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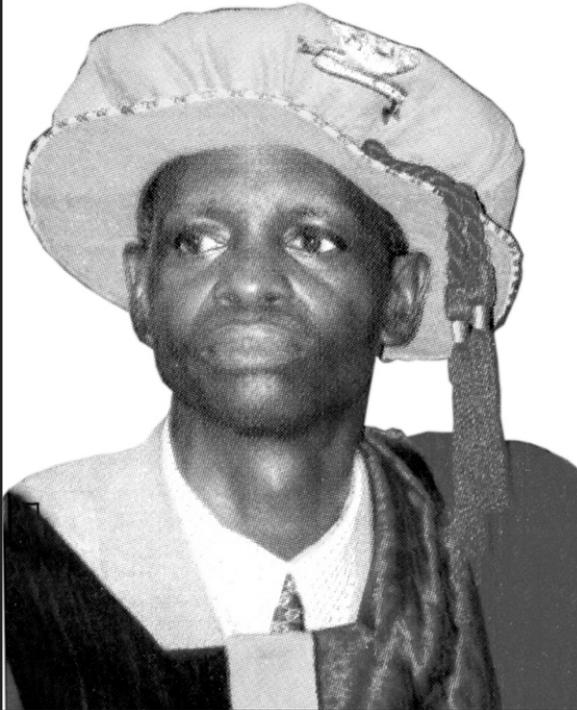
THE FORWARD AND REVERSE ENGINEERING OF INFORMATION TECHNOLOGY IN AN EMERGING ECONOMIC SYSTEM

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INTRODUCTION

Africa is generally believed to be the mother of mankind supported both by archaeological findings [Davidson, 1974]; and biblical evidences [Munroe, 2001]. The contribution of Africa to early civilization is a clear testimony and reinforcement to this claim. Some advancements in science and technology were first made in Africa long before they were known in Europe. For example, in Egypt the great engineering ingenuity of constructing the pyramid of 250 meter by 250 meter base, the production of paper, the development of mechanized irrigation, writing and calendar. Also in the same ancient Egypt, advancement was recorded in mathematics, and remarkable contribution to architecture was made. Furthermore the Egyptian unprecedented breakthrough in medical science in preservation of dead bodies for thousands of years without decomposing still remains a mystery even to the western world.

The Mali empire in the 14th century was reputed to be one of the largest, richest, and most powerful in the world. It is on record that when Emperor Mansa of Mali visited Cairo in 1324 BC with such a large quantity of gold, the price of gold was forced to fall drastically and it took over twelve years after his visit for the price of gold to recover in Egypt. The King of Ghana in the 11th century was known to have a formidable army of 200,000 men. Among other enviable contributions to early civilization was the Nok Culture in Nigeria specializing in the working of terracotta.

The University of Sankore in Timbuctu was famous for her

outstanding academic performance and one of the first universities in the world. Records had it that the earliest European visitors, the Portuguese, met well organized societies in Africa. This impression led to initial bilateral trading between Africans and Europeans.

The bilateral trading was short lived, and gave way to slavery which led to Africans in diaspora to the tune of 12 millions able bodied youths between 1441 and 1888.

The anguish of loss of the loved ones coupled with the deprivation of 12 million manpower brought to a stand still development in Africa while accelerating Europe and America in development.

African slaves developed agriculture in Britain and her principal colony, America, and ushered in the industrialization age. This brought about abolition of slave trade so that the African slaves would not benefit from the new wealth production techniques. The end of slave trade signaled the beginning of colonization in order to remove forcefully raw materials from Africa to sustain industries in Europe.

These same people who took us out of history are now saying we have no history; they robbed us of our wealth and say we are synonymous with poverty; and they invaded our serenity and in return call us salvage.

It is true that colonization is abolished in Africa because it has served its useful purpose, not because they loved us. This is necessary to give way to another mode of depleting Africa of her labour force. The new mode is called brain drain which is needed to support the new economic system called knowledge economy in Europe and America.

