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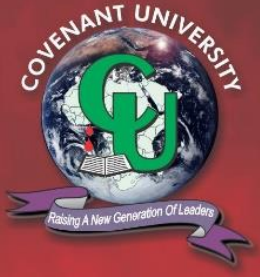

Public Lecture Series
Vol. 1, No. 16, September 2007

GLOBALIZATION, ENERGY, EDUCATION AND POVERTY ALLEVIATION: PROSPECTS & CHALLENGES FOR DEVELOPING NATIONS

James Katende

PUBLIC LECTURE SERIES

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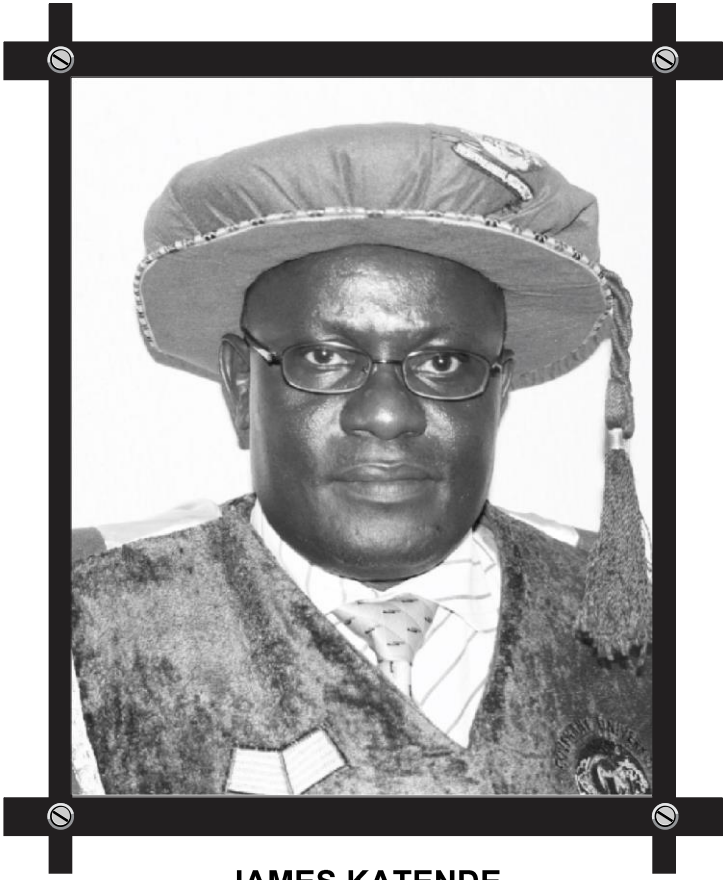
Covenant University Press
Canaanland, Km. 10, Idiroko Road, Ota, Ogun State, Nigeria

ISSN 2006---0327
Vol. 1, No. 16, September 2007



JAMES KATENDE

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1. Introduction

Excellencies, distinguished guests, members of the Press, ladies and gentlemen, this is a unique day and unique occasion for me. In the first instance, it is a singular honour and privilege to be given this rare opportunity to address such a distinguished audience on the sore issue of poverty in Africa that has agitated my mind for several years now. But most importantly, today happens to be the birthday of our Chancellor, Dr. David Oyedepo, whose passion, vision and raison d'etre is the restoration of the dignity of the African, through intellectual and economic empowerment.

My interest in poverty in Africa first started in 1983 while I was doing my PhD at the University of Rome. On a hot summer afternoon a young man met me drinking water from a running tap and he went on to cajole me that I should be thoroughly enjoying it since there was no cool tap water in Africa. Providing running tap water in Nigeria, for example, has remained a mirage in spite of the enormous amount of funds the World Bank has injected into water projects. My interest in poverty in Africa reached its pick some time in 2006 after watching the CNN documentary "*Surviving Hunger*". The documentary showed shrunken, bony, hungerstricken Ethiopians, first of all running away from a healthy wellbuilt human being (the reporter) and ultimately

scrambling to eat small pieces of green grass. At that time I was teaching a section *Technology and Society* of the General Studies Course at Bayero University, which made me look into some of the reasons developing nations are poor.

This paper is partly based on material from those lectures. It first of all examines the rather pitiable state of developing countries as represented by our Continent, Africa. This is done by looking at images of Africa captured by the creative minds of three African poets and the Chancellor of Covenant University. The rest of the paper outlines how globalization technologies, energy, and education have common features that may be exploited to impact positively on poverty alleviation on the continent and therefore highlights existing opportunities and challenges.

2. Africa

Africa is the world's second largest and second most populous continent after Asia. At about 30,221,535 sq km, including adjacent islands, Africa covers 6% of planet Earth's total surface area and about 20% of the total land area. As at 2005, Africa accounted for 14% of the world's human population. Most of the countries in Africa are classified among the so-called ***developing nations*** hugely characterized by **poverty**, conflicts and attendant political instability. A lot has been written and said about Africa. Permit me to illustrate the picture of Africa as painted in the following three poems written by fellow Africans.

Poem No. 1 by David Diop.

Africa

Africa, my Africa
Africa of proud warriors in ancestral savannahs
Africa of whom my grandmother sings
On the banks of the distant river
I have never known you
But your blood flows in my veins
Your beautiful black blood that irrigates the fields.
The blood of your sweat.
The sweat of your work
The work of your slavery
The slavery of your children
Africa tell me Africa
Is this your back that is bent
This back that breaks under the weight of ***humiliation***
This back trembling with red scars.
And saying yes to the whip under the midday sun
But a grave voice answers me.
Impetuous child that tree young and strong
That tree over there.
Splendidly alone amidst white and faded
flowers That is your Africa springing up anew
Springing up patiently obstinately
Whose fruits bit by bit acquire
The bitter taste of liberty

Poem No. 2 by Mustapha Muhammad.

