CHAPTER 8

Challenge of Science, Technology Engineering and Mathematics (STEM) in Technological Development of Nigeria.

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Challenges of STEM in technological development of Nigeria

The goal of Nigeria vision 20:20/20 is to make Nigeria one of the 20 largest economies in the world, able to consolidate its leadership role in Africa and establish itself as a significant player in the global economic and political arena. However, it is a shame that with her many endowed natural and human resources, Nigeria is still behind in areas such as biotechnology, electronics, genomics, information and communication technology, food technology, materials technology and production and process technology. Instead, we still depend on foreign products and even go for foreign expatriates for operations and maintenance of many of our machines when we have many trained engineers around us. With the actualization of democracy in 1999, many believed that Nigeria was bound to experience developmental changes in all sectors. Nearly two decades after transition from military regime to democratic regime, Nigeria is still poor scientifically and technologically. Today, political changes provide the nation with the opportunity for a fundamental review of policies and social programs that will prepare the country to meet the challenges of the new century. For example, Vision 20:20:20 envisages the country to be among the first 20 countries in terms of industrialization, democracy, educated human resources etc. by year 2020, with the Millennium Development Goals (MDG5) which include policies to eradicate extreme poverty, achieving universal basic education, promoting gender equality and empowerment of women, reducing child mortality and improving maternal health, controlling of HIV/AIDS, malaria and other deadly diseases, developing global partnership with other countries and ensuring environmental sustainability. These policies all aimed at giving special attention to core economic, political and social variables to speed up development of Nigeria as a nation.

Evidence of Scientific and Technological Backwardness in Nigeria

(a) Inability to produce capital goods such as cars, buses, tractors, lathe machines, drilling machines, trains and other earth moving equipment.
(b) Inability to exploit the nation's prodigious natural resources except with the help of foreigners who will provide the technology and expertise required for such exploitation.
(c) Dependence on advanced countries for supply of spare parts for industrial machinery.
(d) Inability to produce military hardware and software needed for national defense and security.

(e) Export of raw materials such as crude oil to other countries as against finished products such as premium motor spirit (gasoline), kerosene, aviation fuel and diesel.
(f) Inability to mechanize agriculture since crude implements such as cutlasses and hoes are still used for agricultural production activities by a large percentage of the farmers.
(g) Dependence almost entirely on rain-fed agriculture with little or no irrigation to ensure food production year round.
(h) Inability to preserve and process food crops in an effort to eliminate the annual 40% loss of harvest to pests and diseases.
(i) Inability to guarantee food security for citizenry as only about 5% of the people can afford the required 2,350 calories of food per person per day with the rest making do with about 500 calories per person per day. Hence, Nigeria depends on food importation to feed its teeming population which now stands at 180 million people.
(j) Inability to power economic development of the country through electricity generation and distribution as it requires at least 40,000 megawatts but currently generates only 4,000 megawatts.
(k) Inability to maintain all basic and essential infrastructural facilities. For instance, according the former Corps Marshal and Chief Executive of the Federal Road Safety Commission (FRSC), Mr. Osita Chidoka, at the 2011 Nigerian Institute of Safety Professional's' Conference in Warri, "Nigeria is currently 191st out of 192 countries of the world's unsafe roads."
(1) Inability to provide gainful employment for its over 40 million secondary school leavers and university graduates.
(m) Inability to educate over 10 million children of school age who presently are not in school.
(n) Inability to embark on urgent training and massive production of Nigerians in Science, Technology Engineering Mathematics and (STEM) to ensure future technological and economic development.
(o) Poorly equipped, inadequately staffed and underfunded educational institutions at all levels of education.
(p) Inability to collate and commercialize research findings.

Entrepreneurship

There are different definitions of entrepreneurship. For instance, Steinfioff and Burgers (1993) explained entrepreneurship as the ability to develop a new venture or apply a new approach to an old business while Gana (2001, cited in Salami, 2011) defined entrepreneurship as the ability to seek investment opportunity for exploitation. On the other hand, entrepreneurship has been linked to the creation of five basic "new combinations" of (a) introduction of a new product, (b) a new method of production, (c) opening a new market, (d) conquest of a new source of supply, and (e) creating a new organization. Generally speaking, entrepreneurs can be defined as innovators, creators, coordinators, initiators, organizers, gap-fillers, leaders and risk takers.

Entrepreneurship may be classified into two broad types, viz., opportunity-based entrepreneurship and necessity-based entrepreneurship. Opportunity-based entrepreneurs perceive a business opportunity and decide to pursue it. For such people, a period of economic meltdown is a perfect time to pursue new market opportunities. That is, recession tends to favour the creative and innovative entrepreneurs. On the other hand, a necessity-based entrepreneurship is borne out of a

survival strategy when there are no other options to earn a living and by compulsion, entrepreneurship is chosen as a career. For instance, during the Nigerian Civil War of 1967-1970, the secessionist Biafrans were forced to device various innovative survival strategies to meet their daily needs for food, fuel, transportation, weapons, etc.

Entrepreneurship strategies for enhancing food production and economic transformation in Nigeria

Agriculture is absolutely essential to the transformation of the Nigerian economy as it is the largest employer of the workforce (70%) and the biggest contributor to the country's Gross Domestic Product (42%). Farmers grow the crops needed to feed, clothe and produce energy for the country. Hence, by investing in farmers, the country can meet the needs of her 180 million people. Some of the entrepreneurial strategies for achieving food security and economic transformation of Nigeria include the following:

(i) Increasing land area under cultivation

The Nigerian agricultural sector has the potential to grow its current output, valued at ₦ 15.25 trillion, by 160% to ₦ 39.4 trillion by 2030. This growth potential could be achieved by increasing both the productivity and total acreage of cultivated land since about 38% of Nigeria's arable land of 80 million hectares is yet to be tapped. The area under cultivation can be increased through sustainable utilization of forested land, use of alley cropping and application of organic fertilizers to rehabilitate eroded and denuded soils. Agricultural productivity can also be enhanced by irrigation of arid soils and deserts through water harvesting and reclamation of denuded and hydromorphic lands. Scientifically, food is free because it is a product of photosynthetic activity of green plants that capture free energy of the sun and transform same into grains of rice, wheat, maize and tubers like yam, cassava, potato etc. It is therefore a 'sin' of illiteracy, laziness, ignorance, lack of technical know-how and lack of governmental political will for Nigeria to continue to suffer food insecurity and experience poverty in the midst of almost 40% of her arable land 'begging' for cultivation . Both opportunity-based and necessity-based entrepreneurs should be encouraged by the three tiers of government in Nigeria to exploit the vast untapped agricultural lands for agrarian and economic transformation of the country.

