UNITED NATIONS EDUCATIONAL, SCIENTIFIC
AND CULTURAL ORGANIZATION

SEMINAR FOR HIGH-LEVEL EXPERTS

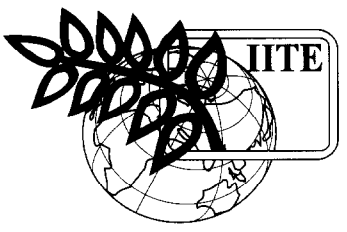
POLICY FORMULATION AND PRACTICAL USAGE OF ICTs FOR HIGHER DISTANCE EDUCATION IN COUNTRIES IN AFRICA

29 October – 1 November 2002, Nairobi, Kenya

Final Report and Selected Materials

UNESCO INSTITUTE
FOR INFORMATION TECHNOLOGIES IN EDUCATION

MOSCOW
2003



UNESCO
UNESCO Institute for Information Technologies in Education (IITE)

IITE editorial coordination:
Yuri Zaparovanny

Within the framework of the IITE international project *Information and Communication Technologies (ICTs) in Distance Education,* the UNESCO Institute for Information Technologies in Education held the seminar for high-level experts *Policy Formulation and Practical Usage of ICTs for Higher Distance Education in Countries in Africa* in Nairobi, Kenya, from 29 October to 1 November 2002. The participants from seven countries, namely Ghana, Kenya, Namibia, Seychelles, South Africa, Uganda, and United Republic of Tanzania as well as the representatives of four national focal points for cooperation with IITE, UNESCO Regional Bureau for Education in Africa (BREDA), UNESCO International Institute for Capacity Building in Africa (IICBA), World Bank Group, US International University, Centre for Flexible and Distance Learning of the University of Auckland (New Zealand), and African Study Center (Netherlands) took part in the seminar. The results of this work are presented in the Final Report and Selected Materials.

For further information please contact:

UNESCO Institute for Information Technologies in Education
8 Kedrova St. (Bld. 3), Moscow, 117292, Russian Federation

Tel.: 7 095 129 2990
E-mail: info@iite.ru

Fax: 7 095 129 1225
Web: www.iite-unesco.org

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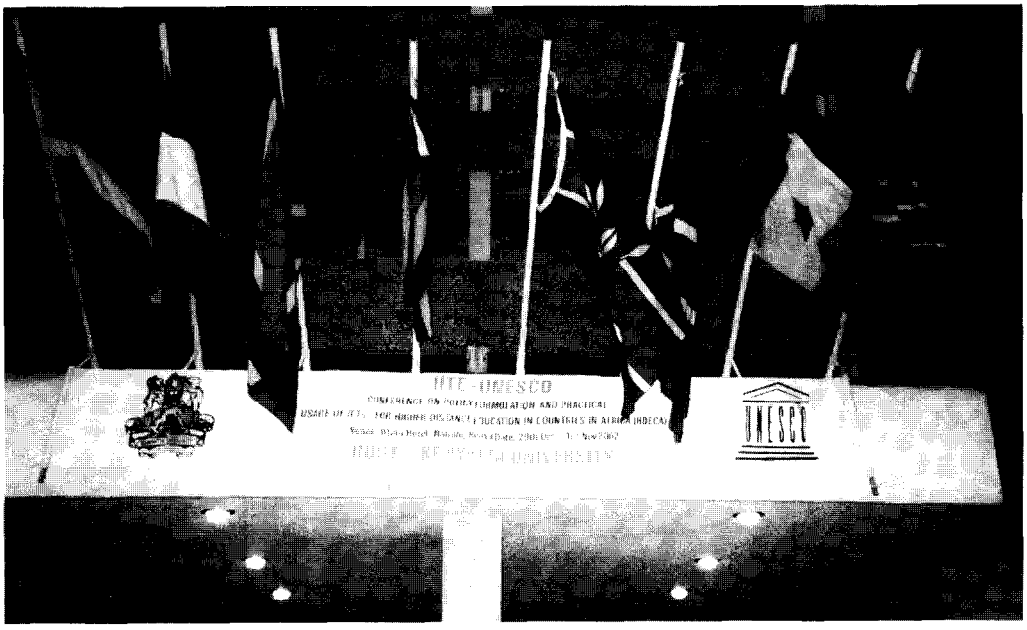
FINAL REPORT



EXECUTIVE SUMMARY

Seminar for high-level experts *Policy Formulation and Practical Usage of ICTs for Higher Distance Education in Countries in Africa* was held in Nairobi, Kenya, from 29 October to 1 November 2002.

The main goal of the seminar was to identify the ways and modes of policy formulation and practical usage of ICTs in higher distance education in countries in Africa (HDECA) through:

- discussion of strategy formulation for training and retraining of educational personnel in HDECA;
- familiarization with IITE educational programme and its components, in particular, on ICTs usage in distance education;
- analysis of technical and pedagogical implications of ICTs in teaching and learning in HDECA;
- study of staff development for ICT usage in higher distance education in participating countries;
- establishment of partnership and networking.

In order to ensure fruitful work and positive outcome of the seminar, information materials and reference documents were prepared and distributed in good time among the participants (see Annex 2. *List of Documents*).

The participants from seven countries, namely Ghana, Kenya, Namibia, Seychelles, South Africa, Uganda, and United Republic of Tanzania as well as the representatives of four national focal points for cooperation with IITE, UNESCO Regional Bureau for Education in Africa (BREDA), UNESCO International Institute for Capacity Building in Africa (IICBA), World Bank Group, US International University, Centre for Flexible and Distance Learning, University of Auckland (New Zealand), and African Study Center (Netherlands) took part in the seminar (see Annex 3. *List of Participants*).

Prof. George Eshiwani (Kenyatta University) and Prof. Vladimir Kinelev (IITE)

Welcome video address of Mr John Daniel to the participants of the seminar

During the opening ceremony Prof. George Eshiwani, Vice-Chancellor of Kenyatta University, greeted the participants of the seminar. He underscored the important role that ICTs play in distance education development.

Mr John Daniel, Assistant Director-General of UNESCO for Education, in the welcome video address stressed that UNESCO always devotes special attention to the issues related to distance education with strong focus on developing countries, especially on the countries in Africa; and highlighted six major concerns in realizing UNESCO mandate, namely:

- application of ICTs in all areas of UNESCO's work with special emphasis on education;
- pre- and in-service training of teachers to use ICTs in distance education;
- dissemination of educational programmes worldwide;
- training of teachers on ICT application as catalytic agents of educational change;
- popularization of important work of IITE and mounting its training course on ICT usage;
- seeking for appropriate strategies to meet the challenges of change, approach, and coverage in the context of Education for All.

In the opening address Prof. David Wasawo (University of Nairobi, Kenya) made a broad overview of the major problems in African education, which have been and continue to be the issues of access, equity, cost, personnel and curricula, as well as the provision of adequate facilities to the growing population. He pointed out that the seminar specific aims are:

- to interrogate the current training and retraining of educational personnel with regard to ICT usage with particular focus on higher distance education;
- to discuss and recommend various strategies to be used in training and retraining of educational personnel for higher distance education.

Prof. David Wasawo (University of Nairobi)

People expect higher education to play a key role in knowledge augmentation and to offer theoretical and practical recommendations concerning existing problems and innovations that would enable countries to take on future challenges. Be it in economic, political or social realms, higher education is meant to contribute to the overall quality of life in an increasingly globalised and liberalized environment.

Prof. George Eshiwani and Prof. Mohammed Rajab (Kenyatta University)

Finally, he noted that the staff development programme focused on technology diffusion should be viewed as a long-term effort, supported by adequate resources and stable funding over a period of time. Such programme must have strong administrative backing when institutional heads take an active role in training activities and provide lecturers/instructors with necessary and sufficient follow-up for effective transfer of technological skills into the pedagogical practice.

After the main goals, agenda and timetable of the seminar were adopted (see Annexes 1, 4). Prof. Mohammed Rajab (Kenyatta University) was elected Chairperson of the

Prof. Olive M. Mugenda (Kenyatta University)

seminar and Prof. Olive M. Mugenda (Kenyatta University) – Rapporteur.

In the opening presentation Prof. Vladimir Kinelev, Director of IITE, stated that knowledge is the main asset and product of the information society upon which continued economic well-being and social development depend. Distance learning is in the mainstream of these developments. Distance learning and the information society are both concerned with the creation, acquisition, sharing, dissemination, delivering, support and recognition of knowledge. Distance learning is the means for providing access and achieving continuous learning necessary for successful participation of all social groups in the information society.

Prof. Kinelev stressed that in the field of its competence the UNESCO Institute for Information Technologies in Education strives to assist UNESCO Member States in sharing experience in distance education by promoting international cooperation. For instance, on 20 and 21 September 2001 the Institute held expert meeting *Distance Higher Education in Africa: Professional and Course Development* and workshop *ICTs in Distance Education.* These events were arranged on the basis of the Open University of Tanzania, and the central themes of the discussion were the prospective approaches to the capacity building for distance education in higher school in countries in Africa as well as possible joint activities of IITE and UNESCO Member States in Africa fostering the application of ICTs in education, especially in the profession and course development for distance education. The participants of the expert meeting surveyed international experience of ICT usage in distance learning, particularly in the universities in Africa, discussed issues related to the educational programmes and application of ICTs in staff training for distance education, reviewed the courses developed for distance learning and the role of international cooperation in building up national capacities for higher education in Africa.

Prof. Kanwar Asha Singh (BREDA)

Prof. Kinelev pointed out that in accordance with the recommendations adopted by the participants of the expert meeting *Distance Higher Education in Africa: Professional and Course Development* in Tanzania, IITE has been encouraged to form a representative group of experts to elaborate a policy that can be used as a potential resource for ICTs and distance education policy formulation in Africa.

He mentioned that in accordance with the recommendations of the expert meeting in Tanzania, the specialized Institute's web site with a broad range of services was created. Among them is the forum, which provides direct access to all materials and documentation of the seminar and allows the participants to carry out fruitful discussions with moderators (Prof. George Eshiwani, Prof. Wayne Mackintosh).

Prof. Valery Meskov (IITE) and Mr Severin Ndunguru (Open University of Tanzania)

In conclusion IITE Director expressed the hope, that the seminar will help make a new step toward determining strategies in training and retraining of educational personnel in ICTs for

Prof. George Eshiwani (Kenyatta University), Mr Atta Gyamera Emmanuel (Ghana Education Service), and Mr Ayoo Phillip Ouma (The Inter-University Council, Uganda)

higher distance education in countries in Africa, facilitate the implementation of the Institute's educational programme for successful integration of ICTs in distance education, and stressed that the present seminar, a follow-up of the previous one, continues Institute's activity in Africa, with Africa and for Africa.

Prof. Eshiwani in the presentation *Forming Strategies for Training and Retraining of Educational Personnel in the Usage of ICTs for Higher Distance Education in Countries in Africa* gave an outline of ICT usage for higher education in Africa, which covered the issues of access to higher education, budgetary allocations, human resource capacities and competencies as well as ICT infrastructure. He made clear that Africa is the weakest region in the field of ICT use. The density of telephone calls and the Internet access are the lowest in the world. With the population of 780 million, 13% world population, Africa owns only 2% telephone lines. The continent occupies a tiny section in the use of the Internet in comparison with other regions. In 1998, when the number of Internet users in the world was more than 152 million, Africa comprised only 1.14 million compared to 27 million in Asia and the Pacific, 33 million in Europe, 0.78 million in the Middle East, 87 million in the USA and Canada, 415 million in South America. However, it is worth noticing that the access to the Internet grew rapidly last years. Since July 1999, 53 out of 54 African states have got the Internet access in the capitals. However the Internet is expensive and scarcely available outside the capital cities. Only 17 countries possess Internet servers in provincial towns. With such limited coverage, for the majority of people, even if they can afford a computer, it is a long distance call (which is very expensive) to use the Internet. Now there are over 500,000 dial-up subscribers in Africa (about 175,000 outside of South Africa). Each computer with the Internet or e-mail connection has three users on average. Thus, the current estimates of African Internet users are somewhere around 1.5 million. So, the underdeveloped telecommunication is a major problem for the use of ICTs. This could be attributed to the weak policies and non-dynamic strategies in the field. Poor telephone lines remain an important obstacle.

Currently in Sub-Saharan Africa, more than 140 public and private institutions provide tertiary distance education, although it is still based on traditional technologies. The African Association of Universities (AAU) found out with its questionnaire that only 52 of 232 African academic and research institutions have the unlimited Internet access. The cost of ICT use remains a constant concern for Africa. Although few precise studies are available on the cost of open and distance teaching in Africa, some indications could be provided. In Madagascar, the cost per student is at US$40 per year. Open University of London estimates that this cost is one third of the figures for traditional universities. Most higher education institutions lack competent staff to build networks, design training programmes and develop sound environment for the use of ICTs. The capacity to assure maintenance of equipment is insufficient either. Furthermore, in Africa the frequent use of projects realized in other environments does not seem to be the best means of creating appropriate and sustainable institutions. Development of local competences is absolutely indispensable.

Dr Marew Zewdie (IICBA)

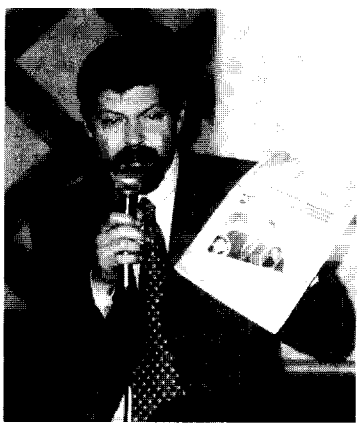
Prof. Eshiwani stated that as in other regions of the world, higher education in Africa has to be adjusted to ICTs. This is the

price to pay in order to avoid marginalization and exclusion from the actual knowledge society and to reduce the gap separating African countries from the industrialized ones. Everywhere in Africa, lectures by the most renowned specialists should be easily accessible for any academic or student. It will help improve the quality of teaching.

To reach this objective, the African higher education institutions must make some important decisions:

- To formulate clear policies and strategies for ICT development and use in the new paradigm for teaching and research.
- To assert the priority of entering the new information society.
- To implement a coherent policy for human resource improvement to comprehend, develop and manage ICT programmes, including the production of software for teaching.
- To put an accent on the development of indispensable infrastructures for a sound use of ICTs in favour of a qualitative higher education teaching.
- To mobilize budget resources of each Member State for the sake of ICTs.

In the presentation *A History of the Future for Distance Education in Africa Society, Education and ICTs* made by Prof. Wayne Mackintosh, the importance of past and present history of distance education as a basis for the development of an appropriate model/framework to implement ICT usage in African countries, was underscored. He indicated that the process is influenced by two factors: predeterminations and uncertainties. He proposed one way of forecasting – scenario planning. Since teaching and learning are separated in distance education, they can be mediated only technologically. This requires creativity, special techniques and methods, pedagogical, organizational and institutional structures radically different from traditional approaches. The drivers of change in higher education are:



Prof. Wayne Mackintosh, University of Auckland (New Zealand)

- mass character;
- global knowledge society;
- advance in digital ICTs.

Distance Education is characterized by mass standardization of products and processes. However, digital technology enables mass customization of products and processes which is cost effective and client friendly.

According to Prof. Mackintosh the mass character of education has given rise to the models, viz. mass standardization and customization of educational products in distance learning. He believes that mass customization is a better model to achieve higher distance education goals.

In conclusion, he supposed that the levels of customization would be enhanced through Open Source Software, which has the following advantages:

- cheaper to produce;
- easier to prioritize educational needs over commercial considerations;
- greater opportunities for customization according to individual needs;
- enhanced collaboration among large communities of expert researchers.

Dr Bob Day (UNISA, South Africa)

In the presentation *Higher Education Institutions (HEIs) and ICTs: their Unique Strategic Potential for Africa (a South African perspective)* Dr Bob Day, Executive Director of ICT Principal's

Office of the University of South Africa (UNISA), spoke about the traditional campus model, which is too expensive and cannot be scaled up for *Education for All (EFA)* goals. The essence of UNESCO's EFA programme[1] is to work toward the eradication of abject poverty throughout the world. The global tertiary sector combined with the traditional values of society, should be positioned ideally to address this. However, today's universities face a perplexing task of balancing the tensions of Mr John Daniel's eternal triangle, i.e. to improve quality, cut the costs and serve for more and more students. Around the world today we need an equivalent for one large new university to be opened every week to keep tertiary participation rates constant.

Representatives of IITE focal points: Mr Atta Gyamera Emmanuel (Ghana), Mr Benjamin Choppy (Republic of Seychelles)

There is a widely spread belief in South African HEIs that they fall behind the developed world in the application of ICTs. For the public higher education system operating with extremely limited resources, this is especially serious. Even the best HEI systems are not as sophisticated as those of the developed nations, and there are many institutions, which systems and levels of connectivity can be considered negligible. The absence of appropriate technological support and infrastructure necessary to secure high levels of connectivity is likely to disadvantage the entire academic and research enterprise of the higher education system. Consequently, it will severely compromise their ability to collaborate, support, and teach the ICT sector (and, of course, all other sectors of society).

Dr Bob Day stressed that ICTs can be and are used in various ways by HEIs in South Africa. His analysis was structured in terms of teaching, administration, community service, and research. However, the range of national ICT strategic initiatives shows that there is a much broader spectrum of ICT capabilities that need to be created to satisfy the growing needs of South African emerging knowledge society. This is a chicken and egg situation: if we do not provide such people, society will not grow, i.e. it cannot be demand-led. Our society must take the risk of anticipating the demand collectively.

The major concern of the ICT sector is that a far insufficient number of the appropriately qualified people is available, especially from the black community and women; other concerns are voiced that the dynamic course components get outdated very quickly (currently it takes years to rewrite curricula in HEIs). What remains non-addressed, however, is a big and growing need in such ICT technologists and professionals for ALL other sectors of society (private, public, development, etc.).

Secretariat at the work

[1] UNESCO, 2000. Text adopted by the World Education Forum Dakar, Senegal, 26-28 April 2000. http://www2.unesco.org/wef/en-leadup/dakfram.shtm

These people must be educated and trained to understand their sector FULLY (e.g. agriculture, tourism, etc.) as well as all ICT aspects relevant to that sector (current and future).

In simple words, to improve teaching ICTs can be used in two ways: delivery of teaching, and better teaching materials. However, both have many subcomponents, and the picture gets more complicated due to the mode of teaching, i.e. contact, distance or their combination. However the speaker believes that the problems expressed above are not unique to South Africa, being repeated to varying degrees across Africa. The potential is significant, therefore, for HEIs working in unison as a national sector rather than regional consortia, to build powerful partnerships with the ICT sector to address these problems. The solutions will benefit not only South Africa, but can accelerate the success of the ICTs appropriately applied in HEIs throughout the continent.

In conclusion Dr Bob Day conveyed the feeling that we face a future (threat or opportunity?) full of countless initiatives that need to be embarked upon in order to facilitate the ample usage of ICTs. What must be done first is less important, than how a given initiative seeks to enhance social and economic benefits South Africa might derive from ICTs, and how readily it may be joined up with complementary initiatives. This emphasises a widespread demand of innovative, collaborative arrangements overcoming the constraints of existing institutions, and shapes a vision of 'partnership' with fractal qualities.

During the round-table discussions the participants identified a number of obstacles that impede the implementation of ICT programmes in countries in Africa:

- Technological changes: ICTs change rapidly leading to obsolescence of both hardware and software for ICT usage. Other sources of power require other forms of energy to be exploited, for example, that of the Sun and wind.
- Cost implications: there is a need to implement preferential pricing policies in relation to ICTs and education.

The discussion covered the following concern: What collaboration efforts can be put in place to develop ICTs in distance education?

The participants agreed that the educational sector is to be differentiated inevitably, and the technology advance does not necessarily follow linear progression.

Closing speech by Prof. J. Irina (Head of Commission for Higher Education, Kenya)

The following items were assumed to be necessary components of an ICT policy:

- mission and vision;
- curriculum and pedagogical models accounting for context, language and level;
- accreditation and quality assurance;
- capacity building (personnel and infrastructure, recruitment, training and retraining, design and delivery);
- access to education and ICTs;
- ongoing research of ICT curriculum, new pedagogy of ICT skills;
- infrastructure (hardware, software, networks);
- awareness and positive attitudes among leaders, especially active involvement of the community.

On closing the seminar the following recommendations were worked out:

1. IITE in cooperation with BREDA, IICBA and in tight partnership with UNESCO Member States come together with a proposal for a sub-regional project on ICT applications in distance education in Sub-Saharan Africa countries.

2. Draft project should include the suggestions made by the participants of the seminar.

3. IITE drafts a project plan to implement a pilot course for training future trainers in ICTs for distance education with IITE specialized training course *Information and Communication Technologies in Distance Education*.

Pilot project plan should comprise the suggestions worked out during the seminar.

ANNEX 1

IITE/MOS/S1/02/DOC.1

AGENDA

1. Opening of the seminar

2. Adoption of the agenda

3. Election of Chairperson of the seminar

4. Election of Rapporteur of the seminar

5. Presentations by keynote speakers on:

   - Forming Strategies for Training and Retraining Educational Personnel in ICTs for Higher Distance Education in Countries in Africa
   - A History of the Future for Distance Education in Africa: Society, Education and ICTs
   - IITE Educational Programme: Information and Communication Technologies in Distance Education

6. Thematic discussions:

   - State-of-the-Art, Needs and Perspectives of ICT Usage in Higher Distance Education in Countries in Africa
   - Improvement of ICT Usage in Higher Distance Education and E-learning in Africa: Required Resources, Possible Partnership and Networking

7. Round-table discussion:

   - Training Activities on ICT Usage in Distance Education in the Universities in Africa

8. Adoption of the main documents of the seminar

9. Closing of the seminar

ANNEX 2

IITE/MOS/S1/02/INF.3

LIST OF DOCUMENTS

IITE/MOS/S1/02/DOC.1	AGENDA
IITE/MOS/S1/02/DOC.2	WORKING DOCUMENT
IITE/MOS/S1/02/DOC.3	FINAL DOCUMENT

INFORMATION DOCUMENTS

IITE/MOS/S1/02/INF.1	TIMETABLE
IITE/MOS/S1/02/INF.2	LIST OF PARTICIPANTS
IITE/MOS/S1/02/INF.3	LIST OF DOCUMENTS

ANNEX 3

IITE/MOS/ME2/02/INF.2

LIST OF PARTICIPANTS

PARTICIPANTS

Mr Phillip Ouma AYOO
Electronic Database Specialist
The Inter-University Council
P.O. Box 7110
Kampala
Republic of Uganda
Tel.: 256 41 256251
Fax: 256 41 342007
E-mail: payoo123@hotmail.com
Web: www.iucea.org

Mr Benjamin CHOPPY
Technical Adviser to the Minister
Ministry of Education
Mont Fleuri, P.O. Box 48
Republic of Seychelles
Tel.: 248 283 283
Fax: 248 224 859
E-mail: benchoppy@emails-sc
Web: www.education.gov.sc

Mr Atta Gyamera EMMANUEL
Science Resource Centre
Ghana Education Service
P.O. Box M.45, Accra
Republic of Ghana
Tel.: (233-21) 78 39 04
Fax: (233-21) 61 07 068
E-mail: eagyamera@hotmail.com

Prof. George S. ESHIWANI
Vice-Chancellor of Kenyatta University
President of the Association of African Universities
PO Box 43844, Nairobi
Republic of Kenya
Tel.: (254-2) 812 677; 812 676
Fax: (254-2) 811 575; 81 14 55
E-mail: kuvc@nb.net.co.ke
eshiwani@nbnet.co.ke

Prof. Wayne Grant MACKINTOSH
Director
Centre for Flexible and Distance Learning
University of Auckland
Private Bag 92019, Auckland
New Zealand
Tel.: (64-9) 373-7599, ext 2400
Fax: (64-9) 373-7565
E-mail: w.mackintosh@auckland.ac.nz
wgmackintosh@worldonline.co.za

Mr Calvin John MARTIN
National Institute for Educational Development (NIED)
P.O. Box 1396, Okahandja
Republic of Namibia
Tel.: (264-62) 50 24 46
Fax: (264-62) 50 26 13
E-mail: cmartin@nied.edu.na
Web: www.nied.edu.na

Dr Kashorda MEOLI
Associate Professor or Information System Dean
School of Business
United State International University
P.O. Box 14634, Nairobi
Republic of Kenya
Tel.: (254-2) 861 940
Fax: (254-2) 862 017
E-mail: meoli@usiu.ac.ke
Web: www.usiu.ac.ke

Prof. Ratemo W. MICHIEKA
Vice-Chancellor
Jomo Kenyatta University of Technology
P.O. Box 62000, Nairobi
Republic of Kenya
Tel.: 0151 52033
Fax: 051 52164
E-mail: jku-vc@nbnet.co.ke

Prof. Olive M. MUGENDA
Deputy Vice-Chancellor (Finance, Planning & Development), Kenyatta University
P.O. Box 43844, Nairobi
Republic of Kenya
Tel.: 254 2 811194
Fax: 2542 811517
E-mail: dvcfinance@wananchi.com
Web: www.ku.ac.ke

Mr Severin NDUNGURU
Senior Lecturer, Open University of Tanzania
P.O. Box 23409
Dar-es-Salaam
United Republic of Tanzania
Tel.: (255-22) 266 88 20
Fax: (255-22) 266 87 59
E-mail: avu.out@udsm.ac.tz

Prof. Mohammed RAJAB
Deputy Vice-Chancellor (Administration)
Kenyatta University
P.O. Box 43844, Nairobi
Republic of Kenya
Tel.: 254 2 811 535
Fax: 2542 811517
E-mail: kudvcadmin@wananchi.com
Web: www.ku.ac.ke

Dr Marcel RUTTEN
Consultant
African Study Center
P.O. Box 9555 2300 RB Leiden
Kingdom of the Netherlands
Tel.: 31 0 71 527 33 96
31 0 24 311 64 72 (Home)
Fax: 31 071 527 33 44
E-mail: rutten@fsw.leidenuniv.nl
Web: http://asc.leidenuniv.nl

Dr Robert (Bob) Stephen DAY
Executive Director
ICT Principal's Office
University of South Africa (UNISA)
PO Box 392, UNISA 0003
Republic of South Africa
Tel.: (27) 12 429 6022
Fax: (27) 12 429 3405
E-mail: dayrs@unisa.ac.za

OBSERVERS

Dr Bruce DAHLMAN
East African Representative
Interactive Health Network
P.O. Box 20, Kijabe
Republic of Kenya
Tel.: 0733 777680, 254 2 3204 6500
Fax: 254 2 3204 6355
E-mail: bruce.dahlman@aimint.org

Dr Vitalis O. MUSEWE
Registrar
Jomo Kenyatta University of Technology
P.O. Box 62000, Nairobi
Republic of Kenya
Tel.: 0722 719111
E-mail: vmusewe@clubinternetk.com

Ms Tanya SCOBIE
Education Specialist
International Finance Corporation
The World Bank Group
2121 Pennsylvania Avenue NW, F10K-180
Tel.: 202 473 4978
Fax: 202 974 4792
E-mail: tscobie@ifc.org
Web: www.ifc.org

Dr Wilson SITONIK K.
Director, Information Technology
Ministry of Finance & Planning
P.O. Box 55958, Nairobi
Republic of Kenya
Tel.: 254 2 338111
Fax: 254 2 213588
E-mail: wsitonik@treasury.go.ke

Dr Peter K. TORONGEY
Dean, Faculty of Science
Moi University, P.O. Box 3900
Eldoret
Republic of Kenya
Tel.: 0321 63162
Fax: 0321 63257
E-mail: dphysics@irmmoi.com or deanfs@africaonline.co.ke
Web: www.mu.ac.ke

IITE

Prof. Vladimir KINELEV
Director
Tel.: 7 095 129 19 98
Fax: 7 095 129 12 25
E-mail: kinelev@iite.ru

Prof. Valery MESKOV
National Programme Specialist
Tel.: 7 095 129 49 62
Fax: 7 095 129 12 25
E-mail: mvs@iite.ru

Dr Yuri ZAPAROVANNY
Project Manager
Tel.: 7 095 718 07 44
Fax: 7 095 129 12 25
E-mail: yuz@iite.ru

BREDA

Prof. Kanwar ASHA SINGH
Consultant
12 Ave LS Senghor BP 3310
Dakar, Republic of Senegal
BREDA
Tel.: 221 8492 382
Fax: 221 82383 293
E-mail: a.kanwar@unesco.org
Web: www.dakar.unesco.org

IICBA

Dr Marew ZEWDIE
Senior Programme Officer
P.O. Box 2305
Addis Ababa
Federal Democratic Republic of Ethiopia
IICBA
Tel.: 55 75 89
Fax: 251 1 55 7587

ANNEX 4

IITE/MOS/S1/02/INF.1

TIMETABLE

October 28, Monday

Arrival of the participants; meeting at the airport; hotel accommodation

October 29, Tuesday

08.30 – 09.00	Registration of the participants
09.00 – 09.20	Entertainment Harmony Band Kenyatta University Culture Village Dance Troupe
09.20 – 09.30	Welcome address Chairman of the Organizing Committee Prof. George S. Eshiwani
09.30 – 09.50	Welcome address Assistant Director-General of UNESCO Mr John Daniel
09.50 – 10.15	Presentation of the participants
10.15 – 10.30	Election of the Chairperson Election of the Rapporteur Adoption of the agenda and timetable
10.30 – 11.00	*Tea-break*
11.00 – 11.10	Official opening Chairman of Council, University of Nairobi, Prof. David Wasawo
11.10 – 11.30	Opening presentation Director of IITE Prof. Vladimir Kinelev
11.30 – 12.00	Keynote speech *Forming Strategies for Training and Retraining Educational Personnel in ICTs for Higher Distance Education in Countries in Africa* Prof. George S. Eshiwani
12.00 – 12.45	Keynote speech *A History of the Future for Distance Education in Africa: Society, Education and ICTs* Prof. Wayne Mackintosh
12.45 – 13.00	Plenary discussion
13.00 – 14.00	*Lunch-break*
14.00 – 16.00	Work in groups (discussion on the results of the online seminar): • Group 1. *State-of-the-Art, Needs and Perspectives of ICT Usage in Higher Distance Education in Countries in Africa* (moderator – Prof. George S. Eshiwani)

- Group 2. *Improvement of ICT Usage in Higher Distance Education and E-learning in Africa: Required Resources, Possible Partnership and Networking* (moderator – Prof. Wayne Mackintosh)

16.00 *Tea-break*

October 30, Wednesday

9.00 – 10.30 Continuation of work in groups:
- Group 1. *State-of-the-Art, Needs and Perspectives of ICT Usage in Higher Distance Education in Countries in Africa* (moderator – Prof. George S. Eshiwani)
- Group 2. *Improvement of ICT Usage in Higher Distance Education and E-learning in Africa: Required Resources, Possible Partnership and Networking* (moderator – Prof. Wayne Mackintosh)

10.30 – 11.00 *Tea-break*

11.00 – 13.00 Continuation of work in groups

13.00 – 14.00 *Lunch-break*

14.00 – 16.00 Plenary session
Report summary of group work

16.00 – 16.30 *Tea-break*

16.30 – 18.00 Tour of Kenyatta University

18.00 *Cocktail Party*

October 31, Thursday

9.00 – 10.00 Plenary session
Keynote speech
IITE Educational Programme: Information and Communication Technologies in Distance Education
Prof. Wayne Mackintosh

10.00 – 10.30 *Tea-break*

10.30 – 13.00 Plenary discussion

13.00 – 14.00 *Lunch-break*

14.00 – 15.30 Round table
Training Activities on ICT Usage in Distance Education in the Universities in Africa:
- objectives and expected results
- methods and forms of activities
- needed resources:
  - human
  - inancial
  - pedagogical
  - technological
  - networking
- international cooperation

15.30 – 16.00 *Tea-break*

16.00 – 17.00 Continuation of round table

November 1, Friday

9.00 – 10.00 Plenary session
Main Issues of Policy Paper on Strategies for Training and Retraining of Educational Personnel in ICTs for Higher Distance Education in Countries in Africa
Prof. George S. Eshiwani

10.00 – 10.30 Plenary discussion

10.30 – 11.00 *Tea-break*

11.00 – 11.30 Plenary session
Main Aspects of Implementation of the IITE Specialized Training Course "ICTs in Distance Education" in Countries in Africa
Prof. Wayne Mackintosh

11.30 – 12.00 Plenary discussion

12.00 – 13.00 Adoption of the main documents of the seminar

13.00 – 13.30 Closing of the seminar

ANNEX 5

IITE/MOS/S1/02/DOC. 2

WORKING DOCUMENT

INTRODUCTION

Universities are expected to be at the forefront of knowledge creation and dissemination in addition to spearheading national development through innovative research aimed at addressing economic, political, social, and cultural challenges. Institutions of higher education are also assumed to redress the problematic issues of access and equity in higher education programmes and services. To this end many universities are reengineering themselves by offering market-driven programmes that respond to the changing educational and demographic profiles in their respective countries. Rapid changes in the areas of knowledge creation and dissemination and the critical role played by the Information Communication Technologies have given rise to the need to evaluate the status of institutions of higher education at the global level.

