The Role of Academia in Fostering Private Sector Competitiveness in ICT Development

TOM WANYAMA*
Department of Networks
Faculty of Computing and IT, Makerere University

VENANSIUS BARYAMUREEBA
Department of Computer Science
Faculty of Computing and IT, Makerere University

This paper presents the prerequisite to producing computing graduates who have the skills required to fostering private sector competitiveness in information and communications technology development. Furthermore, the paper discusses the steps the Faculty of Computing and Information Technology at Makerere University, has taken to ensure that our graduates are of high quality and have the computing skills needed by the private sector and other potential employers. Finally, the paper presents the issues that need to be addressed, so to ensure sustainable private sector competitiveness in information and communications technology development.

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1. INTRODUCTION

Increased adoption of eCommerce and Information and Communications Technology (ICT) in the private sector often leads to expanded economic growth by opening new markets, increasing access to market information, and improving efficiency [The Asia Foundation 2001]. For example, the use of eCommerce has the potential to expand the operations of Small and Medium Enterprises, and increase their competitiveness in the global supply chain network.

* Author's Address: Tom Wanyama, Department of Networks, Faculty of Computing and IT, Makerere University, P.O. Box 7062, Kampala, Uganda, *wanyama@cit.mak.ac.ug, www.cit.ac.ug*;
Venansius Baryamureeba, Department of Computer Science, Faculty of Computing and IT, Makerere University, P.O. Box 7062, Kampala, Uganda, *barya@cit.mak.ac.ug, www.cit.ac.ug*

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Moreover, for many developing countries, the export-oriented information services, or "eServices" sector provides tremendous opportunities for developing economies, even for those countries that have limited economic potential due to scarce capital, poor infrastructure, and limited natural resources. This sector is unique in that it allows a local company to provide high-value services, such as software development and data processing that can be delivered to the recipient country across the Internet. However, for any country to attract, maintain and benefit from private sector investment in ICT, it must have a critical mass of highly skilled people. Therefore, it is no surprise that it is China and India that have a large number of Computing and Technology institutions that have taken the lead in benefiting from private sector investment in ICT among the developing countries.

Like in all other science fields, in the computing field, it is very important that institutions of higher learning adhere to discipline definitions that have national, regional and international recognition. This assures the private sector and especially the foreign investors that people produced by the academia have at least the minimum skills expected of someone in their disciplines. Inline with this reasoning, the Government of India ensures that institutions of higher learning take into account the concept of globalization during discipline definitions and curricula development. This is done through the country's agency for quality assurance in higher education [Gopal et al. 2006]. It should be noted that assuming all the other factors constant, an investor views a country where he/she does not have to retrain workers as a better investment destination than a country where the workers need to be trained so to attain the minimum skill-standards that the investors are familiar with. In the worst-case scenario, if the discipline definitions in a country do not adhere to any standard, foreign investors may feel obliged to recruit workers from other countries, which reduces the competitiveness of their investments, and makes the country a less attractive investment destination.

Having clear and recognized discipline definitions is a necessary, but not a sufficient requirement, for higher institutions of learning to produce people with relevant skills, to foster private sector competitiveness in the ICT development. Instead, it is necessary to complement clear and recognized discipline definitions with curricula that is relevant to the country and/or region where the institution is located, and that provide students with at least the minimum skills which are internationally expected of people in the various defined disciplines. In order to ensure that appropriate curricula are developed, the academia has to consult with the following entities during curriculum development and review: professional bodies, quality assurance agencies, and the private sector. In some cases, governments can actively encourage curricula development or improvement in particular areas of national interest through scholarships and grants [Taylor et al. 2006].

Provision of appropriate skills for fostering private sector competitiveness in ICT development requires supplementation of formal diploma and degree programs that are associated with recognized discipline definitions, and that have appropriate curricula; with short courses that provide skills in specific areas, technologies, equipment, and/or software. Furthermore, it is necessary that all forms of training be complemented with academia-industry collaboration through joint activities such as research, industrial training, consultancies, workshops, and conferences.

Well defined computing disciplines, as well as good curricula for formal programs and short courses cannot lead to producing highly skilled computing graduates, without highly motivated and well trained academic human resource. Therefore, it is imperative that higher institutions of learning acquire and retain this type of human resource so to produce graduates who foster private sector competitiveness in ICT development.