Few questions are pertinent here: Are we aware of the new

economic system and the damaging effect on Africa of the brain drain ? And what can we do to reverse it ? Mr. Vice Chancellor, Sir, this is what this story is all about.

1.0 DEFINITION OF TERMS

It is appropriate here to define some terms:

Information can be defined as a processed data, that is, giving meaning to data. For example, the performance information derivable from the given data in Table 1 depends on the type of applied process. In a course unit system the five students have the same performance because they all score B or grade point of 4, but in another system, the five students have five different performances. Hence, one stream of data can lead to many informations depending on the process applied.

Table 1. Data on students' scores

Student	1	2	3	4	5
Score, %	64	60	68	69	62

TECHNOLOGY is defined here as applied scientific skill or scientific ability to do something. And knowledge equation is:

KNOWLEDGE = INFORMATION + ABILITY to do.

Therefore,

KNOWLEDGE = INFORMATION TECHNOLOGY

Forward Engineering is concerned with development of a product

based on in house research findings.

Reverse Engineering is concerned with in-house development of a similar or modified product based on the study of an existing product.

Emerging Economy refers to the economic system of the developing nations.

System is defined as the interrelationship of components to perform a function.

3.0 IMPORTANCE OF INFORMATION TECHNOLOGY

There are presently three types of economic systems. The capitalist economic system, the socialist economic system, and the third economic system, Mr. Vice Chancellor, this is where Africa is classified and is often called by many derogative names such as the Third World, Developing World, or underterministic and confused economic system. This is really a food for thought. What went wrong ?

The answer is straight forward, the effects of slave trade and colonization destabilise the economic system of Africa. Besides impoverishing the Continent for over 400 years during which about 12,000,000 workforce was ceded to Europe and America to develop them at the expense of their own fatherland; colonization dealt it own blow. For example in Nigeria, the British colonial masters determined the crops to be planted by Nigerian farmers. These are usually cash crops that will serve as raw materials to their industries and it did not matter even if the people are starving because they could not produce enough food to feed. These two reasons may be largely responsible for Africa losing out in the industrilisation revolution.

Information technology, IT, era is here, and rather for positive

contributions from Africa all we are witnessing is usurping of IT products and turning our Continent to IT dumping ground. The worst aspect is exodus of Africans sending themselves to what Oyedepo(2003a,b) described as the 21st century slavery in Europe and America bated by attractions such as USA Visa lottery. It is sad to note that majority of the victims are well educated and qualified men and women who could have contributed meaningfully to development of their fatherland but opted for menial and manual work abroad.

In fact the most popular testimony in our churches today is visa procurement. My advise to these people is that they should take a cue from the story of a man who left his country with his wife and two sons to a land of his choice, without God's consent, only to loose his life and the lives of his two sons as recorded in Ruth 1: 1-7.

Knowledge is power [Dainton, 1981] and since it is also proved that information technology is synonymous with knowledge, information technology is also power. It is pertinent to note that a nation's economic power determines her value and respect , not the nation's location. The geographical North Hemisphere and the South Hemisphere is becoming irrelevant, it is now given economic connotation. People of the north are usually associated with wealth and affluence while people of the south with poverty and disease. West Africa including Nigeria and the entire North Africa though are geographically located in the North Hemisphere but are economically classified to be in the South; while Australia at the bottom of the south hemisphere is grouped with the “rich” north.

Vice Chancellor, Sir, technological power, the father of economic power, declares one nation as righteous and the one without it as a

terrorist; technological power makes a buyer determines the price of a product he wants to buy the product from the seller without this power; technological power dictates how a nation without it is to be governed; technological power turns a nation with a vast amount of resources to a mere store-keeper to a nation with technological power who will acquire it.

The developed world are embarking on research for better production environment in space in the area of biotechnology, and genetic engineering. This will be like an IT rapture to nations that fail to do something about their technological standing.

It is, therefore, imperative to start to contribute to information technology, just consuming without producing will throw us out of competitiveness and keeps us down perpetually economically. A saving grace is the new unified economic system called knowledge economy for the empowerment of nations that take IT and the skill to applied it seriously.