The realization of the phenomenal changes in knowledge production and processing has prompted various international bodies to deliberate on the imperative to make education responsive to the emerging trends in higher education institutions. Such efforts include the World Bank report entitled *Higher Education in Developing Countries Peril and Promise*: International Association of Universities' (IAU) *Towards a Century of Cooperation – Internationalization of Higher Education,* the Conference of Rectors, Vice-Chancellors and Presidents (COREVIP, '99), on: *Revitalizing Universities in Africa: Strategies for the 21st Century*, among others. UNESCO has played a leading role in initiating various educational projects that specifically address access and equity concerns with regard to the provision of education (LNAT, GENA among others).

The documents have formulated a number of issues related to the expanding access to higher education and the role of ICTs in knowledge creation and dissemination. Paramount is the question of institutional policies on the role and use of ICTs in higher education: content production, infrastructure, human capacity building, financing, quality assurance and accreditation, intellectual property and copyright.

Outstanding Issues

Several technical and socio-economic problems hinder access to ICTs and its subsequent use in distance education. These are:

- small number of potential ICT users,
- lack of adequately trained IT personnel,
- low level of reliable and accessible physical telecommunications infrastructure,
- high costs of IT equipment, software and training,
- unawareness among the targeted users and decision makers,
- few local resource centers,
- insufficient cooperation and/or coordination between governments and educational institutions,
- poor management and administration of learning activities,
- numerous languages spoken,
- monopoly of telecommunications associated with overly restrictive regulations and high costs, and
- inadequate IT development of educators and teachers.

For teaching and learning in HDECA to progress, these outstanding issues must be addressed adequately. There are various solutions that can be applied at various levels to cope with these problems. The solutions should involve players at all levels – local, national, international – each player playing his part. Organizations like UNESCO that are present in many countries can accomplish a vital role coordinating cooperation between governments and institutions of learning in different countries.

Partnership

There are several multinational organizations active at one or another level in education that can assist or operate as catalysts to form partnerships between institutions (or organizations) that are located in different countries or physically remote, but can still benefit from the exchange of information between the institutions. Even though ICTs are capable of traversing physical and/or political boundaries, there must be a coordinated effort between the parties involved so as to take advantage of ICTs.

Flexibility

Demographic changes make it necessary for educational institutions to install flexible delivery systems that meet the needs of a variegated learner body. Flexibility means that geographical diversity; time, curricula, working and family circumstances of a learner must be taken into account.

Similarly, there is recognition of strategic issues with regard to how higher education institutions respond to changes in rapidly globalised and internationalized environments. This awareness implies distance education, open and life-long learning approaches to educational provision.

Implementation

ICTs used for distance education must account for new pedagogical approaches, which are learner-centered and activity-based in nature. Various studies have indicated the reluctance of teachers to use ICTs. It arises from their meager knowledge, skills and institutional culture of ICT applications in their practice. Majority of teachers are inadequately trained to manage the changes arising from the developments of information revolution. In addition most countries and educational institutions have not formulated ICT policy to provide guidelines on the role and use of ICTs in education.

Cost Implications

The costs of using ICTs in distance education will depend on an educational model prevailing in a country. Options are determined by the available individual technologies, technical platforms and infrastructure in a country. Transition from traditional educational modes of delivery to application of ICTs requires serious costing and pricing considerations. Any distance education programme will have to address the cost, effectiveness, and efficiency of ICT use for distance education purposes.

Use of ICTs in Distance Education

ICT can be used to perform a number of functions:

- information production and dissemination, and exchange of academic publications,
- communication of teachers and students,
- teaching, learning, and research,
- access to digital knowledge and information resources.

In Sub-Saharan Africa, teaching methods are often exam-oriented, mainly focused on rote learning and passing of examinations. There is very little learner-centered skills education. If Africa is to change this approach, African countries will have to enhance the skills of teachers by raising their competencies through training (pre-service), retraining (in-servicing) and promoting new pedagogies.

The current status requires innovative ways to support education for all. Technology has great potential to extend knowledge and education to poor and marginalized people. Technology, too, enables us to change the traditional mode of content delivery. However it will require a higher investment in training lecturers on content development such as writing of textbooks, modules, study guides and workbooks as well as scripting skills for audiovisual and computer/Web-based teaching. There is, therefore, the demand to:

- train pre-and in-service teachers how to use ICTs for educational purposes,
- produce learner-centered, activity-based course content,
- facilitate the formulation of new curricula based on market-driven courses,
- train teachers and school managers on better education management skills,
- set up national resource centres/libraries which will enable learners to get education information,
- establish appropriate ICT infrastructure that will facilitate distance learning.

ACCESS AND EQUITY IN OPEN AND DISTANCE LEANRING IN AFRICA

The terms – access and equity – are interdependent. In any field of activity, the lesser the access to educational opportunities is, the more iniquitous the situation becomes. Broadly speaking, access includes enrolment to school, retention at school and quality education. African countries' concern for access has been based on two premises:

- Education for all is valued as a basic human right;
- Education is a means to achieve the stated national educational objectives/goals.

It is now clear that among other things, the issue of quality education varies widely according to the type of school, location, staff qualification, facilities and how well teachers in a particular school are trained.

Equity can be achieved only by making education affordable to the majority, bringing facilities closer to the learner and retraining (in-servicing) teachers on a regular basis. The combination of Open and Distance Learning and use of ICTs hold a lot of promise in redressing the issues of access and equity in education delivery and provision.

Training Needs

ICTs have disclosed a variety of new opportunities for higher education in general and for distance education programmes in particular. Recently printed materials were used in distance education; today we are on the threshold of producing entire programmes in a completely digital manner and deliver them by electronic means. ICTs enable both teachers and learners to access distance education programmes irrespective of place, time, curriculum, working and family circumstances of the learner. ICT approaches radically change teaching and learning process as they:

- offer multiple forms of interaction and experience,
- are 'neutral' regarding content, but specific regarding skills,
- can be matched to appropriate conceptual models.

The importance of interaction between students and teachers is a cardinal point in considering learning effectiveness. ICTs offer learners independent, interactive, and collaborative learning environments and promote critical thinking.

Training of Educational Personnel

For this training to be effective, educational personnel referred to here covers a wider spectrum which includes not only teachers but technicians as well who will operate and maintain the ICT equipment. Since this is a relatively new mode of teaching, the teachers should be trained how to disseminate their knowledge using ICTs effectively, and the technicians should be adequately trained to operate and maintain the ICT equipment. The latter is a very important aspect not to be overlooked because the ICT equipment properly maintained will greatly enhance its service life as well as the quality of the lessons offered.

Ideally, training should be offered before the equipment is installed, so that by the time it is operational the personnel is qualified to run the devices. Thus, the situation will be avoided when the available ICT equipment is underutilized or unutilised in some cases. A way out is to procure relevant

training along with the ICT equipment, as training will be one of the factors determining whether the equipment is used adequately and efficiently.

Distance Learning Technologies

Traditional distance education was based on correspondence courses, in which printed materials were mailed to students and returned to teachers by post. Even though there are now numerous other options for distance learning, print remains a significant component of most courses. A variety of learning technologies is available for both a distance education practitioner and a learner. These include Print, Voice/Audio, Video, Satellite and Computer technologies.

Print Technologies

As a supplement, text materials may take the form of worksheets or study guides used in conjunction with video or voice technologies. It is important to note that supplementary print materials may be disseminated by regular mail or the Internet. In addition, fax machines are often used to transmit print materials to students and teachers.

Voice/Audio

Audio or voice technologies offer cost-effective ways to enhance distance-learning courses. The audio component of a distance-learning course can be as simple as a telephone with voicemail, or it can be as complex as an audio-conference with microphones, telephone bridges, and speakers.

Voicemail is generally used as a supplement to other technologies in a course. The main advantage of voicemail is that people with easy access to a telephone can pick up voicemail messages at any time of day or night. It is significant that voicemail can complement to distance learning initiatives, for example:

- students can leave messages for instructors regardless of time,
- instructors can leave messages for individuals or groups,
- quizzes can be administered (though it requires some programming),
- serves an alternative to e-mail for those students who do not have a computer.

Audiotapes

Audiotapes (cassettes) are inexpensive, easily duplicated, and versatile. They can be used to deliver lectures, panel discussions or instructions for a distant learner.

Telephony

Telephones are one of the simplest, most accessible technologies for distance learning. Telephone conversations can be used to mentor individual students or reach numerous students simultaneously via a conference call (audioconference).

Video

The ability to see and hear an instructor offers opportunities to model behaviour, demonstrate, and instruct on abstract concepts. The transmission media (videotapes, satellites, computers, and microwave) define the nature of the video techniques for distance learning. Each media can be described as how it relates to the direction of the video and audio signals – one-way video; two-way video; one-way audio; and two-way audio.

Computer Technologies

With the increased popularity of the Internet, computer technologies are receiving more and more attention as a means of delivering distance learning. The primary computer technologies used for distance education include e-mail, online collaborations, and Web-based education.

Web-based Education

The World Wide Web has opened a new arena for distance learning courses and the access to remote resources. The Web can be employed to enhance education through remote access to resources or experts or it can be used to deliver educational programs. There are several software packages that facilitate access to WWW educational resources. Learning Management System from Skillsoft, WebCT, TopClass, Web Course in a Box, and Learning Space are examples of Web course management software.

Computer Technologies are best suited to a distance learner because they:

- allow self-paced instruction,
- incorporate text, graphics, audio, and video,
- are highly interactive and inexpensive, accessible worldwide.

These technologies have far reaching technical, pedagogical, financial and socio-cultural implications, which assume a profound nature when ICTs are used in a distance education programme. Many educators do not have the prerequisite knowledge and skills in the use of ICTs for educational purposes. It becomes imperative to impart the necessary knowledge and skills in order to assure the success of distance education programme.

ANNEX6

IITE/MOS/S1/02/DOC. 3

FINAL DOCUMENT

We, the participants of the seminar for high-level experts *Policy Formulation and Practical Usage of ICTs for Higher Distance Education in Countries in Africa*, represent seven countries, namely Ghana, Kenya, Namibia, Seychelles, South Africa, Tanzania and Uganda as well as four national focal points for cooperation with IITE and international organizations, namely the UNESCO Institute for Information Technologies in Education (IITE), UNESCO Regional Bureau for Education in Africa (BREDA), UNESCO International Institute for Capacity Building in Africa (IICBA), the World Bank Group (IFC), US International University, Centre for Flexible and Distance Learning, University of Auckland (New Zealand) and African Study Center,

Taking into account the decisions of:

- World Education Forum (Dakar, 2000) which adapted a Framework for Action committing the governments of UNESCO Member States to "the achievement of education for all goals and targets for every citizen and for every society";
- 31st session of the General Conference of UNESCO;
- 2nd Pan-Commonwealth Forum on Open Learning in Durban (South Africa),

Recognizing an exceptional role of Higher Distance Education (HDE) for the progress of society and the necessity in training and retraining of qualified specialist,

Sharing the ideas and suggestions in:

- welcome address by the Assistant Director-General of UNESCO for Education Mr John Daniel to the participants of the seminar; and in
- keynote speeches, namely:
  - *Forming Strategies for Training and Retraining Educational Personnel in ICTs for Higher Distance Education in Countries in Africa* by Prof. George S. Eshiwani;
  - *A History of the Future for Distance Education in Africa: Society, Education and ICTs* by Prof. Wayne Mackintosh;
  - *IITE Educational Programme: Information and Communication Technologies in Distance Education* by Prof. Wayne Mackintosh.

- plenary presentation
  - *Higher Education Institutes (HEIs) and ICTs: Their Unique Strategic Potential for Africa* by Dr Bob Day;

Using as a basis for discussion:

- report of Prof. Vladimir Kinelev, Director of IITE, concerning the results achieved by IITE in the field of ICT usage in HDE in Sub-Saharan Africa (SSA) countries;
- working document of the seminar;
- research, training and information materials in the field of ICTs in Distance Education prepared by IITE, as well as
- preliminary results of online seminar *Policy Issues for Practice in ICT Usage in Higher Distance Education in the Countries in Africa*,

Strongly supporting the endeavours of IITE toward facilitating partnership with SSA countries to develop, build capacities and reinforce a national potential of ICT usage in education,

Striving to achieve the expected outcomes of the objectives of the seminar:

- share experiences on HDE development and training personnel for it;
- contribute to policy formulation concerning ICTs usage for Higher Distance Education in Countries in Africa (HDECA);
- formulate suggestions of possibility and forms of the use of the IITE specialized training course *ICTs in Distance Education* for training and retraining of educational personnel in participating countries,

Discussed:

- key issues regarding HDE development in the world with particular emphasis on SSA;
- policy formulation and practical usage of ICTs in HDECA;
- state-of-the-art of ICT usage in HDE in participating countries;
- needs for training and retraining of educational personnel;
- ways of implementing the IITE specialized training course *ICTs in Distance Education.*

Recommend:

1. IITE in cooperation with BREDA, IICBA and in tight partnership with UNESCO Member States come together with a proposal for a sub-regional project on ICT applications in distance education in SSA countries.

2. Draft of the project proposal should include the suggestions made by the participants of the seminar:

- the expert meeting considers the implementation of a pilot course to train trainers using IITE specialized training course *Information and Communication Technologies in Distance Education* as a worthwhile exercise,
- the roles of different organizations and institutions regarding future rollout of the training initiative must be determined,
- at least two participants per country must be nominated to promote sustainability and local motivation levels,
- criteria to evaluate the outcomes of the first pilot must be established,
- potential participants for the course can include anybody from institutions involved in open distance learning (ODL), institutions planning to offer ODL at tertiary level or any other stakeholders with an interest in ODL, e.g. refugee education,
- criteria of choice to be placed on discussion forum,
- the first pilot must establish a network to ensure interaction and support for the first group of trainers to share experiences with their own training initiatives after the pilot course,
- the first pilot is planned for 20 participants approximately,
- the deadline to nominate participants is 1 December 2002,
- the expert group recommends that the specialized course must be translated for Francophone Africa, and a similar pilot for training trainers in ICTs for distance education must be commissioned for Francophone Africa.

3. IITE drafts a project plan to implement a pilot course for training future trainers in ICTs for distance education with the IITE specialized training course *Information and Communication Technologies in Distance Education.*

SELECTED MATERIALS

David Wasawo
Chairman of Council
University of Nairobi
Kenya

Opening speech

Introduction

It is indeed the honour to be asked to make a few opening remarks at this seminar *Policy Formulation for Practical Usage for ICTs in Higher Distance Education in Countries in Africa*. I find the seminar important in view of numerous challenges facing education in African countries. The major challenges in African education have been and continue to be those of access and equity, cost, personnel, curriculum and provision of adequate facilities to the ever-growing population.

I note that the aims of this meeting specifically are to:

(a) interrogate the current training and retraining of educational personnel with regard to ICT usage with particular focus on higher distance education,
(b) document the needs and demands in the sector, and
(c) discuss and propose various strategies to be used in the training and retraining of educational personnel in higher distance education.

All societies expect higher education to play a key role in knowledge creation and to offer both theoretical and practical suggestions in relation to existing problems and innovations that would enable countries to face future challenges. Whether in the economic, political or social realms, higher education is meant to contribute to the overall quality of life in an increasingly globalised and liberalized environment.

Globalization and liberalization have affected virtually all sectors of society ranging from individual to societal. Educators and scholars need to assess the explicit policy issues on internationalization of the education setting. Certainly, institutions of higher education are better placed to lead the way, as they are major stakeholders in the development and dissemination of knowledge.

Based on various theories of human capital, countries embarked on reforms and repositioning of higher education in 1980s and early 1990s. These efforts aimed at widening access to education, moving it from an elite to a mass system. Subsequently, there was a need to diversify content and modes of delivery. This pressure for change culminated in concepts like the learning society, learning organization and life-long learning. Developing countries find it increasingly difficult to effectively participate in the global economy due to constraints from globalization.

Educational Reforms

The World Bank and UNESCO commissioned study *Higher Education in Developing Counties: Peril and Promise* which articulates the demand for developing countries to undertake educational reforms as the essential ingredient to future national, social and economic development. The report points out that higher education is grappling with issues of "expansion, differentiation and knowledge revolution". Expansion refers to the phenomenal increase in the number of students. Differentiation constitutes the emergence of new educational products, providers and the attendant question of quality assurance. Knowledge revolution, on the other hand, raises concerns about the knowledge/information economy and the necessary human capital.

In order to effectively function in the information society, learners are expected not only to possess a larger repertoire of specific skills but also the capacity to readily acquire new knowledge, to solve new problems and to employ creativity and critical thinking in developing new approaches to the solution of new and existing problems. Given this scenario, higher education should help learners develop life-long learning abilities and equip them to cope with the challenges of the 21st century.

Increasingly, educators, policy makers, business and other community groups are looking to technology as a tool to reshape and improve education. How can technology support this transformation? Research shows that instructional impacts made by technology are inseparably associated with the way the technology is used and in the activity structure that surrounds it, rather than with the hardware and software itself (Means, 1993). A new term "emerging pedagogical practice", (derived from Pelgrum, 1997) is gaining currency to highlight changing pedagogical goals

and practices resulting from the use of ICTs in education as opposed to those usages that aim at enhancing the effectiveness of traditionally important pedagogical practices.

Pelgrum characterized the practices having an "emerging paradigm" as those possessing "emerging" characteristics for the institution, the lecturer, and the learner.

The implications of this description of "emerging paradigm" on pedagogical practice are still unclear. However, it raises a number of pertinent questions, namely:

- Now that some higher education institutions have access to computers and the Internet to support teaching and learning, how do instructors and learners make use of them?
- What impacts have ICTs made on "classrooms/teaching practices"?
- What changes, if any, have ICTs made on the roles of instructors and learners and the interaction between/among them?
- Do distinctly different paradigmatic pedagogical practices exist when ICTs are used in teaching and learning situations as suggested?
- Are there more effective models of ICT implementation in higher distance education, and if so what are their characteristics?
- How will the implementation strategies affect the pedagogical practice paradigm of ICT use in higher distance education in Africa?

Educational Uses of ICTs

Much literature on educational uses of ICTs categorizes the modes of usage according to the function played by the technology: as tutor (Taylor, 1980), as cognitive tools (Solomon, 1986), or mind tools (Jonassen, 2002).

However, Jonassen (1999) eloquently points out that educational uses of technology that strive to be "teacher-proof" or "leaner-proof" fail to exploit the capabilities of the technologies or the learners. I think that you will consider the need to match appropriate technology tools with clearly understood roles of the instructor, the learner and the technology in designing effective learning experiences of the learners – their family background and support; technological infrastructure and technical support available.

Pedagogical Practices

The focus of your seminar is on policy issues and usage of ICTs for higher distance education. I would like to suggest that you consider the importance of ICT pedagogical practices being an integral part in organized teaching and learning situations of the formal curriculum. The implementation of ICT-supported pedagogical practises as an integral part of the institutional curriculum cannot be a simple adoption of new technology but must be comprehended in the context of educational change and innovation. (Fullan, 1991, 1999). I believe you will come up with a framework that will capture the specific change strategies adoptable/adaptable to different institutional and national settings.

Irrespective of the pedagogical practice used, research findings indicate that the teacher (who makes the crucial pedagogical decisions) largely depends on personal beliefs and orientations. Law et al (2001) have identified five pedagogical approaches:

(i) Expository
(ii) Resource-based Inductive
(iii) Task-based
(iv) Problem-based Inductive
(v) Social-Constructivist

I will leave it to your seminar to comprehend the salient implications of these approaches on the usage of ICTs for higher distance education for countries in Africa. In a discussion on policies and

usage of ICTs for higher distance education, one must determine the models of change in the ICT implementation strategies. Scholarship has established that institutions use three models namely:

i) Integration Model
ii) Catalytic Integration Model
iii) Technological Adoption Model

Research findings suggest that there seems to be a close relationship between the model of change adopted for ICT usage and the ICT-supported pedagogical practices in the institution. As experts on policies and ICT usage for higher distance education you may shed more light on pedagogical practices and modes of change for ICT usage.

Staff Development for Technology Diffusion

As educators are increasingly required to integrate new technologies into classroom practice, the complex process of staff development becomes critical to the successful implementation of new technological innovations. I would like to propose an interactive model grounded in Maslow's theory of motivation and Bloom's taxonomy of the cognitive domain, which illustrate how effectively the needs of individuals influence cognitive processes and transfer of skills within a psychological/social context resistant to technological change.

A cardinal goal of staff development is to help educators acquire knowledge, skills and perspectives that will improve instructional effectiveness and increase productivity through the use of more sophisticated instructional delivery systems. At both institutional and classroom levels, instructors are expected to incorporate new technological innovations, methodologies and ideas into their practice. It then becomes imperative for lecturers and instructors to learn new technological skills and applications, explore alternative approaches to planning and delivery of content; creatively analyse new situations, and utilize problem-solving abilities in a new context. They are also challenged to reconsider personal attitudes and beliefs held on their roles as educators and re-examine their vision of technology's place in society, institution and their lives.

Bloom's taxonomy of cognitive processes has significant importance to policy formulation and practical usage of ICTs for higher distance education. Many ICT programmes in educational systems are founded on wrong assumptions. Learning to use ICTs is a complex process involving the development, understanding, application, and integration of many knowledge bases and sets of skills.

Another faulty assumption is that once a knowledge/skill base is developed, lecturers/instructors will automatically transfer the skills to a new setting without modelling, guided practice, feedback, and follow-up assistance. Lack of support and guidance in applying new skills will frustrate both lecturers and learners.

I am sure that as you discuss effective staff development for technological change you will interrogate the implications of the following three parameters:

i) organizational context,
ii) technological goals and contexts, and
iii) staff development processes.

Conclusion

I would like to note that a staff development programme focused on technology diffusion should be viewed as a long-term effort, supported by adequate resources and stable funding over a period of time. Such a programme should have strong administrative backing when institutional heads take an active role in training activities and provide lecturers/instructors with the necessary and sufficient follow-up support for effective transfer of technological skills into the pedagogical environment. Effective institutional leaders are those who are supportive, clearly communicate expectations, participate in staff development activities and assist lecturers/instructors in the implementation of

newly learned skills and strategies. Institutional administrators must be not only instructional but technological leaders, if technology diffusion is to be attained. Administrators should model behaviours and attitudes toward technology, which are expected of lecturers and instructors.

Technology diffusion programmes ought to have goals and content, that are explicit, operational, and relevant to the needs of lecturers, especially in relation to new technology within their disciplinary and subject areas. ICT usage programmes should be shaped by personal and professional needs of lecturers. Lecturer's participation in the creation of such a programme will lead to the acceptance and integration of technology with his pedagogical practices. Administrators have to grapple with the continuing challenge of keeping abreast of the new, more sophisticated technological systems that are developing faster than institutions can conceptualise and integrate them into their pedagogical practices and culture.

May I leave you with a word or two.

While knowledge is universal, the flavour of that knowledge and its application to real situations are home grown. We in Africa ignore that at our own peril.

I wish you all, the very best in your deliberations. And now I have the pleasure of declaring this seminar officially opened.

I thank you all

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Vladimir Kinelev
Director
UNESCO Institute for Information
Technologies in Education

The Activities of the UNESCO Institute for Information Technologies in Education in the Field of Distance Education in Africa

Opening presentation by Director of IITE
29 October 2002, Nairobi, Kenya

Esteemed Mr Chairman,
Distinguished Participants,
Ladies and Gentlemen,
Dear Colleagues,

It is a great honour and pleasure for my colleagues and me personally to be with you today in the beautiful capital of the Republic of Kenya.

Therefore, I would like to express my deep gratitude to the National Commission for UNESCO of the Republic of Kenya for its invitation to the UNESCO Institute for Information Technologies in Education to hold the seminar for high-level experts on *Policy Formulation and Practical Usage of ICTs for Higher Distance Education in Countries in Africa.*

I would like to warmly thank the Kenyatta University, the Organizing Committee of the seminar and personally its Chairperson Prof. George Eshiwani and Vice-Chairperson Prof. Olive Mugenda for the excellent organization of the seminar.

I would like to express my deep gratitude to the distinguished experts for the fact that you have found time to be here today to discuss the issues concerning policy formulation and practical usage of ICTs for higher distance education in countries in Africa.

In his welcome address to the participants of the seminar Assistant Director-General of UNESCO for Education Mr John Daniel stressed that UNESCO always devotes a special attention to the issues concerning distance education with strong focus on developing countries and especially on countries in Africa.

In this connection it is worth mentioning such important UNESCO cross-cutting project as *Higher Education Open and Distance Learning Knowledge Base for Decision-Makers*, UNESCO Joint Initiative in *Distance Education in Nine Countries with Largest Populations*, UNESCO project *Regional Information Network of Africa* with the aim of organizing an education-mail facility to form a part of a regional computer network, the 2nd Pan-Commonwealth Forum on Open Learning in Durban (South Africa) which was held from 28 to 31 July 2002.

The World Education Forum (Dakar, 2000) adapted a Framework for Action committing the governments of UNESCO Member States to "the achievement of *Education for All* goals and targets for every citizen and for every society".

The delegates pledged to work together on programmes to harness new information and communication technologies to achieve the goals of *Education for All.* It goes without saying that in the new millennium, information and communication technologies will provide tremendous opportunities to narrow the socio-economic development gaps between communities and nations. These technologies are an opportunity for the increased exchange of knowledge and know-how for greater understanding among nations. Information and communication technologies give all nations a new chance that cannot be missed.

That is why the leaders of virtually all countries striving to prepare their citizens to respond adequately to the challenges of the 21st century have professed their desire to transform their countries into learning economies and learning societies, inasmuch as the Information Society needs competently knowledgeable citizens. The age of new information and communication technologies does not eliminate the most difficult problems that the world of education faces now and that have to be solved irrespective of whether the new technologies are adopted or rejected. Nevertheless, training and development, social and professional requirements, globalization of communication, economy, and political projects of building a new society heavily rely on the introduction of information and communication technologies into education. The alternative is to chronically lag behind these developments and, in effect, fail to meet the challenges of the 21st century.

Presently, there are tremendous efforts on behalf of most governments to modernize their countries' educational systems on the basis of information and communication technologies perceived as a key

to such modernization. Some countries consider information and communication technologies as a vital component in upgrading the quality of education through changes in curricula, introduction of training in new skills and wider scope of knowledge. In other countries information and communication technologies are utilized mainly to ease access to education for various groups of the population or are used for the narrower purpose of facilitating self-education through programmes broadcast via radio and television. Yet other countries emphasize the reliance on technologies as a means of transforming the educational environment or satisfying specific needs of different categories of students.

Hence, the question arises: Why does the evolving Information Society need distance learning? First of all, to meet large scale learning needs emerging from social and economic development. For the first time in history, information and knowledge are not simply means of improving society but main products of economics. More and more people are being drawn into the Information Society as workers, learners and consumers, since it is fast becoming central to employment and learning. It could be explained by new understanding of social security and specific conditions of economic development in the Information Society. The fact is that social security in the Information Society can be guaranteed only to a comprehensively educated person capable of doing different jobs in order to meet the requirements of the latest technologies and the market. Moreover, knowledge is the main asset and product of the Information Society upon which continued economic well-being and social development depend.

