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Information Communication Technologies in the Management of Education for Sustainable Development in Africa (Pp. 414-428)

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Abstract
The growing complexities of university governance and the challenges posed to university managers in Africa makes the application of Hi-Tech information and ICTs indispensable for quality assurance and goal attainment. The crucial role that ICTs play in effective management of university education for sustainable development in Africa was the focus of the paper. The paper analyzed the variables ICTs in students' learning, ICTs in teaching and research, ICTs in university administration, and challenges of ICT application in African universities. On the basis of the foregoing analysis, proprietors of public and private universities and their top management were challenged to embrace the ICT revolution, integrate them into all areas of university life and properly fund the timely initiative. The need for this decision is both urgent and demanding.

Keywords: ICT, managing university education, sustainable development, Africa.

Introduction

Management of Education

Education is a large social service enterprise made up of pre-primary, primary, secondary (including vocational-technical) and tertiary educational levels. It also embraces the adult non-formal including the open and distance, special and early childhood education (FRN, 2004). The dynamics of social change and the demands on education had always been the reason for the various editions of the National Policy on Nigerian education. The Policy (2004, p.4) asserts that the fourth edition was necessitated by some policy innovations and changes, one of which was the introduction of information and communication technologies (ICTs) into the school system. The federal government was to provide basic infrastructure and training for the realization of this goal at the primary school level (p.17). The national policy affirms that education is a potent instrument for solving most of the problems plaguing the nation in order to bring about national development (p.4). It therefore means that the lower - level, middle-level, and higher-level of education need to be properly managed for the enterprise to be result-oriented. Since education is accepted as a veritable instrument for national development, it seems that it is only when the three levels of education are effectively managed through the assistance of ICT initiatives for set goals to be attained that a sustainable national/economic development can emerge.

Sustainable Development

A sustainable society is one that meets its needs without compromising the ability of future generations to meet theirs (Akpan, 2007). Actions are considered sustainable if: there is a balance between resources used and resources generated; resources are as clean at end use as at beginning; the viability, integrity and diversity of natural systems and functions are restored and maintained; they lead to enhanced local and regional self-reliance; they help create and maintain community and a culture of peace; and each generation preserves the legacies for future generations (p.145). The three pillars upon which sustainable development stands are economic development, social development and environmental protection and it is only qualitative management of education that will provide the catalystic strength need to move the pillars towards achieving a rapid, efficient, equitable and sustainable development in a country (Imam, 2005).

The United Nations re-emphasized, inter alia, capacity building for sustainable development (UNCED, 1992). Capacity building relates to the ability to groom a cream of skilled and qualified manpower for developmental purposes. Umoren (2007, p.64) believes that the attainment of sustainable development is predicated upon the blending of human and material resources, since it takes an appreciable number of talented and skilled people to search for, discover and tap a nation's natural resources, mobilize capital and develop requisite and relevant technology for industrial production. He argues that a considerable amount of business-oriented training is needed in order to address the need for building the necessary capacity and knowledge on the use of sustainable development indicators. The concept of sustainable human development (SHD) which is said to be "pro-poor, pro-jobs, pro-women, and pro-environment" (Bassey & Effanga, 2007) can only be actualized through careful and proper management of education. For instance, when the objectives of education at the primary, secondary and tertiary levels are achieved, it is likely that poverty levels will be reduced in society since educated persons can go into paid employments or self-employments; can create jobs for themselves and employment openings for other people; women, especially housewives will be empowered educationally to aspire for paid employments, self-reliance or political appointments; and our environment shall be better off since sound environmental education should have been taught in the schools. Emeh (1997, p.207) believes that environmental education is needed if the goal of sustainable development is to be a reality. He argues that this decision will lead to environmentally sound production, sound consumption and sound political policies. It therefore seems that if our university curricula planners embrace environmental education as a necessary instrument of change, this instrument then becomes a tool for producing new types of consumers, producers and policy-makers who are guided by the global interest to adopt environmentally sound strategies for development purposes.