The outline of this paper is as follows. The definition of disciplines is discussed in Section 2, and Section 3 deals with curricula development. Section 4 addresses the role of short courses, Section 5 addresses the role of the academia-industry collaboration, and Section 6 addresses the role of academic human resources in fostering private sector competitiveness in ICT. Section 7 deals with efforts being made by the Faculty of Computing and Information technology (FCIT) to foster private sector competitiveness in ICT development. Section 8 addresses the future of the FCIT in fostering private sector competitiveness in ICT development, and Section 9 presents key conclusions.

2. DEFINITION OF DISCIPLINES

Professional bodies and quality assurance agencies play a very important role in the definition of disciplines because of the following reasons:

- Professional bodies have membership of academicians with varied teaching and research experiences, as well as professionals who have industry experience and are well versed with the interaction of various fields and disciplines in industry. Knowledge of these two types of professionals makes an important input to the definition of disciplines.
- Quality assurance agencies normally employ auditors who have extensive knowledge in their fields of expertise.

As a matter of fact, professional bodies and quality assurance agencies have a responsibility to define disciplines and to develop benchmarks and/or frameworks for evaluating discipline programs developed by academic institutions. Unfortunately, professional bodies in Uganda, such as the Uganda Institution of Professional Engineers (UIPE), Uganda Computer Society (UCS) and the quality assurance agency, the National Council for Higher Education (NCHE) have not developed any discipline definitions for the computing field. Moreover, these bodies and agency are not affiliated to any international organization so as to ensure that any discipline definitions that they make are internationally accepted. However, at the international level, a number of professional bodies are involved in discipline definitions of the computing field.

The computing field has grown rapidly and in many dimensions so that the many degree programs in the field have left many students, parents, and potential employers of computing graduates confused. To dispel this confusion, Association for Computing Machinery (ACM), Institution of Electrical and Electronic Engineers – Computer Society (IEEE-CS), and the Association for Information Systems (AIS) have made efforts to clearly define the various computing disciplines [The Joint Task Force for Computing Curricula 2005]. These efforts have resulted in defining five computing disciplines as shown in Figure 1. Moreover, Figure 1 reveals that computing professionals are aware that in the future, other new computing disciplines shall have to be defined (upcoming computing discipline include Bioinformatics and Computer Engineering Technology). Please note that the years shown against each computing program in Figure 1, stands for the year when the curriculum for the discipline was last updated.

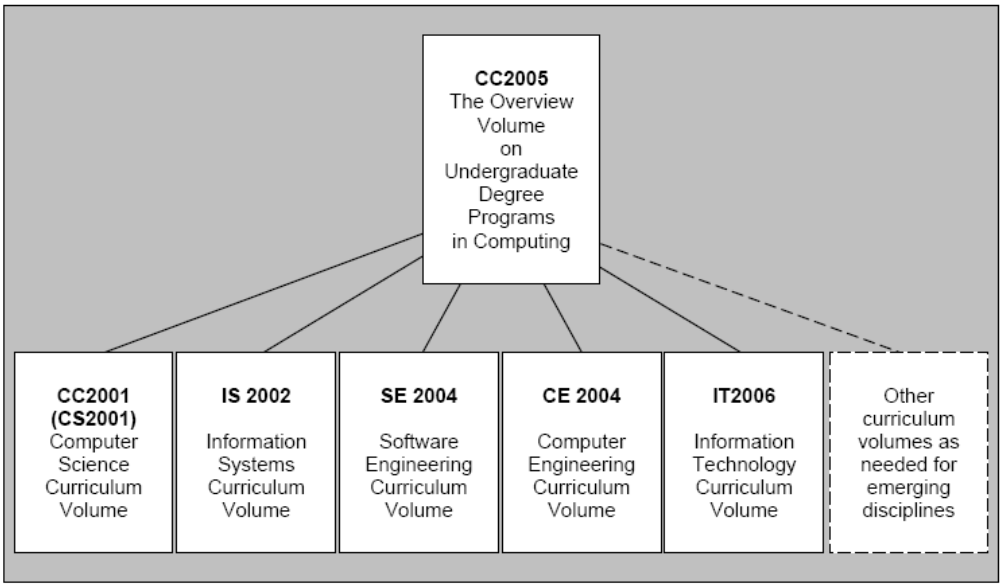

Figure 1: Computing Disciplines [adopted from Computing Curricula 2005, @2005, held Jointly by the ACM, AIS and IEEE Computer Society]