Africa

Wake up! Wake Up!
Rise to this distress call
Threats to your survival
Multiplying in quick succession
Arise sleeping benefactor
I'm jut one of your dying cells
A looming danger A
venomous serpent
A sprawling gangrene
Snapping out lives in my neighbourhood

All around me is diseased
Around the heart a greater malaise
Along the spine all is deadly white
The cerebrum is saturated with toxic fluids
Cannibalizing brain cells
Feasting upon themselves
The giant lethargic feet
Infested with life-sucking pests.

Awake before I too expire
Find the herb that is instant in cure
Re-invigorate the yet surviving cells

March back to the glorious past
March back to the distant past
And make it the future of our ravaged world

Take full stock my dear land
Of that past of ***humiliating*** *pain*
Of those infamous days of yore
Of the ***present that is all bleak***
Dig deeper beyond the White horizons
Discover the stainless Black pasts
Therein the old ways you find
Therein our foundation you unearth
Historical rubbles nursing the ancient se4eds
Sprouting lively green to uproot dead foliage
Germinating anew to overrun poisonous shrubs
A healthy garden that requires careful cultivation
A blossoming garden to cool our ***enraged*** *hearts.*
And ensure the end of our ***humiliating*** *status.*

Poem No. 3 by Michael Adeyemi

Africa, Oh Africa!

Africa, my land of abode.
Africa, the land of my lineage;
the dwelling of the black race.
How I love to see your ***children gathered****;*
Your young filled, your poor satisfied and full*. Though you are called deserted, weak*
and not sophisticated, yet my love for you is

more than the love for a woman., you beat
hard on the tablet of my heart daily.
Africa, my Africa
If I have my hands full of hyssop,
oh, I will wipe off the blood that
has stained your white garment. If
I have my feet painted with green,
I will tread your land until you are filled
with food in abundance.
If I have a lift to reach the firmament, yet
will I lift to the sky and bear your sun
until the day it shines to the end of the
earth. Africa, oh my Africa …
I cannot stop but thinking about you.

In all the above three poems, emphasis is mine.

David Diop's '**Africa**' was written in the 1970's (barely a decade after independence) and depicts:

- The pre-colonial era of grandeur and proud warrior tribes.
- The colonial experience of subjugation and humiliation.
- The optimistic post colonial period of freedom and sovereignty.

In the euphoria of the successful independence struggles, Diop envisions Africa's ultimate rebirth "springing up anew".

On the other hand, Mustapha's "**Africa**" was written in 2004, more than 30 years after independence of most African nations

and portrays disillusionment with the state of things in post-colonial Africa. Mustapha, a Professor of English at Bayero University, Kano depicts a sleeping giant ravaged by a deadly disease and whose brain is saturated with toxic fluids and self-destroying cells. Decades after independence from colonial rule, the giant cannot stand up on lethargic feet that are infested by life sapping pests (such as jiggers corrupt leaders). The poet longs for the precolonial era and envisions an end to Africa's "humiliating status" marked by a new beginning in the imagery of "a healthy garden that requires careful cultivation". In that garden there are herbs for instant cure of Africa's malaise in other words Africa's solution to its problems is within Africa. It is noteworthy that both Diop and Mustapha allude to **humiliation** or *poverty of dignity* of the African. They depict a feeling of hopelessness. In his international bestseller, *The World is Flat*, Thomas Friedman asserts that humiliation is the most underestimated force in international and human relations and that humiliated people or nations tend to lash out and engage in extreme violence. Little wonder that civil conflict appears to be common in the continent of Africa. Presently, several African nations are either in conflict, total war, or are emerging from the rubbles of war which obviously aggravate the poverty conditions of the people.

Written in 2005, the third poem is the most recent of the three poems and is by a much younger man, Michael Adeyemi, a

Covenant University student of psychology. The poet depicts a state of hopelessness and wishful ness arising from the fact that he does not have what it takes to lift the beloved continent from the humiliating condition of her children being scattered around the globe in search of green pastures while those on the continent are walloping in poverty and hunger. He ends the poem on a promising note that he is wearing his thinking cup with a burning desire to do something about the unsatisfactory state of his beloved continent. This is certainly in line with Covenant University's motto of "**Promoting Mental Productivity**" and vision of **producing a new generation of leaders** who will turn around the fortunes of the continent.

It is instructive to also consider The Mandate of Dr David Oyedepo, the Chancellor of Covenant University:

> "*About twenty-five years ago, precisely on May 2, 1981, at the end of a visionary encounter that lasted about eighteen hours, I saw a roll of afflicted, battered, beaten, tattered, deformed and all that one could ever imagine, groaning and agonizing, as a result of pains and pangs, crying as it were for rescue. I was so moved with compassion that I began sobbing profusely asking, 'Why Lord?' I heard the Lord say to me, '**But from the beginning it was not so**'. I questioned further, 'But why Lord?' And then came the mandate. '**The hour has come to liberate the world from all oppressions of the devil***

through the preaching of the word of faith, and I am sending you to undertake the task.'"

This takes place two decades after independence, and again a picture is painted of a people who are traumatized in need of liberation. It is of note that Dr David Oyedepo took up the assignment and is still at work on it day and night. The results today are in testimonies given by many who have had an encounter with the word of faith. The liberation has found expression in the establishment of Covenant University, for raising an army of creative, imaginative and God-fearing men and women who will lead the African continent from the dehumanizing poverty-edge to the competitive edge of a knowledge economy.