Distance learning is in the mainstream of these developments. Distance learning and the Information Society are both concerned with the creation, acquisition, sharing, dissemination, delivering, support and recognition of knowledge. Distance learning is the means for providing access and achieving continuous learning necessary for successful participation of all social groups of population in the Information Society.

Thus, learning issues are of central importance to the evolving information society. The development of modern information and communication technologies is creating an environment of rapid and ongoing changes. The current pace and magnitude of change break the traditional framework of historical gradations. For the first time in the history of our civilization, generations of products and ideas come and go faster than generations of people succeed one another. Even in private life, change tends to oust continuity and stability. Moreover, changeability reveals itself through earlier unparalleled diversity, making it impossible to define our era through any single event or development in the life of society. This environment demands, in principle, a new approach to learning. A human being needs new skills and understandings and must develop the facility to enhance these skills and understandings on an ongoing basis. In other words, humanity must embrace and promote a culture of life-long learning. New information and communication technologies exceed the traditional framework of the learning process. Learning can no longer be viewed as a ritual that one engages in during only the early part of a human being's life. Information and communication technologies are being used to cross the age, time and space barriers to bring life-long learning to all. People of all ages, in all places and in all different environmental contexts are learning all the time in whatever things they are doing – they comprise the learning society.

Amazing standards and prospects of applications offered by information and communication technologies in learning and teaching processes show that the humanity is on the threshold of new stage of the educational revolution, which will entail a dramatic shift in all spheres of human existence. These circumstances and new social demands, the new world community shaped by the new information and communication technologies and models of action call for new literacy of the information society. The new literacy demands, in principle, the creation of new technology for obtaining scientific knowledge, new pedagogical approaches for teaching and learning, new school curricula and methodological materials for teachers and learners. All of this is to awaken the student's intellect, shape an individual's creative potential and mentality, develop a holistic world outlook in an individual to let him or her gain a foothold in the information society. Thus, it will be a mistake to think that the application of new information and communication technologies automatically raises the quality of education. In order to exploit effectively their opportunities, such fields as computer psychology, computer didactics and computer ethics should be better devel-

oped, explored and employed by educationists. It is worth keeping in mind that in spite of a variety of information sources and teaching technologies that transform information into knowledge, there is only one way to convert knowledge into education. Such a conversation takes place in a human being's consciousness. It is the most interesting and mysterious interaction that is going on between the psychic space and cyberspace. A human personality is born and develops as a result of this interaction. It allows us to contend that no two educations evolving as a result of this interaction can be treated as completely congruous, inasmuch as no two human personalities are the same because each individual is unique. The priority of the human personality was the main result of the past century. The priority of the human personality is the main imperative of the 21st century.

The present level of development of information and communication technologies lays out a realistic basis for creating a global system of distance learning, which will help people create open educational milieu without boundaries. There are two main obstacles that a human being should overcome in order to create an educational environment without frontiers: geography and varying capacity of different people to transmit and perceive the same information.

The present level of development of information and communication technologies provides a realistic ground for a global educational system as a basis for practical implementation of the UNESCO's slogan "Learning without Frontiers".

In my view, there are two main obstacles that we have to overcome in order to create educational space without frontiers: geography and varying capacity to transmit, receive and comprehend the same information by different people, particularly those with special needs.

Distance learning helps education overcome the first barrier of space and time. Regardless of the physical distance, new information networks ensure direct communication between the teacher and the student that has always been characteristic of full-time education as well as its undeniable advantage.

It goes without saying that in the near future, the development of information and communication technologies will result in a broad spread of so-called digital libraries, the laboratories with remote access, open virtual universities and global virtual campuses as the basis for a single educational and scientific environment serving the world community.

So, new information and communication technologies will bring about dramatic changes in the educational technologies of obtaining knowledge, its conversion into education and realization of education through actions. Thus, the emerging Information Society calls for modern theory of distance learning comprehending its key areas such as: policies and legal aspects; regulations and restrictions; appropriate organizational and pedagogical models of distance learning; its funding and effectiveness, professional staff development and management, technological infrastructure and quality assurance. I am convinced that only then distance learning will be able to provide high quality and open character of education and help people meet the challenges of the 21st century. I think that in this very situation one can say that a good theory is the best practical result.

It is worth mentioning that the development of information and communication technologies has a special meaning for those people who due to various reasons are unable to obtain education through other standard methods. It is of particular significance for people with special needs. New information technologies as well as man-created artificial intellectual environment have a capacity to, at least partially, return to many people the abilities and communication possibilities that they may have been deprived of by nature, environmental disasters, military conflicts, or human violence.

I am confident that this is a two-way street, since after demolishing the barriers of inter-human communication so-called "ordinary people" will be able to obtain a broader impression of the essence of a human being and of the surrounding world. This seems to be the major humane tendency related to the use of information and communication technologies in education, science and other spheres of practical and cultural activities of a human being.

In the field of its competence the UNESCO Institute for Information Technologies in Education strives to assist UNESCO Member States in sharing experience in distance education by promoting international cooperation. For instance within the framework of its international project *ICTs in Distance Education*, on 20 and 21 September 2001 the Institute held expert meeting *Distance Higher Education in Africa: Professional and Course Development* and workshop *ICTs in Distance Education.* These events were arranged on the basis of the Open University of Tanzania, and I would like to use this opportunity to thank again National Commission for UNESCO of the United Republic of Tanzania, Open University of Tanzania for an excellent organization of the events.

The central themes of the discussion were the prospective approaches to the capacity building for distance education in higher school in countries in Africa and possible joint activities of IITE and UNESCO Member States in Africa to foster the application of ICTs in education, especially in the professional and course development for distance education. The participants of the expert meeting also observed international experience of ICT usage in distance learning in the world and, particularly in universities in Africa, discussed issues related to the educational programmes and the application of ICTs in staff development for distance education, reviewed examples of course development for distance learning, discussed the role of international cooperation in the development of national capacities for higher education in Africa.

The experts maintained the endeavors of the Institute in launching the UNESCO project on distance education and open learning in higher education in Africa.

In accordance with the Recommendations adopted by the participants of the expert meeting *Distance Higher Education in Africa: Professional and Course Development*, the IITE has been encouraged to prepare the analytical survey *ICTs and Distance Education in Africa: State-of-the-Art Needs and Perspectives*, to form a representative group of expert to develop a policy framework that could be used as a potential resource for ICTs and Distance Education Policy formulation in Africa.

The expert group recommended that a continuing service should be established to exchange best practice on all relevant distance education and open learning issues among African higher education institutes. The participants of the expert meeting stressed that capacity building initiatives for ICTs and distance education should be instituted with corresponding strategies to ensure access and sustainability of the human development. The expert group recommended that higher education institutes in Africa should be supported in their efforts to develop teaching-learning resources for distance education and open learning.

The expert meeting reconstituted itself into a workshop to provide comments and suggestions on the specialized training course *ICTs in Distance Education.* The Institute elaborated the specialized training course in cooperation with the international working team headed by Prof. Michael G. Moore at Penn State University of the USA.

The course was prepared for policy- and decision-makers in education sphere, both pre- and in-service teacher trainers, trainers in vocational development institutions, instructional guidance specialists and schoolteachers.

At the workshop *ICTs in Distance Education* the participants came to the conclusion to adapt this course module for distance education in African higher school and later use it to train staff for distance education.

In response to this request, IITE formed the international team headed by Prof. Moore and Prof. Wayne Mackintosh, and they adapted the course to be applied in countries in Africa. As a result they successfully developed the course specifically tailored to the needs of developing societies but at the same time ensuring adherence to the knowledge base associated with the best global practice in distance education. So, I would like to use this opportunity to thank Prof. Mackintosh and Prof. Moore for their brilliant work.

Now the UNESCO Institute and the group of authors present this course for your consideration.

Dear participants of the seminar, last year the Institute strove to fulfill the recommendations of the expert meeting *Distance Higher Education in Africa: Professional and Course Development*, which was held on 20 September 2001 in Dar-es-Salaam in Tanzania. We consider the present seminar to be a continuation of the previous one, the continuation of the Institute's activity in Africa, with Africa and for Africa.

In my opinion, the online seminar *Policy Issues and Practice for ICT Usage in Higher Distance Education* will contribute to the success of the seminar, to be precise, its face-to-face stage.

For this reason, in accordance with the recommendations of the expert meeting in Tanzania, as you know, the specialized Institute's website with a broad range of services was created. Among them is a forum, which provides the direct access to all materials and documentations of the seminar and allows the participants to carry out fruitful discussions with moderators (Prof. Eshiwani, Prof. Mackintosh).

I sincerely hope that this seminar will allow us to make together a new step toward determining strategies in training and retraining of educational personnel in ICTs for higher distance education in countries in Africa, to facilitate the implementation of the Institute's educational programme for successful integration ICTs in distance education in countries in Africa.

Dear colleagues, in accordance with the UNESCO Medium-Term Strategy as well as the Medium-Term Strategy of the UNESCO Institute for Information Technologies in Education for the years 2002–2007 the bridging digital divides between developing and developed countries and within countries becomes a prime strategic challenge throughout UNESCO's activities. This entails activities to strengthen national capacities and professional skills of a human being, to create a new content of education, to enlarge access to information, to foster scientific research and to share scientific knowledge and information through networking, communication media and information systems.

Thus, political guidelines, ethical principles and educational opportunities can provide a real basis for an effective educational strategy, overcoming the digital knowledge divide between developing and developed countries and within them and creating necessary conditions for sustainable development of the evolving information society.

In conclusion I would like to say that I sincerely hope that this seminar will become the one among many steps toward our mutual and fruitful cooperation in the realm of Education, Education for All, Education without Frontiers.

Thank you for your attention

George S. Eshiwani
Vice-Chancellor of Kenyatta University
President of the Association of African Universities
Kenya

Training of Educational Personnel in ICT for Higher Distance Education

TRAINING OF EDUCATIONAL PERSONNEL IN ICT FOR HIGHER DISTANCE EDUCATION

A Keynote Address at
The Seminar for High-Level Experts on
Policy Formulation and Practical Usage of ICTs
for Higher Education in Africa
By
Professor George S. Eshiwani, Ph.D
Vice-Chancellor, Kenyatta University
& President of the Association of African Universities
October 29th, 2002, Nairobi - Kenya

Overview of the Presentation

1. Higher Education in Africa
   - 1.1 Access
   - 1.2 Budgetary Allocation
   - 1.3 Digital Divide in the emerging Knowledge economy
2. ICT in Africa: its Effects on Distance Education
   - 2.1 Situation
   - 2.2 What is ICT infrastructure
   - 2.3 Obstacles
   - 2.4 Some international initiative
   - 2.5 Proposed Strategies
3. Competing in the Learning Society

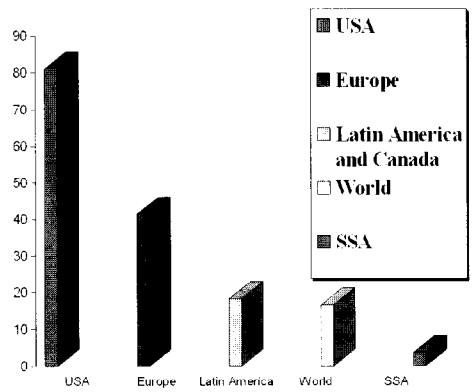
1.1 ACCESS

- **Very low access to higher education:**
  - GER<5% compared to world average of approximately 16% (1996)
  - Increasing unmet demand. Only 25% of qualified applicants admitted to University
  - Shortage of qualified staff, brain drain
  - Declining budgets
  - Over-dependence on government funding
  - Weak institutional capacity
  - Limited and outdated facilities and equipment

SSA has the lowest University Gross Enrolment Ratio in the World

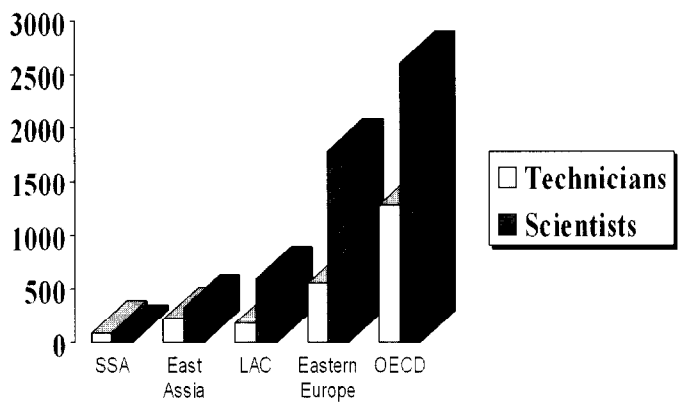
On average, only 25 to 30% of qualified Students are accepted In Universities

Enrolment in Sciences and Engineering are particularly Low (Only 16% of university Students in 1995.



Source: UNESCO Statistical (Year Book 1998)

Technicians and Scientists per Million



Source: World Bank - 2000

1.2 BUDGETARY ALLOCATION

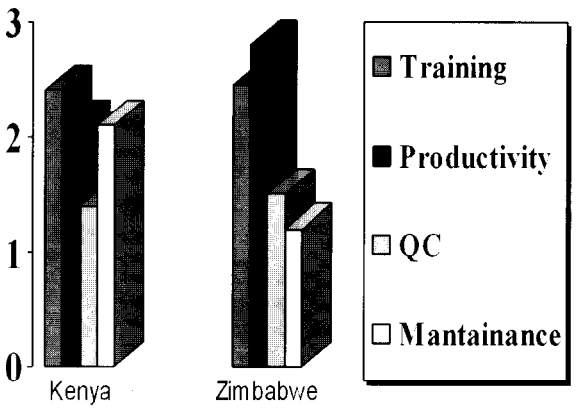
Over-stretched government budgets for higher education

- Annual cost per student > 400% average per capita
- Competing demands in favour of basic education
- Weak national economies
- Weak private sector economies in transition: Economic reforms have yet to fully produce the desired effects

Dearth of skilled labour and limited quality training facilities in Africa

- Low growth rate (average 2% GDP growth rate in the 1990's)
- Lack of skilled labour threatening FDI
- High costs of overseas training
- Very low level of computer literacy
- High interest in computer and business training including MBA (AVU Market Study, 1999)

Highly Desired Support Services



Source: Manju& Srivastava: Training and Productivity in African Manufacturing Enterprises, 1995

1.3 Increasing Isolation of Africa in Emerging Knowledge Age

Region	% World Population	% Internet Users
USA	4.7	26.3
OECD (without USA)	14.1	6.9
Latin America & Caribbean	6.8	0.8
South East Asia and Pacific	8.6	0.5
East Asia	22.2	0.4
Sub-Saharan Africa	9.7	0.1
South Asia	23.5	0.04
East Europe	5.8	0.4
Arab States	4.5	0.4

Source: University of Osnabruck, 1999

2. ICT IN AFRICA: IMPLICATIONS FOR DISTANCE EDUCATION

SITUATION:

2.1 Africa is the weakest region in the field of the use of ICTs. The density of the use of telephone and the connectivity to the Internet is the lowest in the world. With its population of 780 million inhabitants, 13% of the world population, Africa owns only 2% of telephone lines. The increase of the density is among the lowest: 1.88 compared to Europe (43) and America (30).

2.2 Africa has a tiny part in the use of the Internet in comparison with other regions. In 1998, as the number of the Internet users in the world was more than 152 million, Africa compiled only 1.14 million compared to Asia and the Pacific, 27 million, to Europe, 33 million, to Middle East, 78 million, to the USA and Canada, 87 million, to South America, 415 million.

2.3 However, we notice that access to the Internet grew rapidly these last years. Since July 1999, 53 out of 54 African States have access to the Internet in their capitals.

2.4 Infrastructure of Information in the countries of Sub-Saharan Africa

- The number of radios for 1,000 inhabitants varies from 54 in Angola, 236 in Ghana and 254 in Malawi to 163 in China, 355 in South Africa, 469 in Malaysia and 404 in Lithuania.
- The number of TV posts for 1,000 inhabitants varies from less than 1 in Eritrea, 55 in Ethiopia and 64 in Cote d'Ivoire to 322 in Trinity and Tobago, 469 in the Czech Republic and 805 in the USA.
- The number of computers for 1,000 inhabitants varies from less of 1 in Burkina Faso to 3 in Zimbabwe, 27 in South Africa, 38 in Chile, 172 in Singapore and 348 in Switzerland.

- The number of telephone lines for 1,000 inhabitants varies from 1 in Niger to 9 in Kenya and 41 in Botswana to 75 in Brazil, 166 in Malaysia and 35 in Bulgaria
- 53 African countries have access to the Internet. The rate of utilisation for 5,000 inhabitants in Africa is difficult to compare with the average in the world which is 1 for 40, or that of Europe or North America which is 1 for 6. Furthermore, most part of 1 million users of the Internet in Africa live in South Africa

2.5 The use of the Internet is progressing every day. In the USA, 44% of secondary schools use the e-mail; 45% of students use the Internet every day. One third of teaching uses the Internet

In Sub-Saharan Africa, more than 140 public and private institutions currently provide tertiary distance education although this is still based on traditional technologies. The AAU(African Association of Universities) found that only 52 out of 232 African academic and research institutions responding to its questionnaire have full Internet connectivity.

What is Information and Communication Infrastructure?

- Telecommunications
- Internet
- Computers and software.
- Broadcasting, TV & Radio
- Human resource to install, operate, develop and set policy

Infrastructure is the key barrier to information society development, requires longer planning time horizons and very substantial capital resources-just doubling the phone lines would cost about US$20billion

Radio is the most widespread Medium on the continent, but diversity of broadcasting is limited

- A growing number of countries have liberalized the sector and allowed private sector radio and T.V. station
- A few countries such as Mali, South Africa and Uganda, have issued notable numbers of community radio and non-profit licenses
- But outside capital cities, coverage is still usually limited to one or two state operated channels

Telecommunication

Infrastructure is even more limited

- In '98 there were about 17 million lines for about 750 million people – 1 in 50
- But in the Sub-Sahara outside South Africa there were only 3.5m lines- 1 in 200-less than the number installed in china in '97 alone
- Access to public phones is similarly restricted- about 1 for every 15,000 people compared to a world average of 1 in 600

The Internet is now widespread in Africa

- Three years ago, only 12 countries had full Internet access
- By the end of 1999 the Internet was locally available in the capitals of every country in Africa
- Low cost communication and access to global information source has fuelled rapid adoption

But the Internet is expensive and not widely available outside the capital cities

- At an average of US$50/month, ISP subscription fees are more than an average monthly salary
- Only 17 countries have Internet servers in some of the secondary towns
- With this limited coverage, for the majority of people, even if they could afford a computer, it is a long distance call to use the Internet

Number of users are still very low

- There are now over 500,000 dial up Subscribers in Africa (about 175,000 outside of South Africa)
- Each computer with an Internet or Email connection has an average of three users
- This puts current estimates of African Internet users at somewhere around 1.5 million

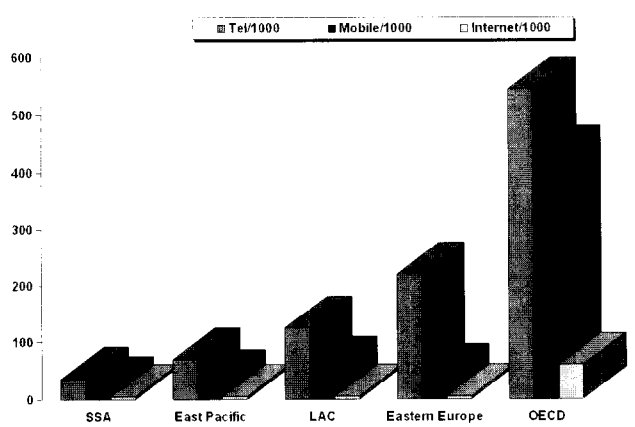
- Most of these are in South Africa (about 1,000,000),leaving only about 500,000 for 700 million people
- This is about one Internet user for every 1,400 people, compared to a world average of about one user for every 35 people, and a North American and a European average of about one in every 3-4 people
- About half the African countries have 1,000 or more dial up subscribers, but only about 9 countries with 5,000 or more

Local call charges are still a big barrier

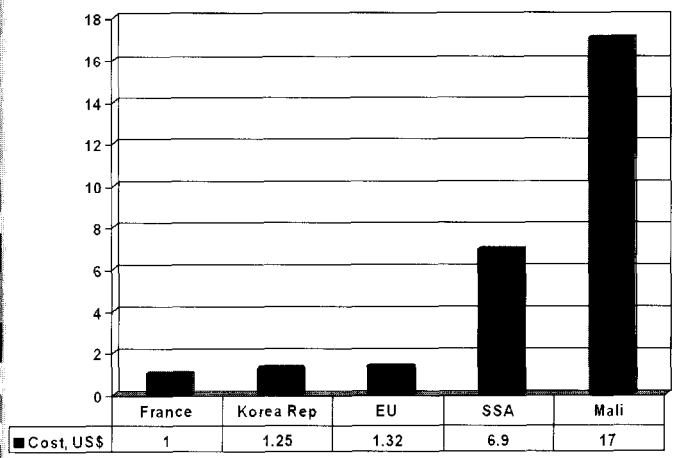
- Even in the African countries with the lowest local call charges, these are still the largest part of the cost of the Internet
- Not a problem specific to Africa- even some European countries are considering adopting flat rate local calls in an effort to match North American Internet Access

- Local call charges are as low as US$0.60/hr, they average US$2.5/hr but in 10 countries are more than US$4/hr and some are US$8/hr or more

Access to Telephone, Mobile phones & Internet per 1000 Inhabitants



Cost of a Three Minute Telephone Call



Source: World Bank, 2000

Obstacles for the development of ICTs in Africa for Distance Education

Insufficiency of computer infrastructure

- The development of telecommunications is a major problem for the use of ICTs. This could be attributed to the weakness of policies and dynamic strategies in the field. Problems related to connection remain an important handicap.

Non-reliability of electricity

- In many countries power cuts are frequent. Using generating stations is not easy and bears on the budgets of institutions. It is regrettable that Africa is not in position to make massive use of alternative sources such as the solar energy.

The insufficiency of human resources

- Most part of higher education institutions has not enough competent staff to build networks, design training programmes, develop on line libraries and contribute to develop a sound environment for the use of ICTs.
- The capacity to assure maintenance of equipment remains a concern.
- Furthermore, the frequent use in Africa of projects conceived in other environments does not seem to be the best means of creating appropriate and sustainable institutions.
- Developing local competences is absolutely indispensable.

Problems related to financing the use of ICTs

- The cost of the use of ICTs remains a constant concern for Africa.
- Although few precise studies are available on the issue of the cost of open and distance teaching in Africa, some indications could be provided.
- In Madagascar, the cost per student is estimated at US$40 per year. Open University of London estimates that this cost is one third of those of traditional universities.

- It is generally admitted that only a few of African countries are financially able to support the cost of telephone and the Internet connection. In Africa, the average cost for the use of a local Internet account for an approximate duration of 5 hours a month is estimated approximately.
- By comparing the monthly costs of the access to the Internet in OCE countries to those of some African countries South of Sahara, the difference is shocking. For OCDE countries, the cost of access is less than 5% of GNP per inhabitant. For Sub-Saharan African countries, the rates exceed 100% of the GNP per inhabitant. Nor doubt that this cost constitutes a major obstacle for the use of access to the Internet for education purposes, particularly in rural zones and most disadvantaged regions.

- According to Jensen (1998), ten Sub-Saharan African countries have decided to provide Internet access in all places and institution. This will need to support the cost of infrastructure of information, particularly in rural zones that are actually deprived of telephone or electricity facilities. The cost of equipment and of the software should be added to limited competences in the field of ICTs. These are additional charges for schools and universities.

Some international initiatives for improving the access to the Internet in Africa

Among one hundred initiatives in Africa to improve the access to the Internet and ICTs, we will give some examples linked to the development of networks for higher education institutions.

- The support of Carnegie Corporation in order to develop a database on African universities.
- The support of the Dutch Ministry of Cooperation (DGIS) to improve the use of ICTs in 7 African Countries.
- The support of the International Federation of Librarians' Associations (IFLA) to develop a database on libraries (of which several are in the African countries).

- The support of USAID – Education for Development of Democracy Initiative (EDDI): Support for 100 African universities in the use of ICTs.
- Regional Informatics Network for Africa (FINAF): an initiative of UNESCO in cooperation with the Italian Government. The RINAF project implies also some projects in the field of distance education and of community multimedia tele-centres.
- UNESCO's initiative on virtual libraries. This project seeks at promoting the development of virtual laboratories for the distance training of the African researchers in the developing countries, especially in Africa.

- The COPINE network: Cooperation Information Network linking scientists, educators, professionals and decision-makers: an initiative of the United Nations in favour of 12 African Countries connected to research centres in Europe.
- OCT/OAU Academic Information Network Project: aimed at proving the necessity of the use of ICTs in order to break the isolation of researchers.
- African Information Society Initiative (AISI): created in 1996 by the Conference of African Ministers for the reinforcement of the use of ICTs in view to narrow the digital divide.

- African Development Forum (ADF): initiated by the United Nationals Commission for Africa (UNECA) for the implementation of an agenda for the development of ICTs in Africa.
- The Development of Access to Information Centres (CIFED): initiated by AUF (Agency universitaire de la francophonie)), a project that seeks the establishment of access to information centres as genuine virtual resource centres and scientific and technical databases.
- AUF will also develop distance education courses (tropical illnesses, fundamental rights, international environmental law).

The information access centres are meant to be turned into French Speaking Electronic Campuses, which will offer students the necessary tools to join the information society mainly through the Internet.

They will provide

- Academic training
- Training in the use of new technologies
- Direct access to scientific information is available upon subscription in 31 access centres located in 26 French-speaking countries

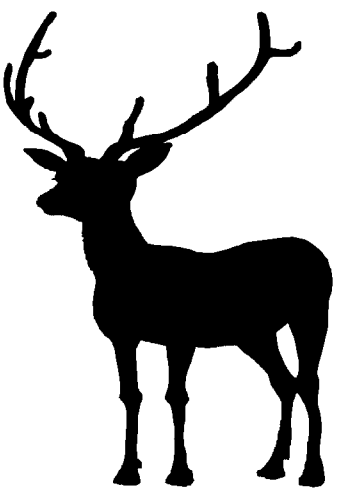
- RESAFAD: African Network for Distance Education provides for in-situ training of national specialists, partly on the distance mode by using ICTs.
- The African Virtual University (AVU), initiated by the World Bank represents an important project for the use of ICTs distance education.

Some proposals for the improvement of the use of ICTs in higher education in Africa

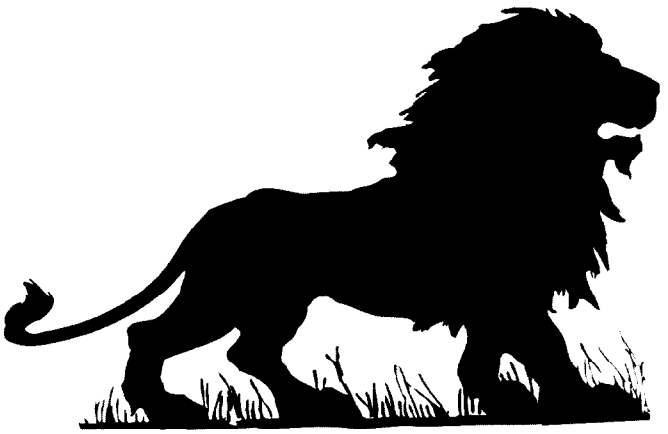
- As for other regions in the world, higher education in Africa has to adapt itself to the ICTs. This is the price to pay in order to avoid the marginalization and the exclusion from the actual knowledge society while contributing to reduce the gap separating African countries from industrialized ones.
- Everywhere in Africa, lectures by the most renowned specialists should be directly accessible for any academic or student. This will help to improve the quality of teaching.

- In order to reach this objective, the African higher education institutions must make some important decisions:
  - To formulate clear policies and strategies for ICTs development and use in the new paradigm for teaching and research
  - To assert the priority of entering the new information society
  - To implement a coherent policy for human resource development for conception, development and management of ICTs programmes, namely the production of software for teaching
  - To put accent on the development of indispensable infrastructures for a sound use of ICTs in favour of a qualitative higher education teaching
  - Each Member State should mobilise resources from its own budge in favour of ICTs

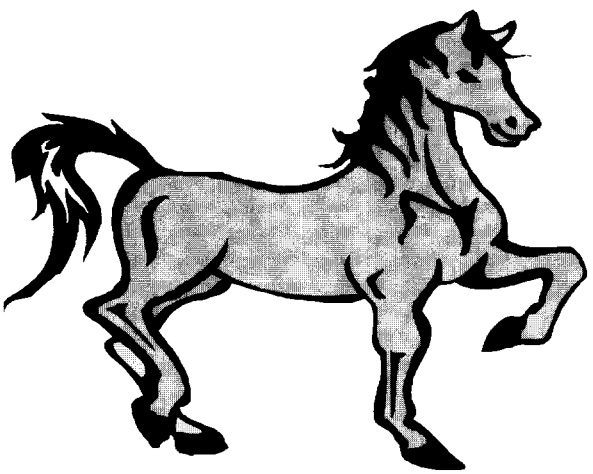
Competing in the Learning Society



Competing in the Learning Society.....



Competing in the Learning Society



THANK YOU

Wayne Mackintosh
Director
Centre for Flexible and Distance Learning
University of Auckland
New Zealand

A History of the Future for Distance Education in Africa: Society, Education and ICTs

A History of the Future for Distance Education in Africa: Society, Education and ICTs

Wayne Mackintosh
Centre for Flexible and Distance Learning
University of Auckland

A simple message

- John Chambers (CEO Cisco)

The next application for the Internet is going to be education. Education over the Internet is going to be so big it is going to make e-mail usage look like a rounding error in terms of Internet capacity it will consume.