(ii) *Enhancing quantity and quality of food production per unit area of land*_Worldwide, agriculture accounts for 34% of the land area and 70% of water consumption. A variety of practices such as conservation agriculture and technologies such as drip irrigation or improved rainwater harvesting, can help manage natural resources more sustainably. Hence, since land area is limited, there must be continuous search and research for production needs to increase the quantity and quality of food per unit area of land. This objective can be achieved through some novel agricultural practices such as the use of biological nitrogen fixation such as the ENPOST Rhizobium Inoculant developed by this author (Odeyemi, 2008) (Fig. 2 and 3). Other beneficial practices include mycorrhizal phosphate nutrition, multiple cropping, relay cropping, intercropping and use of improved crop varieties and breeds of animals. Proper consideration must also be given to more efficient use of fertilizers and soil conditioners as well as improved soil and water management, weed control and pest management. For instance, the FAO (2004) employed our ENPOST Rhizobium biofertilizer to enhance pea yields of cowpea by about 50% in Niger, Nasarawa, Katsina, Bauchi and Kogi states of Nigeria (Odeyemi, 1991; FAO, 2004). By increasing

crop yields, natural habitats can be protected from being cultivated and forests and bushes would continue to sequester carbon to mitigate emissions promoting climate change (Fig. 13.2). For instance, the average yield of rice in Nigeria is about 5 t/ha, but through the use of improved varieties and good agricultural practices, the yield can be boosted to about 10 t/ha. Local production of rice should be encouraged urgently in order to reduce the current alarming volume of rice importation which stands at one billion Naira per month.

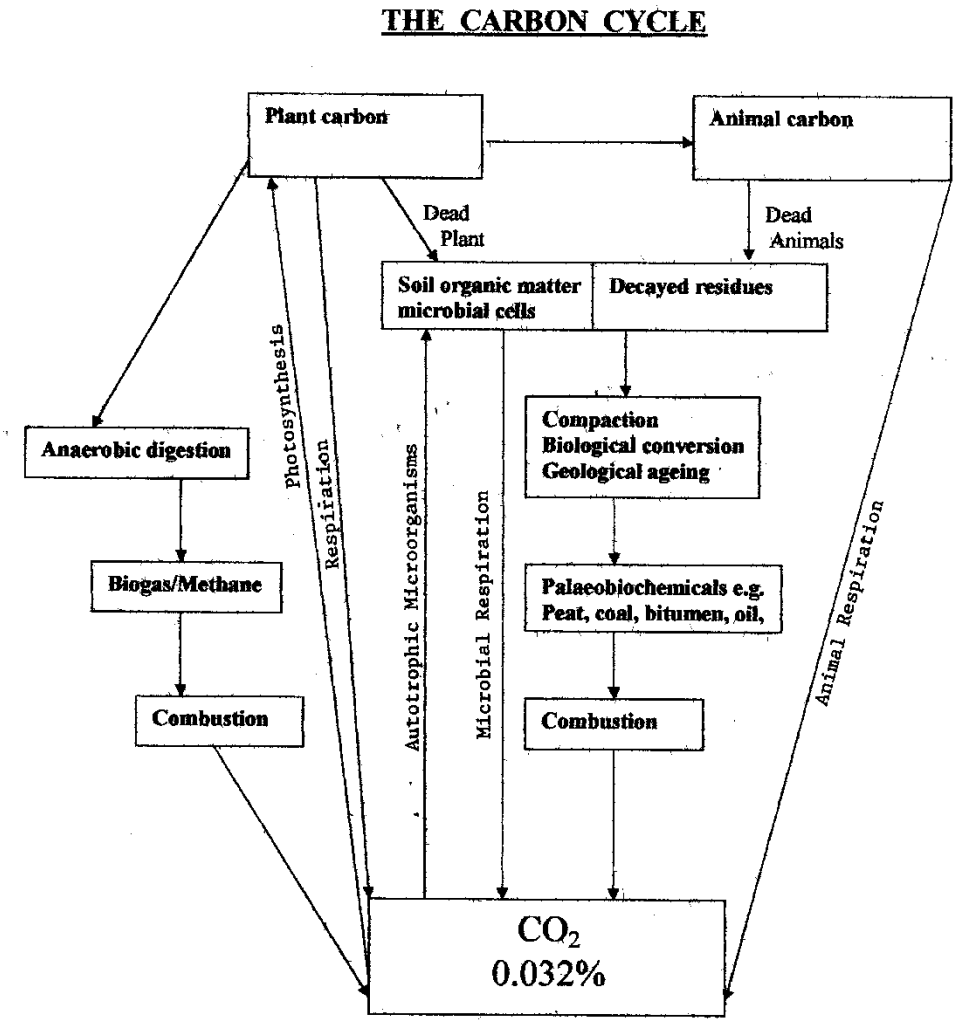

Fig. 1: The Carbon cycle

(iii) Technology innovation

Most of Nigerian farmers find it very difficult to adapt to new innovations partly due to illiteracy and lack of effective training and extension services. Yet, strengthening rural innovation systems, developing effective clusters that can add value to unprocessed raw materials, and promoting value chains across such diverse sectors as horticulture, food processing and packaging, food storage and transportation, food safety, distribution systems and exports are all central to moving beyond

subsistence agriculture to generate growth, spawn economic transformation and engender prosperity.

Agricultural productivity, entrepreneurship and value addition foster economic growth especially in a rural-based economy like Nigeria. Unfortunately, the small-scale farmers and research institutes do not interact in ways that can accelerate the transition from subsistence to commercial value-added agriculture. Therefore, a comprehensive approach to agricultural development in Nigeria must involve the creation of an innovation system that fosters interactions among government, industry, farmers, academia and civil society, all of which are essential components of agricultural transformation. In particular, efforts should be made to bring higher technical education such as available at the Federal Colleges of Agriculture, Agricultural Research Institutes and the Universities to the service of agriculture and the Nigerian economy. Agriculture must be viewed as a knowledge-based entrepreneurial activity, hence, the Nigerian government must invest adequately in agricultural research as part of a larger agenda to promote innovation, build human capacity and stimulate entrepreneurship.