3. Poverty and the Vital Difference

.The simple dictionary meaning of poverty is a state or condition of being poor. A nation is poor if a fair proportion of her population lives under poverty condition whereby they lack basic needs such as adequate and nutritious food, clothing, clean water, clean environment, health-care, and easy means of transportation and communication. The several possible causes of poverty in a given nation include:

- Insufficient natural and human resources
- Lack of capacity to harness available natural resources
- Over population

- Inadequate education and employment opportunities
- Mismanagement of available resources
- Environmental degradation

Table 1, taken from a 2002 UN report, reveals that:

- Science and technological capability has made developed (or First world) nations achieve sustained social and economic development.
- Lack of science and technological capability has made developing (or Third world) nations to be relatively poor.
- Almost the entire population of developed nations is literate (i.e. can read and write) whereas only half of the population of developing countries is literate. Indeed our people perish for lack of knowledge (Hosea 4:6). These are the vital differences between the developed and developing nations. In other words developing nations are poor because of their negligible investment in science and technological know-how and their people do not have the capacity to inform themselves in a competitive knowledge-driven world.

Table 1: The vital difference

		Developed Nations	Developing Nations
Economic Indices	Per capita GNP	$10,011	$640
	Manufacturing per capita	$2,297	$126
Living standards	Infant mortality rate per 1000	11	94
	Adult literacy	97%	48%
Technological capability	Share of science and technology capability	95%	5%
	Share of expenditure on R & D	99%	1%

The consequences of poverty include:

- Migration of people from rural areas to urban areas

  thereby stressing the services there.
- Influx of rural dwellers into urban areas without capability of partaking in any productive activity increases the level of urban poverty.
- It increases the level of social malaise characterized anti-social behaviour, prostitution, robbery, drug peddling and use, etc.

- General insecurity and disregard for human life and values.

4. Globalization

The term *globalization* is quite controversial and has several definitions. In the context of this paper, globalization is a process that involves increased integration of economic, cultural, political, religious and social systems through internationalization and localization. Globalization seeks to promote international trade in goods and services as well as cross-border movement of information, technology, people, investments, and services. Globalization generally results in a growing interdependence of all peoples of the world and is characterized by, among other things: increased international trade; growth of multinational corporations; internationalization of finance; market liberalization; regional cooperation and collaboration; and widespread use of information and communications technology (ICT), transportation, energy, and power.

Today, our world has to deal with problems that cannot be solved by individual nation-states acting alone. Examples of such problems include:

- Cross-boundary air and water pollution
- Over-fishing of the oceans.

- Environmental degradation
- Outer space
- Global warming.
- Terrorism
- Poverty
- Diseases, e.g. Bird flu

Solutions to these problems have necessitated new forms of cooperation, collaboration, and the creation of new global and regional institutions as well as powerful multinational corporations. Apart from the well-known world bodies such as the United Nations (UN), the World Bank, and the International Monetary Fund (IMF), every continent or region of the world has at least one major integration movement or institution: EU in Europe; ASEAN, APEC and SAARC in Asia, NAFTA in North America; Latin America Integration Association (LAIA) and Andean Common Market (ANCOM) in Latin America; Caribbean Community (CARICUM) in the Caribbean; Council of Arab Economic Unit (CAEU) in the Middle East; and Central American Common Market (CACM) in Central America. In Africa, apart from the African Union (AU) that was formed in 1963, there are 14 sub regional bodies including: ECOWAS, SADC and COMESA.

A good example of globalization at the multinational corporation level is the France-based Airbus consortium well-known for manufacturing wide-body commercial jetliners:

- It is jointly owned by companies from four countries: France, German, Britain and Spain.
- The wings of its planes are from Britain, the fuselage and tail from German, the door from Spain, Cockpit and final assembly in France.
- It employs 500 suppliers in 27 countries.
- More than 35 of components for the consortium's aircraft are supplied from American companies.
- Numerous suppliers also are located in the Asia-Pacific: Singapore Technologies Aerospace produces wing ribs and passenger doors for the A320, and engine mounts and thrust reverser doors for the A340; India's Hindustan Aeronautics Ltd. also builds A320 passenger doors.

A good illustration of the driving forces behind globalization lies in vegetable exports from Zimbabwe or the flower export business by East African countries. In the case of Zimbabwe vegetable farmers near Harare used to supply fresh vegetables to London markets. The vegetables were picked and trucked immediately to Harare Airport, flown through the night to Heathrow and placed on the shelf at Tesco the next morning.

Vegetable or flower exports from African countries to London, for example, depend on at least three things:

I) Cheap and fast air transport.

ii) Modern telecommunications flowers and vegetables are delivered to order.

iii) An open British market it could not happen if import quotas or high tariffs prevented sales.

Consequently there are three primary driving forces for the globalization process.

a) Falling transportation costs lower amounts of money and time foregone to move goods over long distances.

b) Falling trade barriers lower tariffs and many cases fewer non-tariff trade impediments.

c) Falling communication costs technology that allows **ideas** to be moved long distances quickly and cheaply.

Other drivers of globalization include: search for better investment climate or markets; challenges of energy supply; and **improvement of quality of life**. The latter is amply illustrated by the following global initiatives for Africa's development:

- The Millennium Development Goals (MDGs) aimed at poverty reduction over a stipulated period of time with globally defined measurable indicators of progress;

- The World Summit on Sustainable Development (WSSD) which places science and technology at the heart of policies to promote sustainable development;
- The Blair Commission Report for Africa; and
- The New Partnership for Africa's Development (NEPAD) targeted at repositioning Africa in the world economy.

