THE ROLE OF PHYSICS IN NATIONAL DEVELOPMENT: A LESSON FOR NIGERIA

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Abstract

Some people may believe that 20th and 21st century physics research has less of a direct impact on their daily lives than biology, chemistry, engineering and all other fields. Perhaps they think of physics as an unrealistic, enigmatic or purely academic endeavour. Others think that physics only contribute to the development of atomic bombs. This article dispels this myth and enlightens the ordinary person on how physics has worked to reshape societal values and influence economic and national development. The benefits of some areas of physics to the development of a nation and the need to promote physics research in a developing country, like Nigeria, is also highlighted.

Introduction

The key words in the title of this paper are Physics' and 'National Development'.
Physics is the study of the properties of matter and interrelationship among space, time, matter and energy (Okeke & Ndupu, 1989). Physics is one of the aspects of science that has contributed to all facets of man's well being. Man's development and mastery of his environment is a function of the degree of his mastery of Physics concepts.

National development connotes social, political and economic advancement of a Country (Ugodulunwa, 1999). In the context of physical sciences, national development can be viewed as an act of harnessing the human and natural resources of a country in a structured manner, so as to bring about significant and sustained advancement of that country, and it citizens in all spheres of life (e.g. social, political, and economic outlook).

A society develops as it citizens increase their capacity for dealing with the environment, thus harnessing the resources available in their environment for better equitable distribution and productivity. Citizens of developed countries have high standard of living, are enlightened about most events that affect their lives and their countries, and have adequate opportunities to improve themselves. Most of the items required for use by these citizens are manufactured in their respective countries. This means that, all developed countries are highly industrialized.

From the foregoing discussion, there are two major indices for national development, namely level of industrialization of a country and level of awareness of its citizens. Industries depend on raw materials, and they require energy to run the machines. Most of the raw materials used in industries, and almost all the energy resources are derived directly or indirectly from the knowledge of physics.

Nigeria is reputed as the giant of black Africa and she has been trying hard in various ways to catch up with the rest of the technologically advanced countries of the world. When compared to developed nations like America, Japan and other Countries in Western Europe, Nigeria is still struggling to be self-reliant. Self reliance here means developing her own consumer products enough to stop importing technology.

Nigeria imports technology and this has caused more problems than solved to the country. For example, the countries from whom Nigeria imports her technologies have seized the opportunity to use Nigeria as dumping ground for absolete technologies.

Other problems that Nigeria is facing as a result of importing technology include lack of skilled manpower, low level of industrialization, high cost of living, weak economy, unemployment, imporishment, and many others. These problems, put together, have given rise to the present state of underdevelopment in the Country.

The scientific method and pioneering work of brilliant thinkers, which led to far-reading discoveries, are found abundantly in the field of physics more than any other branch of science. Most of the brilliant thinkers behined the technologies imported by Nigeria are physicists. Nigerian physicists like their counterparts else where, have the potentials of bringing forth ideas that can lead to the development of far-reaching technologies in the country. However, physicists and other scientist in Nigeria have not been given the enabling environment to carryout any form of research.

It is in the light of these problems that this paper intends to draw the attention of the Nigerian Government and people to how other countries have encouraged physics researches and used them to develop their countries. The paper also creates an insight to what Nigeria is likely to achieve if physics research, in the Country, is given more attention.

Physics and Technology

Engineering and technology use the inventiveness and knowledge of physics (and other sciences) to provide solutions to difficulties that can lead to the development of a nation. Consider the following examples:

Electrical generators used in power stations, is the harvest of discoveries made by Faraday (Duncan, 1994). So too are electric motors, the heart of so many of today's appliances, including robots which are becoming increasingly important in manufacturing industry.

Radio and televisions were developed from the theoretical ideas of Clerk Maxwell (a physicist) pertaining the relationship between electricity, magnetism and light. Subsequently the efforts of Hertz, Marconi, logie-Baired and others made possible the transmission of signals over a distance (Duncan, 1994).

Predictions about the paths taken by artificial satellites and space vehicles are based on the fundamental laws put forth by the English genius, sir Isaac Newton in the late 17th Century; they have contributed to the 'conquest' of space with its many beneficial spin-offs.

Nuclear power is possible because of the increasing knowledge about the structure of matter that has come about during the twentieth Century by a physicist called, Ernest Rutherfold. It has become possible to exploit physics to shape our world quite dramatically. The devastating power unleashed by the manipulations of the structure of the atom, is one solution to our attempts to find new sources of energy.

In medicine, discoveries in physics have stimulated the development of devices like x-ray machines, ultrasound scanners, and lasers, which are used to cure diseases, and quickly diagnose health problems.

