THE CONTRIBUTIONS OF BIOLOGICAL SCIENCE TO NATIONAL DEVELOPMENT: NIGERIAN EXPERIENCE*

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Abstract

The world is a global village and globalization is a process of interaction and integration among the people, companies, and government of different nations, a process driven by international trade and investment and aided by information technology. This process has effects on the environment, on culture, on political systems, on economic development and prosperity, and on human pbysical well being in societies around the world. This current wave of globalization has been driven by policies that have opened economies domestically and internationally. Science has been the principal driver of globalization. Advances in information technology, in particular, have dramatically transformed economic life. Information technologies have given all sorts of individual economic actors-consumers, investors, businesses-valuable new tools for identifying and pursuing economic opportunities, including faster and more informed analyses of economic trends around the world, easy transfers of assets, and collaboration with far-flung partners. Therefore, the imperative role of science to national development cannot be neglected and there is a lively debate on the link between biological science and national development. The motivations for science research way from one field to another. Some science questions have immediate goals, clearly directed towards solving specific problems or addressing particular conditions in society. Much medical research, for example, focuses on finding answers to questions such as why cancer cell develop and how to inhibit their growth. Military research is also usually focused, investigating, for instance, the effect of strong bursts of electromagnetic energy on missile guidance systems. Material sciences explore the properties of substances that make them useful in applications such as TV transmission, power distribution, or computer chip manufacture. Other biological sciences pursue questions more distant from current everyday concerns: biochemists seek to understand how complex protein molecules fold into their compact forms; astronomers attempt to discern whether the expanding universe will ever stop and recollapse; and high energy physicists probe the forces and particles at the heart of all matter, at the smallest distance scales imaginable. Biological science generate continuous innovation (technological, organizational, managerial) generated by learning entities that have been shown to be responsible not only for productivity increases, but also for dynamic competitive advantage of firms, industries and nations in the unfolding global economy. This presupposes that science is multidimensional and it is inevitable for any society aspiring for national development. Therefore, this paper argues essentially, that biological science is a sine qua non for national development.

1. Introduction

Mankind loves mystery, but it hates mystery the more. This humanity has explained and systematized its perceptions of the external world and called the resultant "knowledge". Knowledge is not wisdom; wisdom is knowledge, when it is tempered by judgment. (Frank Egler, 1970).

There is more than one road to knowledge. That of superstition is linked with witchcraft and quackery, myths, mystiques and magic, fads, fancies, frauds and fakes. Mysticism, occultism, theosophy and some of the world's religions rely on mystical insight. However, some dogmatic religions use divine revelation or infallibility as a source. Science is just another road to knowledge that depends on certain rules and regulations, which are considered, at least by their makers, as rational and reasonable. There are many definitions of science, some extremely simple and some clothed with jargon only intelligible to the initiated.

By the definitions above, it is often difficult to find a common core among the diversities. As knowledge of the world about us, we refer to the so-called "natural science" the function of which is to describe

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and explain the things, properties and phenomena of nature. To others, science is the accumulation and classification of 'facts'.

To others still, it is the organization of these facts by means of concepts into a coordinated body of knowledge. From another point of view, science is a philosophy, a method, a viewpoint, and an attitude, one of several ways that may explain the world about us. However, for the general public, there is simply nothing that the 'god' science cannot accomplish, given a big enough team of men and enough money thrown into the project. Undoubtedly, science is a bit of all these things, ever reflecting a faith in the intelligibility of nature.

Science can best be described as a body of knowledge of us, and the world about us, systematized, organized, with accepted principles and concept. It is allegedly logical in its explanations, purportedly reasonable in its methods, hopefully reliable in its predictions. (Frank Egler, 1970).

Modern Nigeria needs an education in the science i.e. up to date and relevant to the contemporary life. The engineering scientific technological industrial society has brought great demand for scientific manpower both in quality and quantity of training. Science is special to human life because it generally improved the living conditions of mankind; this results from the application of the knowledge and processes of science to enhance human activities.

