Information and Communication Technology Education Policy in Kenya

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Abstract. In this paper the author argues that information and communication technology (ICT) education is complex because it encompasses ICT-mediated education, ICT-enabled education and ICT education. It also exists within political and socioeconomic realities that may work for or against its success. In view of this ICT education requires a policy that originates from a National ICT Policy that makes the major strategic decisions and provides the political and socioeconomic basis for the fulfillment of the education policy. The author goes on to present two strategies for working from a National ICT policy to an ICT education policy: a human resource planning approach and a technology diffusion approach.

1. Introduction

In the Longman Dictionary of the English Language,1984 a policy is defined as:
an overall plan, especially of a governmental body, embracing general goals and procedures and intended to guide and determine present and future decisions.

Provision of education to the Kenyan population is a priority for the Kenyan government and also a global goal as embodied in the millennium development goal number 2 that states that universal primary education will be achieved by 2015. The Kenya Institute of Education (the arm of the Ministry of Education that deals with curriculum development) enumerates the objectives for computer education under Technical Education Programmes (2002) as:

- To provide increased training opportunities for the increasing number of school leavers to enable them to be self-supporting.

- To develop practical skills and attitudes which will lead to income-generating activities.

- To provide practical education and training skills which are responsive and relevant to Kenya's agricultural, industrial, commercial and economic needs.

- To provide technical knowledge and vocational skills necessary to enhance the pace of this nation's development.

• To encourage self-employment while at the same time produce artisans, craftsmen, technicians and technologies for both formal and informal sectors at the ratio of 1 technologist to 5 technicians to 30 craftsmen/artisans (1:5:30)

These objectives affirm the government's assertion that technical education will support the national goals of employment creation and technological development. Technical education could thus be perceived as central to the country's economic recovery strategy.

Despite the critical role that technical education plays in the achievement of development goals as set by the government, technical education in Kenya has never been compulsory. For example, technical subjects are classified as optional subjects (Group IV) in the Kenya Certificate of Secondary Education curriculum. One reason for this anomaly may be that most technical subjects require expensive infrastructure and highly-skilled teachers for their implementation (Lynton et al. 1993.) By keeping them optional the government protects itself from over-burdening the education budget, while creating room for schools that have the necessary resources to offer technical subjects. This paradox – an appreciation for the critical need for a subject combined with a pragmatic decision not to make the subject compulsory – provides an appropriate backdrop to a discussion about ICT education policy in Kenya.

In the author's conceptualization of education there are four cycles that should be satified in order to provide quality education. This concept is illustrated in Figure 1.
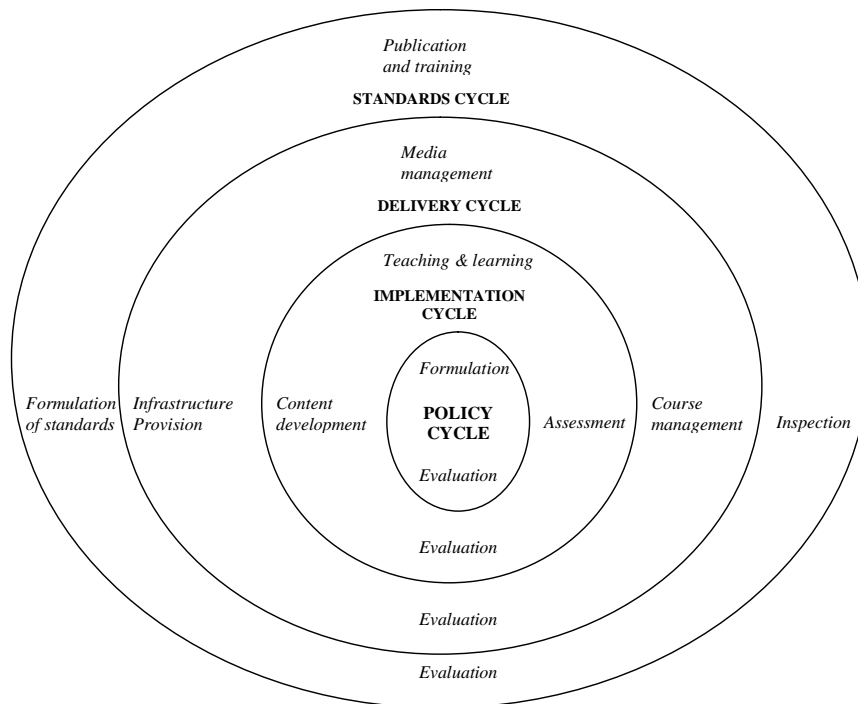
Implementation Cycle

