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Impact of international cooperation on curricular, teaching methods and evolution of internationally accepted engineers: The African perspective

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ABSTRACT: The training and education of an Engineer depends to a large extent on his pre-degree foundation, syllabus of the institution, qualifications and currency of lecturers, availability of relevant and current textbooks, adequate infrastructure for instruction, and even government policies on education. Some African institutions have suffered largely because of unhelpful government policies, under-funding leading to inadequate infrastructure, student unrest and frequent closures. The application of Information Technology however promises to influence positively the training and education of engineers in African countries. This paper considers the impact of international formation using Information Communications Technology, on the training of Engineers. The issues of collaborative ventures in the evolution of curricula, syllabi and approaches to teaching are discussed.

INTRODUCTION

With the recent development in Information Communications Technology (ICT), the world has truly become less than a global village and indeed, a revolution as important as the Industrial Revolution has come alive. It has become increasingly difficult for the more developed countries to develop in isolation since ICT has resulted in shrinking virtual geographical separation between the developed and the developing world. ICT is already challenging slow-moving bureaucratic way of the developing nations since it forces the way people act and think. ICT causes important benefits for education, health care, environment, Job training, food security, management and government efficiency.

It has been said that ICT represents "a major opportunity for developing countries that can access and use it effectively and a threat to those that cannot"[Hanna & Boyson, 1993]. As laudable as international cooperation is, little can be achieved unless these is adequate awareness of the basic requirements to achieve maximum benefits in terms of human, material, infrastructure and political components. Cooperation of course need not be seen as a master-slave relationship but rather a symbiotic one, no matter the ratio of benefits to the main actors.

In order, however to achieve the maximum benefits, governments of countries all over the world must evolve well coordinated ways of making inter-governmental cooperation work. Unhelpful political, technical, and educational policies need to be re-visited. In particular, a universal and well-coordinated development of curricular, teaching methods and infrastructure should be addressed by a special body set up for such international collaboration.

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THE GLOBAL INFORMATION INFRASTRUCTURE (GII) AND INTERNATIONAL COOPERATION

Computer and communications technologies, the two elements of I.T. are transforming national and global societies and economies into information driven societies and economies. Global Information infrastructure (GII) is the instrument for such transformation [Radicella, 2000] GII is a worldwide assembly of systems that integrates four essential elements namely, people, communication networks, high performance computers and information services. Not only are people needed to operate the infrastructure, the issues of human capacity building is also paramount. Information services must provide the necessary data bases and libraries via the Internet. There is a dramatic increase in the number of users getting on line as shown in Fig 1. Unfortunately Africa and the Middle East lag behind in the statistics (Fig 2).

Since the GII is a global network that spans nations, true international cooperation cannot thrive without comparable rate of development of GII in all countries especially the developing ones. For effective international cooperation, there must be a desire and effort by the developing countries to grow at a rate comparable to that of the more developed countries. The absolute status of GII may differ between the two but the rate of growth must be comparable.