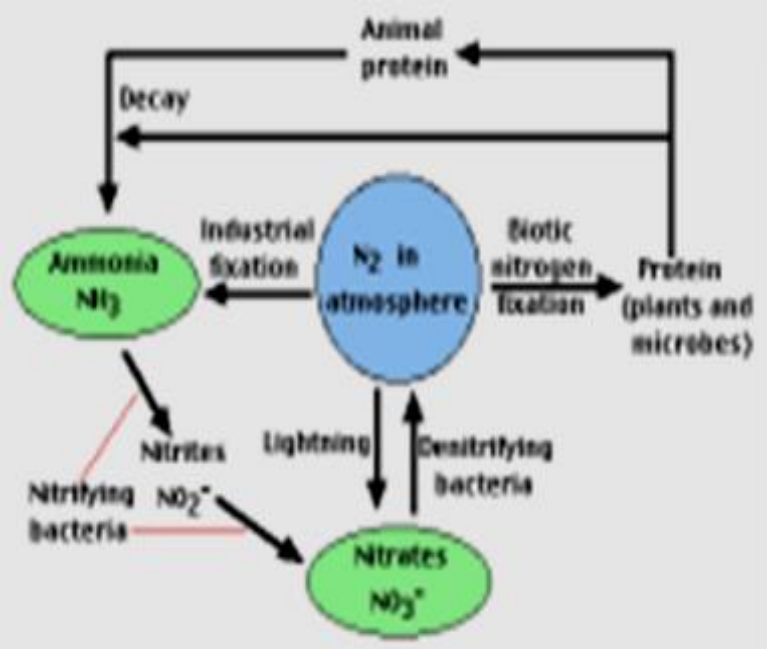

Fig 2: Nitrogen Cycle

(iv) More food from livestock and fishery

Animal production can be enhanced through genetic improvement, adaptation to environmental stresses, resistance to pests, parasites and diseases and improved feeding and nutrition. Efficient management and exploitation of aquatic species in the numerous bodies of water in Nigeria can ensure increased production of fish (Fig. 4) and other aquatic resources. Formulation of cheap local fish feeds and other animal feeds is important in reducing cost of producing animal proteins.

Improved processing, curing, packaging and preservation of animal products are also relevant. Aggressive marketing strategies at local, national and international arena are also necessary for improved production of animal products.

Fig. 3 ENPOST *Rhizobium* inoculants for commercial use in legume inoculation by farmers.

Fig. 4: A typical fish pond at ENPOST Farms, Ilesha, Nigeria.

(v) Improvement of post-harvest technology

In Nigeria, about 40% of crop harvest is lost annually to pests and diseases. Most of the approximately 100,000 known species of fungi are strictly saprophytic, living on dead organic matter that they help decompose and about 100 different species cause diseases of human and animals, but more than 8,000 species cause plant diseases, especially post-harvest diseases, which are very damaging. For instance, the rust diseases caused by different Basidiomycetes are among the most destructive diseases known to humanity. They have caused numerous famines and economic depressions, and still reduce the world grain harvest by an estimated 10% per year.

Improved techniques to reduce losses may include better timing of harvests, improved handling, threshing, transportation, drying, curing, and conditioning of farm produce. Effective control of insects, rodents, bacteria, mites, termites, moisture, etc. in stores, bins and warehouses are also crucial. Improved milling, processing, packaging, preservation and fortification are essential post-harvest technologies. Thus, by investing in storage and processing facilities to reduce post-harvest losses and transport links to access markets, farmers can more reliably increase the quantity and quality of crops they grow and bring to markets.

(vi) Improvement of infrastructure and marketing

To stimulate entrepreneurial interest in agriculture, the government must invest in enabling infrastructure such as roads, railways, electricity, fertilizer factories, seed banks, human and animal clinics, treated water supplies and information and telecommunication networks. It is also necessary to review the 1999 constitution of Nigeria to liberalize the accessibility to and ownership of arable lands by farmers and youths. Sustainable and profitable agriculture can only thrive when there are reliable, viable and functional markets for farm produce. The local, state and federal governments must create community, intra-state, inter-state, national, regional and international market accessibilities for our farmers. For instance, Nigeria should intensify fostering of regional markets among ECOWAS countries and learn from the achievements of Rwanda and Malawi or those of China, Brazil and India, in this regard. Indeed, there is the need for countries in central, eastern, western, southern and northern Africa to work together cooperatively at the regional level to scale up agricultural development, marketing and economic transformation. South-south and north-south cooperation is also critical to creating agricultural markets and fast-tracking economic transformation of Africa in general and Nigeria in particular.

(vii) Financing of entrepreneurship in agriculture

It is well known that economic returns on agricultural investments are very low, hence, banks are always reluctant to advance loans for agricultural enterprises which they perceive as extremely high risk, unpredictable and unreliable endeavours. Yet, if Nigerian agriculture must transit from the subsistence level to the entrepreneurial and commercial status, which can guarantee profitability, it must enjoy private- and public-sector funding.

Several efforts have been made by previous governments in Nigeria to support agricultural financing but not much success has been achieved in this regard. However, recently, the Central Bank of Nigeria (CBN) launched the ₦ 77.5 billion Incentive-based Risk Sharing System of Agriculture (NIRSAL) meant to de-risk lending to the sector. According to the CBN, NIRSAL is aimed at lifting Nigerian agriculture from the subsistence to the entrepreneurial and commercial level to engender profitability in agricultural enterprises. NIRSAL is also expected to help banks understand profitable agricultural financing. The five components of NIRSAL are: (a) Risk sharing facilities which are allocated ₦ 46.5 billion (b) Insurance facilities, ₦ 4.65 billion (c) Technical assistance facilities, ₦9.3 billion (d) Agric bank rating system, ₦1.55 billion, and (e) Bank incentive mechanism, ₦ 15.5 billion (Olarewaju, 2012). As laudable as the NIRSAL proposal appears, the CBN still needs to sensitize and educate all the stakeholders about the workability of the scheme. For example, how will the federal and state governments collaborate with the CBN in implementing the scheme? How will the thousands of peasant farmers and prospectus agricultural entrepreneurs access the loan without much stress?

IMPORTANCE OF SCIENCE TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM)

Sweet as the goal of Nigerian's vision 20:20:20 may sound; every right minded person in this nation will agree that without science and technology, the attainment of the core values of vision 20:20:20 will be elusive. It will definitely be impossible to achieve vision 20:20:20 without successfully harnessing and developing technological manpower. In fact no nation can achieve developmental growth without technology. The importance of technology which is defined as the know-how and creative processes that may assist people to utilize tools, resources and systems to solve problems and to enhance control over the natural and man-made environment in an endeavor to improve the human condition, in the development of a nation, cannot be overemphasized. This involves generating ideas and taking action, as well as developing techniques and products that satisfy human needs.