3. CURRICULUM DEVELOPMENT

It is a role of the academia to ensure that computing curricula foster private sector competitiveness in ICT development. To do this, the academia needs to work closely with professional bodies [The Joint Task Force for Computing Curricula, 2005; quality assurance agencies (QAA) 2006] and the private sector [Rizvi et al. 2005], during curriculum development and review. In addition, it is important that professional

bodies and quality assurance agencies develop their own generic curricula, which the academia can use as benchmarks when developing curricula for their institutions. Like in the case of discipline definitions, Uganda's professional bodies and quality assurance agency do not have any such curricula in place. But as revealed in the following examples, the case is different in other countries:

- In the United Kingdom the Quality Assurance Agency (QAA) was established to provide an integrated quality assurance service. The main activities of the QAA are to ensure the quality of education delivered in UK Universities and other institutions of higher education. This is done at a subject level, and also at an institutional level, using periodic reviews. These reviews involve the production of self-evaluation documents by the institutions, and audit visits of the institution by QAA auditors [QAA 2006].
- The Government of Bermuda participates in the development of curricula through its Ministry of Education [Barron et al 2001].
- The Government of the United States of American influences curricula development and improvement through scholarships and grants [Taylor et al. 2006].

Moreover, ACM, AIS, and IEEE-CS have developed generic computing curricula that can be customized to the needs of a particular country and/or region while keeping an international outlook of the discipline in the curricula [The Joint Task Force for Computing Curricula 2005].

4. SHORT COURSES

In order to ensure that the private sector obtains all the computing skills required to keep it competitive, it is necessary that the academia supplement the conventional programs in the defined disciplines with a range of short courses. Such courses cover specific skills that are known to be lacking in the conventional programs. They include courses that provide skills for implementing and maintaining vendor-specific technologies, hardware, and software (vendor-specific certification programs). In the computing field, vendor-specific certification programs include the following courses:

- Certificate in Computer Applications (CCA)
- International Computer Driving License (ICDL)
- Oracle Certified Associate (OCA)
- Oracle Certified professional (OCP)
- Cisco Certified Network Professional (CCNP)
- Cisco Certified Network Associate (CCNA)
- IT Essentials I & II
- Security Plus
- IP Telephony
- Wireless LAN
- Microsoft Certification programs, namely: Microsoft Certified Professional (MCP), Microsoft Office Specialist (MOS), Microsoft Certified Database Administrator (MCDBA), Microsoft Certified Systems Engineer (MCSE), Microsoft Certified Systems Administrator (MCSA), and Microsoft Certified Solution Developer (MCSD)

Besides covering specific skills that are known to be lacking in the conventional programs, short courses such as those identified above enable professionals to keep up with the ever-changing technology in various fields. Keeping this in mind, it is imperative that short courses are developed and ran in closed collaboration with the industry (Siegel, 2006).

5. ACADEMIA-INDUSTRY COLLABORATION

Institutions of higher learning not only provide the private sector with skilled human resources, but also support the sector in many other ways, including research and development (Rizvi et al., 2005). Therefore, collaboration between the academia and industry plays a crucial role in fostering private sector competitiveness in ICT development through both indirect and direct knowledge transfer. The indirect knowledge transfer is achieved through such activities as industrial training, using members of the academia as consultants in the private sector, holding joint workshops and conferences, and journal publications. On the other hand direct knowledge transfer is achieved through collaborative research and/or purchases of patents.

It should be noted that in both types of knowledge transfer, knowledge flow is in both directions. That is, knowledge flows from the academia to industry and from industry to the academia. The reason being, the academia provides expertise in ICT while industry provides knowledge, in the application of ICT, project design and implementation, data analysis, and regulatory affairs. Knowledge from the academia to the industry is used to improve products and services, while the knowledge from industry to the academia is used to define disciplines, develop curricula, design short courses, and improve pedagogy. In reality the ICT industry is a fast-expanding major source of funding for research in academia and the principle source of applied ICT research. In return, industry gains valuable insight into its products from ICT experts in academia as well as leaders in the basic sciences. Ultimately, of course, the private sector benefits from a better understanding of ICT as an enabler, and from better ways of applying the technology.