Biology on the other hand is the branch of science that involves studying living things. It is a science devoted to the study of living organisms. Science has progressed by breaking down complex subjects of study into their components parts so that today there are numerous branches of biology such as; physiology, histology, genetics, microbiology etc. (Excerpts from Biology science).

The aim of Biology must ultimately be to explain the living world in terms of scientific principles, although appreciating that organisms behave in ways often seem beyond the capabilities of their components parts. Certainly the consciousness of living organisms cannot be described in terms of physics and chemistry, even though the neurophysiologist can describe the working of the single neuron in physiochemical terms. Notably, Biology is defined as any of several branches of science, such as medicine, anthropology or ecology that deals with living organisms and their organisation, life processes and relationships to each other and their environment. Biological science includes botany, zoology and all their sub-divisions; the life processes or characteristic phenomena of a group or category of living organisms, the biology of viruses. Lastly, the plants and animal life of a specific area or origin (Leani, 1989).

The world is a global village and globalization is a process of interactions and integration among the people, companies and governments of different nations, a process driven by international trade and investment and aided by information technology (Biology science).

Therefore the imperative role of science (Biology) to national development cannot be neglected and there is a lively debate on the link between biological science and national development. The motivations for science research vary from one field to another. Some science questions have immediate goals, clearly directed toward solving specific problems or addressing particular condition in society. Much medical research, for example, focuses on finding answers to questions such as why cancer cells develop and how to inhibit their growth. Other Biological sciences pursue questions more distant from current every day concerns: biochemists seek to understand how complex protein molecules 'fold' into their compact forms; astronomers attempt to discern whether the expanding universe will ever stop and recollapse; and high energy physicists probe the forces and particles at the heart of all matter, at the smallest distance scale imaginable.

Biological science generate continuous innovations (technological organizational, managerial) generated by learning entities that have shown to be responsible not only for productivity increases, but also for dynamic competitive advantages of firms, industries and nations in the unfolding global economy. This presupposes that science is multidimensional and it is inevitable for any society aspiring for National development.

Contribution of Science toward National Development

National development of any kind must start with the people and their education. This process has effects on the environment, on culture, on political systems, on economic development aud prosperity and on human physical well being in societies around the world. This current wave of globalization has been driven by policies that have opened economies domestically and internationally. Science has been the principal driver of globalization. Advances in information technology, in particular, have dramatically transformed economic life.

Indeed, in the past three decades the occupants of the industrialized parts of the world have become increasingly convinced of the importance of science and technology in social change. The impact of science has become an obvious fact. The close connection between social development and technical ability has become an even more acute issue within the last decade, particularly in Britain but also in the least-industrialized countries of continental Europe and North America (Steven yearly, 1988).

The importance of science cannot be over emphasized. Frame, (1979) has shown how closed scientific output -in terms of the numbers of published scientific papers and the amount spent on science-

correlates with state of development of countries as measured in economic terms. Yet the importance, which we attach to science and technology in economic development, indicates that the opportunities of the world's poorer countries are adversely affected by their small complement of scientific personnel (Steven, 1988).

The study of science and the study of development show an interesting and important similarity. The direction of progress has seemed obvious; the only question is how best to move in that direction. With regard to science, the situation has appeared equally clear cut. Science is commonly regarded as an edifice built upon the collection of data.

Ironically, theories come and go as our factual knowledge increased. Every year since 1990, United Nations Development Programme (UNDP) has commissioned the Human Development Report (HDR) by an independent team of experts to explore major issues of global concern. A worldwide advisory network of leaders in academia, government and civil society contribute data, ideas, and best practices to support the analysis and proposals published in the report.

The concept of Human Development looks beyond per capital income, human resource development and basic needs as a measure of human progress and also assesses such factors as human freedom, dignity and human agency, that is, the role of people in development. The objectives/roles of National development is driven towards achieving the following goals:

- Eradicate extreme poverty and hunger;
- Achieve universal primary education which is science based;
- Reduce child mortality;
- Improved health;
- Combat HIV/AIDS and other Diseases;
- Ensure environmental sustainability; and
- Promote self-reliance.