- Future of DE in Africa must be digital

If not Africa will ...

be deprived of next generation pedagogy

not find cost-effective, sustainable solutions for mass access to quality education

not capitalise on its strategic strength – her people – and risk the bane of the 2nd colonisation

Overview of the presentation

- DE is unique

  Lessons from the past

- The future will be different from the past

  Foresight for the future is constrained by the rules of the past

- Suggestions for policy and strategy

  Strategic directions derived from scenario-planning techniques

Defining distance education

"Distance education is planned learning that normally occurs in a different place from teaching and as a result requires:

- *special techniques of course design,*
- *special instructional techniques,*
- *special methods of communication by electronic and other technology,*
- *as well as special organizational and administrative arrangements"*

Moore & Kearsley, 1996

The history of HE Delivery models

The position at the beginning of the last decade

1 Face-to-face (Traditional)

Same pedagogy as early models associated with Bologna & Paris – 1011AD

2 Distance education (Different pedagogy)

- Single-mode mega-universities (UNISA 1946)
- Dual and parallel-mode universities (Australia)
- Remote classroom (USA: compressed video)

The history of university level single-mode DE

- Single-mode, university-level DE (1946)

  Pioneered by Africa before the era of mass-media for HE provision

- Learner independence & AIM (1964-68)

  Humanist vision of Wedemeyer steers the origins of a system of teaching using mass-media, course teams and underpinned by a philosophy of open learning

- DE & the industrialisation of teaching (1968 ....)

  Otto Peters justifies DE as a consequence of industrialisation, e.g.: Mass production; division of labour and specialisation; planning and organisation, rationalisation, standardisation etc.

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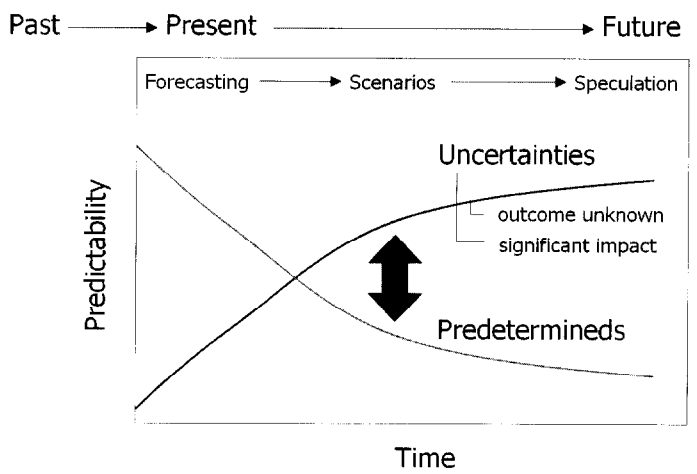
Planning for unknown futures



Access to technology

	Industrial countries	Sub-Saharan Africa
Land lines per 100	42.4	1.4
Cell subscribers per 100	9.17	0.21
Radio receivers per 100	100.5	16.6
Television receivers per 100	52.4	3.5
PCs per 100	15.6	0.3

Source: UNESCO 1999 World Communication and Information Report 1999 – 2000

Use of ODL at different levels

Preprimary	2%
Primary	6%
Secondary	14%
Tertiary	60%
Vocational	26%
Continuing Education	46%
Life enrichment, civic etc	13%

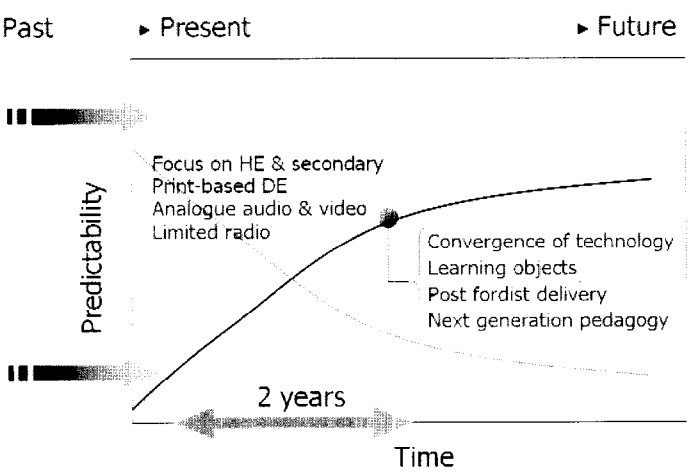
Source: Von Euler and Berg 1998

Types of ICTs used to deliver DE

	Industrial	Developing
Documents	100%	99%
Audio	67%	86%
Video	82%	77%
Computer Assisted Learning	50%	43%
Multimedia	30%	7%

Source: Von Euler and Berg 1998

Risks of using forecasting techniques



What do the gurus say?

The imperative for innovation

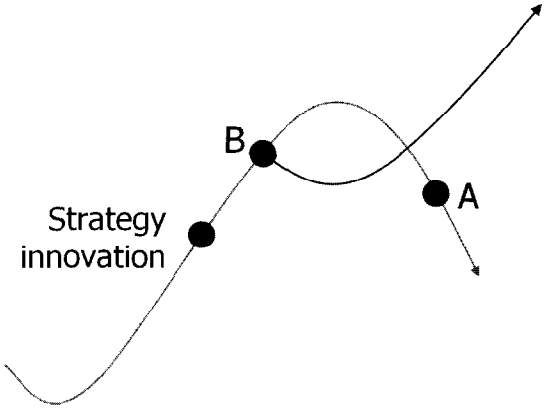
- **Charles Handy**

  When asked why companies fail?
  ... I think to a large extent they continue to do things for longer than they should. They don't realize that the world has moved away from them. And so they try to do the same thing, only harder or cheaper or quicker or whatever and that isn't the answer. They should be doing something different

- **C.K. Prahalad**

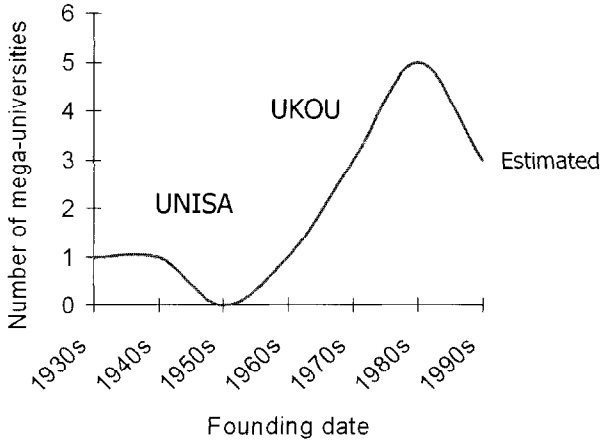
  The significance of foresight:
  The future belongs to the imaginative, those that have the courage to overcome the discontinuities and reshape their firms to meet the challenges of the New Economy.

S-curve analysis & discontinuity

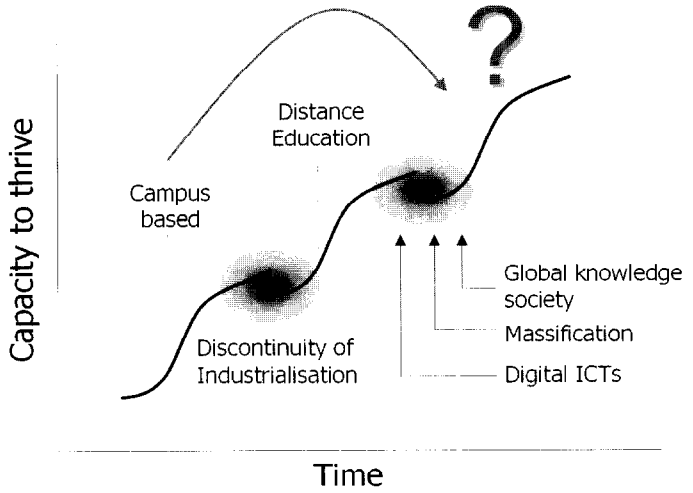


S-curve analysis and single mode DE

The mega-university perspective



Evolution of HE provision



Technology & fundamental transformation

The innovators dilemma:
When new technologies cause great firms to fail.
(Clayton Christensen. (1997) Harvard Business School)

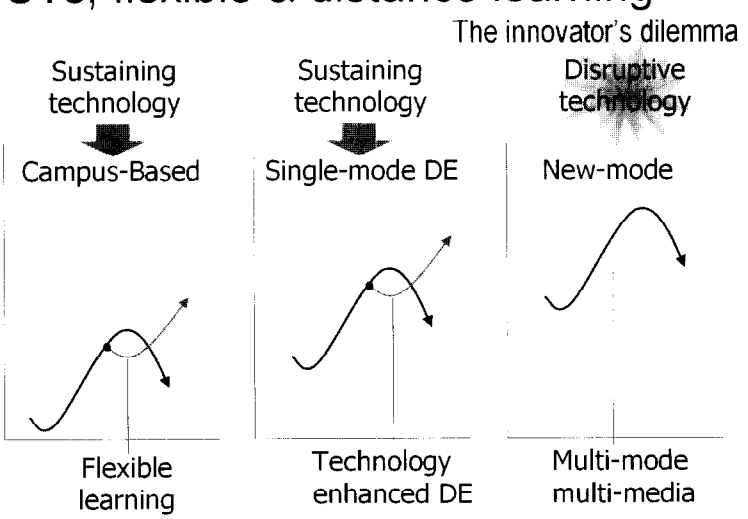
- Sustaining technologies

  Promote the efficiency and effectiveness of existing product performance

- Disruptive technologies

  Establish new markets that did not exist before.

ICTs, flexible & distance learning

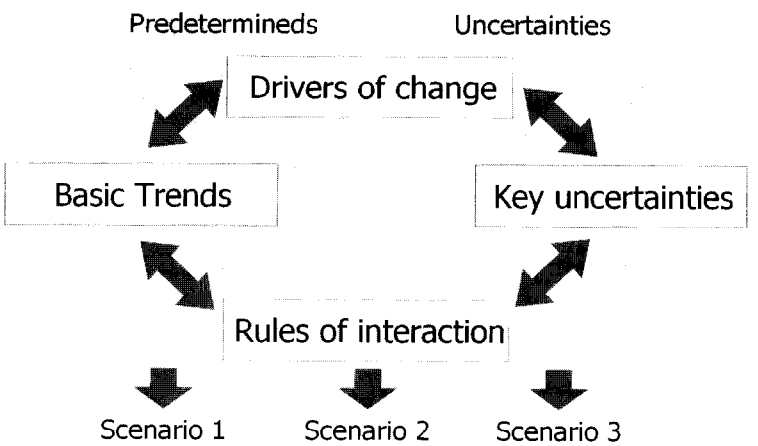


Overview of the presentation

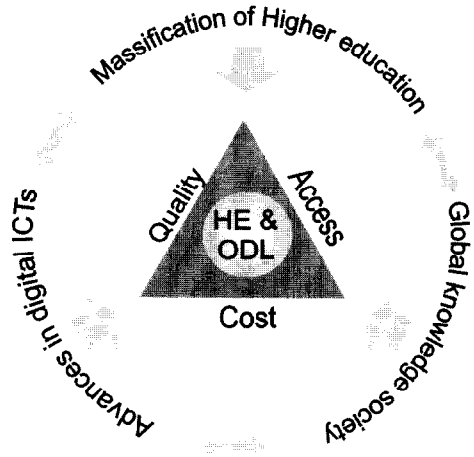
- DE is unique
  Lessons from the past
- The future will be different from the past
  Foresight for the future is constrained by the rules of the past

➡ Suggestions for strategy and planning
Strategic directions derived from scenario-planning techniques

Fundamentals of scenario planning



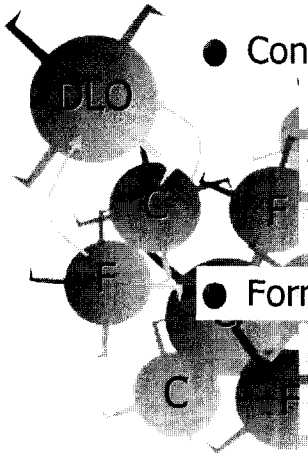
Drivers of change in HE



Key uncertainties

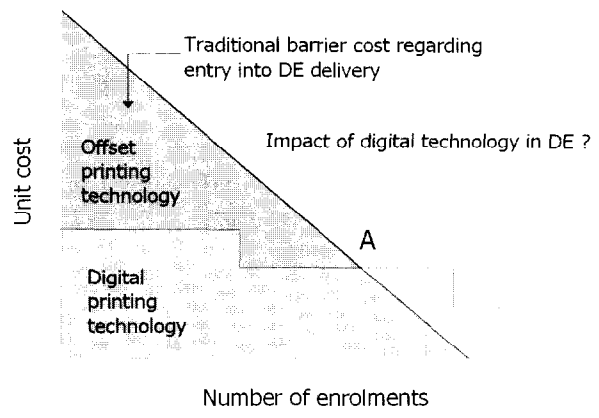
- The technology of learning objects
  - rapid application design
  - object oriented design philosophy
- Dominant ODL business model
  - mass standardisation (Fordist)
  - mass customisation (Post-fordist)

Digital learning objects

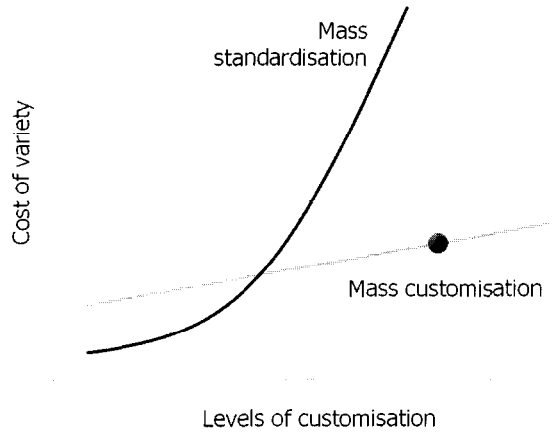


- Content features
  - understandable fragment
  - transdisciplinary capabilities
  - conceptual hooks
- Form features
  - multi-mode (verbal & visual)
  - multi-media

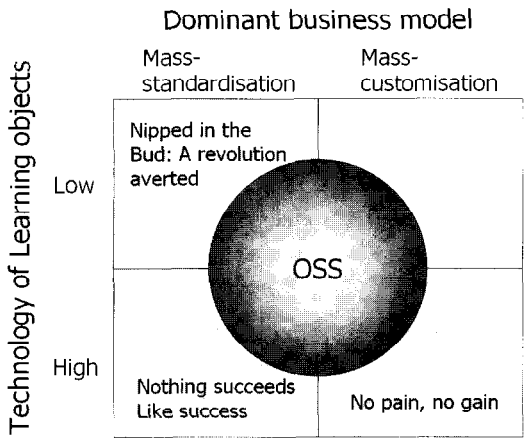
Business model of mass standardisation



Business model of mass customisation



Future scenarios



Advantages of open source software

- Significant cost savings in commercial licensing
- Prioritise educational needs above commercial considerations
- Greater opportunities for customising according to individual needs
- Large community of expert developers
- Already wide range of OSS applications available

Disadvantages of open source software

- Need for high level of technical expertise
- Finding appropriate mechanisms for determining strategic direction of OSS application's development
- Generating significant goodwill in the educational sector to achieve critical mass

Bridging the chasm

- **A difficult balance ...**
  Integrating strategic innovation and operational needs

The solution ...
is to innovate knowledge strategies & systems based on the image of the future

But ...
capable of carrying current operational needs

Regrettably ...
the reverse means you follow instead of lead

Bob Day
Executive Director,
Information and Communication
Technology
Principal's Office, UNISA
South Africa

Tina James
South Africa's top ICT Policy consultant
"Tina James Consulting"
South Africa

Overview of ICTs in South Africa: Role of HEIs (Higher Education Institutions) in Partnerships, Knowledge Productions and Innovation

> Studies that we have conducted and interaction with the Presidential ICT Councils, whose establishment we announced last year, have shown that a critical and pervasive element in economic development in the current age is the optimum utilisation of information and communications technology.
>
> **President Thabo Mbeki**
> State of the Nation Address
> 8 February 2002

SUMMARY

This paper begins with a brief definition of the emerging knowledge society, assuming that it is fundamental to develop new, better, and more widespread partnerships between the ICT industry and HEIs. It is emphasised that although the knowledge society is more advanced in the developed world, much confusion remains. Hence, if Africa is to develop its component of the global knowledge society to satisfy equitably both local and global needs, much more is required rather than to follow the developed world's lead blindly. How well do the ICTs of the developed world serve the needs of the vast majority of Africa's people: the poor, the disadvantaged, and the excluded? Can copying and catching-up do anything but leave these people even further behind? The overview addresses these questions in three sections.

ICT Sector

The arrival of personal computers (PCs) a quarter of a century ago transformed everyone (theoretically) into a potential computer user. In 1980s and 90s, the PC/Internet combination converted the Internet from a tool used by some military and academic cliques into a global phenomenon which, in turn, has changed the nature of the PC (and its most popular applications) from being predominantly a processing tool into a powerful and highly flexible communication platform.

These events have marked the dramatic growth of the global ICT industry, whilst the associated digitization has led to the unprecedented convergence of a range of previously analogue technologies, and a growing number of communication-, broadcasting- and media-related markets. This has created ongoing problems in defining the boundaries of an industry-based ICT sector. The existing industrial classifications failed to keep pace with the fast-moving nature of the ICT industry, and the need in a more relevant definition of the speedy-growing sector of services. There are also few suitable indicators in use that allow to collect accurate statistical data on the ICT industry or supply/demand data on available ICT skills. The restrictive definitions of the ICT industry do not take into consideration the revolutionary role that ICT is playing across all sectors of society.

In 2000, South Africa's total ICT market of R79 billion was the 20th largest country market in the world, accounting for 0.6% worldwide revenues. Important insights from the recent DTI study of the ICT diffusion rate into eight South African industry sectors include the following:

- most organizations appear slow to adopt ICTs other than in the traditional areas;
- universities and technikons did not feature, and were not seen as a source of information or training;
- perceived low levels of innovation are a major concern and, possibly, reflect low levels of interaction between researchers and the industry;
- greatest impediment to ICT diffusion is ineffective and expensive telecommunication services alongside with insufficient bandwidth available;
- Sector Education and Training Authorities (SETAs) in all sectors are not making enough effort to promote and provide ICT training, nor is the ISETT SETA playing any role in encouraging a more pervasive use of ICTs.

A number of recent national initiatives, which should support the establishment of future HEI-Industry R&D partnerships, is discussed. These include the National Research and Technology ICT Foresight Programme; the South African Information Technology Industrial Strategy (SAITIS) project;

the National Research Foundation's (NRF) ICT and Information Society Focus; and the Department of Arts, Culture, Science and Technology's (DACST) Innovation Fund.

A variety of estimates show that the growth of South Africa's ICT sector is being stifled by the lack of at least 100,000 people with appropriate ICT skills and expertise. The current ~65,000 ICT professionals are far from enough, moreover, only 5,000 of them are black. Yet, of ~600,000 tertiary students, less than 2% are in ICT related courses, 65% are male, and 84% are white! What is worse, the SAITIS study suggests that there is a mismatch between the ICT skills produced by HEIs and the needs of industry. Finally, HEI research involving the ICT sector seems uncoordinated, fragmented, and of variable quality.

Tertiary Sector

Global access to tertiary education has grown from 6.5 million enrolments in 1950 to 88.2 million in 1997, more than 1,200% growth. Although this figure appears remarkable, the crisis has deepened. In 1995 a little more than half of the world's tertiary students (47 million) lived in the developing world, with a gross enrolment ratio mostly below 15%. Average number for Sub-Saharan Africa was less than 3%.

UNESCO's *Education for All* challenge is the eradication of abject poverty throughout the world. Global tertiary sector with its traditional values concerning the well-being of society, should be ideally positioned to address them. But, most of the world cannot afford the established campus model, since traditional face-to-face delivery will not be able to scale up the provision to the levels of global demand. Whereas there exists a growing understanding that mass provision represents the only viable solution to the global crisis, a grave danger is that many forms of ICT-enhanced distance education being practiced currently will be misinterpreted as a "massification solution".

Since late 1960s, many national higher education systems around the world have employed strategies and models to increase levels of HEI collaboration. But there is little evidence that either individual HEIs or consortia are addressing the global *Education for All* crisis. Instead, the goals of both appear to address the existing markets more efficiently and cost effectively (often by employing innovative ICT applications), not to break out their traditional, competitive, contact paradigm. In addition, collaboration between HEIs and industry has long been fraught with controversy. Faculty fear that industry's influence will restrict their freedoms, whilst industry worries that HEI research is market irrelevant and that academics lack the discipline necessary to respond to market pressures.

South Africa's higher education system is far from being optimally organized to meet county's human resource requirements. It is seen to be extremely wasteful and guilty of squandering valuable resources, delivering a poor return of investment measured in terms of graduate and research output. National Plan for Higher Education (NPHE) released in March 2001 addresses inequalities in the higher education system in terms of access, programme offerings, quality and infrastructure. The NPHE is not a visionary piece of implemented policy beyond restructuring, yet it currently dominates HEI strategic thinking, and is likely to continue for several years. Hence it may, inadvertently, be deflecting the attention of HEI strategic thinkers away from the even bigger issue of the global education crisis and the need for *Education for All.*

Whereas HEI consortia formed in other parts of the world primarily promote the interests of the member institutions, South Africa's consortia were established in early nineties, first and foremost, to address goals of transformation and rationalization. However, deeply vested interests led to the consortia having become sites of intense power struggles, rather than sites of cooperation. To date, cooperation has been most successful in areas of technical and infrastructural support and services, where the best way to structure collaborative ventures appears to be the one to minimise the amount of sustained institutional collaborative behaviour that is required.

There is a widely held and worrying belief in South African HEIs (even the most privileged) that they are falling behind the developed world in their application of ICTs. The potential impact of ICTs within

HEIs is likely to grow significantly over the next few years, and it is useful to analyse several areas: teaching of ICTs at a variety of levels; use of ICTs to enhance teaching and learning both via delivery and new materials; ICTs to improve the efficiency and effectiveness of HEI administrative processes; ICTs to enhance HEI involvement in community service and development; and use of ICTs to improve all aspects of HEI research (especially, collaborative projects).

Emerging HEI/ICT Sector Partnerships

In order to succeed in implementing the NPHE, a popular (perhaps, industrial paradigm) idea is that HEIs need to be encouraged to behave as a sector, rather than a competitor. However, this approach is unlikely to succeed since regional colloquia have been promoting HEI collaboration for nearly a decade but with very little success. If they cannot collaborate with each other, how can they be expected to collaborate effectively and strategically with the private sector, including the ICT sector?

Historically, HEIs were established to take the cream of the students from secondary education, and mould them into highly specialized elites. Is it surprising, therefore, that the very academics that we now wish to adopt collaborative, sharing styles find it so difficult? Should we attempt to force partnerships into these traditional institutions where the concept appears to be so alien? A viable alternative is available, which is central to the knowledge paradigm, i.e. mode 2 knowledge production teams. The new national R&D Strategy identifies the "innovation chasm", which needs to be filled with a variety of "innovation nodes" or "centres of excellence" independent of both HEIs and large ICT organizations.

In this overview, we are looking not only at existing partnerships, but also at potential partnerships and, in both cases, at their impact on knowledge production (including "blue sky" research) and innovation. There are two angles to this from the HEI viewpoint (independent of the particular industrial sector under focus): teaching and research.

As with most sectors, the standard process has been to examine the "ICT sector", and identify how well the HEIs are addressing their education needs, whether partnerships are playing a significant role, and what quality, quantity and relevance of ICT research the HEI's are carrying out into ICTs, particularly, in partnerships with the ICT sector. For most sectors, this would suffice, but there are additional, important potential couplings between tertiary and ICT sectors:

- *Recognising the cross-cutting impact of ICTs – enabling most other sectors:* this overview needs to cover the current and potential impact that HEIs are having via partnerships in the provision of ICT education relevant to all other sectors, as well as knowledge production and innovation that HEIs are (or should be) stimulating via the research of ICT applications (existing and future) in each of these sectors.
- *Recognising the current and potential impact of ICTs on traditional HEIs:* we should also consider in more detail the impact ICTs are having, and, especially, can have on one of the above sectors, in particular, i.e. the education sector itself (especially HEIs). ICTs are enhancing both indirectly (via supporting organizational processes), and directly all aspects of teaching and research in HEIs, which clearly need to teach and do further research into how ICTs enhance what they are doing.
- *Recognising the role of ICTs in the massification of the tertiary sector:* we have only considered HEIs in their traditional state. It is estimated that if HEIs provided equitable services, there are at least a 100 million potential tertiary students more, primarily, in the developing world. This cannot be achieved via the traditional HEI "contact" model, or its variations. It requires "massification", which involves significant transformation of the essential processes, none of which is possible without the powerful support of current and future ICTs. To implement, we have to make HEIs collaborate in supplementing their current traditional teaching and research with ICT-based massification. HEIs have to do it, to teach it, and to research it, and cannot possibly achieve any of these without appropriate partnerships, not only with each other but, especially, with the ICT industry.

The jumping-off point of the overview, to quote Dr Sibusiso Sibusi, President of the CSIR, is:

> The observation is expressed in various studies and discussions, that there is little visibility of vigorous cooperation in ICT between universities and industry. Universities and other higher education institutions (HEIs) play a key role in the development of a vibrant and competent ICT skills base. However, universities tend to be wary that allowing industry to make inroads into academia, leads to erosion of unfettered teaching and research. On the other hand, South African industry is largely averse to research and often regards university work as too abstract or irrelevant to local industry.

While an HEI's mandate of teaching and research must never be wholly subordinate to the immediate dictates of industry, there is at least a *prima facie* case for greater collaboration. Indeed, academia and industry are more tightly coupled in countries that are leaders in ICTs such as the USA, Finland, Germany and Canada. This overview sets the scene and provides some insights with the intention of encouraging the development of a variety of partnerships in South Africa, thus bridging the academia-industry "systemic gap" to the mutual benefit of both sides, and thereby leading to an enhanced national benefit from ICTs.

INTRODUCTION

Fundamental to the thinking presented in this paper is the assumption that the creation of a knowledge-based economy and information society is essential to not only poverty alleviation and socio-economic development, but also to any efforts in developing ICT industry, and growth of ICT user community.

Knowledge Society and ICTs: What is the Relationship?

The Knowledge Society is a term that is being widely used, even over-used, in a variety of contexts to represent significantly different concepts for a variety of reasons. The knowledge society can be described as:

> the interdependent global society that is currently emerging as the latest manifestation of mankind's relentless and inevitable creation of deeper and vaster social complexity.

Since we are all embroiled in this momentous transformation, it is difficult for us to see it clearly or in its entirety. Hence, it is unlikely that we will fully understand the knowledge society in many decades to come. However, some attributes of the knowledge society that are most commonly identified include:

- Information-and knowledge-intensive rather than energy-intensive.
- Sustained through networks, rather than single organizations.
- Characterised by distributed rather than centralised intelligence.
- Requires multiple skills and continuous learning of individuals and organizations.
- Focuses on multi-disciplinary problem-solving using transitional project teams.
- Replaces lifetime employment with labour market flexibility.
- Promotes the "customer as co-designer" concept, rather than standardised products.

It is important to rectify two commonly held misunderstandings about the knowledge society:

- It is **not** primarily about ICTs. The most useful definition to date is: *the knowledge society is a new paradigm, which emphasises the value of* ***each and every*** *human mind, rather than "automating human muscle".* This makes clear that, in the knowledge paradigm, ICTs play a crucial but secondary role of enabling and enhancing the unique power and capabilities of individual and collective human minds.
- There is **not** a range of separate and different knowledge societies emerging in different regions of the world (developed and developing), nor in different nations, or at different levels of society.

Conceptually, there can be one knowledge society only. It is a global concept, but its fractal properties enable it to be both global and local. The local variations due to culture, language, indigenous knowledge and other factors are integral, enriching components of the single global knowledge society. At this early stage of the knowledge society, the differences in local characteristics are compounded by nationally and regionally differing mechanisms, status, and rates of emergence and implementation.

Knowledge Society in the Developed World

The list of benefits attributed to the knowledge society in the developed world is long and often repeated, from the spread of democracy and democratic processes, through unprecedented economic growth, to widespread improvements in prosperity and quality of life. However, the knowledge society is far from being perfect or well understood in the developed world yet. The mistaken view of the majority, even among leaders of the public and private sectors, is that ICT **is** the knowledge society. Senior information technology professionals, whose expertise in many cases predates the advent of the Internet, often propagate it.

Not only is the developed world's component of the knowledge society imperfect, its benefits are also far from being equitably enjoyed even by the "1st world" societies. Manuel Castells argues that the "fourth world" has emerged, made up of multiple "black holes" of social exclusion.[1] These black holes occur not just in the developing world but in every developed country – in their ghettos, ethnic enclaves, unemployed youth, etc. Functional illiteracy exposes the extent of the exclusion; e.g. over 40 million adults in the USA have "blatantly insufficient levels of reading and writing in English, as well as of elementary arithmetic". Castells states: "The rise of the Fourth World is inseparable from the rise of informational, global capitalism". This implies that the "digital divide" is only a symptom, exposed by the emerging knowledge society, of the more fundamental problem of exclusion, which is found in every society, even in the world's richest and most developed countries.

It is important to emphasise, therefore, that although the knowledge society is more advanced in the developed world, it remains widely misunderstood. They have not perfected it, nor is it their sole property. Of course, the developing world should learn as much as possible from the developed world's valuable and extensive experience. But if Africa is to develop its component of the global knowledge society to equitably satisfy its local and global needs, much more is required than to blindly follow the developed world's lead.

Knowledge Society in Africa

The argument is often made that Africa is not ready for the knowledge society. The reasoning is that before it can graduate to this "highest state" of society's development, Africa must graduate through the previous stages of the industrial and even agrarian paradigms. However, this argument appears to misinterpret the knowledge society as being primarily about ICTs and organizational information processing. It misses the major, but yet unexplored, potential of ICTs to enable each and every human mind, no matter how poor or disadvantaged.

An alternative argument, both in Africa and the developed world, is that Africa can and must become part of the global knowledge society as quickly as possible. The fear is that Africa is being left ever further behind, and the hope is that the knowledge society is the way to "leapfrog" out of poverty and exclusion. The reasoning is usually based on a mind-set of catching-up by copying the developed world's best practices – but this raises a series of difficult questions:

- Historically, the colonial powers forced their "best practices" on Africa, including arbitrary "national" borders, and a wide range of hierarchical, bureaucratic organizations, particularly, in the public sector. Have these best practices worked well for Africa over the past 200 years? Are they relevant now?