6. ACADEMIC HUMAN RESOURCE

The creation of human capital starts with the definition of disciplines and the design of curricula. The curricula must address the skills set required of the graduate and at the end of each course the students must have acquired the required skills that will contribute to the overall skills set of the program. But for the students to acquire the skills set out for each course the lecturer himself/ herself must possess the same skills before he or she can lecture a given course. Therefore recruiting, training, and retaining academic staff in the Computing field is crucial to fostering private sector competitiveness in ICT.

7. EFFORTS BY FCIT TO FOSTER PRIVATE SECTOR COMPETITIVENESS IN ICT DEVELOPMENT

The Faculty of Computing and Information Technology (FCIT) at Makerere University has taken a multi-dimensional approach to fostering private sector competitiveness in ICT development. This approach has the following five main dimensions: discipline definition, curriculum development and review, short courses and academia-industry collaboration, and academic human resource.

7.1. The Discipline Definition Dimension

There are no national benchmarks for defining computing programs in Uganda. Therefore, FCIT defines its computing programs based on internationally accepted definitions, proposed by a joint task force of ACM, AIS, and IEEE-CS; through consultations with the professional bodies, and through reviewing published materials jointly produced by the professional bodies on computing discipline definitions. Moreover, the faculty takes into account the level of development of ICT in Uganda as well as the development goals of the Government of Uganda when defining its programs, through consultancies and academia-industry collaboration. Consequently, FCIT has four academic departments, namely: Computer Science, Information System, Information Technology, and Networks (Please note that the FCIT is split in departments based on the discipline definitions proposed by ACM, AIS and IEEE-CS). Within these departments, the faculty runs computing undergraduate programs in computer science (Department of Computer Science), and in information technology (Department of Information Technology). Moreover, the faculty has proposed programs in Information Systems to begin in 2007/2008 academic year (Department of Information Systems), Computer Engineering to begin in 2007/2008 academic year, and Software Engineering to begin in 2007/2008 academic year. When these new programs begin, the Department of Networks shall be split into three departments: Department of Software Engineering, Department of Computer Engineering and Department of Data Communications and Computer Networks.

By having internationally recognized discipline definitions, FCIT ensures the following:

- Organizations in the private sector that employ our graduate's can easily compare their skills endowment with international organizations. Such comparisons normally arise in such cases as when organizations are seeking international collaboration and/or accreditation.
- Foreign investors can easily identify available skill based on discipline definition that he/she is familiar with.

7.2. The Curriculum Development and Review Dimension

In the absence of national curricula guides, FCIT follows internationally recognized curricula guides. However, through our links with the private sector and other employers of our graduates, we know that graduates from purely computing programs (computer engineering, computer science, information systems, information technology, and software engineering) would lack some of the skills required by the employers in Uganda in particular and the region in general. These skills are mainly professional and vocational. In order to address this, the Faculty of Computing and IT has integrated Cisco Certified Network Associate (CCNA), Cisco Certified Network Professional (CCNP), and IT Essentials in the computing degree programs.

By providing internationally recognized curricula that are customized to the needs of employers in Uganda and in the region, FCIT achieves the following:

- Reduction of the cost of computing/ICT training for the private sector hence fostering private sector competitiveness in ICT development
- Benefits associated with internationally recognized discipline definitions (see Section 7.1)

7.3. The Short Courses Dimension

It is not possible to have all the skills required by the employers especially the private sector integrated in one degree programme. Therefore, in addition to CCNA/CNNP and IT Essentials, all the other professional programs like Microsoft Certified System Engineer (MCSE), Oracle Certified Network Associate (OCA), Oracle Certified Network Professional (OCP), Security Plus, IP Telephony and IT Essentials to mention but a few are conducted during the semester breaks and students are free to take them as optional courses. Similarly, all the other courses that provide skills needed by the employers (mainly the private sector) which have not been integrated into the program curricula are run during the semester breaks and the students depending on their interests in career development are allowed to take any course being conducted. This ensures that by graduation time, the graduates have gone through both academic and professional/vocational training and as a result have acquired most of the skills needed in the workplace; hence reducing the cost of training for the private sector.