4.1 Millenium Development Goals (MDGs)

The MDGs are quantitative; time bound objectives for ***poverty reduction*** and human development. They are the result of series of international conferences and consultations during the 1990s and were approved by the United Nations in the year 2000 and are to be achieved by 2015. The goals constitute a vision of a world with:

- Less poverty, hunger, and disease,
- Greater survival prospects for mothers and their infants
- Better educated children and equal opportunities for women
- A healthier and sustainable environment
- Developed and developing nations partner for the common good.

The eight MDGs are shown in Table 2 together with the set targets. When launching the MDGs, the then UN Secretary-General, Kofi Annan commented as follows:

> *"We will have time to reach the Millennium Development Goals worldwide and in most countries, or even all, individual countries but only if we break with business as usual. We cannot win overnight. Success will require sustained action across the entire decade between now and the deadline. It takes time to train the teachers, nurses and engineers; to build the roads, schools and hospitals; to grow the small and large businesses able to create the jobs and income needed. So we must start now. And we must more than double global development assistance over the next few years. Nothing less will help achieve the Goals"*

Practical measures for achieving the MDGs were enunciated in a 2005 UN Millenium Projects report titled "*Investing in Development: A practical Plan to Achieve the Millennium Development Goals*". The report observed that:

> *"All nations, whether industrialized or developing, face a broad array of challenges that will require the application of up-to-date scientific knowledge and technology. Such challenges include stimulating economic growth, mitigating environmental problems, safely adopting new technologies, and quickly responding to sudden outbreaks of new diseases. No nation can now afford to be without access to a credible independent* ***science and technology*** *research capacity that would help it to develop informed policies and take effective actions in these and other areas.*"

Table 2: The Millennium Development Goals and Targets

Goal	Title	Target (s)
Goal 1	**Eradicate extreme poverty and hunger**	***Target 1:*** Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day. ***Target 2:*** Halve, between 1990 and 2015, the proportion of people who suffer from hunger.
Goal 2	**Achieve universal primary education**	***Target 3:*** Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.
Goal 3	**Promote gender equality and empower women**	***Target 4:*** Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education not later than 2015.
Goal 4	**Reduce child mortality**	***Target 5:*** Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate.
Goal 5	**Improve maternal health.**	***Target 6:*** Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio.
Goal 6	**Combat HIV/AIDS, Malaria and other diseases.**	***Target 7:*** Have halted by 2015 and begun to reverse the spread of HIV/AIDS. ***Target 8:*** Have halted by 2015 and begun to reverse the incidence of Malaria and other major diseases.
Goal 7	**Ensure environmental sustainability**	***Target 9:*** Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources. ***Target 10:*** Halve, by 2015, the proportion of people without sustainable access to safe drinking water. ***Target 11:*** By 2020, to have achieved a significant improvement in the lives of at least 100 Million slum dwellers.
Goal 8	**Develop a Global partnership for Development**	***Target 12:*** Develop further an open, rule based, predictable, nondiscriminatory trading and financial system. ***Target 13:*** Address the Special Needs of Least Developed Countries. ***Target 14:*** Address the Special Needs of landlocked countries and small island developing States. ***Target 15:*** Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term. ***Target 16:*** In co-operation with developing countries, develop and implement strategies for decent and productive work for youth. ***Target 17:*** In co-operation with pharmaceutical companies, provide access to affordable, essential drugs in developing countries. ***Target 18:*** In co-operation with the private sector, make available the benefits of new technologies.

Consequently, international organizations, governments, and multinational corporations have coordinated their development work around the MDGs. The resulting increased cooperation and collaboration is expected to deliver the desired developmental gains. In the case of Nigeria NEEDS (National Economic Empowerment and Development Strategy) was launched in 2004 with the goals of poverty reduction, wealth creation, employment generation and value-orientation. The long-term vision of NEEDs is to make Nigeria the largest and strongest African economy and key player in the world.

4.2 World Summit on Sustainable Development (WSSD)

WSSD recommended that the three pillars economic, environmental and social have to be integrated at the national level by building capacities for elaboration of science and technology policies and strategies. WSSD Secretary-General, Mr Desai asserted that:

> "*Science and technology must be placed at the heart of policies to promote sustainable development. Indeed many of the means of implementation of the Johannesburg Plan of Implementation are measures in, or related to, science and technology policies*"

4.3 The Blair Commission Report for Africa

In 2005 the Blair Commission Report observed that "*an understanding of the cultures of Africa shows that development means putting a greater emphasis on increasing human dignity within a community*". It identified professional skills and leadership as key to achieving development and highlighted the challenges confronting African countries in this regard. According to the report, qualified professionals are essential to all forms of development; for delivery of health, education and other services. Scientifically and technically proficient staffs are crucial and essential with skills for:

- Collecting and managing data.
- Debating and developing good policies, based on the evidence of what works and what does not.
- Implementing those policies and monitoring how they are put into effect.
- Identifying opportunities arising from innovation and scientific discoveries.
- Developing effective policy in areas such as science, trade and resource management.

The report noted that while these skills are particularly needed for high performance and innovation, Africa has been lacking skilled men and women in all these spheres and fundamental to this

shortage is the loss of the loss of much of Africa's pool of skills to the developed world:

> "*Around 70% of Ghanaian medical officers trained in the 1990s have left and it has been estimated that there are more African Scientists and engineers working in the USA than in the whole of Africa. This shortage starts with higher education, which ought to be the breeding ground for the skilled individuals whom the continent needs*".