[1] Manuel Castells, 1998: *The Information Age: Economy, Society and Culture.* Volume III. End of Millennium.

- Are most of the people promoting Africa's inclusion in the knowledge society those, who fully understand the concept and its potential for empowerment, or are they people who, either directly or indirectly, have a product, service or ideology to sell?
- How advantageous is it for Africa to continue to buy, as it is, the developed world ICTs as a developed component of each African state (usually public sector organizations, and parastatals)? Does this transform them into knowledge organizations, or simply further entrench their outdated, unproductive processes and rigid structures?
- How well do these developed world ICTs serve the needs of the vast majority of Africa's people: the poor, and the disadvantaged? Were they designed with these excluded people in mind? Should they, can they be "customised" to try to satisfy these needs? Can copying and catching-up do anything but leave these people (the majority of Africa) even further behind?

Many African leaders realise the need to develop their component of the knowledge or information society in their country. Yet, when it comes to implementation they are confused and intimidated by the range of "off-the-shelf" solutions being thrust at them from many quarters. To break out of this paralysis, should Africa simply adopt the "1st world's" solutions? Alternatively, should it reject and distrust the "1st world" and all it produces, and start to develop all solutions from scratch? Or is there a way to get the best of both worlds (developed and developing)?

In light of the foregoing, it is apparent that the time has come to stimulate the development of Africa's equitable component of the knowledge society via *entities that it can trust and with which it can communicate*. It seems clear that these entities must:

- understand all aspects of the emerging global knowledge society;
- be for Africa, understand and champion Africa's needs, clearly have no vested interests or hidden agendas, and be open, dynamic, approachable and accessible;
- lead by example;
- be practicing, model, knowledge organizations employing and augmenting the most appropriate knowledge management processes.

These requirements, thus, become prerequisites for developing partnerships between the ICT industry and HEIs. The fundamental goal of developing a knowledge society in South Africa also implies that the ensuing research on partnerships cannot focus on the ICT industry alone. It has to take a broader approach that includes ICT-related activities promoting the use of ICTs as an enabler and supporter of the development of "knowledge citizens". This paper, therefore, argues that the research study cannot limit itself to the exploration of ICT industry players only but has to look beyond the traditional ICT sectors to be defined in more detail later.

PART I. ICT SECTOR

The arrival of personal computers (PCs) a quarter of a century ago transformed everyone (theoretically) into a potential computer user, and began to undermine the mystique and power of the "IT priesthoods" serving their mainframe(s) nestling deep in the largest organizations. It was inevitable that the PCs would be linked to the Internet, which was established in the USA in 1960s and '70s. In '80s and '90s, the PC/Internet combination converted the Internet from a tool used by some military and academic cliques into the global phenomenon we are still trying to come to terms with today. This, in turn, has changed the nature of the PC (and its most popular applications) from being predominantly a processing tool into a powerful and highly flexible communication platform.

In the context of the PC/Internet combination, Bond (1997) summarises three powerful trends that are driving the information revolution:

- *Cost of communicating.* The transmission cost of sending digital data has decreased by a factor of 10,000 since 1975. This is largely due to technological developments in fibre optics enabling considerable bandwidth at lower cost, and microelectronics that has reduced costs of telephone networks by replacing electromechanical switching. Smart wireless technology also has a huge impact as evidenced by the phenomenal growth in global cellular telephony.

- *Power of computing.* Computing power per dollar invested has increased by a factor of 10,000 since 1975 as well. Integrated circuits combined with the increased transistor density on microchips and significant gains in the economies-of-scale in the production of these components are largely attributable for this progress.
- *Convergence.* Analogue technologies are being replaced with digital technologies. Using a single binary code system, digital technology is capable of dealing with voice, video and computer data over the same network, whereas before the convergence, independent carrier technologies were necessary.

Taken together, these trends have stimulated the merge of computing (IT) and communication sectors into a single sector referred to as the Information and Communication Technology (ICT) Sector.

What are Information and Communication Technologies?

The following three areas will be generally included under the broad heading of ICTs:

- Telecommunications (the "pipes" that are used to transmit information): landlines, mobile telephones, satellite communication, wireless systems, voice over IP, high-altitude communication platforms (aircraft and balloons), and innovative applications that allow for low cost, stable and reliable communication in rural areas;
- Information technology (the equipment that can store, process and transmit information and data): computers, software and hardware that can carry out such functions as word processing, databases, graphic tools, as well as digital photography, the Internet, the World Wide Web, and content development tools that support multimedia applications; and
- Broadcasting technologies: various applications that support radio and TV broadcasting.

It is becoming increasingly difficult to separate these three areas because of the "convergence" of the technologies; the term ICT serves the useful function of including separate and convergent technologies. To illustrate the concept, technologies are already available to transmit and receive video and audio material on a cell phone, use the Internet to make telephone calls, or Web-streaming to listen to the radio. Convergence is, therefore, a significant trend that has to be considered in any exploration of potential HEI-Industry partnerships.

A further question emerges on whether convergence is driving the formation of new types of alliances in the industry itself. If so, HEIs will need to take into account these developments and ensure that they are in step with such alliances and research areas that underpin the alliances. The OECD, in its recent Technology Scoreboard survey,[2] tried to determine whether the convergent nature of ICTs was leading to higher levels of strategic alliances, mergers and acquisitions (M&As) in OECD countries. It is significant that the ICT sector accounts for more than half of all strategic alliances in Luxembourg (69%), the United States (57%), Finland (54%), New Zealand (53%) and Korea (51%). In terms of cross-border alliances and M&As, 1999 figures show that the ICT sector accounted for 50% of alliances in Luxembourg, 36% in the United States and 35% in Canada. What the situation is in South Africa is unknown, but experience indicates that it is likely to be low, unless driven through multinational alliances.

Defining the ICT Sector

Given the cross-cutting and converging nature of ICTs, it has become rather problematic to define the boundaries of an industry-based ICT sector. The most widely adopted definition is the one developed by the OECD in 1998; it is also the definition that was adopted by the South African IT Industry Strategy Project (SAITIS) in 2000:

> The industries that produce the products (goods and services), support the electronic display, processing, storage and transmission of information[3].

[2] *OECD Science, Technology and Industry Scoreboard 2001 – Towards a Knowledge-Based Economy.* http://www1.oecd.org/publications/e-book/92-2001-04-1-2987/B.9.htm.

[3] South African ICT Sector Development Framework (November 2000), p. 5-6. www.dti.gov.za/saitis.co.za.

This definition is still very much based on a manufacturing paradigm as illustrated in the OECD descriptions[4] presented below.

For manufacturing industries, the products of a candidate industry:

- Must be intended to fulfill the function of information processing and communication including transmission and display.
- Must use electronic processing to detect, measure and/or record physical phenomena or control a physical process.

For service industries, the products of a candidate industry:

- Must be intended to enable the function of information processing and communication by electronic means.

In order to understand the scope of the sector, we present below the ISIC codes that are included in the ICT industry, and which form the basis for the SIC codes used in South Africa:[5]

	Manufacturing
3000	Manufacture of office, accounting and computing machinery
3130	Manufacture of insulated wire and cable
3210	Manufacture of electronic valves, tubes and other electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
3312	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
3313	Manufacture of industrial process control equipment
	Services – goods related
5150	Wholesale of machinery, equipment and supplies
7123	Renting of office machinery and equipment (including computers)
	Services – intangible
6420	Telecommunications
7200	Computer and related activities

According to the existing SIC classifications, radio and broadcasting have been excluded, and most statistical data are classified broadly as:[6]

[4] *OECD Science, Technology and Industry Scoreboard 2001 – Towards a Knowledge-Based Economy.* http://www1.oecd.org/publications/e-book/92-2001-04-1-2987/B.7.1.htm.

[5] SAITIS Baseline Studies: A Survey of the IT Industry and Related Jobs and Skills in South Africa January 2000.

[6] *South African ICT Sector Development Framework* (November 2000), p.5. www.saitis.co.za.

Manufacturing:
- Computer hardware
- Telecommunications equipment

Services:
- IT professional services
- Package computer products – cross-industry- and vertical market applications
- Telecommunications services

There are many grey areas where the inclusion or exclusion of certain ISIC codes has been debated, e.g. the Reproduction of Recorded Media industry (ISIC 2230), which was felt to belong to the "content" industries. Another problem area relates to the definition of the information economy, defined by the OECD as consisting of both the industries that produce content and those that transmit and display the content (ICT industries). The industry classification system that is in current use does not allow this level of definition to be put into practice.

In conclusion, the existing industrial classification systems failed to keep pace with the fast-moving nature of the ICT industry, and the need of a more relevant definition in the speedy-growing services sector. There are also few suitable indicators in use in South Africa that allow to collect accurate statistical data on the ICT industry or supply/demand data on available ICT skills. This makes it very difficult to produce baseline data that will provide for accurate monitoring of the effects of policy interventions in R&D, industrial manufacturing, ICTs or broader strategic interventions. In addition, the high levels of vertical integration apparent in most ICT sectors, including South Africa, are, therefore, not easy to capture.

ICT as an Enabler

The restrictive definitions of the ICT industry do not take into consideration the revolutionary role that ICTs are playing across all sectors of society, where users can easily become producers of digital information, and producers – extensive users. Increasingly, the *definition of ICTs, therefore, includes the development of content.* For this reason the SAITIS sector framework proposed a far broader definition that includes not only infrastructure and applications but content as well. The OECD is currently in the process of defining such content sector. It is also useful to present here the model that formed the basis for the South African Foresight study,[7] which includes a separate section on the role of ICTs as an enabler in society.

The ICT Sector in the Knowledge Society

IT Industry	ICT Empowerment of Society		
Hardware	**PRIVATE**	**PUBLIC**	**DEVELOPMENT**
Software			
Telecommunications	Manufacturing	National	Universal service
- Telkom	Financial	Provincial	Community centres
- Cell Telephony	Retail, etc.	Local	Connected schools
- Private Networks	R&D	Parastatals	Government services
- Satellite/Broadcasting	Home office	Education	Education/training
VANS	Education/training	Research	Innovation
Supply Industry			Pilots
Internet and Intranet			
Professional services			
Education			

To illustrate the pervasiveness of the ICT user base, and therefore the need to examine ICTs in the broader sense, data from the recently completed audit of the ICT sector in South Africa found that the sector itself employs about 212,000 people, about 88% (186,400) of who can be defined as ICT

[7] DACST (October 1999), *National Research and Technology Foresight Project: Information and Communications Technology*, p. 22.

users. Other sectors employ about 7.3 million employees, about 26% (1.8 million) of who regularly use computers as part of their work.[8]

International Trends in the ICT sector

> The next application for the Internet is going to be education. Education over the Internet is going to be so big it is going to make e-mail usage look like a rounding error in terms of Internet capacity it will consume.
>
> **John Chambers**
> CEO Cisco[9]

Recent scan of international trends in ICTs revealed a number of basic technologies and applications that are impacting vertical markets but which are resulting in major R&D efforts, product and service outputs from the ICT industry. An extract from the report reveals the following trends.[10]

Basic Technologies

Wireless Networks and Satellite Technologies have evolved from the point where wireless access is generally available. Use of wireless is made attractive by the emergence of standards (e.g. Bluetooth and WAP), inexpensive standard-based devices, and a wide array of digital programmable devices, many of them portable.

Monitoring and Sensing Technology is proliferating. Monitoring and sensing devices are prevalent in a wide range of applications. For example, they are used extensively in automobiles, where they continuously monitor component performance. They appear in personal medical devices, consumer packaging (including clothing labels) and as part of smart-highway infrastructure. The list of uses expands daily. Coupled with wireless networks, this technology is a key foundation of burgeoning telematics, telemedicine and similar network-based solutions.

Geo-spatial Technology (including remote sensing) is used in a wide range of applications from sub-surface mineral analysis to land-use monitoring and vehicle location tracking. Improvements in sensor technology, especially in the spatial, spectral, radiometric and temporal resolution, have enabled a proliferation of feasible applications. Geo-spatial technology provides the mapping support required for navigation systems that form a key part of the rapidly evolving telematics market.

E-commerce (B2B & B2C) is defined as sales or purchases over the Internet, with or without online payment, excluding private networks. Dramatically increased computing power, the rapid growth of broadband networks, and out-of-the-box software solutions are the key drivers behind the rapid growth of e-commerce across all sectors of the economy.

Robotics systems are becoming more intelligent with more powerful processors and smarter lower cost sensors. They have long been used in manufacturing applications and new uses are starting to emerge in entertainment, social, and environmental fields among others.

CAD/CAM software, and particularly 3D modeling, has long been integral to industrial manufacturing businesses. With the increased availability of affordable, off-the-shelf software and improved 3D modeling capabilities, the use of CAD/CAM and other visualization tools is growing in a variety of industries including, apparel and textiles, mining exploration and production, building estimation and construction scheduling.

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[8] ICT Skills Audit Finds Shortage. ITWEB, 29 August 2002. http://www.itweb.co.za/sections/business/2002/ 0208291159.asp?O=TE.

[9] Quoted from *Future skills, Future Strategies.* Human Resources Inc. local.cips.ca/queencity/Events/archivedEvents/2000-01/SpringSeminar01/CIPS%20Future.pdf.

[10] Esselaar P.; James, T.; Miller, J. and Sibthorpe, G. (March 2002). *ICT Diffusion and ICT Applications in Usage Sectors: An International Scan.* Unpublished report for SAITIS, pp. 96–97.

Applications

eCustomer Relationship Management (eCRM) is the applications software that allows enterprises to deepen their relationships with customers through more effective sales management and customer service. It is based on a variety of technologies, including inbound e-mail management, outbound e-mail marketing campaign management, call centres, chat groups, voice over IP (VOIP), knowledge-based searching, customer self-service, and interactive selling software. ECRM is becoming a cornerstone of eBusiness implementations.

Enterprise Resource Planning (ERP) refers to an integrated suite of business applications that typically includes a variety of financial and human resource management products. At this time, most ERP vendors are actively pursuing e-business integration strategies that include web-enabling ERP business functions, linking e-business servers to ERP business functions, and integrating ERP business functions with their business partners. Convergence between ERP and Supply Chain Management (SCM) applications is also underway.

Multimedia Technologies combine sound, video, text, and graphics into a set of systems, products, and services that are essentially interactive in nature. Multimedia standards, storage and interface technologies, tools and applications are evolving at a frenetic pace. Thus, the content side of the information revolution is now in a position to take advantage of the rapid growth of broadband networks that are making a wide range of new, often interactive, business applications possible. Such applications are starting to emerge in many sectors, and there is obvious potential in the education sector.

Knowledge Management is a business concept that includes concerted, coordinated and deliberate efforts to maximize an organization's performance through creating, capturing, sharing and leveraging knowledge from internal and external sources. Extensible markup language (XML) is a metadata language widely used as the basis for knowledge management in a variety of business applications. A growing set of XML-based language extensions is being developed to meet the particular needs of specific business sectors (e.g. education markup language (EML), automotive, financial reporting).

South African ICT Sector

In 2000 South African IT market accounted R31.7 billion with an estimated increase of 14% that year.[11] BMI-TechKnowledge[12] is predicting that the industry will grow by about 11% a year during the next five years with spending mainly from the financial sector, utilities companies and government. Estimates testify that the IT market will reach R57 billion by 2006, as compared to a global IT spending in excess of US$ 1.4 trillion. Hardware purchasing accounts for 46% of these figures, and 36% of revenue is derived from services (and growing rapidly). Software accounted for only 18% of IT expenditure in 2000.[13]

If the telecommunications market is included, with estimated revenue in 2000 of R 48 billion, the total ICT market equals R79 billion for 2000.

Currently, South Africa is the 20th largest country market for ICT products and services, accounting for 0.6% of worldwide revenues.[14]

Diffusion of ICT into South African Industries

Recent study undertaken by the Department of Trade and Industry examined the rate of diffusion of ICT in eight industry sectors.[15] This was the first study of its type in South Africa, which attempted to

[11] BMI-TechKnowledge Communications Handbook 2001, p. 526.

[12] *Africa Telecomms and IT Decisions.* http://www.mbendi.co.za/bmi-t/newsletter/latest.htm.

[13] BMI-TechKnowledge Communications Handbook 2001, p. 526.

[14] *SANEC – South African Netherlands Chamber of Commerce Trade Directory 2001–2002 – Economic profile South Africa.* http://www.sanec.co.za/publications/trade_directory2002/economic_profile_south_africa.html#ICT_Sector.

[15] Esselaar P.; James, T.; Miller, J. and Sibthorpe, G. (July 2002). *ICT Diffusion and Applications in Eight Industry Sectors in South Africa.* www.tips.org.za/research/dtipsp.

understand in depth, which ICTs were being used in industries, where the gaps were, and possible suggestions on how the ICT industry could play a role in promoting potential economic growth of those industries locally and internationally. Over 400 interviews were conducted with over 42,000 response items analyzed.

With few exceptions, South African organizations in the selected sectors appear slow to adopt ICTs anywhere else but in the traditional areas. Indeed, many organizations are still trying to install and integrate routine operational systems such as inventory control and customer relationship management systems. There is little evidence of so-called transformational usage, such as electronic business (although specifically excluded from the study were the retailing and financial services sectors, both known to be in the forefront of such ICT usage). Also at an early stage of diffusion are more recently proven technologies, such as geographic information systems and new applications, such as virtual reality.

Of particular significance for this study is that *universities and technikons did not feature in any manner in any of the eight sectors.* They were not seen as a source of information or training – traditional areas of activity for HEIs.

The perceived low levels of innovation, as judged by the industry leaders themselves, in most of the sectors, except multimedia, is a major cause for concern and possibly reflects low levels of interaction between researchers and the industry.

The attitude of management and staff toward greater use of ICTs is overwhelmingly positive across all sectors. Sector leaders are enthusiastic about wider usage of ICTs and identify many ICT projects that would realize substantial gains in productivity, market share and other desirable outcomes, such as economic empowerment. Several, especially Biotechnology, advocate forging of stronger links between their sector and the ICT industry. There are presently few or no linkages between these two priority sectors, and *it is significant that ICTs do not feature in the recently formulated biotechnology R&D strategy*, providing this is for an industry that is dependent on highly sophisticated and mega-computing capacity. The sector wants stronger partnerships with the ICT sector itself to exploit new opportunities, such as visualization systems for molecular modeling, and to help deal with major bandwidth issues which are impeding progress. Such partnerships can result in new opportunities for market growth in both sectors. *This should be particularly noted in the examination of HEI/Industry partnerships and the need for the traditional "ICT" sector to work in far closer collaboration with other disciplines within HEIs, and other industries.*

The lack of effective and affordable telecommunications services together with insufficient available bandwidth is reported as the only most important impediment to ICT diffusion in each sector and is regarded as a major cause of competitive disadvantage in the globalising world.

Also, there is general consensus that the respective Sector Education and Training Authorities (SETAs) in all sectors are not making enough effort to promote and provide ICT training, nor is the ISETT SETA playing any role in promoting a more pervasive use of ICTs. This is despite a recent initiative of the Foresight team at DACST to sensitize the most of SETAs to important cross-cutting and enabling roles of ICTs.[16]

In terms of the focus of this paper on the development of a knowledge society, and ICTs as an enabler, it is relevant that many sectors expressed the need to create an ICT-aware society. For example:

- Deciduous Fruit Sector, which deals with perishable goods, such as table grapes, pears and apples, calls for a project to promote the use of ICTs in the emerging farmer community and provide the necessary training and support;
- Health Sector identified that *"silos of information" are separating the public sector, the private sector and the academic and research community*;

[16] *Universal Need for ICT Skills and Awareness*, Presentation by Grewan, R, and Day, RS, at DACST Workshop: *Foresight and SETA's, Common Ground*, 08/08/2001.

- Platinum Mining Sector is a world leader in production of platinum group metals and is expanding its activities strongly in the Limpopo Province. The number of empowerment and joint venture partners will be growing, and there is a strong call for ICT training to enhance their contribution and impact;
- Local Automotive Manufacturing firms in South Africa are among world leaders in the use of ICTs, there remain serious gaps in data standardization and systems integration, especially as it pertains to the so-called Tier One and Tier Two suppliers;
- Multimedia Sector is strongly export-focused – the reasons given are that the local market is not yet enough developed to make use of its products and services, another indication of the need to develop a society with higher levels of ICT awareness and knowledge production;
- Cultural Tourism Sector believes that multimedia technologies should be better exploited to promote cultural heritage and develop products and services.

R&D Needs for South Africa in ICTs

The question arises whether South Africa has identified priority research areas in ICTs that can support the national priorities of the country, and determine to what extent they relate to international developments. In this regard the outcomes of a number of initiatives should support the establishment of future HEI-Industry partnerships. Each of these initiatives is discussed in more detail below.

National Research and Technology Foresight Programme

In 1998, the Department of Arts Culture Science and Technology (now the Department of Science and Technology) launched the Foresight programme, which created "macro-scenarios" for South Africa 20 years on and applied those scenarios to twelve specific economic sectors, including ICTs. The empirical inputs were synthesized and led to a series of recommendations to shape the most appropriate medium for long-term research and technology directions.[17] Of the twelve original sectors, three priority sectors were identified in 2001 for further investigation – ICTs were one of them. A road-mapping exercise is currently underway to determine research focus areas that will leverage ICTs in South Africa.

As the results of the road mapping are not yet available, it is appropriate to present the strategic technologies that emerged from the ICT Foresight working group. To a large extent there is a strong correlation with the international trends already discussed, and despite a three-year gap the trends have been remarkably consistent. However, the specific needs of a developing country must be considered, particularly in South Africa. The legacy of apartheid policies left the vast majority without quality education, resulting in huge skills deficits that do require a greater emphasis on technology-supported education and training, and the underlying R&D to ensure cost-effective rollout to the masses.

It is not appropriate to discuss the outcomes of the ICT Foresight exercise here, but readers are urged to consult the ICT Foresight Report.[18] In brief, the following Strategic Technology Nodes were identified:

- **Future Web** – This refers to future developments of the Internet and particularly the Web, and assumes further convergence of technologies.
- **E-Tagging (Humans, Animals, Plants, Things)** which covers all aspects of electronic security, tracking and auditing.
- **Advanced User Interface Platform (Human and Animal)** – platforms to facilitate the production of seamless, fully interactive, non-intimidating, highly functional computer interfaces that are appropriate for the particular processes in question.
- **Intelligent Systems** – simulation and embedding of intelligence in machines and systems. Emphasis is given to automation, robotics, artificial intelligence, automated surveillance, and particularly to sensors.

[17] See *www.gov.za/dacst.*

[18] See particularly chapter 6 for an analysis of the strategic technologies identified for future R&D.

- **Bio-ICTs (Humans, Animals, Plants)** – the use of ICTs to enhance the abilities (physical and mental) of humans, animals, and plants. Emphasis is given to on- and in-body ICT devices; prostheses (physical and neural, with both silicon and photonic interfaces); and sensory enhancement (visual, audio, tactile, taste, smell, and including extra-sensory ranges).
- **Smart Materials, Appliances and Environments** – materials able to respond to their environment, usually combined with intelligent systems and even Bio-ICT, to create smart appliances and environments.
- **Knowledge Management** – the capturing, classification and dissemination of knowledge, whether it is explicit data or so-called tacit knowledge in the minds of people. Emphasis is given to the ICT-based facilitation of in-situ knowledge production, and decision-making by groups (real and virtual).
- **ICT Supported New Learning Methods (Focus on the Individual)** – the use of ICTs to enhance and implement new learning methods and environments fed by the accelerating growth in understanding of the workings of the human brain and intellect. There is a particular emphasis on appropriate interactive multimedia and virtual learning environments.
- **Content Development** (includes "unstructured data" issues) – emphasis is given to advances in pattern recognition, diagnostics, automatic indexing, modelling and simulation.
- **Advanced Software Development Platforms –** tools and methods built on the latest developments in software science and technology to create ever more advanced, efficient and effective software development environments, minding users with a broader range of sophistication. Simple visual and declarative programming systems are needed for non-programmers, where users ask "what" has to be done but not "how". Professional programmers require advanced software engineering tools. Support is particularly needed to help in coding "million-line" programs by geographically spread-out cooperative teams.

SAITIS ICT Sector Development Framework

Arguably the most extensive and important national initiative to grow the ICT sector is SA Information Technology Industry Strategy (SAITIS) project. Spearheaded by the DTI and funded largely by the Canadian International Development Agency, it produced as major outputs SAITIS Baseline Studies (2000), SAITIS web site and proposed ICT portal, which is still under development, and ICT Sector Development Framework launched in November 2000. The framework is a synthesis of the analytical work that preceded the project, and identifies four areas for specific goal and objective setting and follow-up implementation projects: ICT Sector itself, ICT Usage in other economic sectors, ICT Innovation and ICT Human Resources. The framework lays out detailed goals, objectives and strategies in each area and offers possible follow-up projects, some of which have been pursued through various institutions and consultants.

National Research Foundation (NRF)

The NRF has created the ICTs and Information Society Focus area that addresses four research areas: software development and integration, telecommunications and networking, human information interactions and ICT-driven development. A strong emphasis is on partnership and collaboration.

> ...many of the research areas listed in the focus area can best be addressed effectively through partnerships between the NRF, industry, government, higher educational institutions and social communities. Partnership and collaboration are thus important considerations, which the NRF will use, when supporting and promoting research into the ICT & Information Society research focus area.[19]

In relation to the partnership study, it would provide useful results if the types of partnerships already in existence through this funding channel are studied to reveal the types and levels of interaction that do exist already.

The NRF also manages the collaborative program called *Technology & Human Resources for Industry Programme (THRIP)*. The selection criteria put an accent on partnerships between HEIs and industry.

[19] NRF web site, http://www.nrf.ac.za/focusareas/ict/.

There is no specific emphasis on ICTs, but the research team will investigate the nature of the partnerships in ICT-related projects. As outlined on the THRIP web site,[20] the objectives are:

- To contribute to the increased number and quality of people with appropriate technological skills for industry.
- To promote for the intensified interaction among, and financial support of researchers and technology managers in industry, higher education and Science, Education and Technology Institutes (SETIs), to develop skills for commercial exploitation of SET.
- To stimulate industry to amplify the investment in research, technology and innovation.

Innovation Fund of the Department of Science and Technology (Previously the Department of Arts Culture Science and Technology, DACST)

Innovation Fund is an interesting example of how specific requirements for R&D funding have resulted in changed behaviour regarding collaborative research projects. The annual cycle of Innovation Fund was established as an outcome of the 1994 Science and Technology Policy, and was designed to stimulate:

- collaborative research and technology development programmes;
- multi-disciplinary approach to problem-solving; and
- application-based research programmes.[21]

The ICT funding stream has supported 16 projects to date, all of which are funded over a three-year period. The extent to which the selection criteria for collaboration are promoting collaboration between industry and HEIs needs to be investigated.

Supply and Demand for ICT Professionals – are HEIs producing enough?

HEI Outputs of Graduates

One of the major roles of HEIs is the output of quality graduates who are useful to industry and society, and who are equipped with the appropriate types of skills.

The recent ISETT SETA study estimates that up to 165,000 students will be needed to address ICT skills shortages in the near future. Quoting from the recent study by UNISA's Bureau for Market Research,

> ...the educational profile of South Africa's population is of such a nature that the South African workforce is not educationally equipped to keep the modern sector of the economy growing without tension. ...only about 8% of the population older than 20 or about 4.2% of the total South African population had a matric plus some form of post-matric education or training. In terms of percentage this means that in 1999 only about 8% of the South African population of 20 years and older could be classified as falling into the high-level human resources (HLHR) category.[22]

The report by the South African Department of Trade and Industry[23] indicates that the support of postgraduate study in the areas of engineering and management of enterprises, management and diffusion of IT will be necessary but not sufficient to increase the numbers of graduates required for South Africa to participate in the new economy. Alternative mechanisms involving closer collaboration of industry, learners in the workplace and those emerging from the schooling system will have to be developed.[24]

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[20] THRIP web site, http://www.nrf.ac.za/programmeareas/thrip/.

[21] DACST web site, http://www.dacst.gov.za/science_technology/innovation/Introduction.htm.

[22] Ibid p.1.

[23] South African Department of Trade and Industry (July 2001). *Study on the Development of High Level Skills in Engineering, Information Technology and Management* (unpublished).

[24] James, T.; Esselaar, P. and Miller, J. (2001). *Briefing Paper: Towards a Better Understanding of the ICT Sector in South Africa: Problems and Opportunities for Strengthening the Existing Knowledge Base.* Paper presented at the 2001 Annual TIPS Forum. www.tips.org.za.

Enrolments in South Africa's universities and technikons are now below 1996 levels (600,000, as compared to 580,000 at the end of 2000). In addition, the dropout rate for graduates is increasing with staggering 120,000 dropping out each year. The 1999 HSRC Register of Graduates, which covers university and technikon graduates, illustrates low numbers of ICT graduates that are emerging from the tertiary system. This data does not take into account the numbers of graduates trained in certificated private institutions.[25]

Some figures for 1999 Graduates in South Africa[26]

Total graduates: 580,000
Total ICT graduates: 10,858

	ICT graduates
Females	3,779 (35%) – 86% of these are white
Males	7,079 (65%)

	Electrical/Electronics Engineering
Females	313 (4%) – 87% of these are white
Males	8,186 (96%)

ICT Professionals

Because of the lack of a professional body that embraces all categories of ICT professionals, there has been a dearth of reliable data on their number and skills in South Africa. Presently, estimates range between 54,000[27] and 74,500.[28] The estimates from Forge-Ahead BMI-TechKnowledge's survey of black IT companies and professionals indicate that there were about 5,000 black IT professionals in South Africa in 2000. An additional problem relates to the definitional aspects when organizations use the different categories to define ICT staff, thus making comparison more difficult.[29]

Demand – ICT Skills Shortage

Estimates show that about 235,000 more professionals and managers will be required in South Africa.[30] Several studies have indicated longer-term skills shortages for various categories of ICTs, all involving relatively small sample sizes and widely varied results. Until recently, most of the labour studies on ICTs were underresourced. The proposed SAITIS project to investigate Labour Market Statistics is the first significant effort to gain better insights into this part of the labour market.

