ICT Research Capacity: Challenges & Strategies in Kenya

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Research : Systemic problem

- No National Research Policy
- No national funding mechanism for Research
- Kenyan universities have no funding mechanism for increasing the PhD throughput
- Kenyan universities do not explicitly measure their performance based on the PhD throughput, journal articles published or the patents registered per year
- Low research outputs by Schools , faculties departments
- Staff commitment to research contingent invariably upon promotional opportunities or student supervision rather than promoting scholarship to improve learning outcomes.
- Research Quality is often questionable

	Institution	Level	Respondent	Date	Distance
Private	Kabarak Univ	Departmental	Dean Science	15th Sept	Kabarak (200Km)
	Strathmore Univ	Departmental Institutional	Dean Science	29th Aug	Nairobi
	USIU	Departmental	Sen Lect Info Systems	19th Aug	Kasarani (10km)
Public	JKUAT	Institutional	Registrar RPE	7th Oct	Juja (30km)
	Egerton Univ	Departmental	Chair Computer Science	16th Sep	Njoro (200km)
	Univ of Nairobi	Institutional	Secretary Dean Comm'tee Director SCI	6th Oct	Nairobi
Govt Kenya	Ministry of Higher Education	National	Prof S.O.Wandiga Chair Task Force	13 th Oct 11th Sept	Hurlingham(8km)

ICT in University Education: Weakness1

- Most Kenyan universities have not yet developed comprehensive ICT policies and strategies.
- Most of the investments or recruitments of ICT professionals or faculty are *ad hoc.*
- Most universities allocate only about 1% of their revenues to ICT yet they need to dramatically increase ICT investments and recruitment.

ICT in University Education: Weakness 2

- In general, Kenyan universities find it very expensive to establish and maintain the ICT infrastructure.
- each of the 6 public universities in Kenya has over 6,000 students spread over a large geographical area, sometimes at multiple locations.
- The University of Nairobi has about 32,000 students spread over 10 campus-locations. Creating an integrated campus-network and setting up enough computers can cost over Ksh 500 million.

ICT in University Education: Weakness3

- In addition to the cost of establishing the campus networks, internet bandwidth is also expensive and increases operational costs. For example, a university with 3,000 students would need at least 4 Mb/s of internet bandwidth and this would cost about $ 8,000 per month.
- Most Kenyan universities can only afford about 256 kb/s.

ICT in University Education 4

- Kenyan universities are still unable to provide classroom ICT services or even to equip all faculty offices with computers.
- Most do not have an e-learning platform.
- there are very few incentives for the use of ICT in teaching and learning. faculty and students outside the ICT degree areas are not using ICT in teaching and learning.
- there is very limited locally relevant content that faculty could use for teaching or that students could access. Most of the faculty in the Universities are also not prepared or trained to use ICT in their work.

ICT in University Education 5

Although Kenyan universities have a very large pool of very talented students pursuing degrees in ICT professional degree programmes (e.g., computer science, information systems, electronic engineering,).

- Universities often do not benefit from their creativity and innovations. *For example, many of the final year ICT projects could be commercialized if the universities had an innovation system that supports the students and the faculty.*
- It is possible for universities to support large team-based software development efforts by students and faculty but this is currently not happening.
- Most universities do not fully recognize the innovative capacity or skills of the ICT faculty and students and consequently do not benefit from the large ICT human capacity.

ICT in University Education: Weakness 6

All Kenyan universities now offer at least one ICT professional degree programme.

- there is a very limited pool of ICT faculty available in Kenya, especially at doctoral levels.
- Many of the ICT faculty also has no professional experience in ICT industry as engineers, software developers, or in the emerging area of computer and network security.
- There are very few ICT graduate degree programmes in Kenya and only the University of Nairobi has a small number of doctoral ICT candidates (7) registered locally.
- Current doctoral staff at Universities are an endangered species due to mobility
- Most students who pursue graduate ICT degrees in other countries such as South Africa, UK, or USA never return on study completion. There will be an even greater shortage of ICT faculty in the future as more universities continue to increase enrolments in ICT degree programmes.

ICT in University Education: Weakness 7

- It is possible that ICT degree learning outcomes are not being achieved. It could also explain the limited number of software development companies in Kenya and the limited ICT innovations in Kenya (e.g., patents or new software products).

