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SCIENCE AND ECONOMIC DEVELOPMENT

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Abstract: The paper explains what Science is and gives a distinction between pure and applied science. It treats the concept of economic development and explains some popular theories of economic development. It also discusses why science is important for economic development and recounts some examples of the impact of science in the economic development of a nation. Also, it examines how economic development can be facilitated through proper application of science. It concludes that considering the pivotal role pure and applied science have to play in driving the industrialization of a nation, it is important that a nation like Nigeria emphasize the need for a formidable Science base in all levels of education (Primary, Secondary and Tertiary) and recommends the establishment of a National Science Foundation.

Keywords: Science, National Development, Pure, Applied

INTRODUCTION

Science is the study of knowledge which can be made into a system and usually depends on seeing and testing facts and stating general laws. Science usually is linked with technology, which is the practical application of scientific knowledge or inventions to the solving of everyday problems or facilitating tedious human activities. They both go hand in hand. The product of science and technology has contributed to the development of countries such as America, Japan, China and to an extent in some African countries (Cozzens, 1996 and Cozzens, 2002). Through this application, scientific knowledgeable professionals have been able to invent equipments and machines that are being used in industries and even in our homes. In addition to this, science and technology has helped in easing stress, brought by the movement of goods and people from one place to another, by inventing easy transportation equipment like automobiles, aircrafts and so on.

Therefore, the role of science in achieving Nigeria's Vision 2020 development projects cannot be overemphasized as science is a key driver for growth and sustainable social development and transformation of nations, which can lead to industrialization. Vision 2020 is aimed at accelerating Nigeria's economic development to propel the country to the league of advanced nations by the year 2020. Therefore, it is pertinent to examine and highlight the role science will have to play in achieving this goal.

THEORIES OF ECONOMIC DEVELOPMENT

Economic Development can be defined as an increase in living conditions, improvement of the citizens self-esteem needs and free and a just society or the sustained, concerned actions of policy makers and communities that promote the standard of living and economic health of a locality (Sen, 1983). Economic development will only be successful if the whole nation is willing to give their best efforts towards its achievement. A lot of theories have been forwarded by different schools of thought about how economic development should be achieved. Many

economists have suggested that each country should try to achieve modernization and industrialization in order to achieve economic development. The theories include:

a. **Classical Liberal:** which posit that Economic development is understood as economic growth and capital-formation. In this theory, the key to economic growth was capital formation and the theory places an emphasis on large-scale infrastructure projects and on foreign aid loans.

b. **Social Theories of Development:** These emphasize the importance of "human capital" in development. The key to economic growth was education, health, fertility, etc. it shifted concerns from the overall rate of economic growth to considerations of poverty, inequality, urbanization and other social ills.

c. **Structural Theories:** These emphasized the conditions unique to Third World countries like Nigeria. They theories emphasize that the key to economic growth was recognizing that the experience of Europe could be duplicated in the context of former colonies and this shifted concerns to "import substitution," high tariffs and government protectionism.

d. **Neo-classical Theories:** The theories emphasize that the key to economic growth is free markets. This shifted concerns from the role of government-often considerable in structural theories-to private investment and market efficiency. This set of theories is currently the most widely practiced. M. Friedman is a major theorist (Mansell and Wehn, 1998).

Thus, one could clearly see that to ensure economic development, the theories stress the need for production of goods and services from within a country rather than importing from a foreign country and this can only be achieved when a country is developed in both pure and applied science.

THE NEED FOR SCIENCE

The application of products of pure and applied science has definite impact not only at the development stage of most economies but also has influenced the direction of that development at later stages. A country's involvement in pure and applied science can determine how far and in what way it can grow economically (Coe and Helpman, 1995). Experiences form countries like Korea, Singapore, Taiwan, India and China which have had huge investments in Research and Development (R & D) programmes have shown great economic development (Bernstein, 1989).

In Nigeria, the Ministry of Science and Technology is responsible for the collection, processing, storage and dissemination of data and statistics on science and technology (S & T). It is also responsible for access to foreign R & D information. The National Agency for Science and Engineering Infrastructure established by Decree No. 33 of 1992 has functions which include carrying out basic and applied research and development work in a number of areas such as microelectronics, computer technology and new materials. In addition there have been establishment of several Research Centres in the country such as NARICT, CELTEC, RMRDC, NAPRI, etc whose functions include:

i. To facilitate active and meaningful research for development;

ii. To provide short training programmes in the sciences
iii. To assist researchers in universities and research institutes as well R & D units of industry to use the centre's resources to solve problems and
iv. To act as a catalyst to initiate research and training in sciences.

Such Centres and Councils have been established in other countries including African countries like South Africa, Egypt, Tanzania, Kenya, Zimbabwe, etc. to fast track economic development. Consequently, Nigeria cannot afford to be left behind.