The report also has the following to say about the tertiary educational institutions:

> "*Many of Africa's higher education institutions are still in a state of crisis. They lack physical infrastructure, such as internet access, libraries, textbooks, equipment, laboratories and classroom space. Demand for higher education is increasing; in 2000 Nigeria had the capacity to accept only 12% of qualified candidates. Hit by these pressures and a lack of funding, the research capacity of Africa's institutes has declined. The capacity that does exist is not being used efficiently, as there is limited collaboration, and human and financial resources are spread thinly".*

The reported lamented that the science gap between Africa and the rest of the world is widening and under business-as-usual the gap will continue to grow.

The report therefore recommended as follows:

a) The international community should commit US$500 million per annum over ten years to revitalize Africa's institutions of higher education.

b) Specific action was needed in order to strengthen science, engineering and technology capacity to:

- Enable countries to find their own solutions to their own problems.
- Bring about step-changes in areas of health, water supply, sanitation, energy, climate change, and urbanization.
- Critically accelerate economic growth, and enter the global economy.

4.4 The New Partnership for Africa's Development (NEPAD)

The African Heads of State decried the continuing marginalization of Africa in all aspects and committed themselves to NEPAD as a vehicle for putting Africa firmly back on the global development agenda and "on the path of irreversible and sustainable development so that Africa truly claims this millennium". NEPAD was therefore adopted as the socio-economic vehicle for regional integration, eradication of poverty and sustainable development as a way of complementing other initiatives such as MDGs, and WSSD. Following series of meetings in Nairobi and Johannesburg in 2003, the Ministers of

Science and Technology in Africa noted that the ability of African countries to create, diffuse and utilize scientific technical knowledge would be a major determinant of Africa's capacity to take advantage of international trade and effectively compete in the global economy as well as improve the people's quality of life. Therefore, within the NEPAD framework, there is the need to:

- Champion, as a matter of priority, science and technology as instruments of economic and social development
- Put in place science and technology policies and strategies leading to sustainable development and eradication of poverty.
- Find ways and means of strengthening, individually and collectively, science, technology and innovation systems so that African countries attain sustainable development and integration into the global economy.
- Promote within African countries scientific research and technological innovations and their applications, particularly in the eradication of poverty, seeking solutions to food insecurity and malnutrition, homelessness, lack of affordable energy, and the fight against disease, especially HIV/AIDS, tuberculosis, and malaria.

- Establish appropriate enabling conditions for scientific and technological advancement of African countries and the continent.
- Pursue all measures possible to increase public expenditure on research and development to at least 1 % of GDP per annum.
- Establish networks of centres of excellence in science and technology.
- Adopt common sets of indicators to benchmark national and regional systems of innovation.
- Ensure coordination of science and technology matters between the different sectors of government.
- Promote dialogue among stakeholders in the science and technology community.

4.5 Comment

Globalization has brought about several opportunities and challenges. The opportunities lie in the many initiatives that have been put in place to ensure that developing countries become relevant in the world's scheme of things on a global level. However, the UN report titled "**Africa and the Millennium development goals: 2007 Update**", posted on the UN website (www.unstats.org) on Tuesday 3rd July 2007 noted that at the midway point between the adoption of the MDGs in 2000 and the 2015 target date to achieve them, sub-Saharan Africa is **not on**

track to achieve any of the goals! And of particular relevance to subject of this paper is the report's observation that:

> *"Although there have been major gains in several areas and the Goals remain achievable in most African nations, even the best governed on the continent have not been able to make sufficient progress in* ***reducing extreme poverty*** *in its many forms ..*"

In my opinion the major challenge lies in insufficient infrastructure and utilization of information and communications technology (ICT) on the continent. Thomas Friedman's *flat world* is attributed to advances made in ICT. ICT has rendered boundaries geographical and mental to literary become irrelevant. It is the frontier hero of the global knowledge age which when fully embraced provides a definite competitive edge. Olunloyo asserted that ICT: "*… is driven by ambition and full of courage; replicating itself like a virus, and sweeping all before it. Being neither passive nor moral, it is affecting everything it touches, marginalizing those who will not give it its due*". Apparently African countries are paying the price of not having given adequate due attention to ICT.

Some of the characteristics of ICT that make it the centre point of human activity be it political, economic or social are the following:

- It is global in reach and perspective to a scale so large as to enforce some level of collaboration even amongst competitors.
- It cannot stand on its own but rather thrives on: cutting age innovations in artificial intelligence, informatics, robotics; cost-effectiveness due to convergence of computers and telecommunications; and excellent digitization techniques coupled with wideband transmission and compression technologies.
- The dual nature of the technology and the infrastructure that supports it allowing it to have both military and civilian applications while amenable to easy conversion from military to civilian.
- Dramatic in speed and scale of penetration/proliferation allowing comparison of effects in communications, information gathering, environment monitoring or resource development.
- Facilitates transparency as an agent for promotion of international peace, security and stability, and egovernance.
- Interdependency of information systems such as global information infrastructure (GII), national information infrastructure (NII) and sectoral information infrastructure

(SII). Moreover, with only a few exceptions communication travels via shared systems in a seamless network.

Essentially ICT provides the foundation for a global platform for collaboration and flattening the world. Thomas Friedman asserts that ICT made available "a platform for collaboration that all kinds of people could simply plug and play, compete and connect on in order to share work, exchange knowledge, start companies, and invent and sell goods and services". It is on this ICT platform that the world started to move away from "*a primarily vertical command and control system of creating value to a more horizontal connect and collaborate value-creation model*". ICT enabled several other forms of collaboration that further flattened the world: up-loading, out-sourcing, off-shoring, supply-chaining, in-sourcing, and in-forming, most of which Africa has not yet started to exploit.

