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DEPARTMENT OF MATHEMATICS, FACULTY OF SCIENCE,
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APPLICATION OF INFORMATION TECHNOLOGY AND ITS CHALLENGES

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ABSTRACT

This paper is aim at examining the concept of Information Technology (IT), the new opportunities it offers across the globe and how developing countries such as Nigeria can take advantage of this revolution in Information Technology. This paper will also highlight constraints that have limited the prospect of its usage in developing countries especially Nigeria and offer suitable options where necessary, with a view to empowering Nigerian to develop necessary IT skills for the twenty-first century and beyond.

INTRODUCTION

Information Technology (IT) is the bedrock for national survival and development in a rapidly changing global environment, and challenges us to device bold and courageous initiatives to address a host of vital socio-economics issues such as reliable infrastructure and other essential issues of capacity building. The impact of IT on individuals, organization and society is changing everything. The present extent of technological revolution that the world is presently witnessing as IT has become the vehicle or major engine of the information age which has reduce the world to a global village.

The growing usage of IT is rapidly spreading through societies; its permeating effect is noticeable in educational institutes, government establishments, business organization, homes and offices etc. The implication of these developments is obvious for the Nigerian societies in the sense that traditional ways of doing things, which have been embraced in the past, must now give way and/or adjust to the diverse opportunities offered by IT.

WHAT IS INFORMATION TECHNOLOGY

The term Information is a broad based term used generally to describe the techniques and technologies, methods and applications which support activities involving the creation, storage, manipulation and communication of information (Principally computing electronics and communications) together with their related methods, management and applications.

The technologies, which are extensions of IT, are identified as follows:

- Information Machine e.g. Computers
- Media Communication for example Radio and Television.
- Telecommunication technologies and equipment e.g. satellite, fibre optics cables, facsimile machines.

Others are video and other electronic media forms, which have been developed so that these functions can be integrated into single IT systems. Example of some top Information Communication Technologies include: video conferencing, Internet Technology, digital subscriber line (DSL), Extra-Nets, speech recognition, Internet Chat, Biometrics, electronic books, Avatars, intra-nets, private networks, remote connectivity. However the most resounding aspect of IT is the Internet. Although there is no generally accepted definition of the Internet, most industry commentators would agree upon a description of the Internet as a "network of networks" or "an ocean of resources waiting to be extracted". It is therefore a communication network among computers, which is based around three key technologies:

Packet-switching - Packet switching is a protocol use in dividing messages into packets (messages or fragments of messages) before they are sent. Each packet is then transmitted individually and can even follow different routes to its destination. Once all the packets forming a message arrive at the destination, they are recompiled into the original message.

Client-Server Technology - A distributed computer system technology that allows a computer to access and utilize the services available on another computer.

Transmission Control Protocol/Internet Protocol - This is a set of software protocols that establish the method with which data is transmitted over the Internet between two computers regardless of their make, type or Operating System. Telecommunication infrastructure in particular has become the driving force of IT; it has linked various IT elements together to provide a converging platform for these elements. The convergence of the various elements of IT has enhanced development in all spheres of human endeavour.

CURRENT ISSUES IN INFORMATION TECHNOLOGY

Security

Security remains near the top of the list of strategic issues facing higher education institutions. Given the increasing volume of information that needs to be protected, the expanding body of rules, regulations, and laws governing information security and privacy, and the current economic downturn, which makes it even harder for an institution to obtain the funding necessary to keep up with requirements, this is not at all surprising. With these immense challenges, Security will likely remain high on the Current Issue Survey list in the years to come.

Security is not strictly a technology matter; indeed, it is a foundational element for almost all institutional business. Responsibility for security needs to extend beyond information technology to every functional office in the institution and to the highest level of management. IT professionals can assist in this endeavor by not limiting their own perspective to IT and by modeling behavior to treat security and privacy best practices as everybody's responsibility.

Cyber infrastructure

Many IT leaders have chosen to outsource basic services, e-mail in particular, to third parties such as Google and Microsoft. New sourcing models, including SaaS, are obviating the need to acquire new hardware to run new applications. Open-source communities, including Sakai and Moodle, are tackling inter-institutional software development and maintenance. Instructors are not waiting for the IT organization to roll out new learning applications but instead are adopting freely available Web 2.0 collaboration tools.

Just as server virtualization is decoupling enterprise applications from specific pieces of hardware, virtual desktop infrastructure (VDI) is expected to decouple personal productivity applications from specific desktops and laptops. The computerization of IT is resulting in members of the campus community accessing services through a constantly evolving array of new devices, especially smart phones and net books, which will likely outpace the standardization and support initiatives of the IT organization.

Although *Research Support* was a separate survey issue that failed to rank in the top ten, it is worth noting that in some disciplines, grid computing is breaking down the former relationships determining which institutions provide computing cycles and which institutions employ the principle investigators doing the computational research.