(Experts from "Human Human Development Report", 2003).

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The objectives of the biology curriculum are to prepare students to acquire:

- Adequate laboratory and field skills in Biology;
- Meaningful and relevant knowledge in Biology;
- Ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; and
- Reasonable and functional scientific attitudes.

The biology curriculum recommended the use of the guided discovery approach in the teaching of the topics. This approach involves the use of various activities such as demonstration, individual practical work, group discussions, field- work, project work and building models.

According to Odunsi, (1993) the content of the biology curriculum consist of thirty major topics focused mainly on seven concepts in biology viz:

a. Concept of living
b. Basic ecological concepts
c. Plants and animals nutrition.
d. Conservation of matter/energy
e. Variations and variability
f. Evolution
g. Genetics

These concepts/topics are sequenced into instructional units such that each unit is treated in greatest depth for each successive year. The curriculum developers also provided topics that are of direct relevance to the community. These include: ecological studies and principles, applied ecology, man and microbes, including public health and personal hygiene.

The Goals of Science Education

- To emphasize the teaching and learning of science process and principles. This will lead to fundamental and applied research in the sciences at all levels of education;
- Cultivate inquiry, know national mind for the conduct of a good life and democracy;
- Produce scientists for national development;
- Delivery studies in technology and the cause of technological development and understanding of the complexity of the physical world, the forms and the conduct of life;
- Special provisions and incentives shall be made for the study of the services at each level of national educational system. For this purpose, government shall adequately support the functions of all agencies involved in the promotion of the study of sciences;
- The government shall popularize the study of the sciences and the production of adequate number of scientists to inspire and support national development (Baker, 2000).

How has Biological Science contributed to National Development?

Biological science as one of the basic sciences has contributed immensely to national development. Some of the contributions of this subject to national development are as follows:

- Biotechnology
- Bioterrorism
- Genetics
- Improved Agriculture and Poultry
- Medicine
- Medico-legal matters.
- Biodegradation of oil, in an oil spillage area.
- In vitro fertilization.

Biotechnology:

This is the use of living organisms to make products (D.J Taylor et. al 1984). Biotechnology is the practice of using plants, animals and micro-organisms such as bacteria, as well as biological process such as the ripening of fruit or the bacteria that break down compost to some benefit.

It can be summarized as the manipulation of living organisms to produce goods and services. For example, in industry, medicine and agriculture, biotechnology is used to produce foods, medicines, test for diseases and remove waste. It can also be use to solve problems and conduct research. Overtime biotechnology has formed the basis of learning about people and diseases. Biotechnology is leading the way to a new era in health care, with the development of better methods for detecting, preventing and treating diseases. Biotechnological techniques, such as DNA profiting are also proving enormously useful in other areas of human life, such as forensic science and identification.

On the environment, biotechnology has the potentials to have both positive and negative impacts on the environment. Organisms can be engineered to remove wastes and pollution from the environment.

Bioterrorism/Bioweaponary

The prospect of using agents like deadly bacteria and viruses as weapons has been an issue for many decades, but using them for biological attacks has risen dramatically since the 2001 anthrax-laden letters that killed 5 people and infected 18 others. This has made officials acutely aware of both the importance and danger of bioweaponary research.

Application of Genetics in Medicine

Genetics find application in medicine in a number of ways. Prominent among the various ways genetics is applied in medicine are the following: diagnoses of disease and blood transfusion.

The principles of genetics provide clues for the diagnosis of a number of diseases of man. These principles of genetics guide doctors in knowing how the patient comes bout the disease.

In the issues of Blood group, blood transfusion is one of the various ways the principles of Genetics are applied in providing solution to some medical problems (Fatubarjn, 2003). It is important that the blood to be transfused matches that of the patient who will receive the blood.

Application of Genetics in Medico-Legal Matters

The areas that are prominent here include determination of paternity, crime detection and ownership of documents.

