

Tertiary ICT Education in the East African Community (EAC): Human Capital and Curriculum Development

Rodrigues J Anthony*

School of Computing and Informatics, University of Nairobi, Kenya,

Wafula J Muliaro

Institute of Computer Science and Information Technology,
Jomo Kenyatta University of Agriculture and Technology, Kenya

The liberalization of education has fostered an unprecedented demand especially at the tertiary level. In several deliberations, human capital ultimately emerges as the decisive factor governing the success of any endeavor of scale and substance. In the Information and Communications Technology (ICT) era, as indeed in any other era, the needs of all people cannot be completely fulfilled. Even now the power of ICT has been fully harnessed to apply to a relatively small portion of humanity even though nations, institutions, and individuals are continually thinking of how to use this technology to reach the marginalised. The principal difficulties include the galvanizing of people and aligning different cultures to forge ahead with initiatives that converge on endeavors to satisfy human aspirations, be they physical, emotional, mental, or even spiritual. The development of human capital with the requisite skills, understanding, motivation, vision, focus and commitment without vexing restrictions or constraints are essential attributes for eventual success.

The area for human resource training has been foremost in the minds of the planners. Higher funding levels, the expansion of public institutions of higher learning, and the recognition of the role of the private tertiary education sector to enable a more effective and fast-tracked training of the requisite manpower have been most obvious steps. In the drive to achieve manpower training effectiveness, private education sector has been encouraged, resulting in timely approvals to provide university level courses, especially in capital intensive and or marketable fields like Computer science, Information Technology, Information Systems, Software Engineering, Communication, and Business Administration.

This paper analyses twelve tertiary institutions (private and public) of EAC with a focus on both human resource and curriculum development and presents a snapshot of ICT education status in which the identified opportunities, risks and challenges are discussed. The paper also suggests solutions that could be considered at sub-regional level.

* Author's Address: Rodrigues J Anthony, School of Computing and Informatics, University of Nairobi, Kenya , tonyr@uonbi.ac.ke; Wafula J Muliaro, Institute of Computer Science and Information Technology, Jomo Kenyatta University of Agriculture and Technology, Kenya

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1. INTRODUCTION

Human capital has ultimately emerged as the decisive factor governing the success of any endeavor of scale and magnitude. In the Information and Communications Technology (ICT) era, or indeed any era, the need of all people cannot be completely fulfilled. Countries, corporations, and individuals are constantly thinking of using this technology to carry them forward. The principal difficulties include the galvanizing of people and aligning different cultures to forge ahead with initiatives to converge on a meaningful endeavor to satisfy the human aspiration, be they physical, mental, or spiritual. The development of a pool of relevant skill workers with the requisite skills, understanding, motivation, vision, focus, commitment, and without vexing restrictions are essential attributes for eventual success.

The area for human resource training has been foremost in the minds of the planners [Jonhendo et al, 2002]. The injection of more money, the opening of more places in institutions of higher learning, and the opening up and recognition of the private tertiary education sector to enable a more effective and fast-paced training of the requisite manpower has been most obvious. In the big push to achieve manpower training effectiveness, the private education sector has been given a boost, resulting in many of them being quickly given the approvals to provide university level courses, especially in the emphasized priority fields like computing, communication, and business.

There is need to consciously promote the creation of knowledge workers, builders, and innovators. This human capital must, in the course of their development, be imbued with an open mindset, a positive attitude of problem resolution, a keen eye for current trends, drive and energy for embarking on new initiatives, and a commitment to personal excellence.

ICT education is a young field and not in itself a unique discipline [Almstrum et.al. 2004]. As it matures, the field is developing its own unique perspectives. It is for this reason the new approaches to its curriculum development are being considered and proposed in this paper. Clement [2004] reports that pedagogical methods resulting from research in one field can be revised and transferred to another.

This paper analyses twelve tertiary institutions (private and public) of EAC with a focus on both human resource and curriculum development and presents a snapshot of ICT education status upon which the identified opportunities, risks and challenges are discussed. The paper also suggests solutions that could be considered at sub-regional level including setting up an Information Management Centre, the Education Technology Center, and Center for Instructional and Technology.

The paper also seeks to establish if the general lack of strategic direction (policy instruments) and leadership in ICT education could be a contributor to the observed status.