To actualize the goal of vision 20:20:20, Nigeria must adequately embark on training her citizenry on the need to be technologically literate, leading to self-reliance and sustainability. Effective technology programs encourage students to be productive, innovative and enterprising. In fact, technological education should be a compulsory learning area in our national curriculum for all students from secondary schools and then provide pathways for them to access technological opportunities beyond secondary education. In our contemporary world, only technologically inclined nations command the skills necessary for sustainable economic growth and a better quality of life for her citizenry. Technology helps in building a nation effectively and efficiently and also helps in opening business relationship with other friendly nations. Over the years, our inability to efficiently equip our youth with sound science and technology through technological education has put us at a low level in technology and has perpetually made Nigeria a developing nation. In fact, the difference between developed, developing and underdeveloped countries rests on the ability of the developed countries to convert scientific ideas to usable technology while the developing and underdeveloped countries are yet to effectively do so. For a vibrant technology transfer, it is imperative to first liberate Nigeria from technological illiteracy through technological education. By definition, technological education is the training of technical personnel for the purposes of initiating, facilitating and implementing the technological literacy to the young minds. The objective of technological education is to upgrade students' level of technological literacy. Technological education focuses on increasing students' technological literacy through the enhancement of their technological practice across technological areas and contexts. Technology education needs to focus on enhancing students' technological practice in ways that allow them to become empowered decision makers, participating as mutually constitutive members within their learning community and those communities within which they may participate in the future.

Importance of Technological Education

Technological education plays a vital role in human resource development of the country by creating skilled manpower, enhancing industrial productivity and improving the quality of life. Technological education covers courses and programs in engineering, science, technology,

biotechnology, management, architecture, town planning, pharmacy, applied arts & crafts, hotel management and catering technology. To respond to the recurrent and emerging economic and social needs of our country our youths must be made to acquire the understanding of the role of science and technology in society. Youths must also acquire skills of analysis and problem-solving as well as scientific and technological skills which will allow them maximum flexibility and adaptability in their future employment and other aspects of life. Over the years, we have failed as a nation to empower our youths with technological and scientific career. The consequence of this failure is turning out of schools, restless and disconnected generation of youths. Today, the nation faces crisis of scarcity of scientific and technological manpower. To achieve technological and economic development in the year 2020 and beyond, Nigeria needs to sponsor many students abroad to acquire necessary expertise in various critical areas of science, engineering and technology.

Some of the Causes of Technological Backwardness in Nigeria.

1. **Discouragement of technological growth by our colonial masters**

The philosophy of Nigerian education during the colonial period was built on wrong policy as evidenced by the following statement of Lord Lugard l921; "The chief function of government primary and secondary schools among primitive communities is to train the more promising boys from the village schools as teachers for those schools, as clerks for the local native courts, and as interpreters." There were many reasons why the British came to Nigeria. One of such reasons was to spread the Christian religious faith as missionaries but the principal reason was economic. Nigeria was perceived as a ready market for British alcoholic spirits, dane guns, gun powder, mirrors and slaves.

It should be noted that before the advent of colonialism, Nigerians were weaving their own clothes, smelting bronze, tanning hides and skin to produce shoes and bags, fabricating hoes, cutlasses, bows, arrows and casting an object as intricate as the "Benin/Festac Mask" which was among the numerous art objects stolen by the British. The colonialists discouraged further development of Nigerian technology as they reasoned it was a threat to the marketing of goods imported from Europe. For instance, "ogogoro" was declared an illicit gin by the colonialists, and whoever was caught producing, marketing or drinking it was prosecuted. However, in the 1960s, the late Dr. Tai Solarin and Prof. Femi Odeyemi of Chemistry Department, University of Lagos (this author's older brother) fought vehemently to legalize the locally brewed gin (ogogoro). This legalization led to the establishment of intercontinental distillers, an industrial alcoholic spirit producer by Prof. Femi Odeyemi & Co. at Ota in Ogun State.

2. Weak Industrial Policies after Independence

The various industrial policies put in place by Nigerian government after attainment of independence were patently weak and lacked comprehensiveness. The major thrust of the policies were (a) building of assembly plants such as VW and Peugeot vehicles in Nigeria (b) importation of Completely Knocked Down (CKD) parts into the country for use by the assembly plants (c) establishment of steel plants such as Delta Steel Plant and Ajaokuta Steel Plant and associated foundries to produce automobile parts and raw materials for steel and other fabrication activities (d) establishment of machine tool companies (e.g. Osogbo Machine Tool company) to produce capital goods. Unfortunately, this import substitution industrial strategy did not go beyond the

stage of building the assembly plants, as the technical partners know that if Nigeria stops importing the CKD parts, their companies in Europe would automatically stop production and fold up. In any case, almost all the steel companies, the assembly plants and the machine tool companies are now in a state of disrepair due to abject neglect and complete lack of maintenance.

3. Poorly Equipped Educational Institutions

Almost all educational institutions from primary to secondary and tertiary levels in Nigeria are poorly equipped, understaffed and underfunded. In particular, our Universities, Polytechnics and Colleges of Technology that are supposed to produce competent and proficient engineers, scientists, agriculturists and technologists are completely lacking in state-of —the-art equipment and qualified, adequate and competitive academic staff. Hence, the products graduating from theses sub-standard institutions are obviously poorly baked and consequently incapable of outstanding contribution to the country's technological development. Apart from the developed countries, the so-called BRICK countries i.e. Brazil, Russia, India, China and Korea have developed well-funded, properly staffed and adequately-equipped Universities and technological institutions to produce high quality graduates in fields of instructions such as information technology, electronics, computer engineering, biotechnology, space science, genetic engineering, etc. to fast-track industrial and economic development. No wonder, the economies of these countries compare favorably with those of the countries of Europe and North America. The inadequacy of teaching, laboratory, research and workshop facilities has contributed to the diminution of the quality of graduates, especially science and engineering graduates in Nigeria. Students can be categorized into three groups, namely, verbalizers, visualizers and doers. The verbalizers are those who learn easily if information is presented in written or spoken form. They benefit maximally from lectures, tutorials and hand-outs. Visualizers learn easily when information is presented in pictorial or diagrammatic form while the doers learn more readily when information is presented by practical demonstrations by the lecturer. The inadequacy of basic facilities would put the visualizers and the doers at a disadvantage. The visualizers may also have problems in a class with a large student population. The overall effect of this entire scenario is that only a small percentage of our student population benefit from the present pedagogical system. Additionally, accessibility to internet connectivity has been hampered by power fluctuations and inadequate bandwidth. All these problems must be rectified in order for Nigeria institutions to produce high caliber graduates required to power technological development.