Teaching and Learning with Technology

A growing proportion of learning takes place outside the traditional boundaries of the classroom facilitated by applications such as social networks and technologies that support a culture in which everyone creates and shares. In the current economic environment, IT leaders must make decisions about whether or not to accommodate these miscellaneous technologies. Further, they are being asked to provide technological direction for cultural transformations — such as information fluency — that involve library faculty, department faculty, technology specialists, and students as co-creators of knowledge. Finding the proper balance between systemic and ad hoc technologies will be fundamental for IT leaders as they respond to a student generation that prefers less passive and more agile learning. These instructional modalities will foster transformational innovations such as the need for e-portfolios in a reflective, contextual, authentic, and active learning environment.

All of these developments play out in a landscape where IT leaders bear responsibility for systems that support institutional functionality, that protect the privacy and security of faculty members, students, administrators, and staff, that safeguard information and

intellectual property, that respond to the data and information needs of the institution, and that provide effective means of communication. This responsibility forces IT leaders to function in a mediated environment — one in which they must manage dwindling resources, increasing demands, and the necessity for a collaborative establishment of effective priorities with administrative and academic constituencies.

Identity and Access Management

Outsourcing, hosted, and cloud computing solutions present new challenges. Keeping identity credentialing systems on campus is still a preferred architecture. A separate identity system for the outsourced system can be used, but doing so presents significant challenges — for example, another password for the user to manage or another identity vetting process. As campuses evaluate outsourced e-mail systems, allowing identity credentials to be stored by a vendor service provider causes concern. Institutions must consider whether they should have outsourced e-mail providers authenticate against an in-house system or whether they should outsource credentials.

Federation of identity serves to enable the portability of identity information across security domains, including institutional, agency, and corporate service providers. The need for federation grows as resources, particularly academic research resources, require remote access by trusted associates. Faculty and students are increasingly mobile among campuses, and service solutions must be mobile between campus and vendor. The ultimate goal of identity federation is to enable users of one domain to securely access data or systems of another domain, with vetting and authenticating a user done once and with full trust of credentials presented through the federation.

Adaptability and Responsiveness

In the 2008 Current Issues Survey, the issue of *Change Management* — referring to the ability of an IT organization to drive change within an institution — appeared as #8. The committee re-titled the issue this year as *Agility, Adaptability, and Responsiveness*, which includes not only the ability to drive change but also, and especially important in the present fiscal climate, the ability of an IT organization to *react* to a changing landscape. Current times call for an IT organization and leadership that is able to quickly understand the frequently changing realities of the present environment so as to be able to adapt services and, if needed, restructure to meet those needs.

Being agile during times of relative calm is challenging enough, but doing so in a rapidly changing environment requires IT leaders to be aware of the challenges facing the institution at large and of how their services can help meet those challenges. Doing so requires IT leaders to create an organizational culture in which information is freely, honestly, and quickly shared and in which flexibility in work assignments is encouraged by management and accepted by staff. IT leaders also need to be an integral part of campus-wide discussions about how the institution needs to adapt and respond to the changing world. Many of the "efficiencies" that other departments will seek in times of

THE EFFECTS OF INFORMATION TECHNOLOGY ON THE ECONOMY

The effects of information technology on the economy have been widely studied and discussed. The most common finding is that information technology has led to a significant increase in productivity and economic growth. This is particularly true in the manufacturing sector, where automation and computer-aided design have revolutionized production processes. Additionally, the rise of the service economy and the internet has created new opportunities for businesses and consumers alike.

CONCLUSION

In conclusion, the impact of information technology on the economy is profound and multifaceted. While there are certainly challenges, such as job displacement and digital divides, the overall benefits are substantial. Continued investment in research and development, along with appropriate policy interventions, will be crucial to maximizing the positive effects of this transformative technology. The future of the economy lies in our ability to harness the power of information technology effectively and equitably.

As the world continues to evolve, the role of information technology will only become more prominent. Governments, businesses, and individuals must work together to address the challenges and seize the opportunities presented by this technology. By fostering innovation and ensuring that the benefits of technological progress are shared widely, we can build a more prosperous and sustainable future for all.

THE EFFECTS OF INFORMATION TECHNOLOGY ON THE ECONOMY (CONT.)

Another key area of research is the impact of information technology on the labor market. While automation has replaced certain types of jobs, it has also created new ones, particularly in the fields of software development, data analysis, and digital marketing. The demand for skills in these areas is high, and workers must be prepared to adapt to a rapidly changing job market. Lifelong learning and continuous education are essential for staying relevant in the modern economy.

Furthermore, the digital divide remains a significant concern. Not everyone has equal access to the internet and digital technologies, which can hinder economic growth and social mobility. Addressing this issue requires targeted investments in infrastructure, particularly in rural and underserved areas. Additionally, digital literacy programs are essential to ensure that all citizens can benefit from the opportunities provided by the digital economy. Policy makers must prioritize these issues to ensure that the benefits of information technology are realized by all segments of the population.