2. HUMAN CAPITAL

Although terrorism is a major threat for many nations the greatest danger facing most of them could be the challenge of human capital development. Human capital theory suggests that the human capital of a nation or organizations is an important factor in its economic success, implying that human capital must therefore be of great interest to politicians, economists and training and development specialists [Elkin 2004]. The latter study on OECD shows that human resource development as a factor enhances labour market flexibility, facilitates structural adjustment in economy and cause prosperity. On the same footing, Teitel (2006) observed that the rapid accumulation of human capital, development of technical institutions and public policies in support of enterprise development and innovation, led to the emergence of advanced technical capabilities in a number of semi-industrialized countries. The significant human capital developed in the ICT sector in Asia brought about the so-called miraculous Asian economies with high growth rates (Anonymous, 2006). For example, the application of ICT in the activities of Malaysia's economy contributes significantly to its productivity growth, and the growth of the economy.

Ziliak (2007) argues that there is a strong tie between educational attainment and economic status, hence intensive investments in human capital are needed over the course of individuals' lives to address persistent poverty especially in developing countries. Jonhendo et al [2002] state in their paper that financial success and prosperity

usually come with the persistent persuasion of all people to adopt and use any innovation that will increase productivity. In the Information and Communications Technology (ICT) era, or indeed any era, the needs of all people cannot be completely fulfilled. Countries, corporations, and individuals are constantly thinking of using ICT to carry them forward. The principal difficulties include the galvanizing of people and aligning different cultures to forge ahead with initiatives to converge on a meaningful endeavor to satisfy the human aspiration, be they physical, mental, or spiritual. The development of a pool of relevant skill workers with the requisite skills, understanding, motivation, vision, focus, commitment, and without vexing restrictions are essential attributes for eventual success.

Thus, there is need to consciously promote the creation of knowledge workers, builders, and innovators. This human capital must, in the course of their development, be imbued with an open mindset, a positive attitude of problem resolution, a keen eye for current trends, drive and energy for embarking on new initiatives, and a commitment to personal excellence. The question is, does our EAC institutions ICT education curriculum instill and guarantee output of such characters?

For all practical purposes it is sufficient to say that a knowledge worker exemplifies two organic intertwining attributes: attitude and respect to a vocation and the command of basic knowledge and skills. It is insufficient just to have only one of the attributes. A knowledge worker must have some basic knowledge in some fields and aims at using that existing knowledge to help discover new information or how to do things that have not been done before. A knowledge worker has to be innovative rather than just being productive hence need to inquire, analyze, conceptualize, reason, synthesize, construct, and be willing to impart new knowledge, skills, or wisdom to others.

In order for worker to have all these attributes, a predisposing learning environment must be created in their educational development. This is the role of our education institutions. It is common to get the feeling of lecturers that our present students are a lot of dependent, unoriginal, non-innovative, and selfish individuals who lack the ability to do something in order to improve. Tendencies to copy, plagiarize, regurgitate, and like to be spoon-fed are some of the words used whenever assessments of students' work and attitude are made. With a view to produce competent knowledge workers, the curriculum will have to be structured with emphasis on communication skills, critical thinking skills, creative skills, problem solving skills, social skills, and life skills. Collaborative learning can be introduced into the curriculum and learning process to mimic life situations. Cooperative and collaborative learning help students to develop the requisite skills in teamwork, while life skills prepare students to cope in an increasingly stressful and changing environment. Such skills prepare students to face the challenges of the work place.

3. CURRICULUM

ICT education is not in itself a unique discipline [Almstrum et. al. 2004]. As it matures, the field is developing its own unique perspectives. It is for this reason the new approaches to curriculum development are being considered.

ICT education is challenged by several demands such as globalization that raises the importance of certain attitudes and transferable skills and social competences of graduates. The EAC sub-region through Inter University Council of East Africa (IUCEA), just like the Bologna Process that is aimed at creation of a common European Higher Education Area (EHEA) by 2010 [Heitmann, 2005], can do the following:

- Facilitate mobility of students and staff and professional mobility of graduates,
- Promote internationalization and global competitiveness,
- Raise quality of ICT education and contribute to economic development and growth,
- Enhance the EAC Integration.

