The needs and challenges of Information Systems education - the case of Nigerian Universities

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Abstract

Inadequate human resource capacity for IT development militates against effective IT adoption and utilisation in developing countries. Educational institutions play key roles in providing intellectual resources for society. Many of the organisational, management and development issues which are included in Information Systems (IS) education are not represented in the curricula of higher education institutions in developing countries. Our study examines the Nigerian perspective as one representative example of African IS university education, and examines the level and quality of IS education in Nigerian federal universities as well as the curriculum development challenges.

Keywords

Capacity building, curriculum development, higher education, informatics

1 INTRODUCTION

African countries need to plan sustainability of donor-funded IT projects. They also need to ensure that IT adoption and use should not only be geared to IT procurement but also to capacity building in IT, *i.e.*, indigenous IT industry and human resource development. In addition, research which supports the development of Information Systems that address the distinctive needs of developing countries needs to be addressed (Moyo, 1996). The design, use and management of IT need a carefully-planned educational infrastructure which should reflect the needs and opportunities of each developing country. Both the evaluation and development of IT/IS education curriculum towards more organisationally- and nationally-driven IT/IS courses and programs are needed.

Our study suggests that organisations will demand a cadre of IS professionals with knowledge and skills in technology, business operations, management and interpersonal skills to effectively lead organisational integration and process reengineering activities. Unfortunately, most universities in Africa do not educate students towards this kind of knowledge. There is a lot of effort put into computer science and other technically-oriented aspects of computer science - computer engineering for example, but little effort is put into the field of IS.

Lee, Trauth and Farwell (1995) noted recently that most of the lower-level IS jobs are rapidly disappearing and the requirements for IS professionals are becoming more demanding in multiple dimensions, particularly in the areas of business functional knowledge and interpersonal/management skills. They concluded that 'IS activities in organisations will require corresponding restructuring of IS curricula at universities'. Nigerian universities offering computer science degrees have been placing an emphasis on technically-oriented courses and mathematics.

Our objective is to investigate how much effort is put into the discipline of Information Systems in Nigerian universities, and find out if degrees in computer science or other closely-related disciplines have a minor in IS. The key research questions posed are: (1) What is the level and quality of IS education in Nigerian federal universities? and (2) What are the curriculum development challenges facing those universities?

Nigeria is the unit of analysis and one of its university computer science curricula (University of Lagos) will be used as a comparison with the well-accepted reference model IS '97 curriculum recommendations (Davis, Gorgone, Couger, Feinstein and Longnecker, 1997). We will also discuss our experiences with other Nigerian universities in the field of computer science or IS education. In addition, special characteristics of Nigerian organizations are discussed to reflect the needs of the organizational workforce.

Section 2 will discuss the field of IS education and Section 3 will introduce the IS '97 reference model for further analysis. Section 4 evaluates the African context and its implications for curriculum development. Section 5 concludes with recommendations for policies with international implications and backing.

2 INFORMATION SYSTEMS AS A FIELD OF STUDY

There are significant differences between computer science and Information Systems. 'The important differences are in the context of the work to be performed, the type of problems to be solved, the types of systems to be designed and managed, and the way the technology is employed' (Davis, Gorgone, Couger, Feinstein and Longnecker, 1997).

While the IS context focuses on an organisation and its systems, computer science focuses on algorithms and systems software. The nature of work in IS assumes that IS professionals are skilled in basic knowledgework software. The IS student should understand the relationship of systems to organisational goals. IS personnel are expected to understand IS functions and developments. The purpose of IS is to improve the performance of people through the use of IT.

Universities that have been focusing on the 'hard side' of computer science need to start looking into the 'soft side' (*i.e.* Information Systems) because there is a very high demand for the IS knowledge today. Davis, Gorgone, Couger, Feinstein and Longnecker, (1997) noted that 'a strong demand for IS professionals is forecasted to continue through the year 2005'. Their forecast points to the importance of IS as a discipline that might change our society, just as computers and medicine did in the past.