1998 Labour study done by the HSRC[31] concluded the following (p. 88).

Recent BMR study has found that no convergence of supply and demand will be at the end of 2009. Further analysis of the qualitative data emerging from interviews revealed that the analysis obscured the over- and undersupply of various types of engineers and managers, i.e. there was an undersupply of electrical and electronic engineers and an oversupply of metallurgical and mining engineers. Likewise, there is still a high demand for financial managers but an oversupply of labour-related management skills.

[25] To date there has been no data available on graduates from private institutions. The HSRC is presently in the process of aggregating such data for Scarce Skills Directory.

[26] Human Sciences Research Council (HSRC). 1999 Register of Graduates.

[27] International Labour Organisation (ILO). *World Employment Report 2001. Life at Work in the Information Economy.*

[28] ISETT SETA/ Department of Labour. *ICT Skills Audit Finds Shortage.* ITWEB, 29 August 2002 http://www.itweb.co.za/sections/business/2002/0208291159.asp?O=TE.

[29] This is by no means a unique South African experience. Publication *Building a Workforce for the Information Economy* prepared under the auspices of the National Research Council in the United States, produces estimates of IT workforce which range between about 1.65 million to 3.35 million, depending on the study, methodology and definition of what constitutes an IT worker. http://books.nap.edu/html/IT_workforce/.

[30] SAIRR Newsletter (No. 4/April 2001) *Higher Education: Huge Challenge to Produce Top Skills.* www.sairr.org.za.

[31] Human Sciences Research Council (1998). The SA Labour Market: Future Trends and Workforce Needs.

Current and Forecast Employment for Specified IT-related Professions in Overall Labour Market, 1998–2003

Occupation	Positions in 1998	1998–2003		Vacancies arising from	
		Growth in Demand	Needing Filling	New Demand	Need for Replacement
Electrical/Electronic Engineers	4 462	15–40%	1,000 – 1,999	55%	45%
Electrical and related engineering technologists/technicians	20 546	10–15%	5,000 – 8,000	52%	48%
Computer programmer	10,059	40%+	5,000 – 8,000	88%	12%
Computer systems analyst & related	11,504	40%+	5,000 – 8,000	87%	13%
Other computer science (e.g. database administrator, software systems engineer, computer consultant)	7,108	40%+	2,000 – 4,999	87%	13%

The 1998 HSRC Telecommunications Study revealed similar trends:

The Telecommunications Sector – Forecasts for Employment by Broad Occupation (1998 and 2003)[32]

Broad Occupation	Number of Employees		Composition		Growth
	1998	2003	1998	2003	1998–2003
Professional	22,280	25,665	23.0%	24.9%	15%
Managerial	4,742	5,470	4.9%	5.3%	15%
Clerical/sales/service	16,120	17,804	16.7%	17.2%	10%
Artisan	8,463	8,733	8.8%	8.5%	3%
Semi-/unskilled	45,082	45,532	46.6%	44.1%	1%
Total	**96,687**	**103,204**	**100%**	**100%**	**7%**

Are HEIs Producing the Right Types of Skills?

Little empirical data has been produced to determine whether HEIs are providing graduates with the right levels of skills. Anecdotal evidence from the SAITIS Baseline studies and workshops suggests there is a mismatch between the skills produced by HEIs and the needs of industry. *There have, however, been few attempts of collaboration between HEIs and the industry to jointly develop curricula, and this is one possible area of partnership that can be explored.*

The University of Cape Town (UCT)[33] has lately undertaken a study on Information Systems that shows that there is a mismatch between the requirements of the industry, particularly relating to databases and systems development, though other components are relatively well-matched. This type of data is, to our knowledge, unavailable in regard to other universities, nor across the scope required to meet fully much broader ICT definitions discussed earlier in this paper.

Analysis of the ICT Sector

ICT Sector Classification

The current classification systems are inadequate, particularly in dealing with the dynamic nature of the sector, as well as the ongoing digitally driven convergence of previously distinct technologies and markets. Serious problems include:

[32] 1998 HSRC Telecommunications Study.

[33] The Skills Gap as Observed between IS Graduates and the Systems Development Industry A South African Experience. http://ecommerce.lebow.drexel.edu/eli/2002Proceedings/papers/scott186skill.pdf.

- The terminology of Classification is outdated, e.g. manufacture of electronic valves and tubes. This is particularly problematic, given the dynamic nature of the ICT sector.
- It is often difficult to determine where particular products should be classified, e.g. manufacture of optical fibre.
- Modern equipment often poses a classification problem. For example, how would one classify a Personal Digital Assistant (PDA) with a cellular phone capability and a built-in Global Positioning System? This equipment can be classified as a computer, a radio transmitter/receiver, a sound (and, maybe, video) recorder, and a navigation instrument.
- The Telecommunications sector is classified under "Services – Intangible", which seems incongruous, given the size and nature of this market, and illustrates the inadequate attention to the dynamic and converging nature of the overall ICT sector.

Cross-cutting Research Activities in HEIs

Since this paper addresses the potential role of partnerships between HEIs and the ICT industry, it becomes very important to assess the degree to which HEIs themselves are addressing the need for convergent and cross-cutting approaches to ICTs. It needs to be established whether HEIs have adequate mechanisms in place to carry out research across disciplines and technologies. If the converging road is the one that industry is treading in the developed world, are partnerships and strategic alliances being developed outside the narrow confines of the industrial paradigm? The recent merger of IBM and PWC consulting is, perhaps, an interesting example of a strategic alliance that cuts across sectors.

Industry Perception of HEIs

Recent ICT diffusion study of eight industries showed that HEIs were hardly considered sources of information or training in ICTs. The reliance on vendors for learning material about ICTs is of great concern, as it is unlikely that industry will be prepared to expose details of innovative, leading-edge ICT applications. Yet, such training is essential for South Africa's ICT sector to augment its capacity for product innovation and improved efficiencies. There is a growing belief that the use of Open Source Software (OSS) as an education tool can by-pass this problem, and that HEIs should re-establish their relevance to the ICT sector by using OSS to produce graduates with greater objectivity and understanding.

Research and Innovation and the ICT Sector

Research involving the ICT sector is fragmented and of variable quality. Globally, the ICT research arena is essentially interdisciplinary and cross-cutting, and must cope with a rapidity of change unheard of in many other research disciplines. Some research is done in South African universities. But it is happening in many different faculties that probably do not talk to each other very frequently, e.g. Computer Science, Economics, Business Systems, Law, Social Science, Electronic Engineering and Biology Sciences amongst others. More research is underway in technikons, usually of a more applied nature, as well as by consultants, international funding agencies and the private sector. Little of it is coordinated.

ICT-related research programmes, projects and results need to be distributed more widely and effectively within institutions and among them, as well as between disciplines. The linkage of researchers with the industry needs to be strengthened to allow new thinking to penetrate into the existing businesses that will face new challenges in the new economy. The importance of creating mechanisms to stimulate such linkages cannot be overstated. Both physical environments (centres of excellence, innovation nodes, transitional structures) and virtual environments (electronic workspaces, portals, etc.) must be investigated and established to work as flexible networks of research, innovation, and production.

Investigation is to be done on what these partnerships inhibit from being developed under current circumstances, in the face of overwhelming need. Indications are that before we can promote innovation via partnerships between HEIs and the ICT industry, we must find innovative solutions to more fundamental problems. These issues will be discussed further in the second and third sections of this overview.

PART II. TERTIARY SECTOR

Trends in Global Tertiary Education

Although, the growth of tertiary education globally since 1950 appears remarkable, the crisis has deepened. In many cases, HEIs have shifted considerably from their exclusionary elitist origins to more open learning systems. But, the imbalances between the global supply of tertiary education and the magnitude of the demand for access makes the imperative of providing a decent education for all one of the greatest moral challenges of our age. Meanwhile, most HEIs are forced to do considerably more with a great deal less.

Global access to tertiary education has grown from 6.5 million enrolments in 1950 to 88.2 million in 1997, more than 1,200% growth. This is attributed, at least in part, to a philosophical shift from "class to mass".[34] In 1995 a little more than half of the world's tertiary students (47 million) lived in the developing world, with a gross enrolment ratio mostly below 15%. However, the average for Sub-Saharan Africa was less than 3%. Saint[35] points out that at least 16 countries in Sub-Saharan Africa will need to double current tertiary enrolment in the coming decade just to maintain the existing and unacceptably low gross enrolment ratio.

The essence of UNESCO's *Education for All* challenge[36] is to work toward the eradication of abject poverty throughout the world. The global tertiary sector, combined with their traditional values concerning the well-being of society, should be ideally positioned to address this. However, today's universities face the perplexing task of balancing the tensions of Sir John Daniel's eternal triangle, i.e. to improve quality, cut their costs and serve for more and more students.[37]

Around the world today we need the equivalent of one large new university to be opened every week just to keep tertiary participation rates constant. But, most of the world cannot afford the established campus model. Traditional face-to-face delivery will not be able to scale up the provision to the levels required by the global demand in a manner, which can maintain a sustainable balance among the tensions of the eternal triangle.

> Under the conventional campus model, individual faculty members carry the responsibility for teaching. They have relative freedom in organising the learning environment regarding the implementation of the curriculum, and in how to teach and assess learners in the classroom. The campus model is robust and easy to organise, but the quality of provision is highly variable (excellent subject specialists/researchers are seldom good teachers). This model is extremely difficult to scale up, limited by the campus facilities and the number of learners that an individual faculty member can realistically manage.
>
> The distinguishing pedagogical feature of HE massification (e. g. the mega-universities) is that, instead of giving individual faculty the responsibility for teaching, sophisticated learning systems have been developed based on innovative divisions of labour where the responsibility for teaching is carried collectively by an organisation. The differentiating feature of mass provision via open learning systems is that the institution teaches, not the individual teacher. By replacing the traditional lecturer model with a total teaching system where the functions of teaching are divided into a range of specialisations, HE massification is able to scale up the delivery of quality teaching to the levels that are impossible in conventional campus-based or dual-mode models.[38]

[34] World Bank 2000. Introduction to *Higher Education in Developing Countries. Peril and Promise.* Washington DC: The World Bank.

[35] Saint, W. 1999. *Tertiary Distance Education and Technology in Sub-Saharan Africa.* Washington DC: Working group on Higher Education, Association for the Development of Education in Africa, The World Bank.

[36] UNESCO, 2000. Text adopted by the World Education Forum Dakar, Senegal, 26-28 April 2000. http://www2.unesco.org/wef/en-leadup/dakfram.shtm

[37] Daniel, J.S., 1999. (reprint with revision) *Mega-Universities and Knowledge Media: Technology Strategies for Higher Education.* Kogan Page: London.

[38] Extracted from *Leading ODL Futures in the Eternal Triangle: A Mega-University Response to the Greatest Moral Challenge of Our Age*, by Sir John Daniel and Wayne Mackintosh, 2002: in press.

There is a growing understanding that mass providers (like the mega-universities) represent the only viable solution to this global crisis, operating as a major alternative of tertiary education. However, there is a grave danger that many forms of ICT-enhanced distance education currently being practiced will be misinterpreted as the "massification solution", since, according to Dhanarajan[39] "...there is as much ignorance among many in education as among those outside it about what distance education can do and cannot do, what does and does not constitute good practice in distance education, its efficiencies and governance."

HEI Collaboration and Partnerships – Global Experience

Academics and researchers all over the world have always collaborated with one another across institutional, regional and national boundaries, particularly in research activities sharing and publishing the findings. There are, probably, thousands of examples of work of this nature, including unrecorded joint participation in the delivery of academic programmes. The explosion of interest in teaching methodologies, new modes of delivery and quality assurance mechanisms have also led to much greater sharing of experience and expertise in these areas, while associations of educational administrators at various levels are now far more commonplace.

Since late 1960s, many national higher education systems around the world have employed a range of strategies and models to increase levels of HEI collaboration. A breakdown of major internal and external drivers of these collaborations is shown in the following table:

Drivers of Global HEI Collaboration

Academic (internal)	Enhancements via joint teaching or research projects, and development of shared academic infrastructure support (e. g. library collections) among academics (individuals, groups, and/or formal associations).
Professional (internal)	Seeking mutual benefit by such groups as finance directors, human resource professionals, librarians, academic disciplines, etc.
Brand (internal)	Enhancement of the public (local and global) visibility and status of institutions.
Financial (internal)	Opportunities to achieve economies of scale and cost savings, enhancing efficiency and effectiveness.
Financial (external)	Collaborative initiatives in response to funding incentives (by foundations, donor agencies, governments, etc.).
Strategic (external)	Alignment of HEIs with collaborative socio-economic development policies/strategies in response to government pressure (sometimes in the form of compulsory directives), and regional initiatives.

Collaboration at the institutional level between HEIs and industry have long been fraught with controversy: faculty fear that industry's influence will restrict their freedoms in teaching and research; industry worries that HEI research is "market irrelevant", and academic researchers lack the discipline necessary to respond to market pressures. However, several successful "science parks" have been established around the world, usually centered on a single HEI of global stature.

There is little evidence to date that either individual HEIs or consortia are turning their attention to the global *Education for All* initiative. The goal of both appears to be to address their existing markets more efficiently and cost effectively (often by employing innovative ICT applications) without breaking out of their traditional contact paradigm, and usually with the aim of enhancing their competitiveness as individual institutions. *However, it would be valuable for the researchers in this study to investigate in more depth the global situation (e. g. use of consortia and partnerships, focus on "Education for All", mutual benefit versus adversarial competition, innovative application of ICTs).*

[39] Dhanarajan, G. 1999. Forward in Harry, K (ed): *Higher Education through Open and Distance Learning. World Review of Distance Education and Open Learning.* London: Routledge and Commonwealth of Learning.

Trends in South Africa's Tertiary Education

South African Education system is divided into three levels: primary education, further and general education and higher education. 21 universities and 14 technikons making up the current higher education institutional landscape have very different resources, management capacity and culture. Much of this is the legacy of colonialism and apartheid, in particular, the link between institutional identity and the historical provision of resources.[40]

Contact universities vary in size from 4,000 students to 32,000 students. The general trend in student numbers over the past 5 years has been a decline at historically disadvantaged institutions, and an increase at historically advantaged institutions. However, this has not been a simple migration from one group of institutions to the other. Moreover, as noted in Part I, there has been a general drop in growth rates of the higher education system as a whole. Overall, the anticipated system-wide growth in student numbers has not materialized, mainly due to such factors as:

- poor output from the secondary school system,
- sharp decline in white participation rates, and
- inadequate financial aid for potential students.

The higher education system is far from being optimally organized to meet the human resource requirements of South Africa, and there is a need for clarity about purpose and differentiation. The system's potential is being held back by several factors, including unproductive competition, which manifests by such trends as:

- new managerialism,
- volatility and expanded role of market forces in higher education,
- enhanced student mobility, and
- far-reaching changes in delivery modes.

The system is seen to be extremely wasteful and guilty of squandering valuable resources, delivering a poor return of investment measured in terms of graduate and research output. A series of higher education policy documents has been generated in the last decade to address these problems. In practice, however, implementation has been extremely slow and uneven; hence, the expectations of the most recent initiative, *National Plan for Higher Education*, are very high.

National Plan for Higher Education (NPHE)

The inequalities in the higher education system in terms of access, programme offerings, quality and infrastructure are generally acknowledged. In March 2001, the Minister of Education released the NPHE, which identified five strategic objectives to achieve "the overall goal of transformation of the higher education system" through three main steering mechanisms: funding, planning and quality control. The key considerations of South African University Vice Chancellor's Association (SAUVCA) to realise the NPHE[41] and match these strategies, although the order in which they are dealt with, differs:

- to achieve diversity in terms of institutional and programme mix,
- to restructure the higher education landscape,
- to produce graduates with the skills and competences to meet the human resource needs of the country,
- to retain current research strengths and promote research and knowledge outputs to meet the development needs of the economy,
- to promote equity of access and fair chances for success, eradicating past discrimination.

[40] Extracted from *Exploring Institutional Collaboration and Mergers in Higher Education*, Piyushi Kotecha & Grant Harman, SAUVCA report, November 2001.

[41] Extract from: *Building a Future Higher Education System by Strengthening the Framework and Foundations of the National Plan on Higher Education (NPHE)*, Piyushi Kotecha, SAUVCA, June 2001.

SAUVCA states that the NPHE does not constitute a visionary piece of implemented policy beyond the restructuring but "a serious, pragmatic, cautious and incremental document dealing with issues that the state feels it is able to implement with confidence and political backing at this time". The intended benefits of restructuring the system can be grouped broadly into two pragmatic areas:

- desired technical outcomes such as enhanced efficiency and effectiveness, and
- desired social and political outcomes such as improved equity and access.

NPHE currently dominates strategic thinking in the higher education system, and will likely continue to do so for several years. It is good that it is forcing HEIs to reconsider their relevance in a changing South Africa by stressing the application and distribution of knowledge, by addressing the issues of quality management, and by encouraging institutions to change their modes of operation in order to deliver knowledge faster.

However, because of its pragmatic, cautious approach, the NPHE may, inadvertently, be deflecting the attention of strategic thinkers in our higher education system away from the even bigger issue of the global education crisis and the need for *Education for All*. The traditional, "contact" form of teaching, rooted in the industrial paradigm, is not seriously challenged in the NPHE. Exciting alternatives related to the emerging knowledge paradigm (but requiring fundamental, not incremental change to mass provision supported by ICTs) are left for later consideration. This has serious consequences not only for many thousands of potential students awaiting tertiary education services in remote and rural areas throughout Africa, but also for potential, far-reaching, innovative collaborations between the ICT industry and the transforming HEIs, functioning as a genuine sector.

HEI Collaboration and Partnerships – South African Experience

To date, strategic inter-HEI collaboration in South Africa has been limited. However, the establishment of the NPHE and its associated National Working Group sets the scene for such HEI collaborations to develop a new agenda in response to the imperatives of a developing economy in the global arena.

Regional and Other Academic Consortia[42]

Whereas consortia and alliances are formed in other parts of the world primarily to promote and advance the interests of the member institutions, in South Africa the first consortia were formed in early nineties, first and foremost, to address national goals of transformation and rationalisation, then to promote their own interests. However, deeply vested interests and widely differing redress remedies led to the consortia having become sites of intense power struggles not sites of cooperation.

The first consortia were established in the Western Cape and KwaZulu Natal, where the only two historically disadvantaged universities (HDUs) in urban locations existed, i.e. the University of the Western Cape and the University of Durban-Westville. In 1993 the Western Cape Tertiary Institutions Trust (now known as The Cape Higher Education Consortium (CHEC)) and KwaZulu Natal the Regional Institutional Cooperation Projects (now ATI) were launched. In the period from 1996 till 1998, other consortia were established in the Eastern Cape (ECHEA), in Gauteng and the Northern Environs (FOTIM), and in the Free State, where the existing consortium was formalised as a Trust (FSFHETT). At this time the main distance education providers also set up a consortium known as COLISA.

The existing academic consortia are voluntary associations with governing boards and councils comprising vice chancellors/deputy vice-chancellors and senior managers of member institutions and, in some cases, with provision made for external membership. All consortia have appointed Executive Directors and have functional secretariats of various sizes. There is, however, no uniform

[42] Extracted from: *Uncommon Wisdom: Making Co-operation Work in South African Higher Education*, by PA Gibbon & A Parekh, 2001, commissioned by the Network of Executive Directors of Academic Consortia (NEDAC).

funding policy among the consortia and heavy reliance on donor funding places their activities in a vulnerable position.

Network of Executive Directors of Academic Consortia (NEDAC) in SA meets regularly to discuss consortia matters such as: changes in HE; matters of policy; best practices; development of cooperation culture; and advance of joint research on HE issues. The categories of projects pursued by the consortia are:

- Infrastructure
- Planning, coordination and rationalization
- Human resource development
- Academic and research activities
- Administrative and technical support
- Academic support
- Community service

To date, cooperation has been most successful in areas of technical and infrastructure support and services, e.g. enhancing library access, strengthening ICT capabilities, and establishing a central applications office. This may, in part, be due to the extensive financial support HEIs have received for such projects from donor agencies. Another likely reason is that these projects often provide an additional benefit via economies of scale that could not have been attained by HEIs operating alone. Current ICT cooperative projects run by consortia are listed in the following table:

Consortia ICT Projects

Consortium	Project Name	Status
All	*TENET (was UNINET[43])*	Running
CHEC	*Regional Information Strategy*	Initiated
COLISA	*Network of Learning Centres*	Running
COLISA	*Shared ICT Resources (DRM)*	Initiated
ECHEA	*Regional Management*	Proposed
EsATI	*IT Departments Project*	Proposed
FOTIM	*ICT Challenges: Flexible Learning*	Initiated
FOTIM	*ICT Challenges: ICT HR*	Initiated
FOTIM	*ICTs for GAELIC (Libraries project)*	Running
FOTIM	*Management Information System*	Proposed

Arguably, the HEI greatest and most successful infrastructure collaboration to date is the national academic and research network, where HEIs bought bandwidth from UNINET.[44] UNINET was never managed on a cooperative basis, but as a project of the FRD (later, the NRF), with its manager and staff being employees of the FRD.

[43] A description of the purpose and scope of UNINET can be found on its web site at http://www.frd.ac.za/uninet.

[44] Extracted from: Leatt , JV & Martin DH, CITTE series, 2000: Reflections on Collaboration Within SA Higher Education by Two Bloodied but Unbowed Participants.

The Tertiary Education Network (TENET) was formed to take over UNINET to provide Internet access to universities, technikons and research institutions. At the same time, TENET is the corporate customer through which Telkom SA provides the actual networking services. Like UNINET, TENET has an annual turnover of around R15 million, but unlike UNINET, it does not operate routers, cache servers or other network devices. Instead, it manages the contractual and business relationship with Telkom, the service provision relationships with each of the sites, and any assistance from the US donors.

The generic learning from various stages of this long running project indicates that the best way to structure a collaborative venture, at least in the case of infrastructure projects, is to *minimize the amount of sustained collaborative behaviour that is required.* This can be done by structuring the collaboration to operate as much as possible like a normal business, and by identifying and ensuring arms-length separation between three primary management roles:

- responsibility for meeting the needs of end-users in each HEI,
- responsibility for the provision of the collaborative services, and
- responsibility for institutional commitments to, and shared ownership of, the collaboration.

Guidelines are suggested to assist in developing businesslike structural models for such collaborations:

- Separate the roles of customer and provider;
- Position the institutions as customers;
- Position the collaborative enterprise as a service provider;
- Appoint an expert management board rather than a representative one;
- Have the collaboration owned at political levels in the institutions.

Other Cooperative Ventures in the Tertiary Sector

In South Africa there has also been a significant amount of work done in capacity building for administrative, academic and academic support staff. Agencies working in these areas include the Centre for Higher Education Transformation (CHET), the Council on Higher Education (CHE), and the Tertiary Education Linkages Programme (TELP).

Other organizations that represent interest groups operate at a national level, such as the Forum of Historically Disadvantaged Institutions, the South African University Vice-Chancellors Association (SAUVCA) and the Committee of Technikon Principals (CTP). Cooperation at this level generally does not involve the institutions but rather establishes common positions to lobby government or respond to state-initiated policy directives.

Recently, SAUVCA produced draft guidelines[45] addressing one form of HEI-private sector partnership stressing that its "members will endeavour to apply this Code of Conduct rigorously to all partnerships with the private sector *which concern the delivery of academic programmes...* The idea is that member institutions will support and enforce the Code in a spirit of self-regulation." The Code is very limited, and does NOT deal with HEI-Private sector collaboration and/or partnerships in the areas of ICTs, research, innovation and related issues of joint IPR and "spin-off" start-up companies.

Some HEIs have cooperative relationships with foreign institutions, on the basis of which faculty and student exchange programmes are organized; although these relationships produce institutional gains, they do not have a major impact on the system as a whole.

Analysis of HEI Current and Future Use and Outputs of ICTs

There is a widely held belief in South African HEIs that they are falling behind the developed world in their application of ICTs. For the public higher education system, operating with extremely limited

[45] SAUVCA, 2001: *A Code of Conduct for Public/Private Partnerships in Higher Education.*

resources, this is especially serious. The best HEI systems are still not nearly as sophisticated as those in developed nations, and there are other institutions which systems and levels of connectivity are negligible. Absence of appropriate technological support and infrastructure necessary to secure high levels of connectivity is likely to disadvantage the entire academic and research enterprise of the higher education system. In turn, it will severely compromise their ability to collaborate with, support, and teach the ICT sector (and, of course, all other sectors of society).

ICTs can be and are used in various ways by HEIs in South Africa. Hence, the analysis is structured in terms of teaching, administration, community service, and research.

Teaching of ICTs

The current ICT-related courses provided by the tertiary sector result in a range of accredited qualifications, including degrees (graduate & post-graduate), diplomas, and certificates. These, primarily, aim at creating technicians, technologists and professionals for the long established IT sector and their traditional markets (e. g. military, finance, retail, etc.). They are important people, and South Africa has an immediate need for many more, and of world class. However, the range of national ICT strategic initiatives described in Part I, indicates that there is a much broader range of ICT capabilities to be created to satisfy the growing needs of SA emerging knowledge society. This is a chicken-and-egg situation: if we don't provide such people, society will not grow, i.e. it cannot be demand-led. Our society must, collectively, take the risk of anticipating (and thereby stimulating) the demand.

As identified and discussed in Part I there are three main "layers" of ICT teaching/learning material that are widely needed:

- ***ICT Literacy/Fluency:*** most of this education is likely to occur prior to, or outside the tertiary sector. However, much current literacy material is outdated (e. g. "computyping"), and the dynamism of the ICT sector requires updating at least annually. In addition, much of the material has not been designed for many thousands of potential learners from rural and remote areas. In such cases it is essential that, for example, the issues of language and culture are to be catered for, if we are serious about bridging the "digital divide". Hence, improved ICT literacy learning material that satisfies these needs should be created on an ongoing basis. Ideally, instructional designers, ICT experts, language/culture specialists, and HCI professionals (mostly from the tertiary sector) should partner the ICT sector or any other relevant stakeholder in producing this material on an ongoing basis.
- ***ICT Benefits Awareness:*** This needs to be created for all members of the leadership corps of South African (and African) society, including the public sector, private sector, civil society, academia, etc. The emphasis of such courses should not be on the technologies themselves, but on the potential impact (especially benefits) of ICTs, now and in the future, tailored to the areas of society most relevant to each leader (e.g. economic growth, poverty alleviation, quality of life, information ethics, knowledge sharing concepts, OSS, etc.). They should focus on such topics as Policy and Strategy Development; Foresight Studies; Indigenous Economic Growth; New Knowledge Management/Sharing/Ecology, etc. There is much to be done in most of these areas at both graduate and post-graduate level not just for South Africa, but for Africa's leadership corps. Clearly, this is best addressed by any sector (ICT, tertiary, public, etc.) acting in isolation. Partnerships are required between tertiary experts, the ICT sector, and champions from the sector of society in question.
- ***ICT Technologists and Professionals:*** As described above, the theoretical content needs in this area for the ICT sector are being addressed by current courses and material of many existing HEIs. The major concern from the ICT sector is that appropriately qualified people are being produced far from enough, especially from the black community and women; the concerns are also voiced that more dynamic course components are permanently outdated (due to the years currently required to rewrite curricula in our HEIs). What is not being addressed, however, is the large and growing need identified in Part I for such ICT technologists and professionals in ALL other sectors of society, (private, public, development, etc.). These people must be educated/trained to FULLY understand not only their sector (e. g. agriculture, tourism, etc.) but all aspects of ICT relevant to

that sector (current and future). Again, we argue that partnerships between tertiary experts, the ICT sector, and champions from the sector of society in question should satisfy this burning need.

Use of ICTs in Teaching

Put simplistically, ICTs can be used directly to improve teaching in two ways: delivery of teaching, or creating better teaching materials. However, both have many subcomponents, and the picture is further complicated with the mode of teaching, i.e. contact, distance or a their combination.

Two concepts are frequently used in this area. Although they overlap, there are significant differences; therefore, they should not be confused:

- *Technology-mediated distance education:* This has long been used to increase the range of the traditional contact mode of teaching, often via broadcast media. The synchronous form uses TV, radio, and video or teleconferencing, whereas the asynchronous form uses video- and audio-tapes via TV and radio, recently via the Web. Here the pedagogy is fixed, i.e. the traditional contact mode.
- *Technology-enhanced teaching:* This first emerged in '70s as text-based CBE & CBT. More recently, a wide range of improvements in current learning materials has become possible via the applied interactive digital multimedia: text, graphic, audio, video, animation, simulation, virtual reality, etc.; and via the asynchronous delivery of digital material, whether in a contact institution or in the distance mode. Here the pedagogy is often assumed to be contact, but a wide range of more appropriate alternatives is possible.

Most residential HEIs have been experimenting for some time with both types of enhancement. The most strategic has been the adoption of broadcast mechanisms to provide lectures (usually live) at a distance, thereby reaching thousands more students at satellite campuses and other delivery sites. Less strategic has been the adoption by lecturers (individual and groups) of one or more aspects of ICT-enhanced teaching, often to supplement their lecture material (verbal and textual).

The advent of the World Wide Web (Web) further complicates the already complex picture. The Web allows any learning material, once digitised (e. g. text, graphics, voice, video, animation, etc.), to be available anywhere in the world that has Internet connectivity, either synchronously or asynchronously. It should be emphasised that the Web has introduced the additional major attribute of several levels of ***interactivity***, both synchronous and asynchronous, ranging from e-mail and "chat rooms", through interactive learning environments (taking much from the latest Web-based multi-user games), to voice and/or video conferencing over IP.

Of course, availability of bandwidth and PCs with sufficient power at access points currently imposes a variety of restrictions on what can be received by whom, when and where. But the technology exists to enable us to develop a wide variety of improvements to our teaching materials and the ways in which it might best be delivered to a variety of learners (which go together to create the learning experience). The restrictions come from a combination of HEI "traditionalism" – fuzzy political vision – and private sector indifference. Technology is often used as the scapegoat for inaction in this complex but exciting field of opportunity.