According to Heitmann (2005), the paradigm shift to outcomes orientation and student learning have recently fostered the use of systematic and comprehensive approaches. Heitmann (2005) observes that the experience of undertaking a major curriculum revision points to the fact that the "curriculum as planned" is not yet the "curriculum as implemented" and for sure differs later on from the "curriculum as experienced by students and staff". The successful implementation of a comprehensively and systematically planned new or revised curriculum requires to a certain extent an organizational development and a change of action and behaviour of the persons involved.

Jonhendro et al [2002] argue that it is imperative that education institutions reconsider the necessary ingredients to make learning effective, relevant, and fun for the students. Hence, there is need for EAC sub-region to

create a knowledge ecosystem, comprising students, lecturers, administrators, parents, partner institutions, employers, and the entire community at large. Such ecosystem can provide the necessary enabling environment for establishing and promoting Learning Communities (LC).

Scharff and Brown [2004] reported that effective Learning Communities could lead to higher academic achievement, better retention rates, diminished faculty isolation, and increased curricular integration. As an import to ICT education, Learning Communities can provide a means for tying together courses to help students better understand the connections between ICT education and other fields, as well as across different areas of computing. An interesting pedagogical development in higher education has been the advent of the Learning Community (LC). For instance, the connection between computer science and logic is as significant as the connection between computer science and mathematics. Courses that frequently make use of and refer to logic concepts include Functional Programming, Formal Languages, Automata Theory, Artificial Intelligence, Databases, and Software Engineering. Examples of connections between logic and computer science include pre- and post-conditions, invariants, recursion, symbolic computation, and formal specification and verification. Many mathematical concepts are also basic concepts in logic. These fundamental concepts are very important for computer science students, but tend to be difficult for novices to learn. The opportunity to emphasize the connections between computing and logic suggests the power of including Learning Communities in the computer science curriculum, both as a curricular enhancement and to address issues important to computer science educators.

The society expects college graduates to be able to think critically, solve complex problems, act in a principled manner, be dependable, read, write and speak effectively, have respect for others, be able to adapt to change, and engage in life-long learning. However, according to Scharff and Brown [2004] students undertaking the traditional curriculum generally do not meet expectations, most importantly in three key cognitive areas: using abstract symbols, epistemology, and principled, ethical reasoning – as well as the ability to work cooperatively in teams with different people. They further point out that it is unlikely that the traditional curriculum can lead to the needed changes. They offer two reasons for this. One reason is the relative isolation of topics that can occur during instruction, which deprives students of important opportunities to develop their abilities. Regardless of how well a discipline relates to other topics, instructors often present content without reference to related disciplines. This approach leads to difficulties when students need to apply the skills and concepts they have learned, which they will almost certainly need to do while studying a variety of other disciplines. It also has the effect that students do not develop their abilities. Secondly, the traditional curriculum fails to bring about the needed changes on the grounds that education is often seen as merely fact acquisition, a view frequently connected with the traditional lecture. The goal of education is to improve minds, enabling them to acquire abilities and skills to do things they could not do previously.

Learning Communities (LC) as a possible curricular alternative deserves consideration and has been recommended by Scharff and Brown [2004]. One typical mission for LCs is to develop a sense of community. Other goals and practices are to:

- (1) Incorporate and value diversity,
- (2) Share a culture,
- (3) Foster internal communication,
- (4) Promote caring, trust, and teamwork,
- (5) Involve maintenance processes and governance structures that encourage participation and sharing of leadership tasks,
- (6) Foster the development of young people, and
- (7) Have links with the outside world

LCs commonly follows one of three models below (Scharff and Brown, 2004):

- The integrated model, where courses are integrated into one interdisciplinary course, or
- The linked course or cluster model, where the curriculum materials in two or more stand-alone courses establish a series of connections between the interwoven courses, or
- The student cohorts/integrative seminar model

LCs that follow the linked course model allow the faculty involved to plan their respective curricula so that students will have planned and supervised opportunities to discover a variety of connections or interrelationships. Developing and elucidating two or three such connections or relationships is generally all that is needed to put to rest the notion of the stand-alone course. Because two – or perhaps three – subjects are involved, the faculty must cooperate to plan the curricula together. As one faculty member develops a particular topic, his or her colleague can refer to, or in

some other way make use of, that topic. Thus, not only are connections between the subjects made explicit, but also much of what is learned in each subject turns out to reinforce or help illuminate what is learned in the other.