7.4. The Academia-Industry Collaboration Dimension

The Faculty of Computing and IT, Makerere University has used its collaborations with the industry to help connect students with potential employers through the partnerships it has developed with a number of organisations. These organisations include Uganda Investment Authority, True African, Seven Seas, Public Service, Inspector General of Government (IGG), Uganda Wildlife Education Centre (UWEC), MFI Office Solutions and AFSAT Communications Uganda to mention but a few. These partnerships have exposed students to work-site tours, talk sessions and internship placements. Some of the students have also had the opportunity to be permanently employed.

The Faculty has also established research partnerships with organisations outside Uganda and used these to collaborate with the local industry. Two examples of this effort are the Quality of Service research that was funded by one of the partners, Cisco Systems and had its research carried out on the networks of Uganda Telecom, MTN Uganda and Makerere University. Another example is the research partnership with Radbord Nijmegen University in the Netherlands, which sent its students and the Faculty got them to visit the industry partners.

The Faculty's Work-Force Development Program (WDP) arranges the various partnerships. On average, the industry partners take on students from the faculty every 3 to 6 months, depending on the available projects and/or areas of study. The main challenge faced here is that the number of students is a lot higher than that which the industry has demand for. But the success is, all the students that go through the WDP get equipped with soft skills like writing a good CV and preparing for job interviews. Moreover, the issue of having more students than the private sector can absorb is being addressed by providing the students with entrepreneur skills so that they can be job creators other than job seekers.

7.5 The Academic Human Resource Dimension

Computing is a new discipline and universities in Uganda in particular and Africa in general have very few PhD holders in any of the computing subfields. At Makerere University - FCIT, the undergraduate programmes in computing are run by the fulltime local staff (mainly M.Sc. holders), that use both online

(e-learning) and face-to-face classroom instruction. Due to lack of sufficient local human resource in the area of computing, some departments of the FCIT have started with only postgraduate programs so to generate people who can teach at undergraduate level, before starting the undergraduate programs. This is possible because our postgraduate programs do not only depend on local staff, but also depend on African Diaspora especially Ugandan Diaspora, PhD holders on projects supported by the development partners, occasional (short visits) Professors and visiting fellows on sabbatical leave. Most of the postgraduate students are supervised online by academic staff from institutions around the world. Furthermore, FCIT has devised the following activities as part of the strategies to boost the postgraduate programs:

- **Organizing The Annual International Conference on Computing and ICT Research** (http://www.srec.cit.ac.ug/). This is an annual event that brings together scholars from all over the world every August of every year. This series of conferences started in 2005. Most scholars who come to the conference stay much longer at Makerere University working with local researchers and postgraduate students on several research projects. Some scholars give a series of seminars on different topics in computing. There is always a PhD colloquium that gives the PhD students an opportunity to get advice on their research from several experienced researchers. Postgraduate students especially PhD students have been able to get a 2nd or 3rd supervisor from either the scholars at the conference or scholars at the home institution of the conference participants as a result of networking with the scholars at the conference. Also this conference gives an opportunity to young scholars especially PhD students to have their research peer reviewed.
- **Hosting the International Journal of Computing and ICT Research (IJCIR)** (http://www.ijcir.org). This is a peer reviewed International journal with an objective of providing a medium for academics to publish original cutting edge research in the field of computing and ICT. IJCIR publishes two issues per year. The Journal publishes papers in computing and ICT and other related areas. This journal is hosted by Makerere University in the Faculty of Computing and IT. It has encouraged local researchers and postgraduate students especially PhD students to send in their papers for peer reviews. This journal only publishes papers that meet its high standards but also receives papers from young researchers, which are not necessary published but takes them through the review process so that the young researchers can gain from the reviews to improve their papers and resubmit or submit to other journals. In a way it acts as an incubation facility for young researchers. On a good note most of those younger researchers who submitted papers in this journal have in the process gained confidence and are now submitting good papers to this journal and other international journals for possible publication.
- **Establishing a Program for Visiting Scholars and African Diaspora.** The Netherlands organization for cooperation in higher education (Nuffic) and Makerere University put in place a modest fund to support visiting staff on sabbatical leave to spend 3-12 months at Makerere University. This offer was also extended to African Diaspora of which the Ugandan Diaspora tremendously responded. Of all these categories the Ugandan Diaspora tends to stay much longer and even on return to their home institutions, they continue to dedicate a substantial amount of their time to the activities at Makerere University such as supervision, research, and online instruction with the help of ICT and digital learning environments like blackboard.