Another in the series of physics contributions to the development of our society today is the computer, the transistor, and the World Wide Web. Nearly everyone would agree that these inventions are among the greatest inventions of the 20th century. The economy of the world today is inextricably linked to these technologies. The embrace of this technologies by America is responsible in part, for its status as an "economic super power". The wealth of other nations such as Japan, Taiwan, Countries in Western Europe and others is also partly due to their contributions to the development of these technologies.

Physicists invented all the electronic digital computer, the transistor, the laser, and even the World Wide Web. These inventions make up the foundation of the modern technology. Bindloss (2003) affirmed that the first electronic digital computer was built in the basement of the physics department at Iowa State University in 1939 by professor John Atanasoff, who had a Ph.D in theoretical physics from the University of Wisconsin and his physics graduate student Clifford Berry. Antanasoff was given the national medal of technology in 1990 by U.S. President George Bush in recognition of his invention.

In the 1980s, the thousands of physicists at CERN particle physics laboratory in Geneva needed a better way to exchange information with their colleagues working in different universities and institutions all over the world. Time Berners – Lee a graduate from Oxford University with 1st class Honors in Physics invented the World Wide Web at CERN in 1990 to meet this demand (Bindloss, 2003). Along with creating the first web browser and web server, he developed the soft ware conventions that are key to the web's usefulness, with acronyms like URL (Uniform Resource Locator) and HTTP (Hypertext Transfer Protocol). Berners – Lee's supervisor D.M. Sendall (a physicist) gave him the initial go ahead on the project.

From the preceding, it is clear that physics is the springboard for technology and industrial development. The subsequent sections of this paper have more information on this fact.

Physics Triggers Industry

In 1954, Physicist Charles Townes developed the maser, the forerunner to the laser. This discovery, which was not seen by many to have any practical use, has stimulated the industry today in so many ways. Only a few areas of science have caught the population imagination more than the laser. There are many uses to which lasers are nowadays applied. Some examples follow:

Carbon dioxide lasers are used in some types of Surgery (Duncan, 1994). Lasers are used to correct vision, remove tumours and coronary blood clots, and close wounds (American Institute of Physics [AIP], 2004). Laser sugery is faster than scalpel, can be non-invasive and seals blood vessels, making some transfusion unnecessary. For instance, laser eye surgery takes minutes and require no hospital stay. Blindness in diabetics in advanced countries decreased by 60% because of laser surgery (AIP).

Powerful lasers are used to weld metal together with great precision (Fullick, 1994), making joins of very high quality. Lasers of higher power may be used to cut through hard materials like steel, and in clothing factories hundreds of layers of cloths can be cut to the same pattern simultaneously. Lasers are more precise than traditional cutting and welding methods and are tools that never go dull or wear out.

Modern communication systems use digital methods to send information over long distances. Such methods produce a great improvement in quality over analogue systems, and can also deal with far larger amounts of information. Fiber cable acting as a pipe for laser light carries tens of thousands of phone calls at a time. Lasers play an important part in these systems, producing the short pulses of light used to send the digital signals along strands of glass as fine as a hair. Lasers are also used to read and write data on optical disks, resulting in high-density storage systems. For example, they read digitally coded music on compact discs and retrieve data from computer disks. Thus the multi billion-dollar industry of CD players might not have come into existence were it not for the discovery of the laser.

Surveyors make use of the precision of the laser in making measurements and preparing for construction projects such as roads which require straight lines to be laid out over large distances (Fullick, 1994). They may also be used for range finding, by measuring the time taken for a brief pulse of laser light to make a return trip to a distant object.
Another application of the laser light in practice is the three-dimensional photograph called hologram. The use of holograms in all works of life is on the increase. Examples abound below:

The scanners at a super market checkout are based on a holographic disc, which reads and interprets the bar code on the merchandise (Duncan, 1994). A credit card may contain a hologram, which allows the shopkeeper to check if it is a counterfeit (since holograms can not be forged). A fuel rod in position in a working nuclear reactor can be photographed and the hologram projected and magnified for inspection to detect any distortions.

In Medicine a hologram of a living brain can reveal to surgeons the exact size and location of a tumour. Holography is also useful in the design of artificial joints and can replace 'pickled' specimens used in teaching.

Holograms are used for the display and marketing of goods in the commercial world. A phone card (Durcan 1994), used instead of cash to make a telephone call on a card phone, contains an invisible hologram, which keeps a check on the number of units used. The instrument panel in an aircraft may have a holographic display so that the pilot does not lose vital seconds in moving his head around.