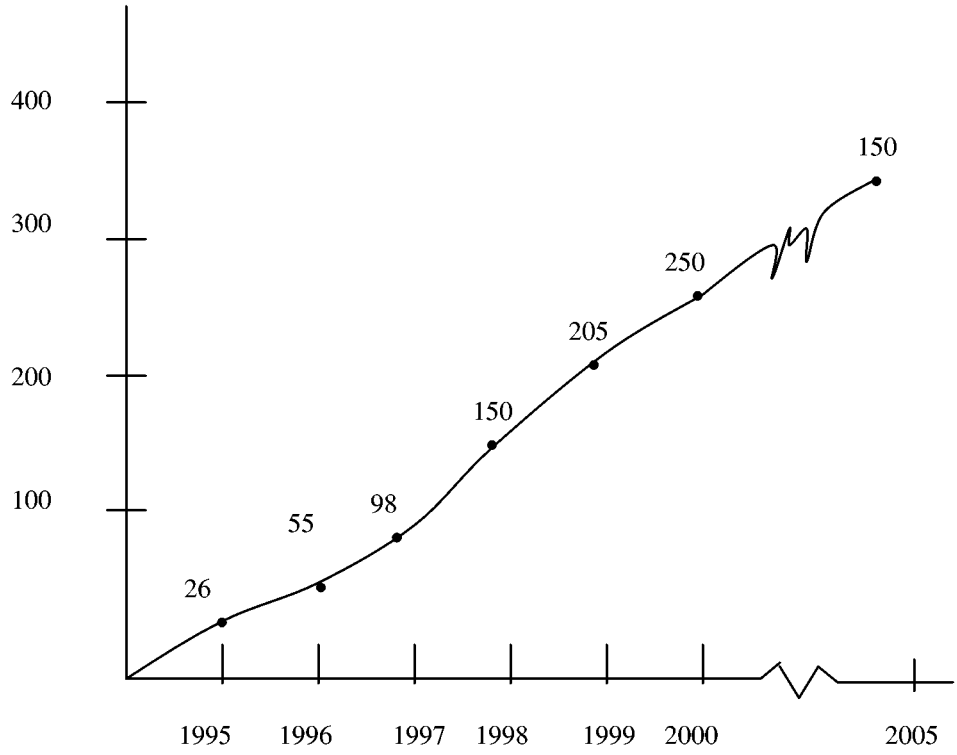

Figure 1. Internet statistics (How many online).

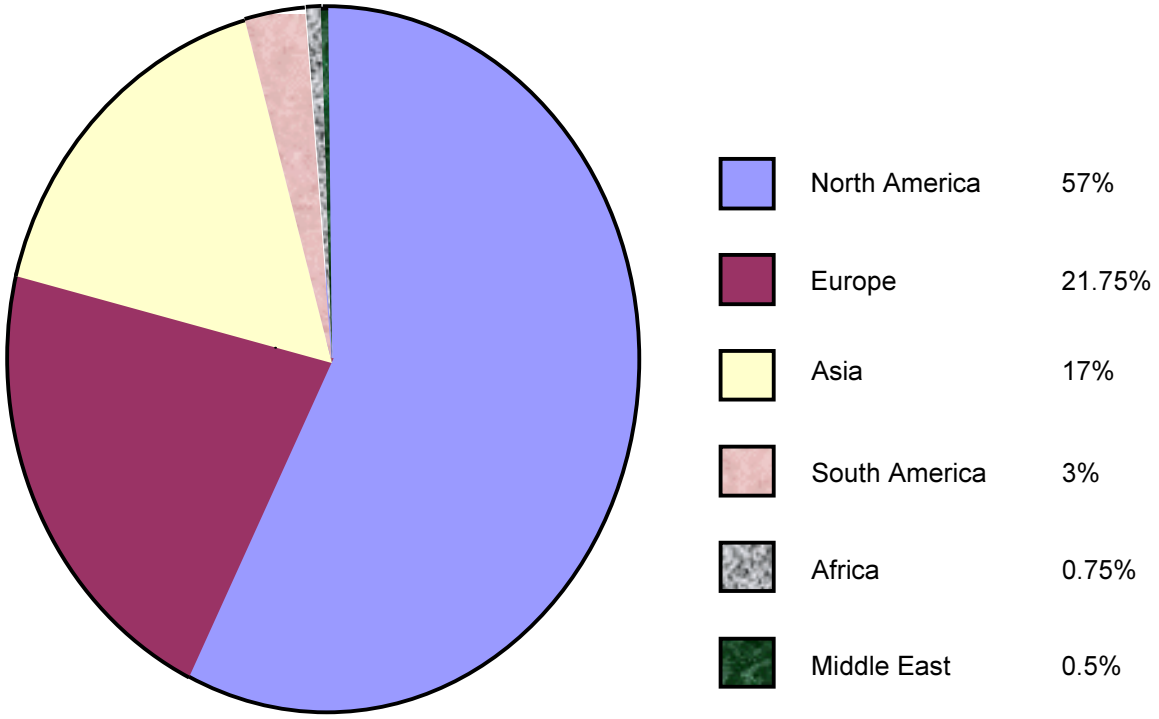

Figure 2. Internet statistics (Geographic Location).