Strategies for Enhancing Technological Education for National Transformation

1. Eradication of extreme poverty and hunger

This is GOAL 1 of the UN's Millennium Development Goals (MDGs) which if properly executed holds the promise of saving of lives, empowering women, addressing the scourge of illiteracy, hunger and malnutrition, and ensuring that Nigerian children have access to education of good quality, and good health to lead productive lives. Developmental goals can be unattainable without quantitative and qualitative education especially in Nigeria with a high percentage of the population (about 75%) living below poverty level. An English adage says that a hungry man is an angry man and a Yoruba adage says "*ebi kìí wonú kí òràn míràn wð*", meaning when you are hungry, nothing else counts or matters. Nigeria must therefore invest a high percentage of its petro-naira into agriculture in order to be able to feed its population of about 180 million. Nigeria has about 80 million hectares of arable land but only about half of it is under cultivation. The Land

Use Act of 1999 should be repealed to liberalize ownership or accessibility to land by intending farmers especially among the jobless youths who should be enticed to take to agriculture. Food security entails adequate food availability, accessibility and utilization. According to the International Food Policy Research Institute (IFPRI), the minimum food needed for a healthy and active life is 2,350 calories per person per day. Most Nigerians can hardly afford 1,000 calories per capita per day. Food insecurity and malnutrition are unlikely to disappear in Nigeria in the next 10 years. However, broad-based agricultural and rural development plus greater public investment in agricultural research and better management of natural resources will be required to eliminate food insecurity in Nigeria. A well-nourished and highly educated citizenry will unleash their heretofore latent abilities to catalyze technological development and economic transformation of the nation.

2. Greater emphasis on technological education

Governments at all levels must vote and spend more funds on education in order to arrest the shameful rot in our educational system and they should stop paying lip service to raising the standard of education especially through their talk shows and wasteful rituals of education summits. In particular, training of technical and technological manpower must be given a top priority. Most of the problems militating against production of high quality scientists and engineers must be squarely addressed. Such encumbrances include poor funding, inadequate facilities, non-availability of adequate human capacity, brain drain, poor staff training and retention profiles. Other factors include poorly-equipped laboratories, defective and substandard curricula, weak University and Polytechnic industry partnership, archaic traditional approach to teaching, inadequate infrastructural facilities such as electricity, water and classrooms as well as lack of quality control mechanisms.

3. Copying of technological items already in the market

This proposal requires laboratories, workshops and other necessary facilities be developed for component analysis and for building prototypes of items to be produced. The idea is to knock down products of interest in the workshops, study and analyze each component in the laboratories to ascertain chemical composition, physical properties and other production parameters of interest and replicate such items for future mass production. Japan employed this method of technology transfer in the 1970s and 1980s to achieve industrial and economic growth. Nigerian government should encourage the so-called "igbo made" goods by improving their quality to meet those of imported items.

4. Industrial espionage

Highly technical, nuclear and defense technologies are closely guarded by their proprietors. Such secrets can only be obtained either by direct heavy financial investments or through espionage. Spies are often employed to collect such top secrets and company documents required for developing such products, which they pass on to their sponsors for free. Many countries around the world engage in this type of industrial espionage especially through their embassies and science and military attaches. Nigeria can also benefit from this well-known but seldom discussed practice to fast-track its technological development and economic growth.

5. Provision and maintenance of infrastructural facilities

Nigeria can take a bold step towards becoming a technologically advanced country by simply providing and maintaining basic infrastructural facilities such as road, railways, electricity, oil refineries, treated water supplies, fertilizer factories, airports, seaports, information and telecommunication networks, educational institutions, inland waterways, stadia, museums, tourism facilities, textile factories, paper mills, aluminum smelting factories, iron and steel production factories. This author wrote letters to President Olusegun Obasanjo in 1999, urging him to establish a Ministry of Infrastructural Maintenance probably as an offshoot of the Ministry of Works, in order to achieve a continuous and sustainable maintenance of our massive infrastructural facilities. Subsequently, the Federal Roads Maintenance Agency (FERMA) was established in July 2003, though the agency appears not effective, probably due to poor funding. The poor state of Nigerian roads is a major aspect of the nation's infrastructural deficit, and is a significant contributor to the unbearably high cost of doing business in Nigeria. If Nigeria has about 30 million jobless youths, why can't we deploy them to maintain our sadly deplorable roads on local government by local government basis at minimal stipends?

6. Bold and ambitious energy provision

Apart from agricultural revolution, an abundant provision of energy is a key ingredient of industrial evolution. These are major factors that launched Europe and America into the technological age. As Nigeria is also desirous of becoming a technologically advanced country, bold and ambitious provision of energy is a sine-qua-non for attaining such a vision. Fortunately, Nigeria is blessed naturally with vast deposits of palaeobiochemicals such as peat, coal, bitumen, crude oil and gas. These natural endowments can be processed to generate energy needed for industrial development. Nuclear technology can also be employed to generate electricity via processed uranium (which is bountiful in Nigeria) as it is done in most of the developed countries of the world.

Electricity for powering technological transformation can also be obtained through renewable energy sources such as solar energy, biomass energy, wind energy and geothermal energy.
With Nigeria's proven oil reserves of 35.2 billion barrels, gas reserves of 176 trillion cubic feet and coal reserves of about 3 billion metric tons, we have no reason to continually be in the dark. At all cost, Nigeria must acquire the necessary know-how to transform these abundant resources into energy for lighting and national development. The Power Holding Company of Nigeria (PHCN) as presently constituted can never light up or power the country sustainably. As soon as feasible, the PHCN must be completely re-privatized to enhance its efficiency in an effort to achieve the vision 20:20:20.

7. Wealth creation from Nigeria mineral resources

Nigeria is an immensely mineral rich country liberally endowed as can be seen on Table 1. Nigeria is reputed to be one of the few countries of the world that is endowed with virtually all the minerals in the Chemistry's Periodic Table. By acquiring the appropriate mining technologies, Nigeria should be able to turn its huge mineral resources into stupendous wealth.
In order to achieve the essential conditionality discussed above, three other important and tangential factors must be addresses seriously and urgently:
(a) Enthronement of peace and security of lives and properties throughout the country
(b) Bold and sustained war against corruption
(c) Subtle control of population explosion.

I want to appeal to Nigerians to please listen to and learn from the following statement of Martin Luther king: "The prosperity of a country depends not on the beauty of its public avenues, nor on the strength of its fortifications, nor on the abundance of its public buildings but it consists in the number of its cultivated citizens, its men of education and enlightenment of character".