Figure 1   The Education Cycle

The innermost cycle is the policy cycle where the aims, goals and strategies of education are set and periodically evaluated. In Kenya, national education policy is normally set through education commissions such as the Koech Commission of 1999. The next cycle is the implementation cycle which involves the development of content, teaching and learning activities, learner assessment, and the evaluation of teachers and the learning environment. In Kenya various implementation roles are carried out by the Ministry of Education, Kenya Institute for Education and various public and private learning institutions. For sucessful implementation there must be a delivery cycle where the physical and institutional structures that facilitate educational activiteis are created, the media of delivery are managed and the courses into which educational activities are organized are managed. In Kenya the same institutions that carry out implementation are also involved in delivery. Finally, the standards cycle aims to ensure that the system is delivering the quality of education that is envisaged in the policy. This involves the formulation and publication of standards, training of human resources so that they can deliver and evaluate to the required standards, and inspection to ensure that the standards are being met. In Kenya basic education is covered by the Inspectorate at the Ministry of Education, while higher education is partially covered by the Commission for Higher Education.

At all stages of the cycle there must be an evaluation to test whether the system is delivering as intended. It should be recognized that this evaluation stems from the policy and is defined by the standards. Policy is thus central to this view of education. We also believe that ICT is important in all cycles: policy, implementation, delivery and standards. This paper will focus on the importance of ICT policy in education.

(Hepp et al. 2004) define the multiple roles of ICT in the education system as not only pedagogical but also cultural, social, professional and administrative. Thus the adoption of ICT in the education system is not only about introducing ICT subjects in the curriculum, but also about using ICT to teach and learn other subjects, promote the curiosity and cultural communication of children, network and share resources, and administer and protect educational resources. The authors state further:

There is no universal truth when it comes to applying ICT in education, and that there is no advice that can be directly applied without considering each country's reality, priorities and long-term budgetary prospects and commitment.

Blurton (1999) also emphasizes the critical role of planning and strategy on ICT education by stating:

The use of ICTs in education is a difficult, expensive and complex undertaking and a host of issues, including infrastructure, curricula changes, teacher training, technical support, and so on must be considered. Such an undertaking, especially on a national level, requires careful planning.

He puts this responsibility for achieving successful use of ICTs in the education system squarely in the domain of government and aptly adds:

Apart from planning, national governments have a role to play in helping to remove political and economic roadblocks that prevent the sharing of educational resources.

ICT policy and strategy are seen as having a critical role in organizations. Sherer (2004) defines strategic IT vision as:

The shared, aspired state of the role that IT should play in the firm. The shared vision connotes institution values and meanings, symbols, and images that shape member's behaviors. We expect that the strategic vision of a firm will affect the projects that are evaluated for investment, the resources allocated to information systems, and the IT governance structures.

There is further suggestive evidence of the impact of policy on the successful adoption of ICT. Bedia (1999) for example, argues that while the spread of ICTs has the potential to increase the efficiency of organizations and spark institutional change, the level of access and the pattern of allocation of ICTs in different regions and countries is prescribed by the prevailing policy environment. Osunkunle (2006) identifies the presence of institutional ICT policies as one of the factors that could explain the negative disparity in infrastructure, programmes and achievements in ICTs in higher education between historically black universities and historically white universities in South Africa. Musa (2005) suggests that the lag in technology adoption by Sub-Saharan African countries can partially be attributed to the neglect of geo-political, cultural, structural, tribal, environmental and socio-economic factors by, among others, ICT practitioners into meaningful policies that would help these countries meet their potential. Cavill et al. (1997) identified policy and programme support for the utilization of ICTs as one of the three key factors that correlated with the likelihood of significant and timely implementation of ICT services for rural areas in Australia. In a survey of 693 higher education institutions in Europe, Australia and USA, (Models of Technology 2002) it was found that ICT policy and objectives, and the methodology of ICT implementation significantly contributed to the successful implementation of ICT in teaching and learning in the surveyed institutions.

The complexity of integrating ICT into the education system requires a strategic approach. We argue in this paper that an ICT strategy must be based on an ICT education policy, and that ICT education policy is best guided by a framework that draws its parameters from a national ICT policy. ICT policy and ICT education policy are interlinked and interdependent. This paper is thus a call for action towards the creation of an ICT education policy which, in turn, lays the foundation for the development of strategies for integrating ICT into the education cycle.

