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Scientific and Technological Researches: An Elixir for Sustainable Development of a Nation

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Abstract
Scientific/technological research outputs (in the form of new technologies) have become the principal tools for meeting the world ever-expanding needs for food, shelter, housing and equitable access to health-care services. This paper posits that scientific or technological research is an activity that will allow a sovereign nation to move from her present undesirable process of growth and development onto sustainable economic growth and development paths that backup sustainable financial investments.

Introduction

Science and technology constitute the basis of classifying nations as developed, developing or underdeveloped. Development is growth or progression from a lower and often undesirable state to a high and preferred one (Adejanju, 2000). It refers to the process of building-up, and some kinds of change in terms of the increase in the capacity to perform some difficult tasks and functions. National development involves a progressive transformation of economy and society. It involves the process of modern technology that enables the production of goods more than before. It pertains to industrial ways of living of the citizenry. It could therefore, be social, political and economic development.

Development goals should include employment generation, increased output through effective exploitation of local resources, skill development and utilization, reduction in inequality in wealth distribution, meeting of basic needs of the citizenry, improvement in the quality of life and promotion of self-reliance. This pre-supposes the deployment of science, technology and research to harness and transform available natural resources into valuable goods and services, in the context of sustainable development.

Sustainable development is an activity that meets the needs of the present without compromising the ability of future generations to meet their own needs. The essential needs of the vast majority of people in developing countries (Nigeria, inclusive) are foods, clothing, shelter, health-care service, and employment. Sustainable development requires the meeting of these basic needs, as well as aspirations for a better life by increasing productive potentials and by ensuring equitable opportunity for all (Garboucher, 1986; http://www.un-documents.net). Sustainable development is firmly rooted in science, technology and research.

The Concept of Science and Technology

Nwala (1997) and Akaneme (2004) define science as

- a method or process of acquiring knowledge or studying and understanding of the natural and physical world
- a body of knowledge such as biology, chemistry and physics.

Thus, science is both the process and product of investigation. The process involves research and the product is set of ideas, theories, and principles, which make up the various bodies of knowledge. The focus of scientific thought is on: What? How? and Why?

Technology is defined (Akaneme, 2004) as the application of scientific knowledge and research with the aim of developing products and processes for the use of man. It consists of practical knowledge of what can be done and how. It is characterized by techniques, devices, procedures, processes and materials.

Inspite of the seeming difference between service and technology, they are intimately and symbiotically, related. This, according to Akaneme (2004) is manifested in the fact that technology would be crippled and blinded, but for new knowledge constantly provided by science. On the other hand, science would not progress much, if technology were not supplying it with new instruments, new technique and powers, through research.

Research Orientation

A research study is either oriented primarily towards the discovery of scientific knowledge without any direct application; or primarily towards finding solutions to practical problems. A study with the former orientation is called pure, basic or fundamental research, while that with the later orientation is called applied research.

Basic research aims at developing theories which will lead to advancement of knowledge in a given field. On the other hand, applied research is not directed towards theory formulation. Rather, it aims at applicability of established theory to practical situations, as well as evaluating the usefulness of the theory in solving practical problems.

Onwioduokit (2000) observed a dynamic relationship between pure and applied research. Amplifying the dynamism, Nworgu (1991) posited that:

> *Basic and applied researches are interrelated. A basic researcher produces the theory and the applied researcher tests the usefulness of the theory in practical situations. This provides some feedback to the basic researcher which will help him in modifying and refining his theory. In this respect, no one type can be said to be inferior or superior to the other.*

Based on its elements, scientific research can be said to be a systematic and objective intellectual activity undertaken for the purpose of either solving known problem or increasing the existing store of knowledge (Onwioduokit, 2000). Scientific research is continuously on the cutting edge of knowledge.

Broad Areas of Scientific/Technological Research

The broad areas of scientific/technological research include biotechnology, pharmaceutical, chemical/material science, electronics, and automotive. Biotechnology seeks to understand and use the fundamental processes of cellular life to develop more effective medicines, consumer products, and industrial processes. Advances in biotechnology have led to new drugs and vaccines and disease-resistant crops. Most of the interest in biotechnology derive from the medical application of its basic and applied research.

