processes of these policies and shown that the major driving force for this was to provide direction and co-ordination of several initiatives, all aimed at ensuring that ICT enhances quality of education and boosts national development. With the exception of Burundi, the EAC countries discussed in this chapter had ICT education policies derived from (or embedded into) their national ICT policies. While there is substantial evidence to show that the East African countries were moving towards the implementation of these policies, we have exposed a number of gaps in such strategies that must be addressed to obtain maximum utility from otherwise expensive initiatives. We offer some recommendations towards minimising such gaps next.

4.1 Recommendations

- The Ministries of Education in charge of these initiatives should publicise information on all on-going initiatives, achievements so far and lessons learnt. This will bar unnecessary duplication, and help new starters to learn from both mistakes and successes of past projects;
- The EMISs should be used to collect and analyse data on ICT infrastructure and its use in schools. Web-based data management systems which allow users to directly upload data to central databases in real-time are more useful because they enable timely analysis of data and taking of remedial action when needed;
- The continued offering of the ICT curriculum to only those schools that can afford it increases the disadvantage faced by the less privileged schools. There should be a balancing point where each school is able to offer the course with basic equipment, in the same way as the teaching of science continues in schools without science laboratories, but with reliance on teacher innovation;
- E-content development and dissemination should go in tandem with access to avoid doubly disadvantaging the under-served schools. Ingenious dissemination models, like use of mobile phones and low-power mp3 players, can be tried out to ensure wider access to materials;
- Teacher training and teacher professional development should shift emphasis from acquisition of basic computer skills to pedagogic application of these skills for improved teaching and learning experience;
- Equity and access plans need to be drawn out clearly in advance, as haphazard fire-fighting techniques do not seem to have the desired impact;
- ICT initiatives require close monitoring and evaluation. Proper management and maintenance systems and sustainability plans need to be developed and enforced to ensure that the expensive investment of ICT in education produces a high return.

We believe that if these recommendations are appropriately applied, ICT integration in schools will result in a smooth, well-coordinated, cost-effective and equitable process. So far, very good policies have been put in place but these need to be followed up with concrete actions and mechanisms to monitor such actions to ensure that the high cost of educational ICT investments pays off in the form of improved and increased educational opportunities for the citizens.

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