Information Communication Technology

Information Communication Technology is a network which offers a steadily expanding range of new services that have major economic consequences for the standardization of information in universities (Nwafor, 2005). It is computer-based tools used by organization personnel in the processing of their information and communication needs. It encompasses the computer hardware and software, the network and several other devices, e.g audio, video, photography, camera, etc., that convert information and so on into

common digital form (Yusuf, 2005a). Njoku (2006) identified three categories of ICT somewhere to be processed information (computer systems), disseminated information (telecommunication systems), and represented information (multi-media systems). Information Technology systems available for university administration in Rivers State have been listed as e-mail, internet, intranet, teleconference, facsimile (Fax), mini-computer, micro-computer, main-frame computer, word processing computer, and basic website (Nwafor, 2005). ICT is an eclectic application of computing, communication, telecommunication and satellite technology. Lopez (2003) argues that they have provided innovative opportunities for teaching and learning and they have engendered advances in research about how people learn, thereby bringing about rethinking the structure of education. The prevalence and rapid development of information communication technologies (ICTs) has transformed human society from the information technology age to the knowledge age (Johnson, 2007).

The objectives of the federal government of Nigeria on information technology are well articulated (Yusuf, 2005b): making ICTs mandatory at every level of education; developing ICTs curricula for primary, secondary and tertiary institution; use of ICTs for ICTs companies investment in education; study grants and scholarships on ICTs; training the trainer scheme for National Youth Service Corp (NYSC) members; ICTs capacity development at zonal, state and local levels; growth of private and public sector dedicated ICTs primary, secondary and tertiary educational institutions; and working with international and domestic initiatives for transfer of ICT knowledge (p.316). Two of the key targets set by the Agency charged with the responsibility of implementing the government's ICTs policy were the provision of information technology (IT) facilities for the various levels of education (primary, secondary and tertiary) including the Universal Basic Education Scheme; and providing of "training the trainers" using existing establishments, like the National Directorate of Employment (NDE) and the NYSC scheme (Iriaejen, 2002).

Babalola (2007) reports of a major reform and development in university education to be significant improvements in communication and ICTs improvements with its positive influence on teaching and research technologies. Also, a major tertiary education reform recommended by the World Bank (2002) was that there should be electronic networking involving e-mail communication capacities for teaching, learning, research,

management and performance monitoring of systems. The Association of African Universities (Emetarom, 2001) believes the universities should be sensitized to improve their management practices, especially their records and data collection processes, with a view to implementing management information systems (MIS) and strategic planning of their programs. Because of the enormous volume of information to be managed in the University of today, it is apparent that the computerized MIS is a sine qua non for effective goal attainment.

Conceptual Model

This paper was premised on the change model characterizing research, development and diffusion (R D & D) perspective of change. The four sequential phases described to achieve this were research, development, diffusion and adoption (Bassey, 2001). Nigerian higher education sector is at the d*iffusion* (i.e. third) stage of the application of this model (Ifinedo, 2007). This third stage consists of disseminating and demonstrating the intended change (ICTs). Series of demonstrations or displays are required by change agents (e.g. salesmen and computer companies) in order to build a positive conviction about the innovation. The first and second stages (*research* and *development*) provided the idea and needed validity, innovation, and design, respectively. The fourth and final stage is *adoption*, which consists of trial, installation and institutionalization phases. Here, change agents will try out the innovation in the context of particular situations before operationalizing for use in specific situations. ICT is an innovation in the education industry. Its application in higher educational management in Africa needs to be properly diffused before massive adoption (trial, installation and institutionalization) is expected.

The paper was an attempt to explain the crucial role that ICT can play in the effective management of higher education for sustainable development in the developing countries of Africa in the 21st century. Specifically, the paper analysed the variables ICTs in university teaching, learning, research, administration and challenges of massive application of ICTs in African universities.