2. An Overview of developments in ICT education in Kenya

ICT education in Kenya has a long history. When computers in Kenya arrived in the late 1960s they were quickly followed by in-house training programmes offered by the large computer companies such as IBM, ICL and Wang Computers. Soon the University of Nairobi began to offer service courses in Computing in the Engineering Faculty. In 1977 an Institute of Computer Science was formed that not only maintained the computer infrastructure of the University of Nairobi, but offered a Postgraduate Diploma in Computer Science (Getao 2004).

By the 1980s, the Kenyan training and education market was becoming aware of the marketability of ICT education and the private sector began to offer a variety of skill training courses. The teaching of computer courses in higher education was also growing slowly; Egerton University launched Bachelor of Science programme in Computer Science. This was followed by the University of Nairobi.

In 1993 UNESCO supported the Mazingira Institute to develop an ICT curriculum to be offered in secondary schools. The curriculum was adopted by the Kenya National Examinations Council as a Group IV subject and a few schools began to offer the subject. Many schools were however, not able to offer the subject because:

- It was not yet offered as a teacher training subject so it was difficult to find and retain teachers for the subject;

- The investment in equipment needed to offer the subject was high;

- There was lack of awareness among key decision-making organs such as boards of governors, head teachers, parents teachers associations (PTAs) on the importance of the subject;

- Parents perceived that, because of its Group IV status, the subject was not strategic for their children's examination success.

Because of these factors there was very slow growth in the adoption of the subject. However, many schools partnered with the private sector to offer private skills lessons as an extra-curricular activity. The effectiveness of these extra-curricular skill training programmes has never been evaluated, although parents spend extra money in supporting their children through these programmes.

However, by the late 1990s there was a strong market push for ICT skills which were perceived as a passport to the job market. Private sector offerings of international certifications were growing phenomenally. At the same time the number of universities offering undergraduate programmes grew from two to twelve within a period of barely five years.

Due to the lack of regulation in the area there was an outcry from the public for educational standards. Employers too were bewildered by the range of qualifications which potential employees held. In 2004 the Microsoft Corporation partnered with the Ministry of Education to train teachers in ICT skills. It remains to be seen whether the cry for policy and standards in this burgeoning area will be heeded.

3. National ICT policy and ICT education policy
The Kenyan ICT policy was gazetted in early 2006. Apart from the national ICT policy, there are several other documents that embody the general framework of the government towards ICT including the E-Government Strategy (2004) and Economic Recovery Strategy: ICT Sector (2004).

All these documents dwell on the importance of education and training for the success of the ICT policy.

The ICT Policy (2006) has a number of objectives and strategies that are relevant to education, namely policy objectives 7, 15 and 17 that state:

• To use ICTs to enhance access to learning, to improve learning outcomes and to improve the effectiveness of educational administration, and to set up standards for ICT education in schools, colleges and other tertiary institutions.

• To stimulate local content creation and sharing of information and knowledge electronically.

• To develop efficient, high capacity and multi-media national backbone to support the expected nationwide network to interconnect schools, colleges, hospitals, government administration and private enterprises.

And strategies iii, iv, xi, xv and xvii that state:

• Promote research and development to enhance the application of technology.

• Develop a dynamic and innovative human resource base.

• Initiate a special programme for e-learning and develop instructional material using IT as a tool in all courses and at all levels from elementary education upwards.

• Initiate ICT-based research and development to enhance the application of Information Technology.

• Develop high value ICT skills necessary for a dynamic and innovative human resource base.

The ICT sector of the Economic Recovery Strategy (2004) also emphasizes the importance of ICT human resource development. The vision of the sector is:

Kenya will be an e-enabled society and knowledge-based society that leverages information and communication technology (ICT) for economic growth and opportunity creation.

One of the key strategies towards the fulfillment of this vision is:

> To build and sustain quality Kenyan, human resource capacity to use, maintain, apply, build, manage and innovate ICTS.

Finally, the E-government strategy (2004) also mentions education and training:

In the preface to the strategy the Head of Civil Service, Ambassador Francis Muthaura states:

> The effective and efficient realization of e-Government objectives depends on the availability of skills and right attitudes across Government. The Government personnel at all levels will be adequately equipped through relevant training to effectively carry

out this initiative. This calls for a change in the way Government carries out its operations and requires training in change management. In order to ensure a continued pool of IT knowledge within Government, all training programmes will have an IT component.