E-Commerce: A need for electronics transaction using the Internet that enables people to view, order and pay for merchandise (Bijan, 2002). Business can be transacted using the internet example are; online shopping, online stock trading, online banking etc. the advantages of eCommerce are, the reduction of cost of transactions and the risks associated with any money based economy such as theft and robbery. Credit cards or smart cards are used to transact these businesses. Also the cost and the risk of transporting oneself from one place to another for business purposes are eliminated.

E-Environment: IT application can help in collecting data about environmental issues. They allow access to information and provide support system to manage and monitor environmental issues. According to Mansell and Wehn, 1998 the geographical information focuses on the collection, storage, analysis, display and application system (GIS) is one of the Geographic Information Technology applications and it can be regarded as an advanced equivalent of a traditional map from which a wide array of information can be extracted for specific purposes. GIS is an automated system that enables the capture, storage, checking, integrating, manipulating, analysis, display and modeling of complex spatial data on climate, soil, and terrains from different sources. This system was seen to be of a great advantage when meteorologist where able to report and monitor the eclipse of the Sun which was experienced in Nigeria, Brazil, North Africa and Turkey on 29th March 2006.

There are several other areas where IT can be put to use or are already being used successfully; these are manufacturing, religion, communication, registration etc.

CHALLENGES FACING NIGERIA INFORMATION TECHNOLOGY

At a world summit on Information society held in Geneva in December 2003, world leaders declared their common desire and commitment to build a people-centered, inclusive and development oriented information society, where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and people to achieve their full potentials (Iboma, 2005). For Nigeria however, integration into the global information society still looks dark. There still appear to be a digital divide within communities where people are separated by economic and knowledge barriers.

After discussing the various application of IT and their advantages, there still exist lot of challenges or limitation facing Nigeria in her bid to be IT complaint despite the implementation of Information Technology Policy formulated by NITDA (National Information Technology Development Agency). These challenges include:

High Cost Of Interconnectivity: The cost of inter access, relevant software and hardware is so high that only few individuals, government institutions and parastatals can afford it as compared to other countries, added to this, is the astronomical cost of the licensing fee for Internet Service Providers (ISPs). In 1995, the fee was 143, 000.00; in 1999 it was increased to N338, 000.00. Presently renewal fee is N1 000, 000 or more (Sesan, 2005). This cost can be a hindrance to prospective investors. This is in contradictions with South Africa where investors do not pay licensing fee. It has remained a limitation issue that must be tackled.

Infrastructure Problem: Linking up to the Internet requires two key basic infrastructures that are power supply, telephone lines or VSAT (Very Small Aperture Terminal/Wireless Radio Wave), the services of these facilities are unreliable in Nigeria. Low and inadequate power supply remains the main drawback of the Nigerian environment. The non-availability and/or high cost of telephone lines or the installation of VSAT militate against the realization of an information society in the country. Some VSAT are still analogue circuits whose connectivity is low. Most cases where telephone lines are connected, few lines are actually operational. This is compounded by the fact that E1 lines for ISPs are seldom available. The current offer by private telephone operators (PTOs) is still exorbitant for the average Nigerian.

High Customs Duties: Excessive duties are paid on imported IT equipment and this makes the cost of procurement of IT equipment beyond the reach of the average Nigerian.

Other challenges facing Nigeria IT are:

- Low usage of the internet
- Lack of competent IT personnel
- Traditional attitude of people

CONCLUSION

The impact of IT in the society is noticeable in many ways and in all spheres of life. IT has simplified many activities, made easy accessibility of materials, enabled easy storage and retrieval of information, etc and has facilitated exchange of Information on the Net. It is hoped that the recent National Policy on IT, if properly implemented and other incentives, including a moderate cost of connectivity, zero duties on IT equipment, internet research funds and an improvement on the required infrastructure would further facilitate the process.

The Nigerian society must therefore be sensitized to take up to these challenges and make positive effort to catch up with the rest of the world on the Information Super Highway so as to bridge the digital divide.

RECOMMENDATIONS

From the foregoing discussing, the following recommendations are made for Nigeria to fully exploit IT facilities and its corresponding benefits:

- There should be an improvement in IT infrastructure and the recent government policy on information technology should be improved upon and fully implemented.
- Government should remove customs duties on IT equipment.
- There should be a reduction in the cost of connectivity, especially for educational purposes. License and permit fees for ISPs should be reduced.
- Special internet research fund should be created for educational institutions to enable them create and maintain websites.
- Telecentres and Cyber cafes should be encouraged as a strategy for improving Tele-access across cities, towns and institutions.
- Government should improve the services of both the Power Holding Company of Nigeria (PHCN/NEPA) and the Nigerian Telecommunications Limited (NITEL) to ease infrastructure problems.

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Information Technology should be made compulsory in all educational curricula. The Nigerian Universities Commission (NUC) should through its NUNET (Nigerian Universities Network) programme, link up all Nigerian Universities, also other tertiary institutions and research institutes through WAN (Wide Area Network) and LAN (Local Area Network).

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