ICTs in Students' Learning

On the perception of impact of ICTs (or e-learning) on students' learning at University of Botswana, Tella (2007, p.91) found that students were able to access information material anywhere anytime; saved students' time and

enabled courses to be covered in time; improved the quality of their instructional materials as they had opportunity to download more information from websites; catered for different learning styles and reduced the pressure on the students which formerly involved going to class; and catered for variety of learners. The fact that these students could access material anytime anywhere and catered for different learning styles of students relates to the issue of flexibility, meeting individual student needs, and building self knowledge. Researchers believe that students are able to forward completed assignments to lecturers through the e-mail; monitoring of students is made easy; managing large classes of 300 or more students is rendered more effective; time is saved and course management is made more flexible (Delvecchio & Loughney, 2006; Mutula, 2002). It is argued that the use of ICTs enhance students' learning through its constructivist approach which improves the performance of students; makes possible the application of multiple technologies (video, computer, telecommunication, etc.) thereby linking theory with practice; valuable computer skills needed in the job market are provided to students; flexible learning is available and accessible thereby catering for students of different learning styles; opportunities for students to collaborate and communicate on projects is increased; and a repertoire of resources to enhance students' learning are provided (Lopez, 2003; Yusuf, 2007).

ICTs in Teaching and Research

Available literature indicate that integrating ICTs in teaching and research is generally positive, leading to radical shift from the traditional teacher-directed/didactic approach to a more student – centred/constructivist approach (Lopez, 2003; Kirschner & Woperies, 2003). Langlois (2001) positions that ICTs in teaching is less expensive, enables lessons to be introduced speedily, provide consistent message, make possible working from any location anytime updating contents easily and quickly, increase learners' retention and management of large group of students. It is argued that ICTs increase the productivity of lecturers and secondary school teachers; help teachers to be more effective and productive; increase teachers' interest in teaching; assist teachers in reorganizing and restructuring their course(s); increase teachers' emphasis on individualized instruction; provide teachers with the opportunity to experiment with emerging technologies thus providing multi-media presence in the classroom; and also provide teachers with increased opportunities to collaborate and network with colleagues (Yusuf, 2007; Tella, 2007).

The competencies that teachers of ICTs require for application in education are that: teachers should become competent to make personal use of ICTs; competent masters of a range of educational paradigms that make use of ICTs; sufficiently competent to make use of ICTs as a tool for teaching; competent in mastering a range of assessment paradigms which make use of ICTs; competency in understanding the policy dimension of the use of ICTs for teaching and learning (Kirschner & Davis, 2003). Yusuf (2007,p.47) argues that in using ICTs, lecturers should be competent in the use of a variety of software, particularly, softwares that have specific application in various disciplines, e.g. lecturers in education should be able to use statistical packages (like SPSS) to enhance their output.

The value of ICTs is very important in designing research, implementing experimental and descriptive studies, statistical analysis, data production, storage, and dissemination of research information. Science used to be composed of two endeavours – theory and experiment - but today it has a third component (computer simulation) which links the other two (Colwell, 2000, p. 6). Yusuf (2007, p.47) and Middleton (2000) contend that ICTs facilitate research in the universities in the following ways:

- Lecturers are enabled to be guided into new frontiers in basic and fundamental researches.
- Lecturers are provided with greater opportunities for research collaboration and networking among scholars.
- Research in any discipline is facilitated as they provide quicker and easier access to more extensive and current information through digital libraries, electronic list, gopher, CD-ROM, etc.
- Complex mathematical and statistical calculations which are important in research can be solved within few seconds, e.g. data manipulation and analysis.
- Ready avenue for disseminating research reports and findings is provided, e.g. e-books, e-journals, etc.

ICTs in University Administration

A strong information system support is vital for meaningful progress in the management of complex organizations, like the university of the 21st century. Yusuf (2005b, p. 316) argues that the ability of modern organization to attain its set goals and the decision-making efficacy of contemporary managers is no longer dependent on just the quality of the manager, but more

importantly is a function of the quality of information channels feeding and transmitting their actions. The Association of African Universities (2001) has observed somewhere that as a complex organization, the universities are required to handle large volume of data which they must process speedily in order to provide information for management decision-making as well as meeting the information requirements of the various, clientêle – students, parents, alumni, government, information community, the general public. Okoli (2007, p. 524) classifies university records into two broad categories, namely management and administrative records. Management records are generated at the top management level (vice chancellor, deputies, bursar, librarian, registrar) in the form of meeting records, procedures, decisions and resolutions. On the other hand, administrative records take the form of admission records, personnel records (employment, leave and duty records), and physical resource records. It seems that the growing complexities of universities in Nigeria and the challenges it poses to management makes the application of Hi-Tech information and ICTs indispensable for quality assurance (Okorie, Agabi & Uche, 2005).