Opportunities 1

- Huge demand in Kenya for ICT applications in business (especially the SME sector), government, hospitals, and educational institutions.
- Since imported software applications are expensive, there is an opportunity to set up software houses in universities or close to universities and use students and faculty as software developers.

Opportunities 2

- the large global business process outsourcing or the call centre market has not benefited universities. *University students, who are ICT literate, are also proficient in English language. This proficiency could be judiciously used by the universities to set up call centres in partnership with the private sector*

Opportunities 3

- Some of the existing private sector partnerships with large ICT companies such as Microsoft, Cisco, Oracle, Safaricom, or Zain could be approached to establish specialised ICT labs in Universities and also to setup software houses.

Threats 1

- Universities have not yet addressed security issues fully and neither do they have operational IT security policies. *Universities are often sources of spam or spyware and are also exposed to international hackers. Such hackers could penetrate some of the mission-critical information systems of the universities.*
- Changes in ICT are also a threat to adoption of ICT in Universities. *Kenyan universities must remain current yet technological obsolescence makes it expensive to maintain the ICT systems*.

Threats 2

- The lack of undersea optical fibre access means that ICT international partnerships for software development and Business Process Outsourcing (BPO) opportunities might not happen. The emergence of other ICT Centres of Excellence in the region (e.g., Rwanda, Mauritius, and South Africa), means that universities might not benefit from the ICT developed talent and might also not retain their critical personnel.
- *The Government of Kenya has set aside KShs. 900 million in the current 2008-2009 budget to establish a Business Process Outsourcing (BPO) Park in Kenya as part of its commitment to Vision 2030 with the goal of transforming Kenya into a premier destination for outsourcing by 2012 and creating 15,000 new jobs primarily for global clients.*
- *In addition to the BPO Park the following projects are set for completion next year: (1) Undersea fibre cable - TEAMS & SEACOM - by June 2009 and (2) Terrestrial fibre cable - connecting all major towns and districts countrywide - by May 2009. This will stimulate demand for both local and global outsourcing as the cost of bandwidth decreases and quality of connectivity improves countrywide*.

Threats 3

- The lack of Foreign Direct Investment (FDI) into the non-telecommunications ICT sector (e.g., software development, internet applications, ICT design and consulting, equipment manufacturing) in Kenya also means that the country will continue to have weak absorptive capacities of ICT innovations.
- Low levels of budgeted annual funding for Research in general
  - Kabarak Univ2 million
  - JKUAT 33.5 million
  - Univ of Nairobi 60 million
  - Egerton 120 million

Key Taskforce Recommendation (7.1)

- **Create networked environments that support and enhance learning, teaching, research, innovation, and management, and increase the reach of Kenyan universities**.

Justification

The integration of ICT in Kenyan University education,

- **Will increase ICT innovations and research output and improve socio-economic development.**
- **will lead to effective participation and contribution to knowledge and business operations and thereby enhance socio- economic development**
- **Use of ICT will enhance e-learning as a means of complementing other modes of delivery.**

The full incorporation of ICT into learning and research at universities is long overdue and expenditures envisaged in this recommendation are aptly justified.

Justification

- Embracing ICT will open up channels for acquisition, updating and dissemination of knowledge.
- ICT will enrich teaching, learning and research.
- Use of ICT will improve the process of data collection, analysis, storage, retrieval, and dissemination.
- Application of ICT will improve institutional operations through the creation of effective Management Information Systems.

Strategic Objectives

- to develop and implement institutional ICT policies and strategic plans;
- to strengthen the ICT human capacity in Kenyan universities;
- to provide adequate networked campus infrastructure to serve the teaching, learning, and management needs of the universities;
- to extend the reach and enhance the capacity and quality of the national university interconnection infrastructure;
- to increase the international internet bandwidth and reduce the cost of high quality service;

Strategic Objectives

- to facilitate educational content creation, sharing, and delivery;
- to collaborate with the National Research and Education Network (NREN) to enhance partnerships with strategic institutions and achieve economies of scale in procurement of ICT equipment and services;
- to increase the quality and quantity of national ICT human capacity in strategic areas; and
- to improve the socio-economic development of the country using ICT innovations and research.