4.0 WHY REVERSE ENGINEERING APPROACH ?

Research from scratch gives birth to forward engineering. This process is usually time consuming, expensive, often results in low yield, and subjected to frequent oscillation between the “drawing board” and the “shop floor”. On the other hand, reverse engineering needs only basic research, and consequently bring a product faster to the market.

Many great technologically developed nations today started with reverse engineering, a typical example, is Japan.

Iraq is another nation that cashed in heavily on reverse engineering, some of their successes include the scud missile which was a reverse engineering of an acquired missile to have a

longer range and more potent than its original form; and their nuclear arsenal.

5.0 THE NEED FOR DO-IT-YOURSELF MENTALITY

Technology transfer is a farce. It takes the Grace of God for anybody to give away freely his source of livelihood. I doubt if the nations we look up to presently for the transfer of technology would do it judging by the past events, since what we had was even taken by force from us, and what we are having are still subtly drained away from us by them. The only way out is for us to develop a Do-it-Yourself mentality. I will give some examples to support this view:

● **Human Face Recognition:**

It is true that people tend to recognize faster people of the same race. For example, to a Blackman all Chinese look alike and vice versa. Getting computer to automatically recognize faces is a difficult task. Research efforts in automatic face recognition have largely concentrated on Caucasian faces of the white race and very sparse, if any, of African faces [Ibiyemi, 2002]. It is this glaring negligence of the Black race from the technology with universal application that motivated me to initiate research in this field of which one of my project students completed and obtained a Ph.D in Automatic Face Recognition of the Black Race in 1999. In order to assist other researchers in this field we have created a large database of digitized face images drawn from Nigerians for free distribution on request.

One of the American Visa application requirements is a passport photograph of a specified size and white background. This is a right format for ease of computer processing. But, Mr. Vice Chancellor, in the recently concluded National ID programme, a

project I understand was contracted to a foreign firm, a dark background cloth with uncontrolled distance between the camera and the object was used to take the photograph of black faces ! it will be extremely difficult for computer to recognize such faces with high success rate.

● **Automatic Voice Recognition**

Automatic voice recognition is gaining attention because of its applications which include using voice communication with computer instead of a keyboard, automatic dictation taking by machine, and voice activated and controlled system. However, the effectiveness of the technique is highly affected by intonation, and Nigerian's intonation is not too similar to a whiteman intonation to say the least. There is also the problem also of recognising some of our local words in Yoruba, hausa, and igbo using imported voice recognition system.

● **Automatic Handwriting Recognition**

Some IT products such as PC, PDA, and PalmTop now support writing freely on the computer screen with stylus which is automatically recognized by the system. It is easier said than done. The failure rate of automatic handwriting recognition of a Nigerian, for example, will be far higher than the failure rate of automatic handwriting recognition of a person from the source of this product, since on the average the cursive handwriting of a Nigerian is very different from that of a whiteman.

● **Automatic Fingerprint Recognition**

One of the most foolproof biometric for personal identification is the fingerprint. The ten fingers and the ten toes of each person have different unique print patterns of which any one of the fingers or toes can be used to identified an individual, and this story is true for the 7 Billion persons in the world. Any of the toes of the farmers

reported to have mutilated fingerprints during the just concluded National ID programme could have been used to sign the ID card.

● **Automatic Iris Recognition**

It is believed that the most foolproof biometric for personal identification is the iris. The two irises of the two eyes have different patterns each of which can be used for personal identification. Iris, like fingerprint, is unique for 7 Billion individuals of the world. If the toes of the aforementioned farmers were also mutilated, they irises, which are highly protected naturally against mutilation, could have been used for the required identification.