Management information system (MIS) is a necessity in university administration, since it is required for need assessment, logistics and planning, resources utilization, operational control and management or evaluation of results. MIS implies both the technique, the process, as well as the structure concerned with systemic, accurate and speedy organization and control of relevant signals, data or messages from the different parts and environment of an activity unit, through appropriate collection, editing, analysis, display, storage and retrieval of signals or messages in manners that would be useful for management decision-making (Emetarom, 2001). The MIS is therefore an integral part of the management process and its potential capacity in university administration will go a long way in ensuring institutional effectiveness. Computer-based MIS in the universities is used for the process of mechanized analysis, updating, storage, display and retrieval of sets of information, particularly those connected with the management and operational sides of administrative decisions. Thus, a computerized MIS is a system that provides each manager with all the information he needs for decisions, when he needs it, and the form that aids his understanding and stimulates action.

In a study on application of information and communication technologies in the management of public and private universities in Nigeria, Okorie, Agabi

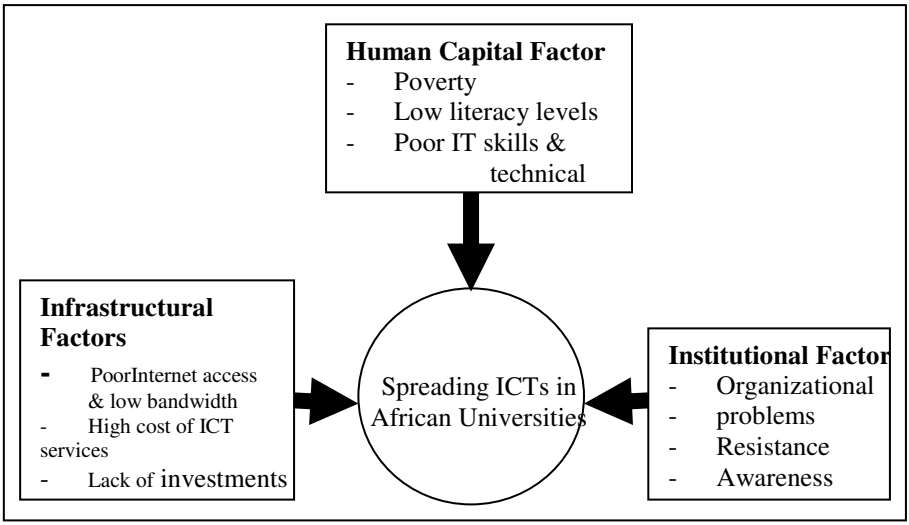
and Uche (2005, p.29) found that public universities exhibited moderate capacity for adopting modernized information management, while private universities demonstrated a high capacity of ICTs adoption in the variables investigated. The level of ICTs application was also investigated. The areas of application were students' personnel record management; students' academic records; staff personnel records; teaching, research and publication; financial records management; and services management. Results showed that public universities have low level of application of ICTs in all areas examined, except in students' personnel records, research and publication; while private universities have moderate level of application of ICTs in all areas examined. Nwafor (2005, p.185) investigated the types of ICTs available for university administration in Rivers State. His respondents consisted of 253 senior non-academic administrators from university of Port-Harcourt and Rivers State university of Science and Technology. There was no significant difference between the opinions of senior non-academic administrators at UNIPORT and their counterparts at RUST on the type of ICTs available for university administration in Rivers State. The ICTs available at the two institutions were: mainframe computer; mini computer; micro-computer; word processing computer, basic website; fax; teleconferencing; internet; intranet; and e-mail. It was recommended that the two institutions should acquire large IT-Systems (mainframe computers) for economy, increased speed of information processing and a greater capacity to adapt university administration to changes in the super-highway of new information technology.