Holography may also lead to the development of extremely space-efficient storage for documents or other information in the form of photographs (Fuillick, 1994). Taking this idea further, it has been suggested that the image for a complete feature-length film could be stored in a piece of transparent material the size of a sugar cube.

According to the American Institute of Physics (2004), between 1980-1990s, lasers makeup a multi-billion dollar industry used in surgery, telecommunications, navigation, welding, grocery scanners, printers, law enforcement, CD players and national defense.

Physics Related Job Opportunities

Research in plasma physics, semiconductor processing, and magnetic materials helped to build one of the largest industry in America, and the government continues to maintain an active leadership role today. The electronics and semiconductor industries account for around 6.5% of the Gross domestic Product representing 400 billion dollars and 2.6 million Jobs in America (American Institute of Physics [AIP], (2003). Today, computers and microprocessors are found every where from our desktops to our cars, cellular phones, TVs and traffic lights, influencing our daily lives in ways too numerous to count.

The physics research in plasma physics, semiconductors, lithography and lasers led to integrated circuits and microprocessors. The 1995 world semiconductor market was 150 billion dollars and employed 250,000 Americans (AIP, 2003). Physics research in magnetic materials, thin films and semiconductors has led to small, affordable computers. The U.S. computer industry employs more than 1 million people and has revenues of more than 100 million dollars each year. U.S. companies sell 8.2 billion PCs every year (AIP). 32% of American houses have a computer.

The telecommunication industry, which earns billions of naira each year and employees, a large number of Nigerians, got a boost from early physics research on radio signals and circuit behaviour. A more recent example of the connection between physics and telecommunication is the World Wide Web, designed by particle physicists as earlier mentioned. The World Wide Web provides access to information on job opportunities and also employees quite a number of applicants in Nigeria.

Research in electronics, batteries, radio signals and detection systems made cordless cellular phones portable and in expensive. This break through has created a lot of employment opportunities for Nigerians in the past four years, especially in the GSM industry.

Physics Improve Health

The use of physics research to develop new cures for diseases and new ways to quickly diagnose health problems is on the increase. Recently, ultrasonic scan (an application of the physics of sound waves) is used in prenatal care to give an image of a baby inside the womb. Ultrasonic scans do not harm the baby, and are much safer than x-rays scan in this situation.

Particle accelerators invented for research purposes by high-energy physicists are used to treat cancerous tumours that are incurable or resistant to traditional radiation therapies. Neutron theraphy takes one-third the time of traditional radiation theraphy, with a cause of treatment that lasts around two weeks (AIP,2004). CD-ROMs can efficiently and inexpensively store baseline images of skin when compared with the patients skin; these can reval changes, identifying a malignancy at an early stage.

Until the end of the last century, for a doctor to take a look inside a patients body meant cutting it open. But many advances have been made in the twentieth century in non-invasive techniques of diagnosis, enabling doctors to obtain information about a patient's health without resorting to surgery. One such technique is the use of radioactive substance to detect abnormalities in the function of particular organs of the body. For example, a solution of an isotope of iodine 131 can be used to diagnose a blocked

kidney, by injecting the patient with the solution. Substances introduced into the body for this purpose are called tracers.

Gamma rays from high activity cobalt 60 sources are used for cancer treatment (Duncan 1994). They are replacing x-rays from expensive x-ray machines used in radiotheraphy for the treatment of cancer. Medical instruments and bandages are sterilized after packing by brief exposure to gamma rays. This is perfectly safe since no radioactivity is produced in the material irradiated by gamma rays.

Conclusion and Recommendations

From technology to industrial growth and Job creation to improved health, physics plays an important role in our lives. There are many other examples of how physics research has benefited society that are not discussed, in this paper. As our ability to manipulate physics increases, the opportunities to develop further useful technologies may well come about.

It is imperative that the Federal Government of Nigeria and private industry fund fundamental research in physics so that physicists can continue to make discoveries and inventions as important as the ones they have made in the past. The low level of industrial development in Nigeria today is not unconnected to the poor funding of research in physics and other branches of science. The benefits of research funding are not always within sight, but the consequences of new discoveries can be far-reaching and can affect everyone. Who knows where a new discovery can lead? the discovery of the electron by J.J. Thompson in 1997 was probably unappreciated when it occurred, it probably sounded like a waste of money to perform experiments on a particle that is too tiny to see. But of course, now, our civilization is dependent on electronics.

If we wish to become a developed nation, we must begin now to improve on our funding of science research especially in physics. Delay or failure is dangerous because the country will find it increasingly difficult to meet the most basic needs of the citizens. The key to advancement in medieval times was the ability to read and write preferably in Latin. Today, a scientific background is completely necessary and physics is a key element.

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