Table 1: Location, reserves and some uses of the solid minerals found in Nigeria. (Source: O. Odeyemi, 2014)

Mineral	Location	Reserves	Some Uses
Tantalite	Cross River, Ekiti, Kogi, Kwara, Nasarawa	No data	For making capacitors, resistors
Kaolin	Akwa Ibom, Anambra, Bauchi,Bayelsa, Ekiti, Imo, Katsina, Kebbi, Kogi, Ogun, Ondo, Plateau, Rivers	3 billion tons	for making ceramics, toothpaste, in light bulbs, cosmetics, paints, etc
Mica	Ekiti, Kogi, Kwara, Nasarawa, Oyo	No data	for capacitors, paints, well-drilling, inert filler and mold release in plastics industry, for decorative coatings, tiles, etc.
Baryte	Benue, Cross River, Nasarawa, Plateau, Taraba, Zamfara	7.5 million tons	drilling fluids in oil and gas exploration, as filling in paints and plastics, friction products for automobiles, etc.
Coal & Lignite	Enugu, Abia, Adamawa, Anambra, Bauchi, Ondo, Benue, Cross-River, Delta, Ebonyi, Edo Gombe, Imo, Kogi, Nasarawa, Plateau	3 billion ton	coal is used for electricity generation, cement manufacture, industrial process heating.
Rutile	Bauchi, Cross-River, Kaduna, Plateau	No data	used in paint, plastics and paper industry. It is also used in electrode coverings and sunscreens.
Talc	Ekiti, Kaduna, Kogi, Niger, Osun, Ogun	Over 100 million tons	widely known as talcum powder.
Bismuth	Kaduna	No data	pigment in eye shadows, hair sprays and nail polishes and as an ingredient in some pharmaceuticals
Gypsum	Adamawa, Edo, Gombe, Ogun, Sokoto, Yobe	Over 1 billion tons	manufacture of cement, plaster of paris (P.O.P), classroom chalk
Marble	Edo, FCT, Kogi, Kwara, Nasarawa, Oyo	No data	for sculpture and as building materials
Gemstones	Bauchi, Kaduna, Kogi, Kwara,Nasarawa, Niger,	No data	used as ornamental stones, making jewelries, etc.

	Ogun,Oyo, Plateau, Taraba		
Feldspar	Bauchi, Borno, FCT, Kaduna, Kogi	No data	used in making glass, ceramics, K-Ar dating, etc
Gold	FCT, Kaduna, Kano, Katsina, Kebbi, Kogi, Kwara, Niger, Osun, Zamfara	No data	for making jewelries, for coinage, in dentistry, electronics, etc.
Clay	In all the States of the Federation	No data	for sculpture, ceramics material, for making earthenware and porcelain, etc.
Silver	Ebonyi, Kano	No data	for making ornaments, jewelry, high-value tableware, utensils, currency coins, conductors, etc.
Ilmenite	Benue, Cross River, Kaduna, Plateau	No data	in titanium dioxide production
Limestone	Benue, Cross River, Ebonyi, Edo, Gombe, Kogi, Ogun, Sokoto	2.3 trillion tons	building industry, production of quicklime, slake lime, cement, mortar, glass making, and collectives used as solid base for road construction
Columbite	Bauchi, Cross River, Kaduna, Kano, Kwara, Nasarawa, Plateau	No data	source of niobium used as an alloy of steel.
Cassiterite	Bauchi, Cross -River, Kaduna, Kano, Kwara, Nasarawa, Plateau	No data	a source of tin, also used as a gem stone.
Diatomite	Borno, Yobe	Over 200,000 tons	used as filtration material, mild abrasive, absorbent for liquids, thermal insulator, etc.
Phosphate	Ogun, Sokoto	No data	in phosphate fertilizer
Manganese	Katsina, Kebbi, Zamfara	Over 4 million tons	for `making alloy, in manufacture of battery, to boost octane rating in gasoline, etc.
Silica Sand	Delta, Jigawa, Kano, Lagos, Ondo, Rivers	No data	manufacture of glass and bottle, optical fiber for telecommunications, ceramics, etc.
Flourite	Bauchi, Ebonyi, Plateau, Taraba	No data	for making opalescent glasses and enamels, telescopes and camera lens, cooking utensils, beads in jewelry, etc.
Bitumen	Edo, Lagos, Ondo, Ogun	About 42 billion tons	To pave roads, building industry, production of quicklime, slake lime, cement, mortar, solid base

			for road construction, glass making
Lead	Cross-River, Ebonyi, FCT, Plateau, Zamfara	10 million tons	used for piping, roofing materials, ammunition, toys, ornaments, coffins and protective coating.
Zinc	Cross River, Ebonyi, FCT, Plateau, Zamfara	10 million tons	Used for protective coating for iron and steel, making brass, soldering fluid, screens for television tubes and fluorescent coatings.
Bentonite	Borno, Edo, Kogi, Ogun, Ondo	700 million tons	in drilling and geothermal engineering, for manufacture of cement and abrasives, as bulk laxative, wound dressing, etc
Kyanite	Kaduna, Niger	No data	used in refractory and ceramics production, porcelain, plumbimg fixtures, dishware, electrical insulators, abrasives, etc.
Iron-Ore	Enugu, FCT, Kaduna, Kogi, Nasarawa, Zamfara, Niger	Over 3 billion tons	Making of pipes, making of tool and equipment, machineries for processing foods and drugs, infrastructure for transportation
Lithium	Kaduna, Nasarawa, Niger, Zamfara	No data	used in the manufacture of batteries, in lubricating greases, in fireworks, etc.
Wolframite	Bauchi, Kaduna, Kano, Kwara, Nasarawa, Niger, Zamfara	No data	a source of tungsten used in electrical filaments, also used for making armor-piercing ammunition
Molybdenite	Plateau	No data	for making alloy, stainless steel, in manufacture of armor, aircraft parts, filaments, electrical contacts, etc.
Dolomite	Kogi, Oyo, Edo, Kwara and the F.C.T., Abuja	No data	ornamental stones, concrete aggregates, a source of manganese oxide, in marine aquariums, to lower acidity in agriculture, etc.

Recommendations

1) The present land policy in Nigeria should be reviewed in order to make more land available for farming. The policy orientation should be directed towards making more farm land available to the farmer by organizing the pooling of land. The Land Use Act of the 1999

constitution that vests all land in the government should be reviewed to liberalize land ownership to the benefit of the youths.

2) The provision of agricultural subsidies for fertilizer, farm implements and equipment should be put in place. Adequate measures should be put in place to ensure that the inorganic fertilizers be available to the farmer and its racketeering be discouraged. The use of organic and biofertilizers should also be promoted.
3) The government should promote the establishment of agro-based industries that are capable of processing Nigeria's agricultural raw-materials in a most efficient manner. This will add more value to produce from the farm and promote shelf life. There should be emphasis on the local processing of raw crops for the local industries as well as for export. This will create more employment opportunities, a sustainable market for the products and more income will be generated.
4) There is a need for a significant investment in the efficient processing technologies and packaging of the different agricultural products. Models of on-farm storage facilities and technology should be introduced and made available to the farmers.
5) Concerted efforts should be made towards providing credit support for small scale farmers who constitute 80% of farm holdings, and some medium scale operators. The lending interest rate should be low and not prohibitory.
6) There is the need to put in place an agricultural tariff regime that would protect Nigeria's agricultural produce from unbridled foreign imports and competition. The policy orientation should be towards minimizing food import through high tariffs on such imported foods; especially those that are produced locally, in order to stimulate their local production.
7) In order for the youths to have entrepreneurial success in the agro-allied business, provision should be made for technical training workshops through the extension services. This would be to x-ray the various business needs and diffuse to them the best technique on how to carry them out, in order to maximize their productivity.
8) There is need for the provision of infrastructure such as good road networks and railways geared towards developing crops required for export.
9) Efforts should be made to alter the movement of people from rural communities to urban areas by extending equal social benefits, establishing rational schemes for agrarian reforms. This will stimulate the hitherto uneconomical small holdings which is typical of our agricultural sector.
10) The 10 million Nigerian children of school age who are presently not in schools must be compulsorily enrolled in schools through the Universal Basic Education to enable them acquire knowledge and skills as essential pre-requisites for wealth generation. Any defaulting state government that will not put all children of school age in schools should be sanctioned for social and economic sabotage.
11) The various organs of the government should be repositioned in order to adequately regulate the educational standard and quality in the numerous primary and secondary schools, polytechnics and Universities springing up in the country.
12) National skill acquisition centres should be established in all the geopolitical zones of the country by the Federal Government so that secondary school leavers and university graduates can spend 6 to 12 months to learn some vocations, trades and skills that are pre-requisites to job creation and wealth generation.