Although the above mentioned experimentation, both with technology-enhanced teaching, and technology-mediated distance learning, often touches on aspects essential for the massification of higher education, it does not represent a national, strategic approach to this major societal need. Instead, individual contact HEIs and the HE consortia are focusing more on the NPHE and their improved competitiveness, both locally and globally. The ODL institutions, on the other hand, have long-established competencies in massification, albeit of the text-based correspondence type. Early attempts to understand and adopt "e-learning" in the context of massification have in most part been suspended under the pressures introduced by the NPHE and other transformation processes.

ICT based massification is not yet recognised as the long-awaited key to *Education for All*, but is seen as an interesting but non-essential, area for consideration in a hypothetical "less stressed future".

There is a major, commonly held misunderstanding here. The ICT-based massification of HE that already could be solving the South African (and global) need for *Education for All* incorporates open distance learning as a critical component. But few manifestations of distance education currently practised by HEIs can be successfully scaled up to mass provision. Massification always contains a form of distance education, but most current forms of distance education cannot lead to massification.

Clearly, there is major potential here for collaboration between the HEI sector as a whole, and the ODL institutions, in particular, with the ICT sector. However, great confusion and misunderstanding exists in this area. It would be very useful if this project could help clarify the issues raised in this section, so that the potential partnerships could be aimed at an holistic, national ICT-based HE massification strategy, rather than ad hoc, wasteful 'technology push' intra-institutional initiatives.

ICTs and HEI Administrative Processes

For many years, South Africa's wealthier HEIs have been using ICT applications for their administrative processes (e.g. finances, human resources, salaries, etc.). Many of these applications have been migrated, with variable success from their original mainframe environments to a variety of server-based distributed network systems. This provides the historic context of the "computing centre" models employed by most HEIs. Most of these centres (as in many other large organisations in South Africa) continue to struggle with the impact that the Internet followed by the Web is having on their environments. End-user computing, mobile computing, multi-tasking, intranets, extranets, web sites and portals are a far cry from the old days when a few select users were happy to queue (often repeatedly) for the outputs of the mainframe.

But the qualifications of many in the staff, especially the centre managers, pre-date these dramatic changes in the ICT world; hence, culture change is a major omnipresent issue. The necessary changes include: from user control to user support; from normal working hours to 24 hour x 7day service; from legacy systems to heterogeneous, interoperable environments; from a large room with a controlled climate to every desktop in the organisation; from security doors to firewalls; from logging in from a dumb terminal to dialling in from anywhere in the world. Computing Centre culture change is difficult enough, but it is compounded by the national shortage of suitably qualified staff and consultants, particularly black people and women; the growing awareness, sophistication, demands (and cynicism) of many end-users; and the drive for cost-effectiveness in the face of partially understood, wide-ranging new needs.

Computing Centres turn to the HEI executives for understanding of their plight and to provide appropriate help, whilst the HEI executives turn to these same computing centres' "ICT experts" to help them understand the bewildering growth of possible applications of ICTs in HEIs. Neither can cope alone. As explained earlier, the most successful consortia collaborations of HEIs have been in the area of ICT infrastructure. But much broader collaboration is needed. The failure of HEIs to act collaboratively and share expertise has also highlighted other disparities such as lack of capacity of some institutions to engage in meaningful planning exercises. While some have Management Information Systems in place and the capacity to use them, others have been unable to generate data that is even remotely reliable or useful.

The problems expressed above, are not unique to South Africa. They are being repeated to varying degrees across Africa. The potential is significant, therefore, for HEIs working in unison as a national sector, rather than regional consortia, to build powerful partnerships with the ICT sector to address these problems. The solutions will not only benefit South Africa, but can accelerate the benefits of appropriately applied ICTs to HEIs throughout the continent.

Finally, the administrative ICT systems to satisfy the needs of HE massification must be addressed but appear to be overlooked. It has been described above how ICTs are essential for creation and delivery of open distance learning materials in mass provision mode. However, none of this can succeed without designing and building the administrative back-end processes (e. g. study materials and scheduling processes). These ICT systems must manage hundreds of thousands of students

interacting electronically in a range of modes with learning material, lecturers, tutors, administrators, other students, and whatever knowledge they may need from the web. This is a major initiative which needs to be attacked in phases, and will take several years to complete. This poses a major opportunity for collaboration between the HEI and ICT sectors, and it is an area where the advantages of Open Source Software (OSS) may prove particularly valuable.

ICTs and HEI Involvement in Community Service/Development

Community service has always been an important output of HEIs. Many students and staff devote their time, usually on a voluntary basis, to outreach projects that allow them to utilise their expertise in communities where such services are generally unavailable or unaffordable. Such initiatives are sometimes run on an individual basis, by groups, or managed by one of more formal structures in the HEI (e. g. legal aid, health missions, arts and crafts initiatives, community projects, etc.). In recent years, many such projects have taken on an ICT component, e.g. school connectivity, television centres, and the provision of computer centres in or near disadvantaged areas to provide ICT literacy and further skills.

Although commendable and necessary, most of these projects deal with the symptoms of poverty, disadvantage and exclusion, rather than address their cause via a more strategic (organisational or national) approach. By contrast, HE massification directly addresses one of the most fundamental causes of disadvantage and exclusion, i.e. enabling all individuals to understand, develop, and use the power of their own minds in the context of their indigenous environments.

Of course, collaboration of the ICT sector in the HEI-outreach projects has been and will continue to be most welcome. However, by investing and collaborating in the long-term process of HE massification, the ICT sector is likely not only to get 'more bang for the buck' (although over a longer time frame), but also to help convert 70% of the population from being receivers of handouts to producers and consumers – i.e. they will be establishing major new markets for their own products and services.

ICTs and HEI Research

For many years, some individuals and groups in South Africa's HEIs have been doing world-class research in several aspects of science, which contribute to ICTs, or in the ICTs proper, although standards vary significantly. As discussed in Part I, THRIP and the Innovation fund encourage multi-party collaborations involving HEIs and the ICT sector. Nevertheless, the conversion of HEI-based ICT research into tangible products and services remains underdeveloped – a major reason for this study.

As described in Part I, ICT needs to be better understood as an enabling technology in the context of all other sectors of society. This raises the question of how well ICTs are being used in HEI research within disciplines not usually directly associated with such technologies (and where some researchers may not be ICT literate), e.g. social science, arts, law, etc. It would be useful to pursue this line of thought in this study, since innovation often stems from such non-intuitive associations.

In the previous sections, which discuss ICTs and HEI teaching, administrative processes, and community service, significant areas emerged for potential collaboration between the ICT sector and HEIs. Much can be done in each of them by applying existing ICTs to current HEI needs, especially if the HEIs collaborate as a sector driven by national imperatives. However, there are many more areas of potential developmental collaboration, which require a wide range of collaborative research initiatives. This is particularly true of the need to develop the mass provision of higher education in the South African context, leading to collaborative research opportunities in the development of multimodal, multimedia-based learning materials; ICT-enhanced remote access and student support; as well as seamless administrative systems to handle the interactive needs of hundreds of thousands of open distance learners.

ICTs and the HEI Sector – Emphasising the Opportunities

The way in which the application of digital ICTs at campus-based institutions develops is likely to be different from how the large open learning systems implement digital technologies in future.

Certainly, campus-based systems will begin to utilise distance-teaching methods to a far greater extent because of the inherent capabilities of digital ICTs to overcome geographical barriers. However, providing learning at scale is fundamentally different from conventional models of delivery.

Mega-universities practice a form of delivery that is, per definition, technology-mediated learning. As a result, they have already had to develop new pedagogical structures and corresponding organisational structures to cater for the specific divisions of labour associated with providing learning at scale. Consequently, the challenges of the mega-universities with regards to digital ICTs are fundamentally different. They do not face the questions of how to integrate traditional university structures and conventional pedagogy with emerging forms of distance education practice. Mega-university challenges concern how best to integrate the power of digital ICTs when operating at scale – a very different question!

The opportunity is that within 5 years 100,000 more potential tertiary students from rural and disadvantaged communities will be provided with quality learning opportunities if the HEIs could find mechanisms to collaborate with each other ***as a sector*** and with other stakeholders (private, public, civil society, etc), but particularly the ICT sector. As described above, this transformed HEI sector would need to develop a wide range of ICT-based processes to achieve the required massification combined with economies of scope, and quality, individualized learning environments.

PART III. EMERGING HEI/ICT SECTOR PARTNERSHIPS

The Industrial Paradigm has been the dominant mental context (often subconsciously) for the past two centuries. It has, therefore, shaped most of our societal concepts, processes and structures, including those associated with collaboration and partnership. In the developing world, development initiatives over the last 50 years have usually failed to achieve their goals, less than 20% showing some signs of success, let alone sustainable success. More recently, public-private-partnerships (ppp), and other variations on collaboration/partnership spectrum have been invoked to accelerate sustainable development. Again, early results were disappointing. However, the emerging knowledge paradigm, even though it is not yet fully understood, provides an alternative context for such partnerships to be formulated. The hope is that this approach will open up more effective routes to innovation and sustainable development.

Re-evaluating the Nature of Partnerships

In order to succeed in implementing the NPHE, a popular (perhaps industrial paradigm) idea is that HEIs need to be encouraged to behave as a sector, rather than competitors (as individual organizations or groups of organizations), to satisfy two major national imperatives:

- **Teaching:** Instead of maintaining the traditional elitist paradigm, our HEIs need to recognize that they have been neglecting the needs of 70% of the population, and failing to provide students with the necessary qualifications in the right numbers to satisfy the current and future needs of society.
- **Research and Innovation:** by coordinating the research outputs of each HEI to produce a sector profile more closely aligned with National imperatives.

However, indicators are that this approach is unlikely to succeed. As described in Part II, regional colloquia have been promoting HEI collaboration for nearly a decade but with very little success. These colloquia have identified a range of institutional issues and concerns that make effective and meaningful cooperation and collaboration between institutions difficult to achieve, some of which include:

- Institutions competing with each other for students and other resources;
- Similarity in the Vision and Mission of institutions, which makes institutions more reluctant to relinquish sole ownership of academic offerings and to identify complementary programmes in other institutions;

- Areas seen as key to the niche of one institution may be fiercely guarded;
- Suspicion and resentment of the motives and intentions of stronger, more well endowed institutions;
- Variation of the development goals and objectives of institutions;
- Conflicting personalities and lack of direction from institutional leadership;
- Lack of clear incentives to cooperate or sanctions for failing to cooperate;
- Perception of job security within institutions under threat;
- Geographical distance which makes collaboration between institutions more difficult.

Planning and coordination should be the main role of the consortia. Yet, this is precisely the area where they encounter the greatest difficulties. If they cannot collaborate with each other, how can they be expected to collaborate effectively and strategically with the private sector, including the ICT sector? Perhaps some answers emerge from one of the few areas of successful collaboration, i.e. shared ICT infrastructure. Here, in the TENET project (see Part II), a separate, independent structure was created, but populated by a team of experts from the HEI and ICT sectors. *Perhaps HEI/ICT collaborations can only succeed if they are stationed outside the established structures of either HEIs or ICT organizations.*

Historically, HEIs were established to take the cream of the students from secondary education, and mould them into highly specialized elites, much respected by but separated from the mass of the population. The primary and secondary educational processes used to select this cream, traditionally have been highly competitive, even adversarial. Is it surprising, therefore, that the very academics that we now wish to adopt collaborative, sharing styles find it so difficult? Were they not educated over many years to be "team averse", like the traditions, structures and processes of the HEIs in which they work?

Perhaps, we should not attempt to force such collaborations onto all academics, nor into their traditional institutions where the concept appears to be so alien. Instead, we can attract the academics who are keen to collaborate (and there are many) into independent structures (physical or virtual) where such collaborations and partnerships may be allowed to flourish or die dependent on their inherent potential, rather than external, inflexible and often irrelevant agendas.

In this overview we are looking not only at existing partnerships, but also at potential partnerships and, in both cases, at their impact on knowledge production (including "blue sky" research) and innovation. There are two angles to this from the HEI viewpoint (independent of the particular industrial sector under focus):

- *Teaching:* The production of appropriately skilled and qualified people in sufficient numbers to carry out the level of "blue sky" research, knowledge production and innovation required both by national (and regional) imperatives and market forces. The skills profile and numbers must mirror not only current needs, but to anticipate (and thereby further stimulate) future ones. Further, it should be recognised that for every researcher/innovator, any particular sector usually requires additional numbers of suitably skilled support personnel.
- *Research:* This includes purely academic research of the "blue sky" nature, but must be appropriately balanced by knowledge production and innovation required both by national imperatives and market forces. It is the latter area where partnerships with industry are likely to bear most fruit.

Direct Interactions between HEIs and Formal ICT Sector

As with most sectors, the standard process is to examine the "ICT Sector", and identify how well HEIs are addressing the education needs of the ICT Sector (and whether partnerships are playing a significant role), and what quality, quantity and relevance of ICT research (knowledge production and innovation) HEI's are carrying out into ICTs, particularly in partnerships with the ICT Sector.

For most sectors, this would suffice. But, the picture is bigger.

Recognizing the Cross-cutting Impact of ICTs – Enabling Other Sectors

Because ICTs are cross-cutting and enabling technologies, they have a growing impact across ALL other sectors of society (industry, public sector, civil society, developing sector, etc.). Hence this overview must cover the current and potential impact of HEIs via partnerships in the provision of ICT education relevant to all other sectors, as well as the knowledge production and innovation that HEIs are (or should be) stimulating via research to apply ICTs (existing and future) in each of these sectors. Clearly, this is a very large, and fast growing field that is far from saturation. Indications are that most ICT-based innovations stem from this field rather than the "ICT sector" itself, and, therefore, it is full of exciting opportunities, particularly, for the developing world.

Recognising Current and Potential Impact of ICTs on Traditional HEIs

In fact, the picture is still bigger, with even greater opportunities. We should also consider in more detail the impact ICTs have, and, especially, could have on one of the above sectors, i.e. the education sector itself (and HEIs in particular). If we take the HEI sector in its traditional state, ICTs already have a significant impact, particularly on administrative processes, but increasingly on teaching, research, and community service. In other words, ICTs enhance indirectly (supporting organisational processes), and directly all aspects of teaching and research in HEIs, which clearly need to teach and do further research in how ICTs enhance what they are doing – there are complex feedback loops in this system.

However the picture is not complete!

Recognising the Role of ICTs in Massification of the Tertiary Sector

We have only considered HEIs in their traditional state. In reality, both in the developed and developing worlds, HEIs are being challenged to transform fundamentally, and are struggling to meet this challenge for a variety of reasons. UNESCO's *Education for All* initiative sums up the growing global understanding that HEIs are morally bound to expand their reach from satisfying the needs of elites (as well as, to a large extent, creating and maintaining the status of those elites). It is estimated that, if HEIs provided equitable services, there would be at least other 100 million potential tertiary students, mostly in the developing world. This cannot be achieved via the traditional HEI "contact" model, or its variations. It requires "massification", which involves significant transformation of the following essential processes:

- creation of appropriate learning materials (team-based approach),
- delivery of materials to students "anytime, anyhow, anywhere",
- provision of customised student support which addresses the potential "de-personalisation" of the massification approach, and
- creation of the necessary seamless back-end administrative systems to serve highly interactive needs of hundreds of thousands of students.

None of these process transformations could be possible without the powerful support of current and future ICTs. Massification is far from being perfect, and will continue to be developed (by HEIs and their partners) for many years to come. But 100 million should no longer be excluded while HEIs prevaricate over whether and how it should be done. We know more than enough to begin today. To implement, we need HEIs to collaborate in supplementing their current traditional teaching and research provision with ICT-based massification. HEIs need to do it, to teach it, and to research it, and cannot possibly achieve anything without appropriate partnerships, not only with each other but especially with the ICT industry.

Moral and political issues aside, embarking on this initiative to reach 100 million of currently excluded people globally could well prove the biggest market opportunity of all.

Globally, HEIs are no longer the primary source of Knowledge Production, but one of several major contributors. Mode 2 knowledge production teams are springing up (emerging, interacting,

producing, delivering – then dissolving!) all over the world (combining physical and virtual team mechanisms as needed where possible), and involving individuals from many disciplines, sectors and organisations. They have become the major mechanism for knowledge production that is timely, relevant, efficient and effective. HEIs should focus more on the re-configuration of this "flood" of new knowledge, as well as stimulate the emergence of and contribute to mode 2 teams as problem areas arise.

We have identified a wide range of areas where collaboration and partnerships between HEIs and the ICT sector might well thrive. However, we have given evidence that such partnerships are unlikely to succeed if set up within the industrial paradigm, and housed within the existing but unwelcoming structures of HEIs (or even large, hierarchical ICT organizations?). A viable alternative is available, which is central to the knowledge paradigm, i.e. mode 2 knowledge production teams. Yet, it is unclear what mechanisms should be used to establish such teams most effectively. The new National R&D Strategy appears to have been written with exactly these concerns in mind!

Challenges and Opportunities (New R&D Strategy)

In the context of the foregoing material, the following extracts from the recently published National R&D Strategy[46] are particularly pertinent.

> Current South African total (public and private sector) expenditure on R&D amounts to approximately 0.7% (government 0.29%) of GDP whereas the average OECD country expenditure is 2.15% GDP. Finland (for example), with an economy of the same size as South Africa, spends 3.5% (government 1%).
>
> Given the very rapid development of key technology areas today, we will expose ourselves to insurmountable security risks if we do not commit to maintaining and developing competencies across the system (universities, research councils, private sector, etc.) in critical strategic areas.
>
> Our human resources in science and technology are not being adequately developed and renewed; we have an aging and shrinking scientific population. The key indicators show that black and female scientists, technologists and engineers are not entering the academic ranks, and the key research infrastructure is composed of people who will soon retire... Currently there is less than one researcher for every thousand members of the workforce, compared to five in Australia and ten in Japan. Given that "technology walks on two legs", the "frozen demographics" prevalent in our National System of Innovation represents a critical state of affairs.

As described earlier (Part I), this picture is even worse for human resource development (HRD) in the ICT sector. Clearly, if we rely on the traditional HRD processes (both in HEIs and the private sector) no significant impact will be made on this fundamental problem.

> Research and development undertaken by large South African companies has shown a significant, measurable decline in the past four years. Global statistics show that the real determinant of technology-driven economic development is a sustained high level of research and innovation by the indigenous private sector, by firms of all sizes. The current drive toward restructuring of large companies in the face of global economic forces has serious national consequences in the area of technology. The ongoing inability to stimulate world-class innovation will relegate the economy to, at best, a "follower" status and transfer of mature technologies (rather than cutting-edge technology innovation).

At least 98% of South Africa's ICT products and services are, and always have been, based on the "follower" model (imported from the "1st world"). This has provided significant success for several companies over the past decade, since South Africa has the largest "1st world" market in Africa, and

[46] The R&D Strategy, due for public release in the near future, has been passed by the Cabinet recently.

has been successfully used as a springboard into the rest of Africa's "1st world market". Inevitably, this strategy has excluded over 70% of Africa's population from the potential benefits of ICTs. Yet, the barriers to entry to develop cutting-edge technology innovation are generally lower in the ICT Sector than in almost all other sectors.

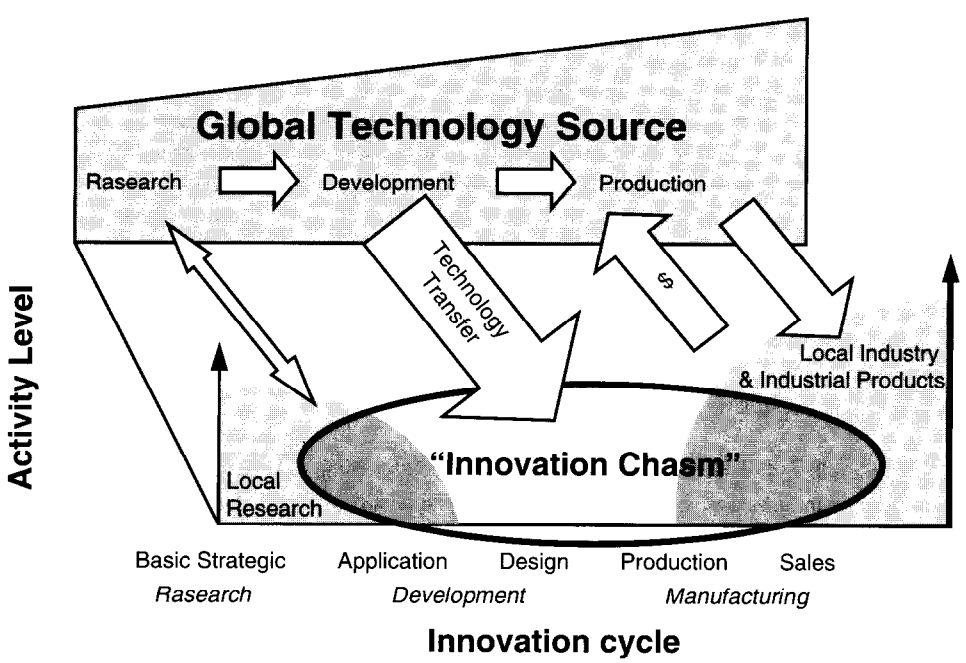
> The fragmented management, frozen institutional arrangements and funding structures for government-led science and technology does not provide the right platform for leadership and strategic response in this domain. Different government departments currently drive a range of technology-intensive institutions and programmes with very little coordination in strategy or sharing of learning.

Again, the role of government in the ICT sector is an extreme case of the above. It is long overdue that all aspects of ICTs should be coordinated across the government departments by an authoritative, fully empowered and globally respected ICT champion working at the President's Office – a national CIKO (Chief Information and Knowledge Officer).

"Innovation Chasm"

South Africa currently suffers from an "Innovation Chasm". Notwithstanding high proportions of private sector participation in some tertiary institutions and research councils, economic growth based on local innovation is low. The focus of activities is on human resource development and incremental research.

A stronger distinction must be made between human capital formation and technological innovation activities. Since these key functions have been insufficiently defined, the innovation gap that exists between the knowledge generators and the market has been never addressed strategically. This is shown diagrammatically in the following figure:



Tactical attempts to put the "innovation chasm" focus mainly or exclusively on connecting the human capital function (universities and technikons) more and more closely with the market. While this seems logical initially, it drives the academic system toward short-term, incremental problem solving and consulting. The resultant downgrading of academic research (relative to greener pastures elsewhere) precipitates teaching overload for existing staff, fewer postgraduates with broad research

experience, and "privatization" of knowledge. It generates an endless search for "efficiencies" in an underfinanced system.

There is an extremely important message for this initiative here. An effort to develop direct partnerships between HEIs and the ICT industry has been made before with little success. It does not rule out such partnerships but does require that more innovative mechanisms should be created to select the appropriate collaborators, and to stimulate and house such partnerships.

The need to deal with the frozen demographics of our human resources, while simultaneously developing appropriate mechanisms to bridge the "innovation chasm", represents the greatest challenge to S&T policy in South Africa. However, no formal mechanism of introducing **new technology missions** has been available until now.

The theme of **technology missions** realized through networked Centres of Excellence as part of an effective system of innovation requires a range of planned actions across the spectrum of technology and basic science. According to the R&D Strategy:

> Such Centres of Excellence:
> - are more likely to succeed if focussed and chosen to support technology missions of key advantages for South Africa;
> - must focus strongly on human resources development and on popularising science;
> - are more likely to succeed if they establish or promote networks of excellence across the African continent.

The Centres of Excellence should be guided by mandates that make them effective elements of the country's national system of innovation. As the R&D Strategy further notes:

> ...all effective national systems of innovation are serviced by the following three functions:
> - a programme for the funding of fundamental research mainly to develop human capital and new knowledge;
> - a programme to promote innovation, technological development and diffusion (mainly oriented to the market);
> - a programme (often incorporating venture capital) to promote the commercialization of research results (oriented to higher economic growth rates).

Finally, the R&D Strategy provides pointers for Centres of Excellence relevant to the ICT mission:

> ICT seems to be pervasive in the country. However, it is clear that the vast majority of ICT investment is in imported technologies (to the level of 98%). South Africa does not have a strong R&D capacity in ICT and where there is significant innovation potential, the results have been patchy. It is, therefore, necessary to invest in a number of ICT domains that have unique characteristics that would favour local development and globalization.

Potential HEI/ICT Partnerships

People and knowledge are central to ICT, whether the accent is on diffusion and socio-economic impact, marketing and support, or research and development (R&D). The activities require associated levels of skill or knowledge. Therefore, education and training are essential, ranging from basic user-oriented ICT literacy through training for product-specific support and maintenance, to more fundamental education in the growing range of disciplines being inexorably sucked into the "ICT field". As discussed above, a comprehensive ICT/HEI partnership strategy must cover these issues.

South Africa is in need of much bigger numbers of HEI students in general, and larger numbers of graduates with a high level and range of ICT skills in particular. With the scholars and researchers, it needs the capacity and excellence that will allow them to participate in regional, national and global "mode 2" networks of knowledge producers who can contribute to both basic and application-driven research on ICTs, and the use of ICTs in a wide range of other sectors. With South Africa's productive

intellectual capacity dispersed and fragmented over a large number of discrete, stand-alone HEIs, even the strongest of these institutions cannot hope to meet these objectives at the level and on the scale that is demanded.

We face a future (threat or opportunity?) filled with countless initiatives that must be embarked upon in order to facilitate optimum utilisation of ICT. The important principle is not so much what must be done first, but rather how a given initiative seeks to enhance the social and economic benefits that South Africa might derive from ICT, and how readily it may be joined-up to complementary initiatives. This emphasises the widespread need in innovative, collaborative arrangements beyond the constraints of existing institutions, and raises a vision of "partnership" with fractal qualities.

Possible Improvements to HEI/ICT Partnerships and Levels of Collaboration

It is a sad fact that there is very little meaningful (especially strategic) collaboration between South Africa's HEIs and its ICT industry. On the positive side, however, this exposes a wide range of opportunities for dramatic improvements, including the following established mechanisms:

- Research publications
- Production of graduates
- Funding of research
- Funding of scholarships and chairs
- Contract research
- Sharing of resources – ICT infrastructure/libraries/lab facilities
- Internal HEI partnerships (within an institution)
- HEI consortia
- HEI/Industry consortia
- Industrial clusters
- Science parks
- Strategic alliances/Shared Intellectual property
- Joint ventures

Varying levels of individual, group and organizational activity will determine the nature of these relationships and levels of interaction.

Potential New Areas for HEI/ICT Partnerships and Collaboration

Unlike other sectors, the HEI sector and the ICT sector form a series of nested feedback loops. HEIs could dramatically improve the numbers and quality of ICT qualified professionals in ALL sectors, some of whom could use ICTs to help improve the teaching and research of the HEI sector, including the essential massification processes. The wide variety of strategic partnership opportunities that both create and that arise from this positive feedback are summarized below:

Teaching of ICTs

This is a chicken-and-egg situation – if we do not provide such people, society will not grow, i.e. it cannot be demand-led.

- ***ICT Literacy/Fluency:*** Improved ICT literacy learning material that satisfies rural needs, etc. should be created by "mode 2" teams of instructional designers, ICT specialists, language/culture experts, and HCI professionals (mostly from the tertiary sector), partnering the ICT sector.
- ***ICT Benefits Awareness:*** There is much to be done at both graduate and post-graduate level for the whole of Africa's leadership corps by partnerships between tertiary experts, the ICT sector, and champions from the sector of the society in question.
- ***ICT Technologists and Professionals:*** Large and growing need in ICT technologists and professionals in ALL other sectors of society, (private, public, development, etc.). Partnerships between tertiary experts, the ICT sector, and champions from the sector of the society in question are required to satisfy this burning need.

Use of ICTs in Teaching

A wide range of improvements to current learning materials has become possible via application of interactive digital multimedia: text, graphic, audio, video, animation, simulation, virtual reality, etc.; and via the asynchronous delivery of digital material, whether in a contact institution or in distance mode. Here the pedagogy is often assumed to be contact, but a wide range of more appropriate alternatives is possible. Clearly, there is major potential here for collaboration between the HEI sector as a whole, and the ODL institutions in particular, with the ICT sector.

ICTs and HEI Administrative Processes

- Major problems are being experienced not only in South Africa but across the continent of Africa. The potential is significant, therefore, for HEIs to build powerful partnerships with the ICT sector to address these problems.
- In addition, HE massification cannot succeed without designing and building the administrative back-end ICT systems that must manage hundreds of thousands of students interacting electronically in a range of modes with learning material, lecturers, tutors, administrators, other students, and whatever knowledge they may need from the Web. This is a major initiative, which should be addressed in phases, and will take several years to complete posing a major opportunity for collaboration between the HEI and ICT sectors, and it is an area where the advantages of Open Source Software (OSS) may prove particularly valuable.

ICTs and HEI Involvement in Community Service/Development

Collaboration of the ICT sector in the HEI outreach projects has been and will continue to be most welcome. However, by investing and collaborating in the long-term process of HE massification, the ICT sector is likely not only to get "more bang for the buck" (although over a longer time frame), but also to help convert 70% of the population from being receivers of handouts to producers and consumers.

ICTs and HEI Research

- In the previous sections, which discuss ICTs and HEI teaching, administrative processes, and community service, significant areas emerged for potential collaboration between the ICT sector and HEIs. However, there are many more areas of potential developmental collaboration, which require a wide range of collaborative research initiatives.
- This is particularly true of the need to develop the mass provision of higher education in the South African context, leading to collaborative research opportunities in the development of multi-modal, multimedia-based learning materials; ICT-enhanced remote access and student support; and seamless administrative systems to handle the interactive needs of hundreds of thousands of open distance learners.

New AIICT: Example of a HEI/ICT Node of Innovation to House Mode 2 Teams

These strategic partnerships have not and, probably, cannot be successfully established or sustained within the existing structures of either the HEI sector or the ICT industry. A range of new, flexible, often transient mechanisms is required, where mode 2 knowledge production teams can find an attractive home. A recently devised example, the Advanced Institute for ICT (AIICT), is described here, not as a rigid template (it is likely to be significantly bigger than most "innovation nodes"), but to expose some of common components:

- The Advanced Institute for ICTs (AIICT) was mooted as a mechanism to forge partnerships between HEIs, industry and the public sector. As envisaged, the AIICT will be allied to – but distinct from – existing HEIs. It will be complementary to the (evolving) higher education institutional landscape, and will not seek in any way to compromise HEIs or their resource streams. Equally, it will not seek to pose a threat to industry. On the contrary, it will seek to create new alignments in the ICT landscape, aim to give rise to a steady stream of indigenous ICT competencies and hence stimulate an associated emergent ICT industrial sector and public service competence.