IMPACTS OF SCIENCE

Science as mentioned earlier is seen as "cumulative, verifiable and communicative knowledge". It has two branches:

i. Pure Science and
ii. Applied Science

Pure science is the investigation of nature to satisfy the need to know whereas applied science is the application of pure science to some practical human needs. It is a body of knowledge and devices by which man masters his environment, being more empirical in its approach to solving problems (PLOS, 2013). Thus, applied science could also be referred to as technology. Today, three major technological areas suffice – agriculture, medicine and engineering. Fundamentally, applied science or technology is an extension of man's capacity to see further and clearer, hear more, travel faster and for greater distances etc.

Furthermore, pure and applied science has helped in the area of medicine. Some natural herbs have been converted to drugs with the aid of modern equipment and these drugs are used in our hospitals and pharmacies. It has also transformed the way surgery is done in hospitals make it more precise and easier by using modern equipment.

Today, rural communities are transformed to urban settlements through pure and applied science. This is achieved by the provision of pipe borne water, hospitals, good roads, electricity, and schools, through the availability of electricity, pipeborne water, good road, schools and other social amenities. Equally, pure and applied science has aided so many sectors of the economy such as the advertising sector, sports and fitness, transportation, and so on.

Importantly also, pure and applied science has made work easier for people to do through the invention of computers and household machineries, it has also made communication faster through the use of mobile phones, televisions and radio used in communication.

FACILITATING ECONOMIC DEVELOPMENT THROUGH SCIENCE

In the last 5 decades researches in the U.S. has shown that S & T has driven the economy and has led to discoveries and inventions such as the discovery of transistors, semi-conductors, software, biotech. Also, University research produced Intel, Hewlett-Packard, Microsoft, Genentech, etc. (Mansfield, 1991).

Industrialists and economists have noted that infrastructure links all industries together and is invaluable in the economic transformation of any nation. A recent colloquium of Nigerian engineers defined it as those physical structures that facilitate the production of goods and services, without themselves being part of the production process. It was noted that they include

highways, airports, harbours, utility production and distributive systems, water and sewer systems, communication networks and energy networks.

Generally our infrastructure is still poorly developed when compared with that of developed and developing countries. For example Brazil, an emerging economy has a population of 179.1 million and generates 86,020 MW of electricity, resulting in per capita generation of 480 watts (Clancy and Elsenberg, 2012). In contrast, Nigeria currently produces about 3000 MW for a population of about 140 million, giving a per capita generation of 21.43 watts, which is not enough to light even a 40 watt bulb, accounting for the nation's virtual perpetual darkness.

Similar contrasting observations can be made with our transportation, communication, agricultural, and education infrastructure. To achieve rapid scientific and technological development, there must be substantial improvements in our infrastructure.

Apart from oil and gas, the majority of national industries are moribund. Human factors which have militated against development of pure and applied science are critical in determining the course of socio-economic transformation. Germany, an industrial giant today, presents a perfect example. Germany was brought together united under the inspirational leadership of Otto von Bismarck in 1871. Before unification Germany was composed of states that were only loosely united as German speaking people each with its own king. Bismarck's inspirational leadership and investment in science and technology signaled the transformation of Germany into a nation with relentless zeal for competition with Britain and France in commerce and industry (Clancy and Elsenberg, 2012).

Nigeria has a proliferation of Universities, and other tertiary institutions that can form the basis for development of pure and applied science at different levels to provide support for the take off and sustenance of an industrial revolution. However, the country must be prepared to address specific obvious loopholes in the educational and industrial systems. For example, there is no foundation established for the development of pure and applied science.

Developed nations in the West have set the pace with about 10 per cent of their countries' GDP set aside by law for development of science and technology. Asian countries such as South Korea have followed suit and set aside over 10 per cent of their GDP for science and technology. In Nigeria, in spite of a proliferation of Universities, Polytechnics and Research Institutes less than one per cent of GDP is allocated for funding of science and technology.

According to the World Intellectual Property Organization (WIPO 2007), there were 882,715 patent applications from China, 5,220,327 from the USA and only 699 from Nigeria between 1985 and 2006. It has been shown that there is a definite correlation between funding of research and development and progress in science and technology which has often led to great economic development.

CONCLUSION

The paper concludes that considering the pivotal role pure and applied science has to play in driving the industrialization of a nation, it is important that a nation like Nigeria emphasize the need for a formidable Science base in all levels of education (Primary, Secondary and Tertiary). Thus, the paper recommends the development of a good strategy that will strengthen primary and secondary education to check the alarming failure in science and mathematics in

WAEC or NECO examinations that paints a bleak picture of the development of science and technology in future. The paper also recommends the establishment of a National Science Foundation and dedication of at least two per cent of GDP per year to it to sustain science and technology in the country.

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