● **INTERNET VIA VSAT [Ibiyemi, 2002]**

The benefits of Internet are common knowledge to all of us. Banks and Cybercafes are acquiring VSAT terminals for their Internet access via satellite. Nigeria is geographically situated between (2.55°E - 14.43°E) longitudes, and (6.02°N - 13.8°E) latitudes and placed by ITU in Region1 (35°W - 57°E longitude) for the purpose of satellite communication. ITU recommended a minimum dish look-angle of 10° for good reception. The look angle is an angle a dish makes with the horizontal (i.e. the ground) when it is pointed to a desired satellite. When a dish look angle is less than the recommended, the dish picks a lot of ground noise and more prone to object blockage. These two factors degrade heavily signal quality.

In order to compensate for these effects, large dish than normal or higher power BUC than required, or both are required. This incurs undue expenses. But surprisingly, many Banks with VSAT in Nigeria are ripped off by foreign VSAT ISP by providing them with bogus dishes, which of course they have to pay for.

5.0 ITANDE EDUCATION

It is difficult to reconcile the fact that the Continent is full of all type of resources , humans and natural , people virtually floating on wealth transforming minerals and yet still remain so poor. In fact, Kwame Nkruma rightly described this scenario as: “An African may be sitting on a deposit of gold and yet be complaining of poverty that the poverty is no longer down stair but upstairs.” Mr. Vice Chancellor, when people talk of poverty alleviation in this part of the world, they tend to associate it with physical poverty. I beg to differ. The root of the physical poverty is mental poverty, which can largely be eradicated through functional and productive education.

The target of poverty eradication in a country like India is definitely different from poverty eradication target in Africa. Since their own poverty is downstairs and our own poverty is upstairs, hence we need to look at different directions.

There are two sources of death according to the Bible. The first is through sin, Roman 6:23, “For the wages of sin is death” ; and the second one is through lack of knowledge, Hosea 4: 6-“ For my people perish for lack of knowledge”. Therefore poverty alleviation in this part of the world should be ignorance alleviation.

Education is crucial to our survival in Africa. It is sad to note that students in our universities and higher institution of learning stay much more out of study than they stay in. I read a story in one of the newspapers recently which claimed that students of a university in this country have been at home for about 11 months. It is also a common knowledge that other universities, except the private

universities and few public ones, have also been at home for up to 5 months.

The Education Minister [Aborisade, 2003] said that the examination failure rate in our universities was about 57%. He did not tell the full story, because people are usually examined on what they are taught. Hence if examination is drawn on 7 to 10 week semester work and the failure rate is 57%, proportionally if examination is drawn on full 15 weeks work the failure rate is likely to go up to 80%.

I have no words to describe the setback, but to urge both the Federal Government and ASUU to please resolve this problem immediately, if not there will be no credible educational system to return to.

Owolabi [2003] recently published in Nigerian Tribune admission requests and available placements in the nation's higher institutions as depicted in Table2. University education is not for everybody, though everybody should be given a chance to prove himself/herself. The upside down pyramidal structure created by the ratio of 5 to 1 of candidates seeking admission to universities to those of polytechnics and colleges of education is not healthy for balanced capacity building of a nation's workforce.

A drastic action has to be taken to reverse the situation by encouraging students to seek admission into Polytechnics and Colleges of Education. Also in order to eliminate cultism in our higher institutions, the cumulative grade point average for remaining in good standing should be raised from the present 1.0 to 2.0.

Some of our programmes and curricula are outdated and need

urgent review. It is sad that NUC, a body that is credited with the responsibility of providing our universities with guidelines on minimum standards is also a victim of moribund programmes and curricula. Information Technology or Information and Communication Technology as a programme should be encourage in our universities. As at now, only two universities are offering a programme in Information & Communication Technology. Covenant University is one of the two.