8. FUTURE OF THE FCIT IN FOSTERING PRIVATE SECTOR COMPETITIVENESS IN ICT DEVELOPMENT

As the largest producer of skilled personnel in ICT in Uganda, the FCIT plays a major role in fostering private sector competitiveness in ICT development. Therefore, the faculty is putting in effort to ensure that it produces computing graduates who have the relevant skills for the social and economic development of Uganda. However, a number of issues remain to be addressed so as to foster ICT development; some of these are discussed in the following subsections.

8.1. Quality of Computing Programs

Currently, there is not any quality assurance frameworks/ subject benchmarks at both national and University level to guide the process of establishing academic programs and developing curricula. Therefore, quite often there are rifts between faculties, on which faculty should host a program and at times faculties have put in place programs, which cannot measure up to international benchmarks. This in the end

renders graduates from such programs unacceptable internationally as a result of following curricula that does not provide the relevant skills or being taught by staff that lack the necessary skills. Fortunately, the National Council for Higher Education is in the process of putting in place a quality assurance framework and subject benchmarks, and Makerere University is also in the process of putting in place a quality assurance framework. We look forward to receiving these frameworks and to reviewing our programs and curricular accordingly. We also hope that professional bodies, such as the UIPE and UCS shall follow the example of the National Council for Higher Education and Makerere University, and develop curricula development guidelines of their own. Otherwise, the FCIT shall continue to develop its programs based on the economic and development needs of Uganda, and on internationally accepted frameworks.

The computing field is undergoing tremendous developments day by day as a result of technological advances. As a result, many students, potential employers, and scholars find it difficult to comprehend what computing is all about. For example, it is common for many academicians to imagine that software engineering is part of computer science and that computer engineering is not a computing discipline. To address this issue, the FCIT and other stakeholders need to sensitize University leaders and Quality Assurance Agencies about the computing disciplines. Information such as Table 1 below is crucial in the sensitization work. The table presents eleven skill areas (column 1), the associated skills (column 2) and the level (0-5) to which those skills are expected of a graduate of a given discipline (column 3). Using such information in discipline definitions shall assist Makerere University and other institutions to optimally utilize the scare resources by housing all the computing programs under one faculty.

Please note the following expectations from graduates of each of the computing disciplines:

- *Computer engineers should be able to design and implement systems that involve the integration of software and hardware devices.*
- *Computer scientists should be prepared to work in a broad range of positions involving tasks from theoretical work to software development.*
- *Information systems specialists should be able to analyze information requirements and business processes and be able specify and design systems that are aligned with organizational goals.*
- *Information technology professionals should be able to work effectively at planning, implementation, configuration, and maintenance of an organization's computing infrastructure.*
- *Software engineers should be able to properly perform and manage activities at every stage of the life cycle of large-scale software systems.*

Having a sensitized public and university administrations in particular on the disciplines of the computing field will enable putting the core lecturers required on computing programs under one faculty. Finally, it should be noted that no single student can have all the computing skills set, but students from different computing programs can undertake joint projects (this is easy when all the students fall under the same faculty). Since most employers normally require graduates in multiple computing disciplines (computer science, computer engineering, software engineering, information systems, information technology), joint multi-disciplinary projects provide students with teamwork skills that are crucial in today's workplace.

8.2. Academia-Industry Partnership

Currently, Makerere University does not have a Technology Transfer Office, which would track innovations at the university so as to market them to the private sector. On the other hand, the FCIT is working towards setting up such an office, and we hope that the University shall also setup one in the near future. Furthermore, the FCIT would like to increase collaboration with the industry to a level where organizations in the private sector shall be able to sponsor long term and/or permanent research chairs in the faculty.

8.3. Availability of Academic Human Resource

The FCIT has to continue training people at undergraduate, masters and PhD level so to work towards providing adequate academic human resources. But we also request Government of Uganda to put in place a framework to involve the Ugandan Diaspora in Science and Technology, and Innovations in the country. With ICT it is possible for them to still contribute from wherever there are based. Also centres of excellence with good terms and conditions of service must be put in place to attract skilled Ugandan Diaspora especially in the area of Science and Technology/ ICT to return home. Ugandan Diaspora have

gained knowledge if tapped by our Universities and Government could boost Research and Development and innovations, which in turn would foster private sector competitiveness in ICT development.