Pharmaceutical research involves the discovery of new drugs, antibiotics and vaccines to treat or prevent a wide range of health problems. Chemical/material science research focuses on the design and creation of new molecules or materials with useful properties. By researching and modeling the properties of molecules under various conditions, scientists in this field can develop new chemical structures that are stable or volatile, rigid or flexible, insulating or conductive. Researches on petroleum derivatives and substitutes continue to be an important part of this field.

Electronic research incorporates a broad range of technologies, including computer hardware, telecommunications, consumer electronics, automated control systems, medical equipment and electronic sensing. Research and development in this field lead to advances that make electronic system faster and more reliable, compact, useful, powerful and accessible. Automotive research and development create new vehicles and systems that are more efficient, powerful and reliable.

From the fore-going discourse on areas of research, it is seen that nearly every need of consumers, from antibiotics, computer hardwares to new vehicles and systems are products of scietists/technologists who conduct researches for newer and better products. In other words, basic and applied researchers are needed because they are the main springs of progress in science and technology which enhance, sustainable national development.

Implication of Scientific/Technological Research

The roles of scientific/technological researches in sustainable development will be better appreciated in the context of specific areas of research such as: biotechnology, agriculture, health, manufacturing industries, natural resources and housing.

Biotechnology

Biotechnology is the technological application of biological findings in industries in order to improve the quality of human life (Ameh-Amegbe, 2008). It is the development of techniques to the application of biological processes to the production of materials of use in medicine and industry (Isaars, Daintith and Martin, 1995). Adoption of biotechnology is believed (Nkweke, 2002) to be a pre-requisite for attaining national food security, environmental management and control. This is because life sciences and related advances in biotechnology have opened up new vistas of increased food production, stemming environmental degradation and adding value to national resources as well as promoting industrialization.

Agriculture

Nigeria is blessed with natural vegetable, good and relatively predictable climate. Today, she is in the business of harnessing her national resources through scientific approach, involving pure and applied science researches, for the good of her citizenry. Fashola (1972) observed that the increasing use of fertilizer and insecticide has brought better yields. She is thus able to produce more cash and food crops which constitute one of the main sources of national income. Harvested crops which do not go for immediate processing are preserved (using chemicals) and stored away in a controlled atmosphere, thereby ensuring the continuity of food supply all year round. Thus, the role of agricultural research, in national development gained recognition in Nigeria more than four decades ago.

Acknowledging the inevitable role of research in Agriculture, Abubakar (1972) claimed that science and technology can be applied to increase food and agricultural yield by launching research programmes which are targeted at

- developing new germ plasma and variety of grains with higher yield per acre.
- Increasing the resistance of the crop to certain disease prevalent in the area
- Improving the storage facilities of foodstuffs
- Introducing new varieties of crops that have a wide range of geographical adaptation
- Processing of foodstuff such as garri so as to minimize wastage of food nutrients
- Studying the chemistry of our soul
- Adapting available agricultural machinery to our local needs and to providing something cheaper
- Producing local fertilizers which are cheap and financially accessible to the average farmer.

Maduewesi (1981) reported that in the area of improved crop varieties, remarkable advances have been made in the production of maize, rice, millet, sorghum, cowpea and tomato varieties which give greater and better yields, and which are resistant to pest and disease. Adeyanju (2000) noted that in the field of agriculture, with the cooperation of the World Food and Agricultural Organization (FAO), Nigerian government has built research centres for the improvement of food values, and control pest and parasites which destroy crops. They help to introduce crops from other parts of the world.

The general level of food production has been stepped up through a series of scientific researches. Researches in science have led to the use of machinery in agriculture, production of different brands of fertilizers and improved seedlings and better methods of cultivation. The production of protein substitutes has received popular attention from scientists in developed and developing countries. New techniques of raising farm animals and fishes have added to the present day food supply (Inyang, 1997).