The strategy for achieving this change is given in the document and consists of four levels of training:

- Basic level training for all personnel

- Operational level training for information maintenance personnel

- Technical level training for systems analysts, programmers etc. responsible for designing, developing, implementing and supporting requisite systems

- Training for monitoring and evaluation.

From the aforementioned it is evident that the government places high value on education and training for the fulfillment of its ICT goals. However, apart from E-government with its four-level strategy, there is lack of a coherent framework to link education and training with the broad policy aims of the government for ICT. In the following section we will attempt to create such frameworks.

4. Policy development models for ICT education

In this section we shall discuss two different approaches towards the formulation of an ICT education policy. Both approaches require a clear ICT policy as a pre-requisite. Regardless of the approach taken to formulate ICT education policy, only an ICT policy can coherently define the goals that the education policy must achieve.

4.1 ICT Policy categories

In a previous paper Aligula et al. (2004) argue that ICT policies broadly fall into two categories: those that mainly focus on ICT as a productive sector and those that mainly focus on ICT as a development enabler. In our policy formulation model we will further argue that the emphasis and level of the human resources required will vary depending on the broad policy focus.

4.2 Human resource policy development model

In the 1960s "manpower planning" was a major exercise. Every year the Kenya government strictly set out the number of professionals such as doctors, engineers, veterinarians etc. needed in each sector. These numbers were used to recruit undergraduate students into degree courses in the university.

By the 1980s this methodology had been abandoned. The populist perception that education is for all meant that educational places could no longer be limited purely by market needs. At the same time, the market was growing in ways that could not be easily measured or anticipated making nonsense of any attempt to predict the numbers of jobs needed in each sector (Getao 2004).

However, in this section we will argue that a human resource planning approach to ICT education may be helpful in the short term to assist policymakers to provide the necessary human resources for planned ICT developments.

A precedent for this approach can be seen in the management of the complex K12 project that networked Chilean schools. Hepp et al. (2004.) report:

An early and transcendental decision in Enlaces was the identification of a small team of highly motivated professionals to initiate and lead the development of the ICT Program from the early definitional processes into its later stages, leading toward a larger provincial launch and then to the national scale. In our experience, it is advisable to assemble a team with solid educational and technical background and also one with strong leadership and political backing so as to remain relatively unhindered in the face of continuous political change. An ICT policy requires stability so that the professional team in charge of its implementation can build its capacity, mature its expertise and to accompany the program from its very early stages… The Management Team should be composed of a mixture of expertise and backgrounds. Professionals such as educators, psychologists, project managers, engineers and graphic designers can play important roles in a core team for an ICT program. It is advisable to include academic experts in education, as well as experienced teachers who have used technology in their classrooms.

It therefore follows that multidimensional teams, encompassing political, managerial and technological dimensions, are needed for both implementation of ICT in schools and complex ICT adoption strategy.
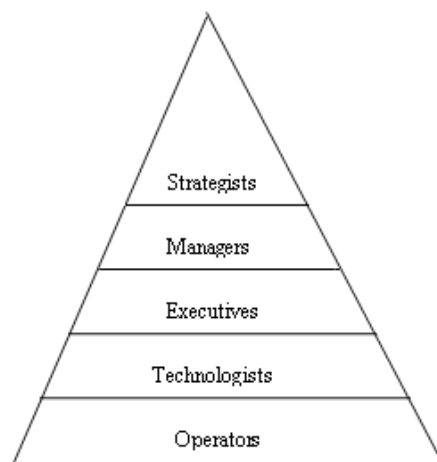

Figure 2: ICT human resource requirement hierarchy

In our human resource policy development model we propose five levels of ICT human resources that will be required by the market as illustrated in Figure 2.

This hierarchy can be interpreted in different ways depending of the national ICT policy strategic direction. In Table 1 we suggest how these levels might be interpreted within an ICT for development policy direction as opposed to ICT for production (export) development strategy. However, in practice, these strategic directions are not mutually exclusive. The overlap in actors in Table 1 demonstrates the congruence between the two strategies.

