European Journal of Business and Innovation Research

Vol.6, No.1, pp.58-77, February 2018

Published by European Centre for Research Training and Development UK (www.eajournals.org)

RESEARCH AND INNOVATION STRATEGIES FOR ECONOMIC COMPETITIVENESS AND INDUSTRIAL GROWTH: LESSONS FOR NIGERIA

E.H. Kwon-Ndung[1], L. Kwon-Ndung[2] and J. Migap[2]

[1]Department of Botany, Federal University, Lafia.
[2]Department of Political Science, Nasarawa State University Keffi
[2]Department of Economics, Federal University Lafia, PMB 146, Lafia. Nasarawa State.

ABSTRACT: *One of the leading unrealized opportunities in Nigerian industrial organizations is the full influence of research ideas and knowledge to transform business products and processes into long-term innovation. Business research and innovation contribute significantly to improvement in enterprise productivity and quality and in the integral components of business strategy and success. Drawing heavily from published literature, this paper highlights the enormous benefits of continual research and innovation on national economies, and proffers recommendations on how Nigeria could key into this concept to promote its economic competitiveness at the global level.*

KEYWORDS: Research, Innovation, Strategies, Economic, Competitiveness Industrial Growth, Nigeria.

INTRODUCTION

Definition

Research can simply be defined as an attempt to find out in a systematic and scientific way. The term Research and development (R&D) is a term encompassing three key activities: basic research, applied research, and experimental development.

Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the fundamental and original foundation of phenomena and observable facts, without any particular application or use in view.

Applied research on the hand is also the original investigation carried out in an effort to acquire new knowledge. It is, however, focused principally towards a definite useful aim or objective.

Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed.

Innovation: It is difficult to agree on one single definition of innovation. It can be defined as a creation of a new device or process resulting from study or experimentation, the creation of something in the mind, the act of starting something for the first time or introducing something new. From these definitions therefore, we can argue short of uncertainty that innovation has proved to be:

1) an effective stimulant for building world-leading organizations

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

2) a discipline of creativeness that attracts the best people

3) a message that supports a corporate drive and

4) a mechanism to foster leadership.

To transform a new or unique thought into a gainful product is a difficult thing to do. Therefore, every prominent or great inventor needs a great entrepreneur and vice versa. Chester Carlson's invention of xerography would never have become the remarkably profitable Xerox photocopying business if not for what Charles Ellis termed "extreme entrepreneurship" of Joe Wilson. Innovation has therefore bred a fruitful collaboration between universities and corporations in many parts of the world. Very often this collaboration has become the space where the future is invented.

Modern economies are built with ideas and knowledge, as much as with capital and labour. It is estimated that nearly half the US' GDP, for example, is based on intellectual property. The EU in 2006 set the 'Barcelona target' of increasing R&D to 3% of GDP by 2010 with aim to become "the most competitive and dynamic knowledge-based economy in the world". China according to OECD estimations spent more on R&D than Japan in 2006 for the first time and it became the world's second largest investor in R&D in 2007 after the US.

Globalisation itself is a product of innovation. The application of constantly improved technologies to the massive means of transport and communication has produced an unprecedented level of global connectivity, of global awareness. Economies are becoming more interdependent, while cultures are becoming more permeable, transparent and stronger through an intensified exchange of goods, services, ideas, values, experts, problems and solutions. Today, innovation is facing new challenges. Its own dynamism has produced a world that requires in many ways a rethinking of innovation itself. In the corporate sector, the determinants of innovation performance have changed in a globalised knowledge-based economy, partly as a result of recent developments in information and communication technologies. This paper is organized into five sections. Following the introductory section, is section two, which provides an overview of conceptual issues in Research and Innovation. Applied research: innovations and applications in selected economies and the role of Intellectual Property Rights in enhancing research and innovation are reviewed in section three. The desirability of co-opting research and innovation as a deliberate developmental policy by Nigerian government through synergy of tertiary institutions and firms are thoroughly discussed in section four. While section five, is concluding remarks.

Innovation and economic growth

Policies such as the relationship between innovation and economic growth have been well studied. Renowned scholars continue to work with incredibly simplified models of an incredibly complex economy. Consequently, empirical results are usually carefully annotated with caveats noting the limitations of all findings and the great uncertainties that remain concerning fundamental assumptions in the field (Statistics Canada, Innovation Analysis Bulletin, 2002).

Adam Smith as far back as 1776 contemplated a theoretical link between innovation and economic growth. Not only did he articulate the productivity gains from specialization through the division of labour as well as from technological improvements to capital equipment and

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

processes, he even recognized an early version of technology transfer from suppliers to users and the role of a distinct R&D function operating in the economy:

"All the improvements in machinery, however, have by no means been the inventions of those who had occasion to use the machines. Many improvements have been made by the ingenuity of the makers of the machines, when to make them became the business of a peculiar trade; and some by that of those who are called philosophers or men of speculation, whose trade it is not to do anything, but to observe everything; and who, upon that account, are often capable of combining together the powers of the most distant and dissimilar objects. In the progress of society, philosophy or speculation becomes, like every other employment, the principal or sole trade and occupation of a particular class of citizens… and the quantity of science is considerably increased by it." (Smith, 1776).