Nwana (2000a) applauded the level of success achieved through science and technology in the area of agriculture. He reported that in Nigeria today, the health and yield of crops are protected and increased by the use of pesticides and fertilizers made possible through scientific researches. By the same token, feed supplements and veterinary medicine are given to animals to increase production. Broilers, a type of chicken can mature in seven weeks if given food supplements. Nwana (2000b) reported that researchers have developed modern tractors. These machines can cultivate, sow, weed and harvest crops. Some modern machines can plow, plant seeds, apply herbicides, pesticides and fertilizer at the same time. All these have been made possible as a result of science and technology discoveries by agriculturists.

In Nigeria, improved strains of oil palm trees capable of having multiple bunches at a time have been developed and even special tool for the care of the palms have been fabricated. Farmers today can harvest their palm trees standing on the ground. This has taken care of the scarcity of climbing harvesters. Even the processing of the palm fruit has been made easier with oil processing machines (Nwana, 2000b). All these lend credence to the fact that scientific research contribute significantly to the sustainable development of Nigerians, as a people and as a nation. The broom stick derived from the frond is crushed and compressed to make high quality table tops in furniture and car seat manufacturing. The interior of the palm trunk is treated with protein and converted to animal feed. Thus, Malaysia has recorded impressive national development through science and technology innovations.

Health

Health is wealth. The economic wealth of a nation depends on the well-being of it's people. Application of medical knowledge has relieved man of pain, by using anesthetic, antibiotic, etc. and thus lengthens the lifespan of man. Hitherto, life expectancy in Nigeria was among the lowest in the world. Among the dreaded diseases that shorten life span are kidney diseases. Scientific research has made artificial kidney available and kidney transplant a possibility. Thus, application of scientific innovations can save the nation the untimely loss of many useful men in their prime of life.

Proper application of medical knowledge has reduced the hitherto high infant mortality. Reduction of infant mortality makes available to the country a larger prospective high level manpower which is very essential for national development. Abubakar (1972) observed that vaccination, a product of scientific research, has reduced the incidence of such epidemic disease as small pox and measles which used to take large tolls on our population.

Thus, scientific researches are needed in medicine so as not only to improve the quality and availability of medical supply but also to uplift the level of health-care delivery.

Manufacturing Industries

Industrial products have their basis in scientific researches. The mass-production of detergent, radio, biro and other products is possible because of the advances in sciences (Jigede, 1990). Industries provide job opportunities and thus reduce unemployment and its attendant problems.

Chemists and material scientists research into the nature of chemical systems and reactions, they investigate the properties of materials and develop new products or processes. They perform research used by a broad array of industries to develop new products. The biologist is required in the brewing industry in research for new and cheaper raw materials as well as quality control of their products. On the whole the research for local raw materials for the industries, an exercise in which biologists are actively involved, is an effort aimed at a self-reliant economy (Maduabum, 1992).

Industries create large scale employment necessary for good living. Through large scale production, industries stimulate regional and international trade. In this way, physical and foreign exchange are generated and the wealth of the nation grows (Adeyanju, 2000).

Natural Resources

The stage of technological advancement in Nigeria has enabled its natural resources to be exploited and developed. For instance, water resource has been utilized and transformed into hydro-electric power, and forest products have been used to produce pulp, paper, timber and plywood while crude oil yields petroleum products. Iron ore is being used for steel, limestone for production of cement and marble for tiles (Adeyanju, 2000).

Transportation and Communication

Linkages between cities and rural areas, in the form of good roads and communication network have been made possible through scientific researches. We are transported around on the ground, across water and in air by vehicles that are by products of scientific/technological researches. The radio and television enable us to learn of events across the globe on daily basis. Researches in science and technology have provided a great impetus to computer and telecommunication industries. The Global System of Mobile Communication, GSM enables a person to communicate with anybody in a GSM environment of the world at anytime, even while in motion. The advent of GSM has made the world very small. The internet serving as an excellent communication platform has made the world flat. Transportation and communication are the life blood of commerce on which economic rests. Technological progress is the prime mover of the economy.