- The AIICT aims to pull together the complementary strengths amongst people in industry, HEIs, research labs and NGOs by "sitting between" these diverse institutions. The AIICT's focus areas may well be inspired by challenges arising from generic ICT, mining, biotechnology, manufacturing, environmental issues and so forth.
- The AIICT is a logical element of the R&D Strategy's IT technology mission. Its mandate will have to cover such issues as people development, high-quality research, innovation, local and global impact, effective networks and partnerships. Such commitment to excellence can also attract highly skilled people from abroad, including people who may have left South Africa because of a lack of challenging opportunities. The country can thus become a global node for ICT innovation, creating a flow of people and knowledge that consolidates South Africa as a serious global player in ICTs.

CONCLUSIONS

Compared with the rest of Sub-Saharan Africa, South Africa's ICT industry looks impressive. However, when compared to the fast growing and evolving global ICT industry, it is clear that our ICT sector's growth and development is being stifled by many factors. These include:

- Lack of a coordinated National ICT policy across the government departments
- Inflexible and outmoded regulations, and uncertain regulatory processes
- A crippling lack of appropriately skilled ICT professionals and technicians compounded by inadequate training and education mechanisms in both public and private institutions
- An historical focus on redistributing into Africa ICTs produced in the "1st world" in response to "1st world" needs. There remains very little indigenous ICT R&D or SMME growth, particularly, focused on the needs of the vast majority of Africa's population: the disadvantaged, the poor, and the excluded.

Again, compared with the rest of Sub-Saharan Africa, South Africa's tertiary sector appears to be doing well. In fact, if UNESCO's *Education for All* philosophy is accepted, the global tertiary sector is in crisis, and South Africa's tertiary sector may even be regressing. For example:

- Most HEIs have done little over the past 10 years to adapt to the needs of the new South Africa, to implement redress, or to understand and lead either society's transformation or their own institutional/sectoral transformation.
- The NPHE appears to be addressing issues of efficiency and effectiveness, rather than encouraging the tertiary sector to broaden its vision and address the needs of the 100,000 of potential students still being neglected in our remote, rural and disadvantaged communities.
- Few HEIs produce learning material that satisfies the ICT needs of the ICT sector itself, let alone the ICT "enablement" needs of the public sector, the private sector, or the "development" sector.
- Although some ICT R&D is taking place in several of South Africa's HEIs, most of it is ad hoc, of variable quality, uncoordinated, and unmonitored. Again, the involvement of, and relevance to the ICT sector is far from being optimal.

Left as it is, there is little hope that these two sectors will quickly overcome the existing problems, let alone growth of successful partnerships that play a significant role in socio-economic development of the country and region. However, within many institutions in both sectors there are many people with the necessary skills and drive to begin to successfully address our socio-economic challenges. We need new, innovative mechanisms and processes to enable these people to contribute. Perhaps these should be the "innovation nodes" and/or "centres of excellence" suggested by the national R&D Strategy to overcome the "innovation chasm".

In effect, the ICT and HEI sectors are currently almost totally de-coupled. However, if the above mentioned innovative mechanisms could be used to more closely link the two sectors, the following opportunities for a wide range of potential collaborations and/or partnerships become viable:

- Direct interactions between HEIs and the formal ICT sector;
- Recognising the cross-cutting impact of ICTs – enabling most other sectors;
- Recognising current and potential impact of ICTs on traditional HEIs;
- Recognising the role of ICTs in the massification of the tertiary sector.

Satoki T. Mahenge
Institute of Educational Technology
Open University of Tanzania
Tanzania

The Role of Information Technology and Challenges of African Universities in the Use of ICTs for Distance Education

1. The Role of ICTs in Distance Education

Introduction

According to 2000 Schools Online article, it is pointed out that although the world has already entered the information age, majority of us do not enter it together. The disparity between people with access to the technology and those without access is outrageous. Even though the Internet is referred to as world wide, less than 2% of the world population has access to it (www.schoolonline.org). The rest 98% without access is largely from developing countries. Moreover, while communication and information technology is transforming the industrialized world, developing countries are basically cut off from this transformation. The purpose of the paper is to focus on the role of the Information and Communication Technology (ICT), in distance learning in African Universities, in particular. Its role has been described by tracing the historical development of utilization capacity, and what it has made available to the present world of education. The paper ends by highlighting some of the challenges for consideration in strengthening the role of ICTs in teaching and learning in the African universities, especially institutions dealing with **distance education.**

The concept of **distance learning** is used interchangeably with the notion of **distance education** in this paper. Unlike on-campus education, where students and lecturers interact personally on daily basis, distance learning can be described as the type of education offered to students who are distant from the institution. The technology of distance learning is a combination of methods, forms and means of student/teacher and student/faculty interaction in the process of independent, but guided study of a particular field of knowledge.

The communication between learners and instructors in distance learning must be provided by technologies. There is a wide variety of available technologies: radio broadcasts, television, audio and videotapes, interactive audio and video teleconferencing, various computer and Internet technologies, as well as print technologies. Mixtures of technologies will always provide better results than any single technology (http://wbweb4.worldbank.org/DistEd/Technology/technolgy.htm1).

2. Historical Development of ICTs in Education

During 1960s and early 1980s the mainframe and minicomputer-based systems were essentially used for payroll and big research data analysis. The people who had direct access were part of an isolated and highly specialised minority known as Management Information Systems Departments. The computer systems worked as disintegrated islands of technology (Tapscott and Custon 1993). During late 1980s and 1990s the technology was advancing tremendously making a smooth transition to the new technological paradigm in the developed countries. For example, the invention of a microchip for microcomputers and its massive production for the market has made a leap toward affordable prices.

Information and Communication Technologies (ICT) represent recent technological revolution that actually started since 1980s. It has gained the technological impetus with positive popularity in educational settings in developed countries. Whereas other conventional media technologies had en-routes in classrooms, apparently they did not make substantive impact compared to the early indications of ICTs. For example, film projectors, radio receivers, television, slide and film strip projectors, overhead projectors, and so on have come in some schools and universities and gone forever or are replaced with new technologies. Good examples include 16-mm motion film technology replaced with the video technology, a manual typewriter replaced with the microcomputer processor, a duplicating machine replaced with a photocopier and so on.

Most African classrooms, including Tanzanian, have had very little use of the abovementioned educational technologies and in most cases have never seen them at all, let alone using them. On the other hand, invention and development of microcomputer technology under the integrative system with telecommunication systems have paved ways to apply ICTs in classrooms in both developed and developing countries.

The very nature of the technology in terms of usability, efficiency and user friendliness will forever be among the most powerful tools of societies. Technology innovations will continue in modified shapes and sizes, increased hardware capacity and updated software. Developing countries seem to be grappling well with the technology in work places and classrooms. Upgraded software, and integration in multimedia, use of integrated data, text, voice and graphics have transformed the environment into the ICT societies. It is, therefore, expected that the 21st century will disclose more of the technology to place the world at a better position in development (Tapscott and Custon 1993). Tapscott and Custon caution the organisations and educational institutions, which do not undergo a transition to the new paradigm technologically, as they will find themselves irrelevant or obsolete.

Kaye (1995) points out that technological influence on the methods, systems, and software that justifies the use of ICTs in education and training, include:

(i) growing availability of low cost yet more powerful microcomputers at home and work places;
(ii) arrival of multimedia in the market, which can be used for all traditional microcomputers software to receive television and video, telephony and fax via a single communication technology;
(iii) increasing miniaturisation of components for portable personal computers (laptop);
(iv) development of interfaces for voices and hand-written inputs;
(v) globalized academic materials and networks attract more users. For example, in January 1991 less than two million people used the Internet. Three years later (1994), twenty million people used it. One can imagine how many people will use the Internet in the 21st century;
(iv) expansion of personal wireless communications from telephony to data-transfer (satellite communications, etc.) and computerised cellular phones.

The above factors available, African Universities can utilise ICTs to reach all students in close and common areas to start with. For example, satellites can be used to beam up educational materials to remote areas and interact with the students, accordingly. Considering the mentioned factors (Kaye 1995) in purchasing and adapting ICTs, one would expect it would be a challenge for African universities to utilise them to the full during the 21st century. The more access to the technology the universities have, the more they get excited by the wonderful nature of its capacities to work out different tasks. It being the case of the nature of diversified and distantly remote students registering for higher studies, one would tend to believe that African Universities would play a key role in utilising ICTs.

3. Capacity of ICTs in Distance Education

Most evaluation studies of ICTs show that it is the learning contexts, which determines the success of an innovation of a particular technology, not the technology itself. For example, the integration of new medium in the course, the support provided by the institution in terms of study resources and opportunities available for interaction, reflection and feedback from the lecturers, can functionally be a part of transformable instructions for students' learning (Mason, 1995). Information and Communication Technologies cover wide ranges of facilities that can be used by distance education as well. They form what is known as interactive multimedia including computers, the Internet, e-mail, CDs, television, video, radio, camcorders, electronic texts, computer-fax and many others. These technologies that formally operated as separate entities are now pooled in one system of computer technology under the umbrella of ICTs. One can now listen to radio programmes using a computer as a receiver instead of the traditional radio receiver.

Similarly, one can read electronic printed materials in books, journals and so on using computers. Some printed material can be downloaded for printing and photocopying. This is a remarkable technological development that the 20th century has offered. Pioneers are now working on computer technology with proper artificial intelligence, which will be capable of predicting/recognising human thinking, and sound to facilitate interaction between a human and a computer, just as it is between humans. Such technological development would also be useful in

distance education where university lecturers can interact with their students as if they were face to face on campus.

In traditional distance education, students may find it very difficult to apply in detailed and well-focussed discussion of their study activities. Recent information and communication technologies can provide valuable enhancement of interactive accessibility of human to human through the Internet and teleconferencing. Essentially, one of the most important functions of the ICTs is in providing the most efficiently interactive distance teaching and learning environment that succeeds in improving students understanding where other physical human interpersonal teaching methods have failed. Together with the interactive multimedia facilities, ICTs are capable of delivering tutorials in various subjects.

The technology is the expert people who programme learning materials with special effects in instruction. For example, the experts have been able to programme instructions that can also cover simulations, exercises, tests and examinations, which may be password-locked or open. Students' accessibility to immediate feedback through performance results facilitates a more challenging and motivational learning environment. Apart from instructional teaching, the technology is capable of identifying errors in students' performance and rendering alternative guidance where necessary. This being the case, university lecturers and professors in developing countries face a big challenge to model their styles of teaching in pursuing what new ICTs can offer in developing transformable learning activities for distant students.

The development of ISDN software has enabled the ICT technology to be more efficient. ISDN is a set of international standards for computer and communication technologies that support video, audio and computer data on a telephone line. With the ISDN educational multimedia material can be easily accessed, processed, and stored through ordinary telephone network or satellites. ISDN can combine a live voice linked with a shared screen. That is to say, it can be possible to link two or more very distant sites into one shared screen. For example, a distant lecturer can be linked with distant students or classrooms to interact face to face as if they were all in the same classroom. Similarly, during conferencing, students from different sites can see and listen to lecturer from any part of the world using several monitors.

Students can ask questions and discuss their views live with a very distant lecturer. Virtual universities have been more efficient through the use of ISDN, so that students from various parts of the country and beyond who are linked to the network can study various courses. Such approach is also applicable to conduct seminars, peer interaction, demonstrations, and training sessions at distance (Saba 1990; Ambron 1990). Kaye (1995) points out that much significant learning and deep level understanding arises from conversation, arguments, debates, amongst and between learners and peers, colleagues, experts and teachers. Brunner (1984) argues that learning is essentially a communal activity involving the social construction of knowledge.

Time is ripe for African Universities to reform the teaching approaches, so that students can learn programmes in different subjects more efficiently and effectively. Training students to use ICTs and providing ICT facilities to various local centres are a prerequisite to successful reformation of teaching approaches. Fast access of students and lecturers to textual database, graphics and file transfer facilitated by the ISDN, means possession of an enormous range of human and material resources and activities. There are virtually no geographical limits in accessing database worldwide. Traditional methods of distance teaching and learning are becoming obsolete in most developed countries. Similarly, very soon the traditional distance teaching and learning will become out of date in developing countries in the 21st century. The need for every academic and administrator of the African Universities to learn how to use ICTs most efficiently and effectively is cardinal. There is no choice for an academician and an administrator in any university today to see the technology as belonging to a typist, a secretary or even highly specialised groups of people.

In higher education, the growth rate of the World Wide Web (WWW) use is becoming profound. Many universities and lecturers/professors are developing their own "home pages" for their teaching programmes. With this facility lecturers and professors can now elaborate course materials in various

disciplines as a part of home pages available to their students most useful for distance education as well. The course materials become available and accessible all over the world (Gilbert, 1995).

Explosion and integration of telecommunications and computer technology make activities that were thought impossible – possible. For example, today there is an increased human contact and interaction all over the world in a matter of seconds. The technology introduces profound changes to the world around us in various ways at home and working places. Essentially, the technology assists the world to reorganize fundamentally work places into information-dependent societies.

The technology has also opened doors of education to facilitate efficient and effective teaching and learning, particularly in distance education. This is a big shift from the traditional teaching through printed book to electronic teaching using electronic learning materials. Mason (1995) points out that now the real question on the use of ICTs in education and training is not "why" but how to use it wisely so that it promotes learning.

This fundamental question of "how to use the technology wisely" poses an essential challenge to the African universities that are still using the traditional approach of chalk and talk, printed books and handouts to deliver the subjects. The challenge starts at decision-making, policy formulation, planning and useful initiatives and efficient development with stages approach. For example, how can a university of a developing country best organise effective and sustainable implementation of ICTs with equally important priorities and scarce resources? How will the same university balance the distribution of ICT network in a remote and highly scattered rural population where telephone and electricity are either absent or unreliable? These are some of the basic questions in the majority of developing countries, including Tanzania. Research and evaluation approach is also important in identifying priorities in order to be well focussed in initiating and developing ICT facilities for distance education.

3.1 Some Clues to Develop Teaching Materials for Distance Education

Holmberg's theory of a guided didactic conversation on developing distance learning materials suggests that the following should appear:

- Easy accessible presentation of the study matter: for example, clear, somewhat colloquial language in writing that is readable with moderate density of information.
- Explicit advice and suggestions to the student as to what to do and what to avoid, what to pay particular attention and consider with reasons provided.
- Invitations to an exchange of views, to question and judge what is to be accepted and what is to be rejected.
- Attempts to involve the student emotionally so that he/she takes a personal interest in the subject and its problems.
- Personal style, including the use of personal and possessive pronouns.
- Demarcation of changes of themes through a change of speakers, e.g. a male followed by a female or through pauses, where it is applicable.

The above techniques make distance-learning materials excessively polite and thus different from traditional textbooks. The main task of institutions dealing with distance education is to integrate the structure of teaching by providing a complete learning package from pre-enrolment counselling to examination and accreditation. However, new technological development has allowed much easier, faster, and more varied contact between tutors and students, between students and the faculty, to organise work of peer groups of distance students online.

In the context of general move to a global information environment, an environment of educational services in the Internet is becoming a very useful approach in DE. Today the technologies allow the video, audio and computer interaction with much less difficulties and expenses. The progress of information technologies changes profoundly the face and character of modern education. Hence, Computer Mediated Communication (CMC) and Computer Mediated Instruction (CMI) are becoming commonly interactive and allow textual exchange in bearing networks in distance education.

According to many DE researchers the near future will bring dramatic technological and organisational changes such as:

- Computer technologies will keep developing. New learning databases will be created capable of simulating different micro-worlds (fields of knowledge), computer programmes will appear which will provide easy and flexible connection between a tutor and a student, students and database.
- A vast multimedia academic network will appear, which will embrace all institutions of higher education in a country or region. Every student will have access to that network from home or from his/her working place with the help of special commercial service centres.
- Every institution of higher education will be equipped with a powerful computer network. Every tutor will have a PC and access to servers, which distribute learning and other necessary educational materials.
- A higher level of standardisation and compatibility will characterise different computer systems and networks.
- All parties to the educational process – students, tutors, administrative workers, etc. – will become literate users of modern information technologies.

The above changes will promote transformation of asynchrony teaching methods into synchronic ones, passive education into active. Static presentation of learning materials will become dynamic (with the use of video and animation); virtual ones will replace real objects. Similarly impersonal presentation of learning materials by individual tutoring will be replaced by interactive communication. Students will get better control of the educational process.

3.2 Types of Technologies for Distance Education

Due to the nature of distance teaching and learning African universities are also expected to have the highest concentration of the latest advance in ICT facilities and human commitment in using them. The following table enlists some important technologies to be used in delivery of distance education.

- E-mail
- Teleconferences via e-mail
- Mail servers
- Electronic billboard
- Electronic libraries
- Access to databases via e-mail
- Video and audio-tapes
- Electronic textbooks
- CD-ROM
- Teleconferences in the online regime
- Access to databases in the online regime
- Voice mail
- TV – broadcast of lectures
- TV – broadcast of lectures with feedback by phone
- TV-video conferencing
- Computer based instructions

4. Challenges of African Universities in the Use of ICTs for Distance Education

One of the problematic issues of universities dealing with distance education in African countries is management of communication with students who are scattered all over in each country. Other constraints include:

1. Financial limits and the need to increase students enrolments.
2. Dispersed student population, especially in rural areas.
3. Desire to interact with students in teaching and learning.
4. Need of equal distribution of educational facilities and materials in different disciplines.
5. Desire to network ICT facilities in rural areas and small towns without electricity and telephone system, which are sometimes available but unreliable.
6. Flexible timing for all students as nearly all distance education students at the university level are full-time employed workers.

The above constraints compel such universities of developing countries to face a big challenge in establishing and managing Information and Communication Technologies (ICTs) efficiently to facilitate distance teaching and learning.

4.1 Endeavouring for Successful Work in ICTs

By the end of the 20th Century people pondered about entering the 21st Century. The expert explanation of the promises of the 21st Century was echoed by political euphoria in rhetoric mass mobilisation as **time for science and technology.** The promise held the public enthusiastic hope as if the new century was like another brand-new fully furnished house. Others discussed the third millennium of science and technology as if we could have things already worked out for us to enjoy them.

However, the 21st century or the 3rd millennium likens to an empty house for countries to strive hard to fill it either with new inventions or to improve what we have created during the 20th century. Essentially, the 21st century is merely a continuation of other previous centuries starting with Stone Age technology, later to abacus and simple calculator age, right through to the industrial revolution to the present information and communication technology age. Each stage human beings **toiled hard with obstacles to event and use** new technologies to solve various problems, including obstacles related to geographical distance, scattered and expanding population, diseases and climatically hash evils, as well as problems connected with teaching and learning.

The continued human effort has made a breakthrough of inventing Information and Communication Technologies launched at the end of the 20th century to solve the problems of information processing and communicating. Such effort requires parallel pursuit in utilising the technology. Hence, it is expected that African Universities will also endeavour in availing more new inventions and full utilisation of the technologies for more efficient and effective teaching and learning in the 21st century. It was pointed out that Tapscott and Custon (1993) cautioned that each organisation has to strive hard using whatever means to acquire and fully utilise ICTs to enhance its development, otherwise it may find itself irrelevant to the society it belongs.

4.2 Setting of ICT Resource Centres at District Level

Ideally, African Universities engaged with distance education should deliver education electronically to each individual student's home. Time will come in favour of developing countries to have highly developed technological environment for African Universities to reach individual students at their doorstep. However, for the Universities that have not been able to reach students at district level, efforts should focus on doing so as economic resources avail.

The objective of having resource-based centres at district level is to make learning more open in terms of students' access to courses which might not otherwise have been available due to various reasons. Essentially, resource-based learning allows open access, self-directed learning from a large up-to-date information resource (Taylor, 1995, Davies, 1989). It is assumed that in each district headquarters, there are electricity and telephone systems, which form a necessary environment to install ICT facilities in each District Resource Centre.

Distance education students have always lacked access to a wide range of materials for study. Unlike students on campus, they mostly depend on textbooks, journals and course-outlines. Not all students have enough money to buy various recommended supplementary books and journals. Rural areas do not have libraries for university students. With ICT, electronic database resources can be available both on the on-line network and through CD-ROMs. Using electronic database, Resource Centres can provide up-to-date reading materials and bibliographical information for students and course lecturers/professors by linking with various websites. It will be easier for university students to access ICT resource materials at district level than go to the Headquarters or have them even at regional/provincial level.

Since developed countries have made successful efforts within a short time and improved the quality of delivering Distance Education at all levels of educational system, including universities, it should also be possible for African Universities to emulate such efforts. For example, in early 1999 England

and Wales passed the policy and curriculum assuming that all teachers at all levels of school system must master skills on how to use ICT facilities as a condition to be qualified in the career of teaching. To implement this policy effectively, the government has issued a statute that every qualified teacher at all levels of school and university systems will be given a microcomputer for ICT use. Some developed countries have advanced in the use of ICTs at the universities to a point that there is no marked difference between on-campus and distance education universities' in delivering the studies.

4.3 Consultancy, Guidance and Counselling Services

Provision of consultancy, guidance and counselling services is very important in assisting registered and potential university students in distance education. Such services would also apply at the initial stages of using ICTs. The services are essential because the universities engaged in distance education face a high rate of students' dropouts and unnecessary long period of studying. Existing residential universities receive most of students from schools and very few from work places. The on-campus environment provides students' sustainable learning climate based on interpersonal interaction at the lectures, seminars and tutorials augmented by physical availability of reading materials in on-campus libraries.

On the other hand, nearly all distance education students come from working groups aiming to improve prospects of their career but for various reasons have not been able to apply for residential university studies. Under their respective prevailing circumstances this latter group needs similar and even more guidance and counselling than, may be, the residential students. That being the case, one of the functions of the University district resource centres is to provide continuos guidance and counselling based on course structures and selection, study and communication skills to use ICTs, time management and building confidence, addressing students' personal questions that affect or may affect their learning.

4.4 Policy and Planning

Any large-scale innovation in an educational system is very costly in terms of funding the infrastructure, equipment, materials, manpower, and running the programmes. Furthermore, it is costly in paying bills for services rendered by other public departments and private companies such as telephones, televisions, media programmes, electricity, water, etc. Given the limited resources available, it is understandably sensible not to attempt starting the impossible projects. Distance education of an African university is just as important to a country as an on-campus university. In that order full support is needed from the respective governments, private companies, public in general and international organisations.

Majority of countries and their respective educational systems are undergoing major transformation in the use of ICTs. Successful transformation will highly depend on thoughtfulness in policy-making about the role of the technology in education. On the other hand, the technology appears somewhat expensive to be introduced in the education system. It also requires new initial investment and transition period to adjust to a new working environment.

As people discover the potential benefits of using the technology in relation to cost benefits, they always want the technology to be part and parcel of their working environment. What is basically needed is careful planning and commitment in policy formulation and economic support in working toward establishing ICT network for the entire education system. In other words, African universities should start reflecting the 21st century demands rather than 20th century forces in educating and training students who will be relevant in the 21st New World of work.

Most of developing countries, especially Tanzania, suffer tremendously from the lack of reliable power source and telephone systems for rural population. For example, Tanzanian rural areas form about 83% national population. Tanzanian master plan includes provision of electricity service to all rural villages. Possibly, the telephone network will also be provided to all villages. The two utilities are almost the heart for ICT functioning. Responsible government and their respective electricity and telephone companies need to consider the concession for the universities to be able to get ICT services in all parts of each country.

On the other hand, the respective governments of developing countries can stipulate clear and sustainable policies that will ensure free or concession services to various educational institutions. For example, it should be a policy in providing free bandwidth of national telephone systems for university ICTs. The same policies should apply to other very important utilities and media services such as television and radio, so that some channels or parts of programmes some days should be free for universities. In that way the use of ICT facilities and programmes can be less costly, especially when considering the long-term costs.

4.5 Infrastructure, Equipment and Materials

Infrastructure is a concept used in this article to cover buildings, power, and telephone systems as some of the basic requirements for ICTs to work efficiently. Similarly, equipment and materials include microcomputers, satellites, television and video systems, and strong up-to-date library and bookshops' facilities. Although the above facilities require big initial budget, they are cost saving in the long run, if the ICTs are efficiently and effectively utilised. For example, the long-term benefits of using of ICT may be seen in the cost paid by the governments, students and public in general in distance education. A good contrast is between an on-campus student at the University of Dar-es-Salaam (UDSM) and a distance education student at the Open University of Tanzania (OUT). An Education student at UDSM is expected to spend about TShs.1,801,200/= per year (undergraduate degree); TShs.3,993,200/= (Masters degree) and TShs.5,961,200/= (PhD.) ***[UDSM Prospectus 1998/99].***

On the other hand, a counterpart of the OUT taking distance education pays about TShs.120,000/= (undergraduate degree) per year; TShs.500,000/= (Masters degree), and TShs.1,000,500/= (PhD degree) ***[OUT Prospectus 2000].*** The difference is significant in that the on-campus undergraduate student spends TShs.1,681,200/= more than a distance undergraduate student. Similarly an on-campus Master degree student spends 3,493,200/= more than his/her counterpart at OUT, and a PhD student at UDSM spends TShs.4,960,700/= more than his/her on-campus counterpart.

Other ways of minimising costs of networking and managing the ICT for distance education can be considered. For example, there is a need for all universities in each African country to formulate and act on common strategies of ICT applications for education in order to minimise costs of networking and managing the ICT services. Having achieved this stage in each country, the same strategy can be applied for all African universities in the continent to be educationally interlined through ICTs to share education and training by distance.

4.6 Meeting Students' Needs

In a country like Tanzania where 83% of the population is living in very scattered rural areas, one would assume that there might be more potential students in such areas for universities. Lack of means for efficient communication justifies minimal or no registration of students for distance education. A few who manage to register in studies have problems of communication either at the regional level or headquarters. Basically, the problems amount to failure in meeting a full range of students' learning needs.

The above limitations require a systemic approach to solve most of the problems. Universities alone cannot solve their problems without sustainable support from the governments, International Organisations, national cooperation and private companies that provide nationwide utilities. Follow-up studies are necessary to identify students' needs and specific problem areas, so that ICTs are employed according to the educational needs of universities and **not by the technological whims and business-oriented fancies.**

4.7 Training of Staff and Students

Much of the initial work must be done first to change the attitudes of working staff in African Universities to shift from traditional approaches to distance teaching methods to the modern instructions that transmute learners. The integration of educational approaches with worldwide network transform learning environment through contact of different types of human and non-

human resources. Basically, the resources from all over the world can facilitate transformative learning process for students. It is out of this new learning environment that the role of students and lecturers will change.

Introduction and adaptation to a new innovation highly depends on changed attitudes and training. Such attitude change demands both national and institutional policies on the use of ICTs. The initial stage of introducing a new innovation has a tendency of facing some resistance, especially if it is completely new and interferes the already established old working habits. People tend to fear interacting with new machines as if they were "wild beasts quite unsafe to handle them". In order to effect change of attitudes and old working environment, there is a need for all members working in the universities to learn how to use ICTs, including those who work at the headquarters and zona/district centres. A policy should state quite clearly that knowledge and skills on ICTs is stipulated as a prerequisite to be hired to work at universities. In support to the training, all academic and administrative staff should have the ICT facilities in the offices at their disposal. Under such condition working environment can be more efficient than the one traditionally accepted.

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J. Irina
Head of Commission for Higher Education
Kenya

Closing Speech

Director of UNESCO IITE Prof. Vladimir Kinelev, Vice-Chancellor of Kenyatta University Prof. George S. Eshiwani, distinguished participants, ladies and gentlemen.

I am highly honoured to be asked to make a few remarks at the closing ceremony of this important seminar for high-level experts on *Policy Formulation and Practical Usage of ICTs for Higher Distance Education in Countries in Africa.*

I wish to thank UNESCO IITE and Kenyatta University for facilitating and organizing the seminar.

I hope that besides interesting discussions you will find and take time to visit our beautiful city and its environs. I am happy to note that yesterday you had opportunity to visit Kenyatta University to acquaint yourselves with some of the developments Kenya is undertaking in the area of higher distance education.

During the meeting you discussed a number of key issues and concerns related to the expansion of access to higher education, equity, curriculum and pedagogy, human resource development and the role of Information Communication Technologies in the process of education change.

I am happy to note that you have engaged yourselves with the concept of globalisation and its wide-ranging implications to your institutional, national and regional contexts. Your seminar programme shows the seriousness of approach in discussing the complex relationship between higher distance education and Information Communications Technologies (ICTs).

This meeting of high-level experts is an ideal forum at which you exchange ideas, research findings and experiences on current programmes and outstanding challenges and innovations at national and regional levels. I would like to single out IITE for its remarkable work in disseminating information on ICTs in education through seminars and workshops like this one. More encouraging is the commendable attempt of turning theoretical suggestions into practical process oriented to training manuals and courses in addition to initiating and nurturing the community of experts in the field of ICTs, educational change and innovation. I am confident that such capacity-building initiatives would result in the emergence and growth of a critical mass of experts in ICTs and education, who will play a crucial role in narrowing both knowledge and digital divides that characterize Sub-Saharan Africa.

The two keynote presentations identified and discussed pertinent features that characterize higher education and ICTs in Sub-Saharan Africa. The paper *Forming Strategies for Training and Retraining of Educational Personnel in the Usage of ICTs for Higher Education in Africa* succinctly contextualizes discussion on access to higher education, human resource development, financial constraints and the status of ICT infrastructure on our continent.

The paper *A History of the Future for Distance Education in Africa: Society, Education and ICTs* discusses the important concept of scenario planning in the context of massification of education provision.

I am glad to note that these analyses were then reviewed in the light of the IITE Educational Programme: Information and Communication Technologies in Distance Education.

I sincerely hope that your deliberations will lead to the formulation of policy and strategies for ICT usage that are relevant and practical to the Sub-Saharan Africa context. Your institutions, countries and regions strive not only initiate but forge collaboration and integration of programmes.

With these few remarks, I would like to officially close this seminar. I wish you a safe journey back home.

Thank you