13) Similarly, all state and local governments should establish vocational and skill centres to enable school leavers add value to their knowledge acquisition for wealth generation, while anybody above 21 years of age should be admitted without any educational qualification to such centres.
14) The so-called area boys, touts and school dropouts should be resettled at skill acquisition centres to learn trades, vocations and sporting activities in order to make them wealth-generating and responsible citizens.
15) There is need for building and maintenance of new facilities, and provision of teaching materials for all categories of teachers.
16) The periodic training and adequate remuneration of teachers must be of serious concern to all proprietors of institutions.
17) The industries should be encouraged to support joint workshops, exhibitions, seminars and conferences for cross-fertilization of ideas and expertise in the industries, while specialists from the industries do part time teaching in the Universities and Polytechnics.
18) All the stakeholders, especially the NUC, NBTE, NCCE and various ministries of education should address the various serious and incapacitating lapses in our educational policy objectives.
19) The study of science subjects must be made compulsory in all primary and secondary schools as Nigeria urgently need to produce a huge pod of scientists, engineers and technologists if we hope to be among the 20 most industrialized nations of the world in the nearest future.
20) Similarly, the study of science and technology must be vigorously pursued in all tertiary institutions.
21) Many professionally and academically competent Nigerians in several European and American countries should be encouraged and induced to come back home to assist the socio-economic and technological development of a great Nigeria.
22) Our leaders should eschew corruption and general indiscipline in order to be able to enthrone virtues of probity, accountability, transparency, hard work, discipline and honesty. The parents, leaders and elders are the mirrors that our youths gaze into daily for their guidance. It is not money but intellectual capital that drives prosperity; hence poverty is driven by and sustained by a lack of intellectual capital. For instance, half of the world's population i.e. about 3.5 billion people live on an average of $500 a year, while Bill Gates, the new millennium Prince of Technology, earns $500 every second. By controlling technology and taxing computer users, Gates has become richer than each of the 70 poorest nations on earth. Hence, by using his financial might, he has conquered more territories than Genghis Khan, Julius Caesar and Alexander the Great, all put together.
23) Finally, it must be understood once and for all that the educational level of a society and economic growth are closely interrelated. Likewise, it is human knowledge and skill that are instrumental to economic and technological progress. The most valuable of all capital is that invested in human beings (O. Odeyemi, 2014).

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SOME OF OUR CONTRIBUTIONS AT ENPOST FARMS ILESHA TO THE DEVELOPMENT OF SCIENCE AND BIOTECHNOLOGY IN NIGERIA.

CLIMATE CHANGE MITIGATION AT ENPOST FARMS

THE FOREST RESERVE IS IMPORTANT FOR BIORESOURCES CONSERVATION AND SEQUESTRATION OF CARBON DI OXIDE.

CHINESE TYPE BIOGAS DIGESTER AT ENPOST FARMS

THE BIOGAS DIGESTER CAN BE USED FOR COVERTING MUNICIPAL WASTES/SOLID WASTES TO METHANE GAS (BIOGAS) WHICH CAN BE USED FOR COOKING, LIGHTING AND ELECTRICITY GENERATION.

INDIAN TYPE BIOGAS DIGESTER AT ENPOST FARMS

BIOGAS DIGESTER DESIGNED BY PROF. ODEYEMI AT ENPOST FARMS

A TYPICAL FISH POND FOR ORGANIC FISH PRODUCTION AT ENPOST FARMS

MAGGOTS FOR FISH FEEDING AT ENPOST FARMS

ALGAE ON FISH POND AT ENPOST FARMS FOR FEEDS AND BIOFUEL PRODUCTION

ORGANIC FERTILIZERS PRODUCED AT ENPOST FARMS

THE ORGANIC FERTILIZERS CAN BE USED FOR PRODUCING SAFE AND EXPORTABLE CROPS.

PARTIALLY ANAEROBIC FIRING OF ORGANIC WASTES TO PRODUCE BRIQUETTES

BRIQUETTE BALLS MANUFACTURED AT ENPOST FARMS

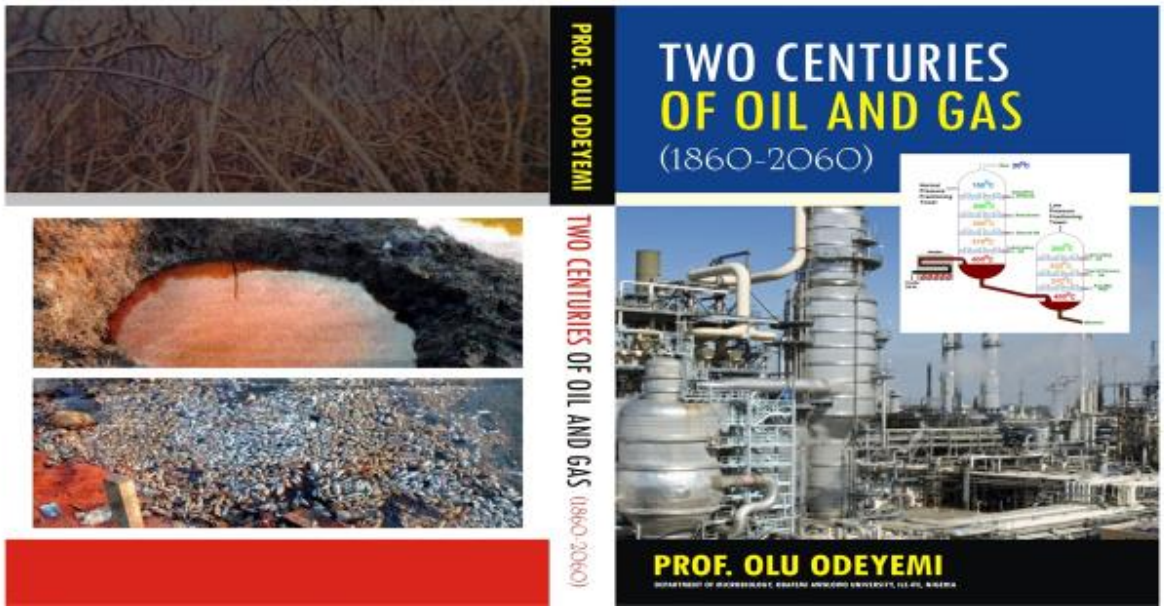
BRIQUETTES CAN BE USED FOR COOKING INSTEAD OF CHARCOAL AND FIREWOOD.