Challenges of ICTs Application

There are many forces and factors that pose as challenges and problems to inhibit effective diffusion of ICTs in African universities. Jagboro (2003:316) reported the reasons for low level of utilization of internet by university students: low level of connectivity (internet/computer outlet); the high cost of cyber café facilities; lack of substantial online learning resources; faculty compensation for teaching online; inadequate funds; facilities; and faculty's unwillingness to use ICTs for lack of skill on the part of staff and students. A study at the University of Botswana (Tella, 2007) identified difficulty in motivating faculty, inadequate equipment, lack of ICT policy, poor attitude of staff, inadequate computers, and problem of connectivity to off-campus students. Some inhibitors identified for investigation at Uniport by Okorie, Agabi and Uche (2005, p. 33) included lack of computer or ICT centre, inadequate facilities/equipment at the ICT centre, irregular power supply,

absence of alternative source of power supply, lack of computer knowledge, expensive nature of ICT facilities, and lack of willpower by management to embrace ICT-revolution. Drawing from the developmental reports of notable bodies, like the G8 DOT Force (2001), United Nations ICT task force (2004), and UNPAN (2005), the authors have adapted a theoretical model (see figure 1) used somewhere to describe the problems faced by developing societies in spreading ICT-based initiatives in highlighting the challenges facing African universities in massive adoption of ICTs.

Figure: Challenges inhibiting diffusion (spread) of ICTs in African Universities



Modified From: UNPAN and G8 DOT Force

Three broad categories of factors are identified as being responsible for the low level of ICTs adoption and application in African universities – infrastructural inhibitors, institutional factors and human capital problems (Ifinedo, 2007).

Infrastructural problems are in the nature of poor Internet access and low bandwidth, high cost of ICT services, lack of investments in ICT, and poor power generation. The countries of Africa, including Nigeria, have poor Internet access (CLI, 2001; Ifinedo, 2005). A few countries recently procured

bandwidths greater than 10 million bps. Previously, countries in Africa, including Nigeria, had bandwidths between 64, 000 bps and 256,000 bps due to high international tariffs and lack of circuit capacity in the region (Ifinedo, 2006; ITU, 2006). Investments in the telecommunications sector used to be very low in Africa, but it is encouraging to note improvements in this direction. Internet access and computers are costly and hence outside the reach of the common man. There is also a near permanent problem of inadequate and irregular power generation.

Institutional problems consist in awareness problems, resistance and organizational factors. Many functionaries in developing countries lack the necessary expertise to manage innovations and changes, including effective implementation of ICT-enabled education (NForg, 2004; Ololube, 2006). The report by the Commonwealth Learning International suggests that administrators in Nigerian universities are either unfamiliar with the use of ICT in education or are unwilling to change from the status quo (Bolaniran & Ademola, 2004). Also, complete lack of awareness regarding the use of ICT in higher education and resistance to change from the traditional teaching-learning methods to a more innovative, technology-based methods by both students and faculty are powerful challenges.

Human capital problems arise from poverty, low literacy levels and poor IT skills and technical ability. As one of the countries of Africa with per capita income of less than US$1.00 per day, it means that the average citizen is poor and so cannot use ICT products maximally especially those related to education. Procuring Internet access, owning a personal computer, subscribing to a telephone line or owning one is beyond the reach of the average African (Ifinedo, 2006; G8 DOT Force, 2001). There is a general low literacy rate for the region and very low levels of IT skills and technical ability amongst university staff and students in Africa. The poor funding pattern of education by the governments (federal, states, local governments) makes it more difficult for higher educational institutions to train skilled IT professionals to match the current ICT needs.

Conclusion and Recommendations

The task of managing higher education, especially university education, in Africa in such an effective manner that it leads to sustainable development cannot be attained if the full use of Hi-Tech and ICT-related educational initiatives (eg. e-learning and distance education) are not explored. It is

apparent that ICT is a necessary and indispensable tool that students, lecturers/researchers and university administrators need for good success in their daily engagements.

In line with the conclusion above, it is recommended that African universities should see the need to:

1. Integrate ICTs into all areas of university life – students' learning, lecturers' teaching, research, and general administration. The need is urgent and demanding.
2. Plan and have a well-structured programme for confronting the various classes of barriers that can hinder effective plan implementation.
3. Develop general online strategies on use and application of ICTs.
4. Improve the capacity and level of adoption of ICT by universities.
5. Fund ICTs educational initiatives adequately.
6. Train, develop and expose staff and students to various uses that ICTs are capable.
7. Cultivate a positive attitude towards the introduction and use of ICT products in university teaching and research.

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