THE ESSENTIALS OF AN EFFICIENT GLOBAL INFORMATION INFRASTRUCTURE [RADICELLA, 2000]

The determinants for an efficient GII are

(a) A good local loop access network technology using a mixture of traditional copper and optical fibre system and conversion to digital networks. There should also be a good urban infrastructure and digital subscriber line.

(b) An efficient long distance communication infrastructure using
  - (i) Synchronous Digital hierarchy (SDH) which allows the use of equipment from different manufacturers
  - (ii) Wavelength division multiplexed (WDM) which enables full utilization of bandwidth and
  - (iii) Asynchronous transfer mode (ATM), which is characterized by a high bandwidth and low delay.

(c) A good wireless infrastructure and a quick migration from analogue to digital. Table 1 shows a comparison of the migration in Africa and Asia.

(d) An efficient Internet infrastructure.

(e) Intelligent networks for easy integration of new facilities with the old. ISDN is the bridge between the old telephony and broad band communications.

(f) The necessary manpower to maintain the facilities.

Table 1. No of subscribers per service: figures in thousands (Repici, 2000).

Years	Africa		Asia	
	Analogue	Digital	Analogue	Digital
1995	455	1972	8367	1661
1996	772	2444	11829	5549
1997	1095	4594	12642	17467
1998	1119	8229	11132	34741
1999	764	15140	10787	60762
2000	543	21989	9355	85011
2001	363	28584	7684	110409
2002	117	36607	6219	136814
2003	0	40715	4533	163267
2004	0	45552	3167	191197

CURRICULAR DEVELOPMENT, TEACHING METHODS AND ICT

Curricular development may demand periodic overhauling of the overall educational system of a nation; beginning from the most basic level. In addition, the development of an internationally accepted engineer will depend on

(a) School Curricular
(b) Quality of teachers
(c) Availability of relevant information world-wide
(d) Teaching Method
(e) Industrial attachment.
(f) Post graduation experience
(g) Interaction with peers worldwide.

If indeed, cooperation between countries is tied to currency of technology and in particular to GII, then it stands to reason that curricular at all educational levels must reflect such trends in ICT development. For cooperation to work there must be minimum acceptable level of expectations met by all operators. In order to make a curricular globally accepted there is a need either for an international regulatory body on curricular development. This body must be broken down into sub- sections depending on areas of commonality and interest.

In Nigeria, curricular development involves the following

(a) National Universities Commission (NUC), a Government parastatal that governs all universities.
(b) The University lecturers
(c) Professional Bodies e.g. Council of Regulation of Engineering in Nigeria.

The NUC has evolved a document called the Minimum Standard Booklet" that stipulates minimum course contents, units, practicals, equipment infrastructure, staff/student ratio etc expected for each courses. Non-compliance in theory will normally mean non-accreditation of courses. Apart from this, professional bodies have parallel minimum standards which are generally more stringent than those from the NUC.

Because of ICT, curricular development and teaching method will not necessarily depend wholly on equipment and facilities on ground at a location but also on

(a) The extent of virtual learning facilities available to the cooperating institutions all over the world.
(b) The local infrastructure to access such facilities
(c) The will of the operators and institutions to make the cooperation work.

For most developing countries, stable electricity and reliable telecommunications infrastructure are among the most important factors that determine success.