Beyond the content-related goals of each course, the LC becomes a learning environment that should lead students to as many of the following objectives as possible:

- Acquire a deeper understanding of course materials by making connections between courses and disciplines, in part by learning to transfer skills, concepts, and ideas learned in one discipline to appropriate uses in another discipline;
- Learn to find similarities in increasingly disparate subject areas in order to find better solutions of a broader range of problems;
- Import and export knowledge from one course to another;
- Experience increased interaction with other students and faculty, as well as a rich learning-centered community inside and outside classroom;
- Participate in active and collaborative learning; and
- Explore and begin to understand diverse perspectives.

Indeed, LCs provide many benefits for students: increased academic achievement, better retention rates, greater satisfaction with college life, reduced time to degree, improved quality of thinking and communicating, better understanding of self and others, and greater ability to bridge the gap between the academic and social worlds. In addition, there are benefits for faculty: diminished isolation, shared purpose and cooperation among faculty colleagues, increased curricular integration, a fresh approach to one's discipline, and increased satisfaction with their students' learning.

A difficult issue for assessment under any circumstance is determining whether students have learned material well enough to apply it practically. Therefore, a LC that combines a computing course with a course in another area, for example business that would give the ICT professors insights into whether their students had learned a skill or concept well enough to apply it in "real life" situations in the other course is recommended.

LCs within the ICT education curriculum could allow courses to provide mutual support for one another. For instance, even when there are prerequisites, computer science topics are often taught as if they are relatively independent of one another. It's a good idea to link computer science courses such as discrete mathematics with data structures, algorithms and data structures with databases, databases with software engineering, and data structures with operating systems.

Introducing LCs in the curriculum can also serve as a tool for programme recruitment. Faculty wishing to attract good students to their disciplines must offer courses that will attract those students. A well thought out LC with an attractive title can have that effect. Students intimidated when faced with studying a difficult subject might find that subject less frightening if it were linked with another subject that they perceive as more accessible. At present, interdisciplinary pairings appear to be particularly interesting and important in attracting students to computer science, as many students apparently pursue computer science because of the influence of computers in other fields. In addition, the interdisciplinary approach might help attract women in ICT computer science and education in general. This paper raises fundamental questions such as why has LC not been considered in any of the EAC institutions of higher learning ICT education despite the numerous benefits and solutions it provides to most of the existing challenges? What policies need to be put in place at sub-regional level that can create an enabling environment for an appropriate ICT education curriculum to be developed? How can EAC institutions of higher learning establish a roadmap to acquisition of ICT human capital needed to spur economic development?

4. ANALYSIS OF EAC INSTITUTIONS OF HIGHER LEARNING

This section presents the analyses of twelve tertiary institutions (private and public) of East African Community (EAC) namely: Daystar University (private), Gulu University, Hubert Kairuki Memorial University (private), Islamic University in Uganda (private), JKUAT, Kyambogo University, Makerere University, Moi University, Mzumbe University (private), Tumaini University (private), Uganda Martyrs University(private), and University of Nairobi. It focuses on both human resource and curriculum development and presents a snapshot of ICT education status as published by IUCEA Report [2007] and discussed in this paper.

4.1. Challenges, Risks and Opportunities

4.1.1. Resource Development

EAC Sub-region institutions of higher learning require more academic, technical and administrative staff if quality ICT education is to be offered. Most ICT education departments in East Africa sub-region are faced with several challenges in maintaining a high quality team of academics. According to the IUCEA report [2007], the challenges include: high turnover due to industry demand for ICT professionals; high remuneration of ICT professionals in the market; rapid growth of ICT departments nationally and worldwide leading to aggressive headhunting; and, emerging professional aspect of ICT.

Identified barriers to recruitment in ICT education departments included: high expectations in terms of qualifications and experience, unattractive terms of service and poor job advertisement strategy. In order to create an enabling environment for the academics, there is need for sound and inspiring leadership; competitive terms of service; opportunities for advancement; recognition; and a collegial atmosphere. Adoption of a remuneration package that is cognizant of market realities could help surmount this barrier.