The demand for IS professionals is increasing as the functional areas of organisations seek to gain more capability in Information Systems. As organisations extend the use of IT to operational processes, decision support and competitive strategy, the academic field grows in scope and depth.

The different names used for the ISs discipline sometimes affects the meaning, which raises even more confusion in Africa. Aina and Mabawonku. (1997) reported that 'to an average, educated African, the information professional is synonymous with persons occupied with journalism, broadcasting, government propaganda, etc.'. It is time to start working towards the establishment of the discipline of IS within the African university communities.

3 AFRICA IN CONTEXT - KEY ISSUES IN DEVELOPING HUMAN RESOURCES

3.1 Selected approach for developing policies

Moyo (1996) describes two alternative approaches to formulating IT-related policies for developing countries. The first is the classical one of analyzing the conditions in developed countries, and then replicating and modifying them in developing countries. As Moyo (1996) and Korpela (1996) argue this approach may fail due to diverging socioeconomic and cultural differences in developing countries. They discuss an approach in which conditions in both developed and developing countries are analyzed, similarities and differences are assessed, and policies are formulated to transfer technology on the basis of local needs and capabilities.

The latter approach is used in this paper to discuss the reference model curriculum as presented by Davis, Gorgone, Couger, Feinstein and Longnecker

(1997). The model is compared against that of the University of Lagos's Department of Computer Science (CS) curriculum, which offers a Bachelor's and Master's degree in computer science. The department also offers a Ph.D. degree in three major areas - Computational Analysis and Applications, Computing Systems and Systems Science, and Operational Research.

Table 1 IS Model Curriculum vs. Computer Science curriculum from 1992 - 1994

Model Curriculum (Davis, <i>et. al.</i>), 1997	UniLag Computer Science Curriculum 1992-1994
Knowledge Work Software Tool Kit	Introduction to Computer Science
Fundamentals of IS	Principles of Computer Organisation
Personal Productivity With IS Technology	Computer Programming I and II
IS Theory and Practice	Introduction to Data Structures
IT Hardware and Software	Introduction to Information Processing methods
Programming, Data, File, and Object Structures	Operating Systems I
Networks and Telecommunications	Structured H/L Languages I
Analysis and Logical Design	File Organisation and Processing
Physical Design and Implementation with DBMS	Machine Language & Assembly Programming
Physical Design and Implementation with a Programming Environment	Introduction to Compiler Construction
Project Management and Practice	Algorithm Design & Analysis
Introduction to Statistical Processing	Comparative Programming Language Project

(Davis, *et. al.* 1997)

The curriculum of the degree programs in the University of Lagos (later UniLag) was selected because the department of Computer science of UniLag was among the first departments in the country to start a degree program in Computer science in 1973.

Table 1 shows the model curriculum and its recommended packaging of learning units for the IS major as well as the recommended sequence and the compulsory courses in the curriculum of the degree program in Computer Science (1992-1994) at UniLag. Some additional courses must be passed before a certificate in Computer Science can be awarded but these are referred to as electives. The courses that are represented in the model curriculum and the UniLag Computer Science degree curriculum are shown in bold. The UniLag curriculum is presented with its recommended sequence of advancement.

3.2 Human resource development and IS education

Human resource development strategies should be linked to many IT-related issues and problems such as national infrastructure development, general improvement of IT awareness in the respective countries, IT education curriculum development and IT industry support. As Avgerou (1996) says, the very common practice of developing countries to export software programming work is not a very long-lasting phenomenon while the real IS expertise demands skills and knowledge to analyze both organizational and business conditions, and the capabilities of IT to make effective Information Systems. Moyo (1996) recommends that managers be more responsible for mapping IT strategies for their organizations while the managers' lack of IT understanding seems to be a drawback for organizations in developing countries. This means that besides IT education curriculum development for long-term human resource development, universities and other professional institutions need also to develop Executive Education programs for African managers.