It appears that the abundance of natural resources in some of subSaharan African countries may also be an albatross. According to Thomas Friedman, the ideal country in a flat world is one without natural resources because countries with no natural resources tend to dig inside themselves by way of trying to "*tap the energy, entrepreneurship, creativity, and intelligence of their own people men and women rather than drill an oil well*". He illustrates using Taiwan which he refers to as *a barren rock in a*

typhoon-laden sea, with virtually no natural resources, except the energy, ambition and talent of her people. He asserts that today Taiwan has the third largest financial reserves in the world.

5. Energy

In physics books energy is described as the ability to do work. Energy is recognized to be the engine for growth and development in all economies of the world. Energy serves not only as a tradable commodity for earning the national income, but also as an input to the production of all goods and services as well as an instrument for politics, security, and diplomacy. Energy plays a dominant role in human existence and in sustenance of life. Sufficient availability of energy and its effective and efficient use are prerequisites for an elevated standard of living.

Energy resources naturally engender networking, collaboration and cooperation among the nations of the world. This is because such resources are unevenly distributed among the nations. Some countries have excess energy resources while others are deficient. This indicates opportunities for energy networks and possible directions for energy movements. For example, Nigeria exports power to Niger and Benin republics via its high-voltage grid lines. Similarly, the huge natural gas reserve in Nigeria has permitted the construction of the West African Gas Pipeline Project to deliver to Ghana, Togo, and Benin Republic with likely extension

to Ivory Coast and Senegal. The philosophy of energy pooling and networking has advantages ranging from economics of scale to energy economy conservation through the equal-increment-cost principle (for electrical power) whereby careful dispatch of high cost sources will be kept strictly for peaking or reserve purposes. It also enables the sharing of spinning and operating reserve requirements for individual nations.

God in His infinite wisdom has endowed Africa with a wide range of conventional and renewable energy resources, namely: Petroleum, Natural gas, Coal, Hydro-potential, Biomass, Solar, Geo-thermal, Wind, Nuclear, and several others including tidal and ocean waves.

The major energy challenges in Africa are: Inefficient energy utilization; inadequate energy supply system; environmental concerns; and restructuring, deregulation and privatization; and exploitation of renewable energy sources.

5.1 Energy Consumption patterns

In the **agricultural sector**, human- and animal-power provide the bulk of the energy for agricultural production. There is evidence of use of petroleum products for motorized irrigation pumps and diesel powered tractors for mechanized agricultural production. Fuel-wood is predominantly used as cooking fuel in the household sector in both the remote villages and the towns. The consequence of this is that unchecked felling of trees to provide fuel-wood requirements has the potential to exacerbate desert

encroachment, soil erosion and loss of soil fertility. Other fuels such as LPG, kerosene and smokeless coal briquettes are also in use. Kerosene is particularly widely used in the rural areas for lighting while it is widely used in the urban areas as cooking fuel. The household sector also employs electricity, but mostly limited to state and local government headquarters as well as some of the big towns. Most of the rural areas are not connected to the electric power grids and therefore rely on Rural Electricity Boards (REB) with stand-alone generating plants.

Mains electricity dominates the energy supply for the **industrial sector** and is usually coordinated by a country's power supply authority, such as the Power Holding Company of Nigeria (PHCN). This is supplemented by electricity generating sets that are fueled by automotive gas oil (AGO or diesel). The foregoing holds for large industries which are mostly located in big cities. For

small towns and villages, most of the small-scale industries are operated on diesel generators. These include bakeries, small-scale steel works, and small-scale ceramic/pottery works. In these localities other small-scale activities like handicraft, weaving, etc employ human power.

In the transport sector, prime motor spirit (petrol) is the major fuel for passenger cars and 'small buses". For Lorries, trucks, luxury buses, and rail transport the predominant fuel is AGO. While for air transport the fuel is aviation kerosene.

In remote rural areas, human power is used for water lifting from wells or rivers and delivery to homes while in the big villages and many towns, diesel powered pumping system are relied upon to lift water from boreholes. Hospitals and health centres in rural areas rely on both REB-generated electricity and diesel generators for lighting, sterilizing of appliances as well as for storing drugs and vaccines. Use is made of fuel-wood and to a lesser extent LPG for cooking. The health centre situation is replicated in boarding schools, barracks, and prisons.

5.2 Inefficient Energy Utilization

Energy utilization in Africa is generally inefficient. Apart from wastages due to direct energy loss, inefficiency has the following major implications:

Investment in energy supply infrastructure exceeds the demand.

- Environmental problems associated with energy utilization are aggravated due to excess energy demand
- Excessive energy consumption adds to the cost of goods produced or service rendered.

There is tremendous potential for energy savings and this is imperative as a way of reducing poverty in Africa. In the household sector, for example, substantial savings can be made by simple switching from incandescent lamps to energy efficient fluorescent lamps. Simple housekeeping measures switching off electrical machinery on no-load condition, and plugging steam leaks in the industrial sector. In the transport sector mass transit schemes can be used to realize tremendous energy savings.

5.3 Inadequate Energy Supply

Inefficient electricity supply and low installed generating capacity result in inadequate energy supply. The efficiency of existing thermal generating plants is quite low while a huge amount of electricity is lost in the power transmission corridors and in the distribution networks. Moreover, there is a serious problem of supply unreliability in most of sub-Saharan Africa. This has necessitated many industries and households to install very expensive generating sets. Unstable power supply has also

resulted in damage to household and industrial appliances/equipment. Persistent power outages have resulted in lost man-hours with adverse effect on small-scale cottage industries. This constitutes huge economic losses and aggravates poverty.