Table 2. (a) 2003/2004 UNIVERSITY JAMB & NO OF POSSIBLE PLACEMENT

No. of Universities & Degree Awarding Institutions	57
Maximum No. of Available Placement Per Year	150,000
No. of Average Admission per Institution per Year	2,630
No. of 2003/2004 JAMB Applicants	1,000,000
Average No. of Prospective Applicants per Institution for 2003/2004 Admission	17,540
The Chance of Gaining Admission	15%
Average No. of Prospective Applicants per Institution for 2003/2004 Admission	17,540
The Chance of Gaining Admission	15%

Table 2. (b) 2003/2004 POLYTECHNIC JAMB & NO OF ADMISSION REQUESTS

No. of Polytechnics	66
No of College of Education	67
No. of 2003/2004 JAMB Applicants	200,000
Average No. of Prospective Applicants per Institution (Polytech. + College of Edu.) for 2003/2004 Admission	1,500

Table 3. Nigerian Universities as at 2003/2004

Total No. of Universities in Nigeria	52
No. of Federal Universities	24
Regular Universities	16
Universities of Agriculture	3
Universities of Technology	5
No. of State Universities	19
Regular Universities	15
Universities of Technology	4
Private Universities	8
No. of universities offering IT related courses	
Electrical Engineering/Electronics	31
Computer Engineering	31
Information Technology/ Information & Communication Technology	2

6.0 INFORMATION TECHNOLOGY AND THE CHURCH

The church has a greater need for information technology and hence a commensurate role to play in its development. Montes [1995] reported that before the year 325 AD, churches in different parts of the world were celebrating Easter on different dates and not necessarily on Sunday ! The reason for the lack of synchronization is that Easter, like any other major religions, based celebration of their festivals on sighting of the moon. It was the church Council of Nicea in the year 325 AD that decreed that Easter must be celebrated on Sunday and went a head to provide algorithm for the calculation of Easter day. Hence, Easter, by that algorithm, is the Sunday immediately following the sighting of the full moon after the spring equinox of 21 March. This algorithm has helped to synchronise the celebration of Easter on the same day worldwide and other Christian religion festivals associated with Easter such as the lent, good Friday, and Ash Wednesday.

In fact, I have already dates of Easter for the next 300 years downloaded from the Internet ! For example, from that downloaded source, Easter will be celebrated in the year 2299 on 16th April.

The unprecedented church growth in Africa, particularly in Nigeria demands that the attendant challenges be solved in-house, since to whom much is given much is expected. Some of these challenges are provision of church shelter. For example, the in-house design and construction of Faith Tabernacle, a 50,000 seat capacity and the largest church auditorium in the world [Adeyinka, 2002] was as a result of the church growth experienced by the Living Faith Church , and the unwillingness based on sceptism of the so-called foreign experts to take on the job.

Other challenges are automatic attendance taking; automatic translation of sermon to multiple languages simultaneously on-line and in real time and in the voice of the speaker; automatic extraction of Bible verses quoted in a sermon and display on screen; automatic speech-to text translation; automatic text-to-speech translation with the author voice; and cost-effective audio-visuals. Chancellor, Sir, these are some challenges for the church in this part of the world to solve in-house. The mission universities have a lot to do in this regards. Hence, basic research and sound teaching should be taken very seriously.

7.0 IT AND GOVERNMENT

It is possible to conduct a fair and free election if information technology is honestly applied. It is also possible to eliminate totally multiple registrations and multiple votings. One thing that I do not understand at the just concluded election, is that both the

right and left thumb fingerprints were used during the registration exercise but surprisingly during voting one was free to use any finger ! The implication of this is that it is impossible to detect multiple votings or unauthorized voting from a different finger which has not got its template in INEC computer. However, that we are moving in the right direction is commendable.

The national ID card can be used to solve many of our election problems. For instance, there is no need for separate registration exercise, and there is no need to restrict persons to where they registered for election. The ID card should be in form of a smart card containing a template fingerprint of the holder. During election exercise, the authenticity of the voter can be determined at the polling booth by matching the voter's live fingerprint with the one on his/her smart ID card.

8.0 DISCUSSION

I believe God cannot deposit such a vast amount of resources at a place such as Africa without a purpose. The prevailing evidences point to the fact that the purpose of God is about to be fulfilled in Africa. Our Continent is like Jerusalem that lies in ruin, wanting Nehemiah to come to re-build it. Are you going to be one of the Nehemiahs to re-build Africa and restore the glory and dignity of a Blackman ?

This is my story and thank you for the audience.

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