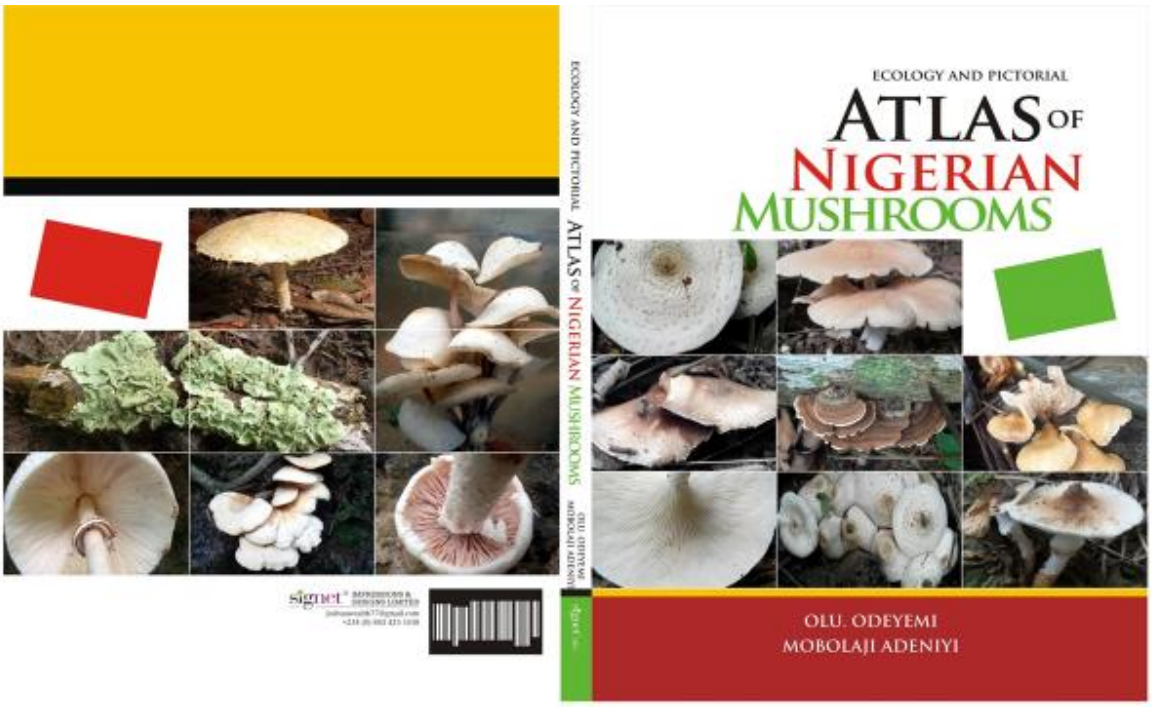
SALT-AND-OIL TREE

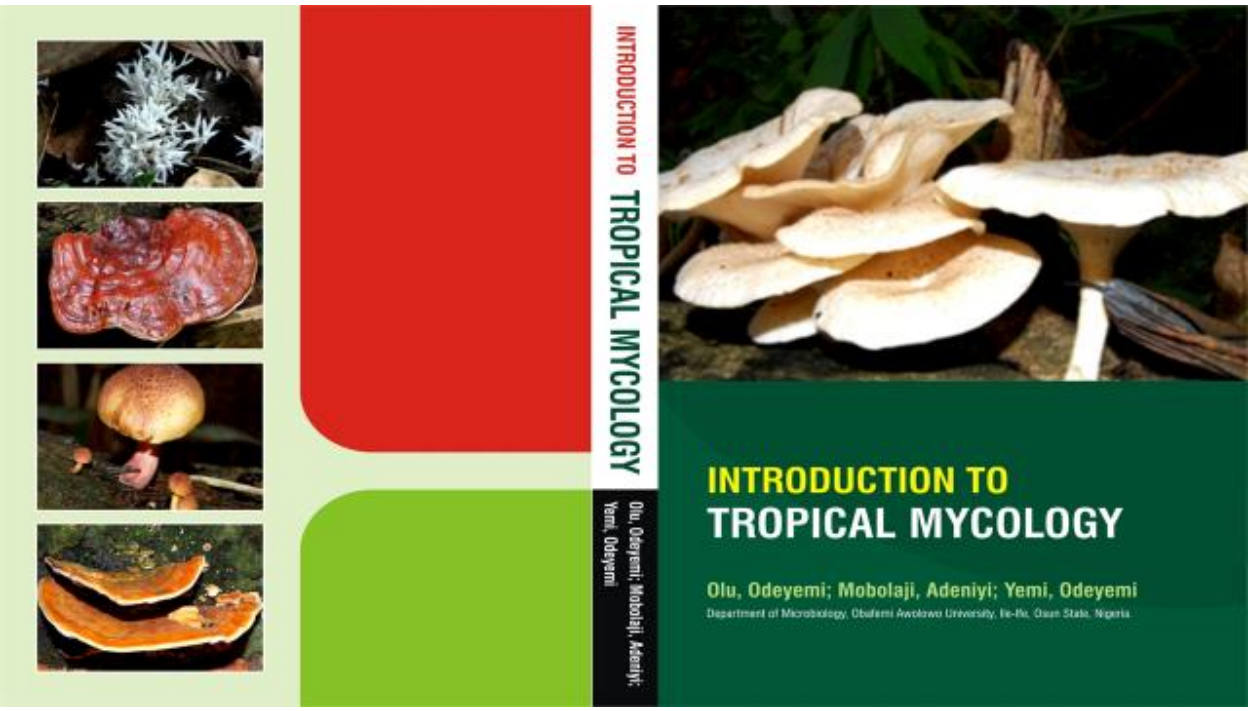
SALT AND OIL TREE IS USED FOR DIFFERENT MEDICINAL PURPOSES AND FOR AFFORESTATION PROGRAMMES.

SALT-AND-OIL TREE (APAKO) SEEDLINGS

RECENT BOOKS AUTHORED BY PROF OLU ODEYEMI



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