Organisational Restructuring of ICT at UoN

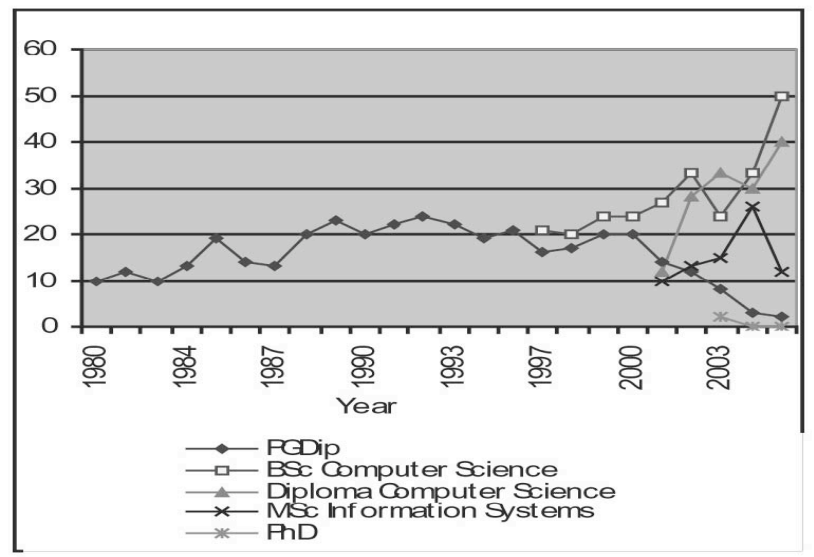
Year	Organisational Restructuring	Line Functions(LF)	Sections
1969	Computer Centre	Technical	Computer Operations
1977	Institute of Computer Science	Academic	Dept of Computer Science
		Technical	Computer Operations
1986	Institute of Computer Science	Academic	Dept. of Computer Science
		Technical	Computer Services
1992	Institute of Computer Science	Academic	Dept. of Computer Science
		Technical	Computer Operations
			Management Information Systems
2002	Dept. of ICT Services	Communication & Network Services	
		Management Information Systems	
		Learning Technologies	
2002	School of Computing and Informatics	Computer Science	
		Information Systems	
		Telematics	

School of Computing & Informatics

On-going programmes:

- Diploma (Computer Science) exit point for BSc(C.Sc),
- BSc. (Computer Science),
- Bachelor of Education (Information and Communications Technology)
- MSc (Computer Science) {specialist course}
- Postgraduate Diploma (Information Systems), exit point for MSc (IS)
- M.Sc. (Information Systems), {conversion Course)
- M.Sc.(Applied Computing) and
- Ph.D.

SCI Graduands 1980-2005 in various programmes



SCI Research & R&D SWOT ANALYSIS

SWOT	Research	Research & Development
Strengths	•A well-established department of over 28 years' standing •A significant kernel of trained academic staff in a wide spectrum of computer science disciplines • Excellent students intake serving as a basis for staff development •Good networking and computing infrastructure •Strategic location of the school	•Strong portfolio of student projects with potential for further development •Some staff members with research degrees •Several project proposals for research funding in process
Weaknesses	•High staff turnovers due to inadequate remuneration in a competitive sector • Inadequate funding for maintenance and communication costs •Inadequate provision to sustain future capital development •Lack of funds for further training •Moonlighting leading to academic fatigue	•Lack of active research activities (inactive research groups) •Lack of funds dedicated to research •Staff morale to carry out research is low •Limited portfolio of research projects and publications
Opportunities	•Ability to acquire specialised computing resources for teaching and research •Fast pace of international developments in ICT research (since this allows room for new researchers) •Potential of collaborating with other institutions	•Increasing participation in relevant contextual research
Threats	• Decreasing funding from the Exchequer • Poaching of human resources	•Fast pace of international developments in ICT research (since it requires resources to keep pace) •High cost of equipment and training

Research groups

- Artificial Intelligence Research Group (AI);
- Distributed Systems Research Group (DS);
- Information Systems Research Group (IS).