Human resource development in EA sub-region requires mobilization of internal resources so as to reduce dependence on development partners. Hence universities need to develop ICT policies in line with their vision. Also adoption or use of standard capacity building framework as in the case of University of Nairobi is encouraged. This would minimize the tendency of waiting to seize opportunities as they emerge and promote deliberate planning for human resource development.

A business/customer oriented approach need to be emphasized in the human resource development as a shift from the traditional ways. Employment of ICT Education staff on contract has shown a negative impact on long-term commitment.

A gender imbalance in ICT education exist and a strategy needs to be put in place to correct the anomaly. Having more female staff is one of the strategies suggested. An interdisciplinary approach promoted by adoption of LCs can help attract women both students and staff into ICT education.

There is need for promoting ICT4D network of Academic in each University as an ICT development watchdogs' mechanism, and extended to sub-regional levels. One of the objectives of AISI that states that every man and woman, school child, village, government office and business can access information and knowledge by 2010 depends on the strategy of fostering a new generation of men and women in Africa able to use ICTs to leverage the development of their nations, which ICT education has a major role to play. Shortage of human capital and appropriate training programs especially in ICT education in EAC sub-region could hamper the development of an inclusive and effective Information Society despite having put infrastructure in place.

E-literacy level varied immensely from country to country, institution to institution, and this has been aggravated by lack of clear and systematic mechanism of sharing the best practices and lessons learned by those who have solved such problems. There appear to be a disconnect between national ICT policy makers and the education sector, which complicates and create a challenge when it comes to buying-in the national ICT vision by the education sector.

Staff development in some of the institutions was guided by established training needs and informed experience that required investment on individuals, departments and faculties, so that the staff and the institution could acquire and utilize new techniques and technologies in order to better meet new performance demands. Endeavours are being made to motivate staff, by giving them opportunities to do research work that can increase their remuneration.

Introduction of short courses to enable staff to upgrade their ICT skills is suggested as a means of improving e-literacy. Also introduction of ICT loan schemes to enable university staff acquire computers and other ICT related items at an affordable rate and payment in installments was among strategies some universities have adopted towards enabling staff acquire necessary facilities for effective ICT education teaching.

4.1.2. Curriculum Development

Curriculum development (CD) involves identifying learning needs, assessing the audience, developing goals and objectives, selecting and organizing content, selecting methods and aids, facilitating learning process, and

developing action plan. It is a continuous process. There should be regular reviews to ensure quality. Feedback from industry, former students and all key stakeholders is important in reviews.

Institutional collaboration is encouraged in CD. On the question of e-learning, it was noted that most institutions are taking a blended e-learning approach, where conventional teaching methods are combined with e-learning to reduce the risk of failing and increase chances of successful transfer to full e-learning.

The EAC institutions suggested Learning outcomes approach to curriculum development without specifying any particular one. We propose that the concept of LCs be embraced.

Open source software (OSS) is not yet popular in most EAC sub-region institutions despite have a promising future. OSS has the potential to give education Institutions flexibility that cannot be found with proprietary software. More so, OSS Learning Management System (LMS) have the potential to serve the institutions in terms of knowledge expansion and collaboration in developing e-learning courses and curriculum.

There is a need for developing standards at sub-regional level upon which content, skills, products can be benchmarked. This would enable the creation of individual, institutional, national and even sub-regional identity. The sub-regional standards would preside over curriculum developed among its institutions in tune with international standards.

Integration of ICT departments and Education departments need to be explored. Currently they are structured separately, which is hindering further developments in ICT education. The EAC universities each needs to identify areas of focus so as to create highly specialized institutions and avoid duplication and unnecessary competition.

The EAC sub-region society as a whole embraces its cultural and linguistic diversity and supports those who are disadvantaged. A society of strong growth and competitiveness is a society of shared values, mutual respect and humanity. In order to move towards such a society, there is need to review the curricula and fine-tune them so that they respond to the dynamically changing world.

5. DISCUSSION

The discussion made attempts to explore the link between the identified challenges, risks and opportunities and the following recommendations found in the IUCEA Report [2007].