SUGGESTED PROCEDURE FOR CURRICULUM AND TEACHING METHOD DEVELOPMENT INCLUDE

(a) Identification of interested institutions and faculties desirous of cooperation
(b) Specification of fields of interest of each institution
(c) Establishment of a joint body for review of curricular and teaching methods.
It should be noted that contents of curricular may not necessarily be same globally since local needs will form important input. For example, engineering design of buildings for the tropics may be different from that of the temperate zones.
(d) Identification of the local needs of each institution, the extent to which and how these needs are to be met.
(e) Preparation of a handbook listing available infrastructure, minimum standards, books, staff /student ratio, teaching methods etc at each institution. This should involve institutions and professional bodies from participating institutions.
(f) Identification of deficiencies and how to remedy these deficiencies
(h) Preparation of a joint agreement on the procedure to achieve the desired gains of collaboration.

PROBLEMS OF DEVELOPING COUNTRIES

Problems of developing countries and Nations include:

(a) Unstable government and inimical policies in the educational sector;
(b) Inadequate Global Information Infrastructure;
(c) High cost of communication. For example, in Somalia local internet service costs $120 to install, monthly fee of $30 and per minute usage charge of $0.75 [OnTheInternet, November/December 1999 pg 12];
(d) Brains drain and low staff strength due to poor remuneration and lack of motivation;
(e) Weak foundation in primary school training;
(f) Poor teaching and research facilities;
(g) Exorbitant cost of text books which puts books out of reach of students and staff
(h) Low level of general salary income but cost of installing a telephone line extremely high
(i) Low teledensity and low growth in teledensity; for example, Africa [Ajayi, 2000]

- has 12% of world population but 2% of world's main telephone lines and 1% of Internet loots.
- has 35 of the worlds 49 least telecommunication-developed countries of the world. Total number of telephones in African is less than that in Tokyo.
- has no well established network backbone that connects African countries and lack of cooperation between African experts in ICT.

(j) Little relationship between industry job and research work in institutions
(k) Poor level of computer literacy and awareness of the importance of ICT.

SOME STRATEGIES FOR DEVELOPMENT

Since ICT will be the major driving force of the global economy and academic development in this millennium, then the following strategies will be useful.

(a) Youths in developing countries need to be educated in preparation for the challenges in ICT.
(b) National Policy should exist to introduce ICT at Primary, Secondary and Tertiary institutions
(c) There is a need for well-articulated inter-governmental agreement.
(d) Involvement of academics and private sector in ICT and curriculum development
(e) Accessibility of up-to-date scientific literature via the Internet and WWW
  - e-mail (mailing Lists / Netnews)
  - electronic workgroups (Electronic Bulletin Board etc)
  - shared white boards
  - Scientific Talk voice over IP
  - Electronic green spaces (shared 3D virtual environment to teach science)

(f) Establishment of a National network with facilities to access internationally accepted databases.
(g) Establishment of specific virtual laboratories.
(h) Capacity building at local and national levels
(i) Discouragement of Government monopoly
(j) Establishment of academic computer networks with connectivities in each country e.g. Nigeria has a host of academic computer networks.
(l) Strengthening of some Internet initiatives in Africa.

At present, some helpful Internet initiatives exist e.g.

- Carnegie Cooperation
- Dutch Ministry of Cooperation
- International Federation of Library Association
- USAID
- Regional Information Network for Africa (RINAF)
- Cooperative Information Network (COPINE) linking scientists, educators, professionals and decision-makers.
- Abdus Salam International Centre for theoretical Physics (ICTP) / Obafemi Awolowo University (OAU) (Academic Computer Network Project).
- University of Kuoppio/Obafemi Awolowo University (collaboration on a Hospital Information System for Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC)).
- Regional Centre for Training in Aerospace Survey (RECTAS)/GDTA/International Institute for Aerospace Survey and Earth Sciences (ITC).

CONCLUSIONS

For successful implementation of cooperation in syllabus development and training, technological infrastructure must be improved in Africa. African countries must also become more visible on search engines.

Public and private policies must be changed to accommodate the new information revolution. The technical limiting factors affecting the developing countries must be addressed rapidly. Outdated networks must be replaced with modern ones.

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