Table 1: Influence of ICT policy direction on ICT human resources

Human resource type	Development strategy	Production strategy
Strategists	Political leaders, Senior civil servants, ICT boards	Entrepreneurs, Industry leaders, Political leaders, ICT boards
Managers	Senior civil servants in ICT and related ministries	Private sector CEOs and senior ICT and IS managers
Executives	Public Government information and communication technology engineers and trainers	Software, hardware, networking and telecommunications engineers and trainers in public and private sectors
Technologists	Programmers and technicians in government ICT departments	Programmers, hardware and network technologists within commerce, industry and education
Operators	All civil servants, public who use systems	National and international users of ICT

It can be seen from Table 1 that the emphasis on educational interventions will differ depending on the ICT policy emphasis. A development emphasis (such as the E-government strategy) will require training of civil servants and also broad-based ICT education offered to the general public to enable them to use ICT systems. However, the production strategy would require a greater emphasis on producing a large number of software and hardware engineers (Getao 2004).

Table 2 shows the educational interventions that are required to produce the different types of human resources. The policy would dictate the numbers, funding and other parmeters of these interventions.

Table 2: Matching educational intervention to ICT policy

Human resource type	Development education strategy	Production education strategy
Strategists	International exposure and networking, executive literacy programmes.	International exposure and networking
Managers	Executive postgraduate programmes	Executive postgraduate programmes
Executives	Specialist undergraduate and postgraduate programmes	Specialist undergraduate and postgraduate programmes, Industrial attachments, "brain gain" programmes.
Technologists	Polytechnic diploma programmes.	Polytechnic diploma programmes, business incubator programmes.
Operators	Popular ICT literacy programmes, ICT courses in primary and secondary schools, civil service ICT certifications.	Popular ICT literacy programmes.

4.3 Technology diffusion framework

The author proposes that another framework that would help guide policy formulation is the technology diffusion framework. This draws heavily on the technology diffusion literature which has identified technology as developing largely due to two forces: a market push (a demand for the products of technology) and a technology pull (innovative forces that lead to the creation of new products) (Stadler 2005).

In the case of ICT education both these forces are present. It has been mentioned earlier that the demand for ICT education has led to push for, among other things, ICT education standards. In addition, technological developments leading to new types of computers and network devices, operating systems and programming languages has led to the development of new educational programmes and certifications. These push and pull forces have kept the ICT education market very dynamic, even in the absence of a documented policy.

One might therefore ask "Is there any need for a policy?" To shed light on this question we would extend the push-pull model of technology by adding some drag forces. We identify two major drag forces that, in the absence of a mitigating policy, can considerably hamper ICT education. These are political and socioeconomic forces. For example, if there is a lack of political vision and will, it will be impossible to get the type of energy and investment needed to push forward ICT education. On the other hand, poverty, ignorance and other socioeconomic ills make it difficult to devote resources to ICT in the face of many other basic needs such as health, literacy and job creation.

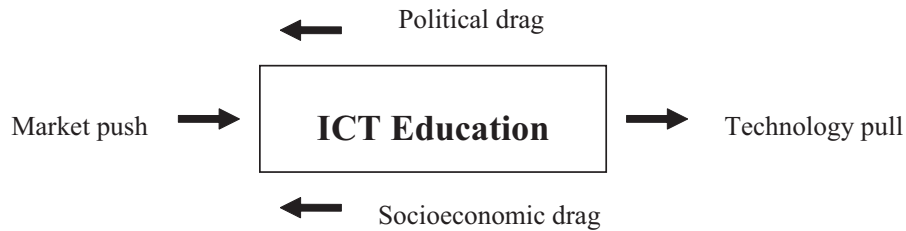Figure 3 illustrates how these forces work and interact.

Figure 3: Forces working for and against ICT education

One of the major contributions that a policy can make is to align the political and socioeconomic forces with market and technological innovation forces so that the effort moves in the same direction. In the absence of a national ICT policy and an ensuing ICT education policy, ICT education will continue to be inefficient.