Area	Performance Capability	CE	CS	IS	IT	SE
Algorithms	Prove theoretical results	3	5	1	0	3
	Develop solutions to programming problems	3	5	1	1	3
	Develop proof-of-concept programs	3	5	3	1	3
	Determine if faster solutions possible	3	5	1	1	3
Application programs	Design a word processor program	3	4	1	0	4
	Use word processor features well	3	3	5	5	3
	Train and support word processor users	2	2	4	5	2
	Design a spreadsheet program (e.g., Excel)	3	4	1	0	4
	Use spreadsheet features well	2	2	5	5	3
	Train and support spreadsheet users	2	2	4	5	2
Computer programming	Do small-scale programming	5	5	3	3	5
	Do large-scale programming	3	4	2	2	5
	Do systems programming	4	4	1	1	4
	Develop new software systems	3	4	3	1	5
	Create safety-critical systems	4	3	0	0	5
	Manage safety-critical projects	3	2	0	0	5
Hardware and devices	Design embedded systems	5	1	0	0	1
	Implement embedded systems	5	2	1	1	3
	Design computer peripherals	5	1	0	0	1
	Design complex sensor systems	5	1	0	0	1
	Design a chip	5	1	0	0	1
	Program a chip	5	1	0	0	1
	Design a computer	5	1	0	0	1
Human-computer interface	Create a software user interface	3	4	4	5	4
	Produce graphics or game software	2	5	0	0	5
	Design a human-friendly device	4	2	0	1	3
Information systems	Define information system requirements	2	2	5	3	4
	Design information systems	2	3	5	3	3
	Implement information systems	3	3	4	3	5
	Train users to use information systems	1	1	4	5	1
	Maintain and modify information systems	3	3	5	4	3
Information management (Database)	Design a database mgt system (e.g., Oracle)	2	5	1	0	4
	Model and design a database	2	2	5	5	2
	Implement information retrieval software	1	5	3	3	4
	Select database products	1	3	5	5	3
	Configure database products	1	2	5	5	2
	Manage databases	1	2	5	5	2
	Train and support database users	2	2	5	5	2
IT resource planning	Develop corporate information plan	0	0	5	3	0
	Develop computer resource plan	2	2	5	5	2
	Schedule/budget resource upgrades	2	2	5	5	2
	Install/upgrade computers	4	3	3	5	3
	Install/upgrade computer software	3	3	3	5	3
Intelligent systems	Design auto-reasoning systems	2	4	0	0	2
	Implement intelligent systems	2	4	0	0	4
Networking and communications	Design network configuration	3	3	3	4	2
	Select network components	2	2	4	5	2
	Install computer network	2	1	3	5	2
	Manage computer networks	3	3	3	5	3
	Implement communication software	5	4	1	1	4
	Manage communication resources	1	0	3	5	0
	Implement mobile computing system	5	3	0	1	3
	Manage mobile computing resources	3	2	2	4	2
Systems Development Through Integration	Manage an organization's web presence	2	2	4	5	2
	Configure & integrate e-commerce software	2	3	4	5	4
	Develop multimedia solutions	2	3	4	5	3
	Configure & integrate e-learning systems	1	2	5	5	3
	Develop business solutions	1	2	5	3	2
	Evaluate new forms of search engine	2	4	4	4	4

Table 1: Relative Performance Capabilities of Computing Graduates by Discipline [adopted from Computing Curricula 2005, @2005, held Jointly by the ACM and IEEE Computer Society]

9. CONCLUSIONS

It is necessary that the academia and the private sector build strong collaborative relationships. Such relationships should not be limited to industrial training, and research and development, but should also include other important areas, such as curricula development, business proposal writing, improvement of business processes, and continuous training of private sector workers. Since it is wrong to think that a single academia-private sector model is beneficial to all units of academic institutions, as well as the private sector, it is essential that each unit of the academic institutions identifies areas where they can build effective academia-private sector relationships. In addition, these units have to identify the endowments they have that can benefit the private sector. The Faculty of Computing and Information Technology at

Makerere University has put a lot of mechanisms to foster private sector competitiveness in ICT development. These include the following: development of internationally recognized curricula that take into account the local and regional needs of the private sector, running short courses to fill the gaps left by formal degree and diploma programs, and providing continuous training to computing professionals, and providing adequate academic human resource to ensure that the quality of graduates of the faculty is high.

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