Naturally the model IS curriculum discussed here cannot be transferred directly to African countries without changes because the model is developed to suit primarily organisations in the Western countries. However the curriculum can be used for guidance.

3.3 A case study of Nigeria in the African context

Nigeria is taken as a representative of an average African country because it has the largest in population in Africa and exhibits characteristics of most African countries (Korpela, 1994). Many companies - except for a few oil companies and banks - in Africa do not have an advanced data processing or IT department. That means that operations are manually carried out in most organisations.

The level of computer use in Nigeria is generally low and, to a large extent, the computers are under-utilised. Key activities are sometimes computerised but computer technologies are hardly used for strategic purposes. Management Information Systems are unknown in most organisations. Transaction processing systems are common but most organizations, including banks, seem not to have invested in a strategic use of IS.

The least computerized organizations are governmental institutions (Adelakun, 1993) - hospitals, primary and secondary schools, universities and ministries. It is not surprising to see a large set of hardware in some room used mainly for word processing or not at all. In governmental organizations transaction processing

systems may not work efficiently enough. However most organizations are waking up - especially in the insurance business. They have begun to understand the need for computer-based IS and are trying to move a step farther toward the strategic use of Information Systems. Most companies have realised that there is a need to invest in IT but the problem is how to do it successfully.

The problem of IS development is one of the key issues facing organisations in Africa. There is a significant lack of IT/IS professionals capable of developing suitable and appropriate ISs for organisations. For example, in 1993 it was very difficult for the second author to find a ready-made accounting system designed for Nigerian companies. Eventually an application developed for Western countries had to be purchased. In Nigeria most of the computer companies are hardware vendors. Over the period 1981-1986 Nigeria alone accounted for 20% of all computer imports in black Africa (Kluzer, 1990). The human resources are not capable of putting installed computers to effective use.

IS is not represented in many universities although the knowledge of IS is needed before the technical skills of computer experts can be converted into appropriate uses. There is a tendency for many organisations to look for applications used in the Western countries and transfer them to their organisations after some modifications. Many researchers have noted that this will not work; indigenous developers are required. (Avgerou, 1996; Korpela, 1994).

Telecommunications can not be over-emphasised. So it is important to develop an IS curriculum that will have relevance for organisations in Africa and that will not conflict with the value of their overall educational systems.

3.4 Course description and recommendations

Now we present our recommendations for the courses to be included in the Computer Science or related discipline curriculum in Nigerian universities. We suggest that since a degree in IS is not generally represented in Nigerian universities those universities could start by offering a minor in IS. Students studying for a major in computer science or computer engineering as represented in Nigerian universities could do a minor in IS if the courses recommended below are incorporated into the curriculum for a computer science degree.

Each course, though similar to the courses described in the model curriculum, has been analysed to suit the need of the organisations in Nigeria. Graduating students with minors in IS will be equipped with the resources needed to face the IS challenges in Nigerian companies.

Knowledge Work Software Tool Kit (IS '97.0)

Content: The course includes a basic understanding of software tools useful for knowledge workers. Examples include spreadsheets, databases, presentation graphics, database retrieval, statistics, word processing and electronic mail.

Analysis: The course seems not to be generally present as a whole in any Nigerian university offering a computer science degree. However computer science students are expected to study some of the topics in on their own. We recommend this course as a fundamental course for all students - even students studying non-computer-related degrees.

Fundamentals of Information Systems (IS '97.1)

Content: The course provides an introduction to systems concepts, IT and application software. It introduces students to how information is used in organisations, and how IT enables improvements in the quality and timeliness of information. Some of the other topics covered in the course include: design and reengineering of ISs; application vs. systems software; programming languages; functions and architecture; telecommunication systems and applications.