Currently, some of the research activities within these three groups includes:

- Natural language processing (NLP): Research in Swahili and other local Kenyan languages, development of text-to-speech systems etc. (AI)
- Localization http://africanlocalization.net/
- Telemedicine (AI group)
- Local language Interfaces for the Visually challenged (AI & DS)
- Grid computing: This involves the use of intelligent agents, scheduling, issues of quality of service etc. (AI & DS groups)
- Mobile phone telephony (AI & DS group) http://www.mopra.org/

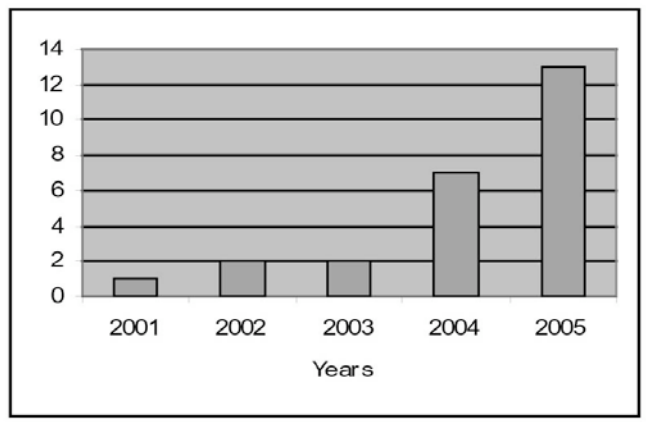
Research groups Activities

- ICT policy and e-governance, e-strategies (IS group)
- Geographical Information Systems (GIS): National Spatial Data Infrastructure, Modelling and decision support (IS group)
- Electronic learning technologies (IS group)
- ICT for development and technology forecasting (IS group)
- Application of ICT in organisational change management (IS group)
- Growth Modelling: Epidemiology , Biomass partitioning (IS)
- Village e-Science for Life
- Information systems Support for Nomadic communities (IS & AI)
- Electronic learner modelling (AI & IS group)

Staff status SCI (71% establishment filled; 16% are women)

Post	Establishment		Academic Staff in Position
	<2001 (ICS)	2002 (SCI)	(PhD)
Professor	2	3	1 (1)
Associate Professor	4	3	2 (2)
Senior Lecturer	6	6	3 (2)
Lecturer	9	13	12 (1)
TOTAL	21	25	18 (6)

Number of peer reviewed publications at SCI



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END

- Managing University Research.ppt

Capacity-building and Mobility at SCI

Partner	Programme	Period	No. of Scholarships	Successful Completion	Retention
UoN/DAAD	PG Diploma Computer Science	1980 1994	2-3 annually	All	3
UNESCO	PG Diploma Computer Science	1985 1989	1 annually (regional)	Most	0
ODA/TCT (UK)	PhD (UK) MSc (UK)	1985-92 1985-88	7 3	6 3	0 3
IDA/World Bank	PhD (UK) HND	1992 1992	1 1	1 1	0 0
	PhD (UK)	1983-86	1	1	**1**
Other	PhD (Finland)	2001-05	1	1	**1**
	PhD (USA)	2001-05	1	1	0
Commonwealth Secretariat	MSc PhD (split)	1995 2004-2006	1 1	1 1	1 **1**
VLIR	PhD (split)	1998-2002	3	2	**2**
	PhD (split) MSc (Belgium) MSc (UoN)	2003-2008 1998-2002 1998-2002	4 8 2	**Pending** 6 1	 1 0
UoN Local Registration		2007-2010	4	**Pending**	
TOTAL (excl. PG Diploma)			37	24	10

To improve the socio-economic development of the country using ICT innovations and research

- **this strategic objective also aims to align the ICT professional education as well as the integration of ICT into university education with the socio-economic development agenda of the country**

Use ICT innovations and research strategies to improve socio-economic development 1

- Establish high quality ICT centres of excellence undertaking cutting-edge research that addresses the socio-economic needs of Kenya. At present, ICT departments in Kenyan universities are not set up as centres of excellence. This limits the research outputs and innovations of the ICT departments. Universities have to find different ways of establishing centres of excellence as separate units or as parts of the ICT departments.

Use ICT innovations and research strategies to improve socio-economic development 2

- Establish ICT incubators and spin-off companies in partnership with the private sector. The private sector in Kenya is willing to partner with ICT departments but that will mean a change of management. Such models have been found to work well in Ireland, Finland and the US.
- One IFC grant of US 200,000 to an applicant while at JKUAT has effectively been privatised (KeKoBi) run independently of JKUAT).