1. An EAC sub-regional ICT in education policy be development.
2. Funding for the human capital development and infrastructure be sourced.
3. Capacity for University Staff in virtual learning systems be built.
4. Learner support systems be developed.
5. Content be development
6. A framework for harmonization and development of an EAC sub-regional quality assurance be developed that will take into consideration:
 - Identification of current subject domains in relation to ICT education body of knowledge
 - Development of sub-regional benchmarks and standards for ICT education
 - Development of key reference points for quality assurance
7. Establishment of a journal for ICT research called *EAC Journal for ICT Development*.
8. Development of an IUCEA portal for dissemination of information.
9. Promotion of OSS for specialized applications.
10. Support ICT R&D incubation and entrepreneurship.

On analyzing the twelve universities of EAC sub-region, it was found that there are some issues that were addressed by all the institutions that we consider critical and deserve attention. These are:

- Sound and inspiring leadership
- Development of ICT policies in line with vision
- Promotion of deliberate planning for human resource development. Development of human capital and appropriate training programs towards an inclusive and effective Information Society.
- Learning outcomes approach to curriculum development.

- Integration of ICT departments and Education departments.

The way forward from the IUCEA Report gives general recommendation that if implemented would tackle most of the challenges raised. However, we would like to argue further on one major issue: A curriculum development approach that would promote ICT human capital development.

As stated earlier, there is need to consciously promote the creation of knowledge workers, builders, and innovators. This human capital must, in the course of their development, be imbued with an open mindset, a positive attitude of problem resolution, a keen eye for current trends, drive and energy for embarking on new initiatives, and a commitment to personal excellence. The concern is that all the EAC institutions ICT education curriculum in the IUCEA report [2007] do not guarantee output of such characters since they are products of the traditional curriculum development approach. We challenge the EAC ICT education sector to create the necessary predisposing learning environment that can output the desired human capital.

According to Heitmann [2005], the paradigm shift to outcomes orientation and student learning have recently fostered the use of systematic and comprehensive approaches. A successful implementation of a comprehensively and systematically planned new or revised curriculum requires to a certain extent an organizational development and a change of action and behaviour of the persons involved. Hence, there is need for EAC sub-region to create a knowledge ecosystem, comprising students, lecturers, administrators, parents, partner institutions, employers, and the entire community at large. Such ecosystem can provide the necessary enabling environment for establishing and promoting Learning Communities (LC).

Scharff and Brown [2004] reported that effective Learning Communities could lead to higher academic achievement, better retention rates, diminished faculty isolation, and increased curricular integration. As an import to ICT education, Learning Communities can provide a means for tying together courses to help students better understand the connections between ICT education and other fields, as well as across different areas of computing. LCs that follow the linked course model allow the faculty involved to plan their respective curricula so that students will have planned and supervised opportunities to discover a variety of connections or interrelationships. Developing and elucidating two or three such connections or relationships is generally all that is needed to put to rest the notion of the stand-alone course. Because two – or perhaps three – subjects are involved, the faculty must cooperate to plan the curricula together. As one faculty member develops a particular topic, his or her colleague can refer to, or in some other way make use of, that topic. Thus, not only are connections between the subjects made explicit, but also much of what is learned in each subject turns out to reinforce or help illuminate what is learned in the other.

LCs within the ICT education curriculum could allow courses to provide mutual support for one another. For instance, even when there are prerequisites, computer science topics are often taught as if they are relatively independent of one another.

We observe that LCs have not been considered in any of the EAC institutions of higher learning ICT education despite their great potential for numerous benefits and solutions to most of the existing challenges faced by EAC institutions of higher learning.

6. CONCLUSION

The EAC institutions need to focus on creation of knowledge workers, builders, and innovators. Such human capital can only be attained if suitable curriculum is put in place. A curriculum that produces characters with open mindset, positive attitude of problem resolution, keen on current trends, and with commitment to personal excellence.

The EAC institutions ICT education curriculum stated in the IUCEA report [2007] cannot guarantee output of desired characters due to the fact that they are products of the traditional curriculum development approach. We challenge the EAC ICT education sector to embrace a new paradigm shift in curriculum that have room for LCs as well as create the necessary predisposing learning environment that can output the desired human capital.

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