The above problems may be attributed to:

- Inadequate maintenance.
- Lack of spare parts
- Obsolete generation, transmission, or transmission equipment
- Lack of skilled manpower
- Vandalism
- Inadequacy of basic industries to service the power sector
- Unmotivated and poorly remunerated personnel
- Square peg leadership in round holes. There is a tendency to appoint non-engineers to head engineering organizations in Africa on political dispensations.

In the oil and gas sector, production, marketing, and distribution systems are often inadequate, inefficient and costly. Refinery capacity utilization is generally low largely due to operation and maintenance problems.

5.4 Environment Concerns

The major environmental challenges associated with energy production, distribution and utilization are:

Deforestation

- Pollution, and
- Flooding

Excessive fuel wood consumption arises as populations grow with the attendant problem of deforestation and desertification. Forests play important roles in the ecosystem. They serve as sinks for CO_2, maintain diverse plants and animal life, and also regulate water flow. Loss of forests may lead to soil erosion, desert encroachment, and loss of soil fertility. Combustion of fossil fuels contributes to air pollution in cities. A major air pollution that poses a health hazard to humans is long exposure to smoke in poorly ventilated kitchens. Major water and soil contamination occur from time to time especially due to oil spillage from vandalized pipelines or in oil producing areas. Dams for hydrogenation have been noted to periodically cause flooding of agricultural land.

5.5 Restructuring, Privatization and Liberalization

The energy infrastructure and its institutions have been mainly owned and controlled by government. Government has expended huge resources on them without achieving corresponding benefits

in the services provided. For instance Nigeria has suffered numerous crises in the supply of petroleum products in spite of the huge financial investment in the NNPC. The same applies to PHCN, the electricity supply authority. Electricity consumers have been over the years frustrated by inadequate, erratic and poorly spread electrical power. The rationale behind restructuring and privatization is that it would allow government to concentrate available resources on its core responsibilities of providing basic infrastructure and ensuring access to key services such as education, health, law enforcement, security, and environment protection, while performing regulatory oversight. Consequently, the electricity supply industry and the downstream oil sectors in Nigeria are penciled down for privatization. Such privatization is expected to integrate the nation's economy and in particular the energy sector into the mainstream of a flat-world economic order.

5.6 Renewable Energy

Presently there are several renewable energy technologies capable of making a significant contribution to world energy needs. The highest-grade sources, suitable for generating electricity directly are hydro, wind, tidal, and photovoltaic energy. Electricity can also be profitably generated from lower-grade renewable sources by burning biomass, from geothermal heat, or from concentrating solar furnaces, using heat to raise steam to drive a turbine and a generator.

The transport sector requires high-grade energy for which renewable energy technologies, such as hydrogen fuel cells, have been invented for electrically powering cars and trains.

Some of the advantages of renewable energy (particularly, wind, solar and biomass) over conventional energy sources are:

- Predictable availability, hence usage can be planned

Suitable for on the spot application thereby obviating problems transportation, political, and other costs.

- Easily adaptable as a complimentary source.
- May not require sophisticated expertise for construction, installation and maintenance.
- No replenishing fuel costs.
- Ease of maintenance.
- Enhanced environment friendliness.

One of the major demerits of renewable energy systems is the high initial capital outlay. Careful planning of the energy mix of a country is required for sustainable availability and therefore improved living and working conditions and wealth creation.

6. Education

The role of education for production of requisite manpower cannot be over-emphasized. Trained manpower (scientists, technologists and engineers) both in quality and quantity are

required to face the challenges in the workplace as well as in R&D laboratories of tertiary education institutions and those in industries..

In one of its reports, the African Network of Scientific Institutions (ANSTI) noted that:

> *"After decades of neglect of all aspects of higher education in Africa, there are now signs that the situation is changing. In particular, there is awareness that Africa cannot achieve any of its development objectives including*

> *the MDGs unless there is a substantial investment in building scientific human resource capacity and in scientific research. There is therefore a renewed commitment to support science and technology training and research institutions*."

This supports the earlier observations gleaned from the Blair Commission Report and the WSSD. Today, more than ever before, the ability of any nation (developing nations inclusive) to successfully realize its potential and sustain any form of national growth depends almost entirely on its ability to build and develop high quality local manpower. Increased competition in a global marketplace, adds to the need and urgency to get the right people, with the right skills, in the right place, at the right time. All global initiatives put in place for rapid transformation of developing nations have indicated the need for developing science and technology manpower.

There four major developments in science and technology today are:

- Scientific labour in laboratories is undertaken by interdisciplinary research teams of scientists and engineers or trans-laboratory networks.
- Scientific work is often today more interested in the development of techniques rather than general theories. Moreover both scientist and engineers work side by side in modern industries.

- Commercial exploitation of scientific knowledge has become necessary for the survival of firms in certain industrial sectors of the economy e.g. in bio-sciences.
- Science and technology have become subject to a growing promotion, monitoring and regulation by national and international agencies. This is because nations are increasingly compelled to exploit their national science bases in order to maximize economic competitiveness.

These developments to me suggest that the practice whereby scientists are trained separately from other technological professionals (i.e. in different Faculties or Colleges) in tertiary institutions may have to be revisited. Close collaboration among scientists, technologists, and engineers as well as other sciencerelated professionals is essential for rapid transformation of scientific ideas into prototypes and ultimate products. Thomas Friedman noted that"

> *"..... there has always been a certain American selfconfidence that whatever America lacks in preparing its kids with strong fundamentals in math and science, it makes up by encouraging its best students to be independent, creative, thinkers. There is a lot of truth to that. Even the Chinese will tell you that up to now they have been good at making the next new thing, and copying the next new thing, but not* ***imagining*** *the next new thing. .... China is now*

> *focusing on how to unleash more creative, innovative juices among its youth"*

It is the innovative enterprise of Americans that has given them a competitive edge in the face the flat world's out-sourcing of jobs, off-shoring of businesses, etc from America.