Though the relationship between innovation and growth had been expressed at an instinctive level for some time, innovation was only introduced into formal economic growth models in 1957 (Solow, 1957). Professor Robert Solow of MIT, was awarded a 1987 Nobel Prize in Economics for this feat and related work. Like scholars before him, he defined growth as the increase in GDP per hour of labour per unit time. He carefully measured the fraction of this growth that was actually attributable to increases in capital, such as investments in machinery and related equipment, since the theory of the day was that capital accumulation was the primary determinant of growth. However, capital accumulation accounted for less than a quarter of the measured growth. Solow's insight was in attributing the remainder of the growth, the majority share, to "technical change." The magnitude of the residual calculated in this empirical study placed the role of innovation in economic growth squarely on centre stage, where it has remained for the past half century.

Following Solow's contributions, the relationship between innovation and growth has been modeled in increasingly sophisticated ways. Perhaps the most notable recent advances came from Lucas (1988) and Romer (1986, 1990), as well as Porter (1990) who emphasized the concepts of human capital and knowledge spillovers, respectively. Following the recent idea of distinguishing human capital, which is developed by investments in education and training, from physical capital, Lucas modeled human capital with constant rather than diminishing returns, thus offering useful insights into the critical role of a highly skilled workforce for long-term growth. Romer (1990) endogenized innovation in the growth model by introducing knowledge spillovers, which resulted in deep implications for how scholars think about growth.

The Romer model works in this form. Organizations engage in R&D or allocate funds to R&D because they expect it will be profitable. This investment in R&D results in the creation of two types of knowledge, that which is appropriable and that which is not. Appropriable knowledge refers to knowledge the firm can utilize itself, exclude others from using, and generate profits from. Knowledge that is not appropriable has the properties of a public good; it is nonrivalrous (use by one firm does not preclude use by another) and non-excludable (it is difficult to prevent others from using). The more knowledge there is, the more productive R&D efforts using human capital are. So, when organisations conduct R&D, they apply human capital to the stock of knowledge for profit-maximizing purposes. In the process, however, the organization unintentionally contributes back to the increasing stock of knowledge. This unintentional contribution is referred to as a knowledge spillover.

In an attempt to determine why some countries succeed others fail in international competition, Porter(1990),published the results of an intensive research which theorizes that four broad

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

attributes of a nation shape the environment in which local firms compete, and these attributes((a)factor endowments-a nation's position in factors of production such as skilled labour or the infrastructure necessary to compete in a given industry,(b) demand conditions-the nature of home demand for the industry's product or service,(c) Relating and supporting industries-the presence or absence of supplier industries and related industries that are internationally competitive, and (d) Firm strategy, structure and strategy-the conditions governing how companies are created, organized, and managed and the nature of domestic rivalry) promote or impede the creation of competitive advantage.

While porter does not propose anything radically new, he does analyze the characteristics of factors of production. He recognizes hierarchies among factors. Distinguishing between basic factors (e.g., natural resources, climate, location, and demographics) and advanced factors(e.g., communication infrastructure, sophisticated and skilled labour, research facilities, and technological know-how).He argues that advanced factors are the most significant for competitive advantage. Unlike the naturally endowed basic factors, advanced factors are a product of investment by individuals, companies and governments. Thus, government investments in basic and higher education, by improving the general skill and knowledge level of the population and by stimulating advanced research at higher educational institutions, can upgrade a nation's advanced factors.

The implications of these models are increasing returns to growth from investments in human capital and R&D due to knowledge spillovers. This is because the more human capital that exists in an economy, the more value that economy can derive from the stock of public knowledge through R&D efforts, which further raises the value of conducting R&D. As a result, the economy engages in more R&D, which in turn makes further contributions to the stock of knowledge spillovers; this argument continues in a righteous circle. This model is based on the assumption that profit-seeking organisations will engage in R&D for selfish reasons, since they can appropriate some of the value from the knowledge they create.

The role of the public or government in funding of some types of R&D, particularly basic research that is often very hard for any single firm to appropriate, is very fundamental since the resulting knowledge spillovers are valuable to the overall economy and would otherwise suffer from under-investment if left to private organisations. This explains why the concept of knowledge spillovers is vital to innovation and growth. Since knowledge spillovers are a public good, it does not matter which country produces them.