Analysis: The course is not well-represented in most universities in Nigeria. We recommend it as a fundamental course for students studying computer science as a major and those who will study IS as a minor. Most professionals working in industry today are missing the knowledge covered in this course and those professionals managing computer projects in most Nigerian companies have been trained in computer science or computer engineering, degrees that do not make provision for the fundamental knowledge of IS.

Personal Productivity With IS Technology (IS '97.2)

Content: The course enables students to extend their knowledgework and improve their skill in the use of packaged software in order to improve their personal productivity. The course topics include: end-user computing support; evaluating end-user requirements for tailored information needs; feasibility analysis; evaluation criteria for packaged software; database products; information retrieval; accessing internal and public databases; accessing shared software; groupware; data conversion and manipulation.

Analysis: The course does not seem to exist in any university in Nigeria at the moment. However parts of some of the topics are covered. It is recommended that the course should be considered mandatory for all students studying computer science, especially those who will take IS as a minor subject.

Information Systems Theory and Practice (IS '97.3)

Content: The course covers systems theory and concepts; decision theory and how it is implemented by IT; level of systems; strategic, tactical and operational; information systems strategies; roles of Information Technology; IS planning; human-computer interface and interaction.

Analysis: This is a very important course and it is recommended that it should be broken into several courses - each course addressing two or three of the topics mentioned above. The courses should be compulsory for an IS minor but not for pure computer science students. According to our experience, none of the selected universities is offering this courses at the moment.

Most organisations in Nigeria - governmental institutions and family-owned businesses - are still highly hierarchical in structure. The flat organisational structure is not very common and therefore the method for IS development used in the West might not work for many Nigerian organisations, which have no tradition of formal planning and little capacity for organisational reform on the basis of requirement analysis. Avgerou (1996) noted that 'Strategic decisions are either political, therefore not amenable to the analytical logic of organisational requirements, or intuitive based on the talent of the entrepreneurs and mistrusting formal management practices'. Therefore this course needs to be carefully designed

from the viewpoint of the Nigerian organisation. We will personally recommend that this course should teach a mixture of the old classical approaches and the new methods to IS development.

Networks and Telecommunications (IS '97.6)

Content: The course provides an in-depth knowledge of data communications and networking requirements, including telecommunications technologies, hardware, and software. Emphasis is on the analysis and design of networks. Important topics are: Telecommunication devices; media systems; networking hardware and software; networking configuration; network application topologies and protocols; network performance analysis; security; and other topics.

Analysis: The course does not seem to exist in any university in Nigeria at the moment. Network devices are taught in some universities - Obafemi Awolowo University, for example - but only to such a very limited extent that we can assume that the course does not exist. We recommend the course as an optional course for pure Computer Science students but an IS minor must pass some of the topic mentioned.

4 CONCLUSION

We have raised curriculum issues to be developed in Nigerian universities to provide better management of the organizational needs of companies. In order to establish a well-grounded IS education infrastructure we need both to educate more IS-oriented students for companies but also set up Executive Education programs for managers in order to raise awareness of IS management (Ruohonen, 1992). Such a strategy demands collaboration between several stakeholders - governmental bodies, companies, vendors and professional organizations such as computer societies, consultants and agencies for development. It has been noted that the more challenging the IS development process is, the more stakeholders we need to include (Ruohonen 1995).

Although the involvement of international organisations in the computerisation process is not uncommon in Africa (Adelakun, 1993), the involvement of highly recognised universities in IS education is almost nonexistent. Meanwhile the development of human resources that will manage the developed Information Systems starts from the training of IS professionals in universities and other higher education institutions. Therefore it is recommended that African universities, Nigerian ones in particular, should establish collaborations with leading institutions in IS research and education abroad. The assistance given should be oriented more toward building capacities than toward financial aid for computerisation. The more adequately trained university graduates of IS enter into the industry in Nigeria, the more adoption and usage of IS will increase.

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6 BIOGRAPHY

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