I therefore propose that the same issue can be considered in a different way by mapping the political policy development process against the technological development process as illustrate in figure 4 below:

Figure 4: Policy and technological development

Political policy development process
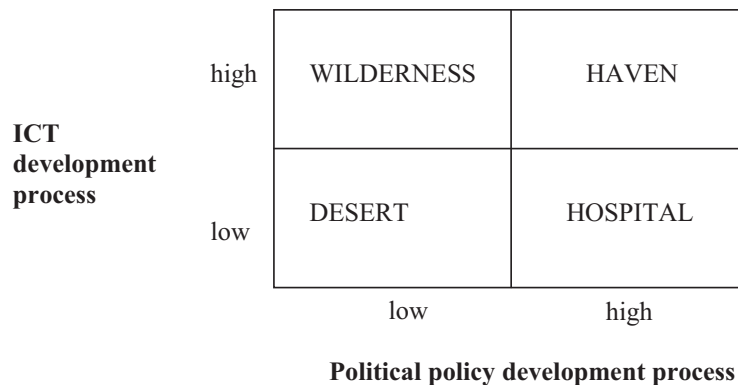
The diagram illustrates four states. Where there is little ICT development and no policy we call this state a "desert." This is because there is minimal ICT activity and no policy to support developments that will encourage the growth of ICT. Conversely, where there is a detailed political policy development process in the absence of ICT developments we call this state a "hospital" since it is hoped that the policy will bring

about actions that will revive ICT development. Where there is both a supportive policy and ICT development the state is a "haven" since this is the ideal state. However, where there is rapid development in ICTs but no policy there is a wilderness since there is no way of controlling or directing the ICT developments into a desired end through policy provisions. Kenya is slowly moving from a 'wilderness' state to a 'haven' state through the post-introduction of a policy into a thriving ICT sector. We can speculate that it is the lack of educational interventions at the strategic level described in the previous section that may initially have led Kenya into the 'wilderness' state.

The ability of a mismatch between political processes and technological processes to create an unsatisfactory state is illustrated by the following report on the Malaysian experience (Vicziany et al 2004):

In the original conceptualization of Malaysia's IT revolution, the focus was on making the private sector of the economy more dynamic rather than directly addressing the issue of education and Malaysia's skilled manpower needs. How can we explain what appears to be the neglect of the tertiary sector in the years between 1991 and 2004? The Indian experience with the IT revolution points to the need to promote tertiary education in order to take advantages of the new IT jobs that are becoming available for educated manpower in developing countries.

The report continues, thus:

> Most important of all, the Malaysia strategy did not fully appreciate how the success of the Silicon Valley model was based on the intellectual and scientific dynamism of Stanford university. despite Dr. Mahathir having identified skilled Malaysian labour as a critical missing variable that was holding back the possibility of sustained Malaysian growth. Nor did the initial conceptualisation of Malaysia's IT revolution place university based research at the forefront of the country's development strategy. In the concluding section of this paper we consider how Malaysian universities responded to this paradoxical situation: namely, the government's general call to get behind the IT revolution coexisting with a lack of specific policy direction or strategies for involving the tertiary sector in that process.

In the absence of a clear ICT education policy Kenya is likely to face a similar pitfall in the fulfillment of its ICT vision.

The technology diffusion approach to the creation of ICT education policy requires the involvement of key political forces in line with the strategic choices contained in the National ICT policy. For example a production strategy requires key participation from the private sector, 'political' groupings at the strategic level. For example the activities of the Kenya Information Federation (KIF) and the Kenya Computer Society, both largely private sector groupings have been instrumental in the push for policy. A more development-oriented approach will require the full political will of the government to push the changes through to full implementation in the civil service and nationally. I would argue, however, that these political forces must be harnessed within a policy framework or a 'wilderness' state will develop.

5. Conclusion

In this paper we present a model of education that is based on four interlocked cycles: a policy cycle, an implementation cycle, a delivery cycle and a standards cycle. We view ICT as a potential positive factor in each of these cycles.

In view of the complex operation and interaction of these cycles we argue that ICT education (and indeed ICT *in* education) requires a clear and coherent policy. Such a policy must arise from an ICT policy that defines the strategic choices and direction of ICT education in Kenya. Only such an ICT education policy will properly underpin successful implementation of ICT-mediated education (a mode of delivery), ICT-enabled education and ICT education within the implementation cycle.

We extend the model of technology adoption based on technology pull and market push to include two counterproductive forces – political and socioeconomic drag. We therefore argue that policy will be out of step with technology unless there is a technology-favourable political climate and socioeconomic realities are factored into the policy. The policy must also account for different levels of human resource development, with strategists (politician and policy-makers) included in the drive for ICT education (so that they have the capacity to develop the supportive policy environment required for successful implementation of ICT education and ICT adoption.)

In view of the rapid development of ICTs in Kenya the policy development effort is urgent, or else Kenya will remain in a wilderness position where developments in the technological arena rapidly outpace the supportive policy environment required for best practices to thrive.

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