Use ICT innovations and research strategies to improve socio-economic development 3

- Increase the number of ICT applications that have been locally developed to serve key sectors of the economy such as the needs of government and SME.
- Such applications could be developed within the incubators or by the spin-off companies established in university clusters. There are very few examples of university-affiliated incubators that are starting to develop local ICT applications

Use ICT innovations and research strategies to improve socio-economic development 4

- Create awareness of the link between ICT and socio-economic development using research-based studies

To strengthen the ICT human capacity in Kenyan universities. 1

- **Establish a competitive scheme of service for ICT professionals and faculty working in Kenyan universities.**
- **Such a scheme would take into account the employment market in the country of competent ICT professionals.**
- **The outcome of such a scheme would be an increase in retention and motivation of the ICT professionals and faculty.**

To strengthen the ICT human capacity in Kenyan universities. 2

- Recruit an adequate number of ICT professionals. The envisaged increase in levels of integration of ICT into university education will require an increased number of qualified ICT professionals and faculty.
- urgent need to recruit and train doctoral level faculty in Kenyan universities.
- necessary to conduct a compressive assessment of the ICT human capacity (professionals and faculty) in Kenyan universities.

To strengthen the ICT human capacity in Kenyan universities. 3

- Develop ICT management best practices. *The intention of this strategy is to develop national guidelines for managing the ICT function in the universities*

To increase the quality and quantity of national ICT human capacity in strategic areas 1

- Integrate ICT into the teaching and learning processes of all degree programmes as well as in conducting all other institutional business.
- Integrate the teaching of humanities and social sciences in ICT degree programmes

To increase the quality and quantity of national ICT human capacity in strategic areas 2

- Enhance the quality of ICT degree programmes offered in Kenya. *None of the ICT degree programmes offered in Kenya have international professional accreditation status. This is an indicator that the ICT degree programmes do not meet internal standards in terms of quality of faculty, quality of equipment, and the currency of the curriculum.*
- Align the ICT professional degree enrolment in Kenyan universities to the national ICT education strategy. *At present, universities in Kenya offer ICT degree programmes to meet the demands of the students without detailed analysis of ICT labour market or even the national areas of focus.*

To increase the quality and quantity of national ICT human capacity in strategic areas 3

- Strengthen ICT doctoral programmes in all universities.
- Although all universities offer one or more ICT undergraduate degree programmes,
  - only three universities (UoN,JKUAT,Stratmore) have graduate programmes at Masters Level and
  - only two (UoN,JKUAT) at doctoral level.
- There is a diminishing number of full time, doctoral level establishment faculty in Kenyan universities. UoN (6 of 18), JKUAT (3 of 6), Strathmore U(3 of 6) Egerton (2 of 7), KU (0 of 9), Kabarak (0 of 8),USIU (2of 6)

To increase the quality and quantity of national ICT human capacity in strategic areas 4

- Create and strengthen ICT entrepreneurship and innovation centres in universities.
- *At present, ICT departments do not encourage students to start entrepreneurship ventures or even to commercialize some of their innovations.*
- It is important that most ICT graduates develop an entrepreneurial mindset that drives their motivation for innovation.

To increase the quality and quantity of national ICT human capacity in strategic areas 5

- Encourage the participation of Kenyan students in national and international project exhibitions and design competitions. *This is normally the best way to encourage students to be innovative and to achieve high standards in their projects. At present, some departments participate in some national competitions organized by IEEE but this needs to be scaled up.*

ICT Degree Programmes in Kenyan Universities

Degree Course	Public Universities	Private Universities
Computer Science	Yes (all)	Yes (African Nazerene U, Daystar Univ, Kiriri Women Un. , Kabarak Univ)
Computer Eng.	Yes (Moi, KU, JKUAT)	No
Electronic Eng.	Yes (UoN, JKUAT, Moi)	Yes (Daystar)
Information Systems	No	Yes (USIU, Stratmore U, Daystar U)
Software Eng.	Yes (KU)	No
Computer Technology / IT	Yes (KU, JKUAT)	No