Housing

One of the most basic needs of man is shelter. In recent past, there was a limit to which a residential building could rise, barring the possibility to satisfy the basic need to find shelter for the ever-increasing world population of people. This limitation was due to designers' lack of the knowledge of the properties (ductility, brittleness, malleability, etc) of the constructional materials of residential building and of the properties of the soil on which the houses were going to stand. Through scientific/technological investigation, this limitation has been overcome.

In our contemporary society, a building can be technologically powered to be as tall as required. Following advances made in geology and soil mechanics, the technological know-how to determine the characteristics and behaviour of the sub-soil strata of a given area as accurately as possible is got. With this knowledge of subsoil conditions, suitable foundations can now be provided.

Recommendation

The following recommendations are made for the enhancement of scientific and technological researches for sustainable development.

1. Enabling environment which is scientifically and technologically based should be provided by all stakeholders in education and economic planning for the conduct of researches and the application of their findings.
2. Political will in implementing research policies by relevant agencies should be demonstrated.
3. Adequate funds as against "lion-share" of national budget should be provided for the teaching and learning of science and technology.
4. Quality teaching and learning of science, technology and vocational education should be encouraged by relevant agencies in the business of education by instituting quality assurance mechanism in Nigeria education system by relevant agencies in the business of education.

Conclusion

A highly developed system of education and research programmes in the basic sciences in particular and vocational education in general is needed by every country to achieve sustainable development. Indepth knowledge of basic sciences is of indispensable value because it is through their research orientation that technological development and growth can take place.

References

Abubabar, I. (1972). The role of science and technology in national development. In Adaralegbe, A. S. (Ed.) *A philosophy for Nigerian education.* Ibadan: Heinemann educational books (Nigeria) Limited.

Adeyanju, T. K. (2000). *NCE/DLS* course book on social studies, cycle 3. modules *1, 2, 3.* Kaduna: National Teachers Institute.

Akaneme, F. I. (2004). History and philosophy of science. Lagos: National Open University of Nigeria Press.

Ameh-Anegbe, C. O. (2008). *Science, technology and society.* Lagos: National Open University of Nigeria Press.

Egbogag, E. O. (2012). The role of science and technology in national development: The miracle of malaysia and the future for Nigeria. *Petroleum Technology Development Journal, 1(1)1-12.*

Fashola, F. B. (21972). The role of science and technology in national development. In, Aderalegbe, A. (Ed.) *A philosophy for Nigerian education.* Ibadan: Heinemann Educational Books (Nigeria) Limited.

Garbouchev, I. P. (1986). Sustainable development. Bulgerian academy of sciences, *http://www.un-documents.net*.

Inyang, N. E. U. (1997). Relationship between science and society. In, Inyang, N. E. and Ekah, M. E. (Eds.). *Science and society*. Uyo: Afahaide and Brothers Publishing Company.

Isaacs, A; Daintith, J; and Martin, E. (1999). *Oxford Dictionary of Science.* New York: Oxford University Press.

Jegede, O. (1990). NCE/DLS course book on primary education studies, cycle i, modules 1, 2, 3, 4. Kaduna: National Teachers Institute.

Maduabum, M. A. (1992). The role of the biologist in Nigeria's development. *Journal of Science Teachers Association of Nigeria, 27(2)18-24,*

Maduewesi, J. N. C. (1981). The impact of indigenous scientific research on national development. *Daily Times, May 20.*

Nwala, T. U. (1997). Definition, branches and aims of science. In Nwala, T. U. (Ed.). *History and Philosophy of Science.* Nsuka: Niger Books and Publishing Co Ltd.

Nwana, O. C. (2000a). NCE/DLS course book on general studies education, cycle I, modules 5, 6, 7. Kaduna: National Teachers Institute.

Nwana, O. C. (2000b). NCE/DLS course book on integrated science, cycle 4, modules 4, 5, 6. Kaduna: National Teachers Institute.

Nworgu, B. G. (1991). Educational research: Basic issues and methodology. Ibadan: Wisdom Publishers Limited.

Onwioduokit, F. A. (2000). *Educational Research, Methodology and Statistics.* Uyo. Dorand Publishers.