It was observed at a Conference on Science & Technology for Development organized by the New York Academy of Sciences at Harare, Zimbabwe:

> "***Innovation*** *is key to Africa's economic future. Times and perspectives are changing. Africa is a young continent. A new generation of young Africans free, educated, and technologically literate will become the scientists who can push the edges of knowledge, the business leaders who can transform knowledge into goods and services demanded by internal and global markets, and the government officials who create a fertile policy environment for both discovery and innovation. A spirit of collaboration must nourish their efforts. Partnerships are the pathways to greater African prosperity*"

Innovation derives from professional imagination and creativity. It may be defined as *the introduction into a market place of new or improved products, processes or services.* Innovation may comprise both radical changes and many small improvements in product design and quality, in production processes or the way in which production is organized, in management, marketing or

maintenance routines that collectively modify products and processes, bring costs down, increase efficiency, enhance welfare and ensure environmental sustainability.

I believe that a major challenge confronting science and technology educators in tertiary institutions is how does one inspire and develop creativity in students. Luckily, as the above definitions of innovation imply, it has to do with either adapting existing products and processes for new applications or generating new inventions. A possible checklist to assist in this regard based on the work of von Fange is as follows:

The creativity check list

1. Can object be put to use?
2. Is any adaptation of object possible? Can't one copy good ideas from other objects?
3. Any modification possible? Can one change colour, sound, odour or shape?
4. etc

A challenge of science and technology education is that it is nowadays highly ICT-driven Deployment of ICT tools and techniques can significantly enhance the design and delivery of science and technology curricula.

- Introduction of distributed multimedia environment in the class-room
- ICT enabled geographically separated learners.

- Implementation of resources sharing in electronic media of

  i. Library holdings ii. Teacher instruction, etc
  Iii. Video conferencing (tutorials, seminars, etc) iv. Visualization tools v. Simulation tools vi. Virtual experimentation
  Vii. On-line lecture notes
  Viii. Etc.

Judging by what is going on today, we are in the era of multiple certifications. These days we have professional certifications like:

- Microsoft Certified Professional (MCP)
- Microsoft Certified System Administrator (MCSA)
- Microsoft Certified Application Developer (MCAP) Being ICT-driven, Covenant University has most of the above items provided to enhance knowledge transfer.

All science and technology teachers must acquire practical industrial exposure so as to be in position to impart both practical and theoretical knowledge to students. Moreover, laboratories should be adequately equipped to provide for thorough learning from experimentation

7. The Way Forward and Conclusion

In the face of globalization and half way through the target period for achieving the Millennium Development Goals by 2015, the African developing nations, particularly those in the sub-Saharan region are far from achieving poverty reduction. In this presentation we briefly examined the reasons for this anomaly and concluded that inadequate educational facilities and inability to embrace science and technology are responsible for our failure to emancipate Africa from the clutches of abject poverty. We noted that poor quality and inadequate power supply militates against achieving sustainable development. We recommended that there is need to exploit the safe and abundant renewable resources, such as wind and solar especially for rural areas which are not connected to the grid presently so as to supplement the conventional power sources. Furthermore we pointed out the need to place sciencebased professionals to head science and technology related organizations, such as PHCN, so as to provide informed leadership We examined some of the initiatives brought about by the ICTdriven globalization process to help developing nations achieve sustainable development. We showed that all of them emphasized the need for education and training of science and technology manpower. We pointed out that such education should employ modern ICT tools to enhance achievement of learning objectives. The need to expose students to creative and

innovative problem solving in science and technology was pointed out as the only way to ensure that they are equipped to find local solutions to our local problems. Furthermore we also highlighted the need for teaching faculty to engage in practical industrial work periodically so as to reinforce their practical base and firm up industry-academia linkages.

Permit me to re-echo economist David Lange's argument (in his book "*The Wealth and Poverty of Nations*") that although climate, natural resources, and geography all play roles in explaining why some nations are able to make a leap to industrialization and others are not, the key factor is actually a nation's cultural endowments, particularly the degree to which it internalizes the values of hard work, thrift, honesty, patience, and tenacity, as well as the degree to which it is open to change, new technology, and equality of women.

I would therefore recommend as follows:

1. Energy is the most strategic infrastructure for national development and requires a lot of attention from all concerned with a view to making energy available to urban and rural areas.
2. In order to broaden our options there is need to develop a wide range of renewable energy sources we are endowed with.

3. Science and technology must be placed at the heart of policies to promote sustainable development. Adequate funds must be made available in support of the 60:40 science/arts students ratio recommended for tertiary institutions so as to provide adequate laboratory space and laboratory equipment.
4. Government's budgetary allocation to Science and Technology activities should not be less than the African Union's recommended 1% of GDP.
5. Broad-band access must be provided for meaningful development of the ICT sector.
6. Parastatals and multinational corporations in developing nations should show more interest in the research and development activities of our tertiary institutions with a view to commercializing the results.
7. There should be a deliberate effort to encourage collaboration and cooperation among scientists and engineers/technologists so as to find home-grown solutions to problems peculiar to developing nations.
8. Science and Technology education should be ICT-driven in order to take advantage of the inherent opportunities.
9. There should be an increase in research funding in tertiary institutions and each research grant should incorporate an amount meant for the researcher's pay.

10. All science-based programmes should incorporate SIWES (students industrial work experience) in order to expose students to practical applications of what they study in school. It should be mandatory for all organizations to design training programmes for students on industrial training.

Produced by:
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