In legal matters involving the paternity of a child, the knowledge of blood groups can be applied. In crime detection, genetical principles find application in crime detection in two main areas in which human beings show genetic variations. These are in the fingerprints and bloodstains. Human fingerprints can be any of four main kinds. These are arch, loop, whorl and compound. The police can carefully study the fingerprint or impression on the instruments used in committing crimes to identify the suspects among those apprehended in connection with a criminal case. In a similar vein, a careful analysis of the blood stains on instruments used in committing crimes can assist in picking suspects after the blood groups of such suspects have been carefully analyzed.

Application of Genetics in Agriculture

In agriculture, improvement of crops and livestock based on Genetical principles are usually carried out by plant and animal breeders. One major technique often used by breeders is the artificial selection. This is an improvement technique whereby plant and animal breeders watch out for desirable characteristics in their corps and livestock. Plant breeders and animal breeders look out for stocks with desirable characteristics such as resistance to diseases and pests, easy harvesting, improvement in their flavour or vitamin content and shorter life cycle-in case of plant.

In animals, breeders look out for animals that possess, these qualities: improvement in the quantity of edible parts of the animal's resistance to diseases and pests, reduction in their gestation period, earlier attainment of productive age and marketable (Fatubarin; 2003).

Biodegradation

According to Dejong, (1980) crude oil spillage on soil makes it unsatisfactory for plant growth. Environmental pollution has been shown to have adverse effects on plant growth and this may range from morphological aberrations, reduction in biomass to stomata abnormalities which may lead to reduction in plant yield (Sharma *et al.*, 1980).

Oil spills pose a major threat to the environment in Nigeria. If not checked or effectively managed, they could lead to total annihilation of the ecosystem, especially in the Niger Delta where oil spills have become prevalent.

Life in this region is increasingly becoming unbearable due to the ugly effects of oil spills and many communities continue to groan under the degrading impact of spills (Oyem, 2001).

Biodegradation is the use of organisms to detoxify pollutant in the environment. Because phytoremediaiton of organic compounds occur in the

presence of plants and a variety of associated microorganisms, a considerable amount of work on xenobiotic degradation of environmental contaminants has been accomplished by a variety of organisms (Sandermann, 1992).

Bacteria is used in petroleum production by injecting suitable culture into oil reservoir, the organisms produce acidic metabolite which in turn dissolve the rock of the reservoir allowing the oil to collect inlayer amount forming a bulk supply. Some bacteria such as methanomonas species are used to locate oil while bacteria such as pseudomas and acinetobacter are useful in petroleum pollutant degradation.

In-Vitro Fertilization (Ivf)

This is commonly known as the test-tube baby technique. It was first devised by Patrick Steptoe and Robbert Edwards in 1978 as a means of helping women with blocked oviducts. It is still mainly used for this problem and for patients with damaged oviducts, which cannot be repaired surgically. However, it may be used in man in case of low sperm counts or abnormal sperm and where the female is producing antibodies against the sperm and in the case of a female not able to produce eggs (Taylor *et al.*, 1997).

The technique involves fertilizing one or more eggs outside the body, and then transferring the fertilized eggs known as pre-embryos, back into the uterus. This step is referred to as embryo transfer. (Taylor *et al.*, 1997)

The main stages of IVF are:

- Stimulation of the ovaries with fertility drugs to produce several eggs;
- Collecting the mature eggs;
- Fertilizing the eggs in the laboratory;
- Culture of the pre-embryo; and
- Embryo transfer

Conclusion

In summary, national development of any kind must start with people and their education. The study of science and the study of development show an interesting and important similarity.

The impact of science and technology on national development has become an obvious fact and the close connection between national development and technical ability has become an even more acute issue within the last decade. (Charles Cooper, 1973). Science has been the principal driver of globalization. Advances in information technology, in particular, have dramatically transformed economic life.

Biological science generates continuous innovations (technological, organizational and managerial), generated by learning entities that have shown to be responsible not only for productivity increases, but also for dynamic competitive advantage of firms, industries and nations in the unfolding global economy. This presupposes that science is multidimensional and it is inevitable for any society aspiring for national development.

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