The Science and Technology Innovation concept

Technological innovation is defined as the first commercial application of a new technology. The emergence of a new technology, which may take the form of a product, process or service, is a result of several activities spanning an appreciable length of time depending on the type of technology. The following phases have been identified as the steps and actions required for taking a project from initiation to commercialization:

Idea generation

Idea generation involves a search for ideas by such means as brain storming, attribute listing and need identification. Ideas normally originate either from Rand D institutions including universities or from specific market needs. These two sources of new technology ideas had in

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

recent years been described as technology push and market pull respectively that is your concept/idea must be market driven.

Screening of ideas

Whatever the source of the ideas, screening entails evaluating all the ideas with the view of identifying and concentrating on those with greater potential for success.

Research and Development (R & D) is a part of the process leading to technological innovation. During the Rand D phase, the idea on papers translated into a physical product, process or service. Technological evaluations including laboratory testing are made to establish the production feasibility. Though there is no direct correlation between R & D budgets and such operating results such as profits or turnover, the R & D phase accounted for between 15%, and 30% of the total costs of successful innovations. The individual actions that should occur within the research organizations are:(a) Laboratory scale research(b) Pilot plant development(c) Scaling up(d) Design and engineering of full scale plant(e) Production trials

Business analysis

The essence of business analysis is to identify product features, estimate market demand and product profitability, and assign responsibility for a further study of the product feasibility.

Prototype Development. During prototype development, the laboratory output is scaled up for pilot plant production. Again technical evaluation is carried out to ensure that the pilot product is not significantly different from the laboratory type.

Test marketing. For a new product such as food, central location testing (CLT) and house use testing (HUT) are made to establish the production feasibility. In CLT, sample of the new product are tested on consumers picked at random in some convenient locations. The test is usually performed by an outside agency, and the manufacturer mayor may not be identified because of protection. If the test is encouraging, the next usual step is the HUT. Here the samples, prepared and packaged in near-commercial fashion, but often with no commercial identification, are provided for consumers for use in their houses. This market tests, in-use tests and other commercial tests are conducted in order to ascertain the feasibility of the full marketing programme. At the test marketing stage, design and production factors may have to be adjusted as a result of test findings. This stage aids the management to decide whether to proceed to full-scale production or abandon the project.

Commercialization

At the commercialization stage, full-scale production and marketing programmes are perfected and the product is launched into the market. After launch, the product enters its lifecycle, and the external competitive environment becomes a major determinant of its survival.

Technological growth and innovation: inseparable twins in modern-day economics

The global economy is on its way to achieving a historic growth record. With an annual growth rate of nearly 3.2% since 2000, the world economy has grown more in the past ten years than in any five-year period since the Second World War. With a projected increase of nearly 7% in 2012, some researchers say global output could be heading for one of its best decades ever. This economic expansion has happened in spite of a number of global economic and political shocks such as collapse of the stock market bubble in 2000, the terrorist attacks, wars, the

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

escalation of oil and commodity prices etc. Despite all this, the economic wheel is moving forward. What looked as a recent global economic slowdown turned out to be a "rebalancing" of growth. The slowing pace of activity in the US and Japan, which should remain well contained, is being compensated by an apparently solid upswing in the euro area. Furthermore, and perhaps most surprisingly, the global economy now runs on a new powerful economic turbine: the emerging economies (Gurria, 2007). Several experts have reported that China and India, along with other developing nations, are in a position to give the world economy its biggest boost since the industrial revolution. The participation of these countries in global economic flows has been increasing at a remarkable pace, representing now: more than half of total world GDP (measured at purchasing power parity), 43% of world exports and nearly half of the world's energy consumption.

As a relatively poor country, India is not normally thought of as a nation capable of building a major presence in a high technology industry such as computer software. In little over a decade, however, the Indian software industry has astounded its skeptics and emerged from obscurity to become an important force in the global software industry. Between 1991-92 and 2001-02, sales of Indian software companies grew at a compound rate in excess of 50 per cent annually. In 1991-92, the industry had sales totaling $388 million. By 2002 they were around $8 billion. By the early 2000s, more than 900 software companies in India employed 200,000 software engineers, the third largest concentration of such talent in the world. In explaining the success of their industry, India's software entrepreneurs point to such factors as a highly educated middle-class, government emphasis on engineering courses in tertiary schools, the relatively high wage rate for software engineers, and the presence of satellite communication which has removed distance as an obstacle to doing business for foreign clients. In order to maintain their competitive position, Indian software companies are now investing heavily in training, research and innovation in leading-edge programming skills.

The Protection of Intellectual Property.

Intellectual property refers to property that is the product of intellectual activity, such as computer software, a screenplay, a music score, or the chemical formular for a new drug. Ownership rights over intellectual property are established through patents, copyrights, and trademarks. A **patent** grants the inventor of a new product or process exclusive rights form a defined period to the manufacture, use, or sale of that invention. **Copyrights** are the exclusive legal rights of authors, composers, playwrights, artist, and publishers to publish and disperse their work as they see fit. **Trademarks** are designs and names, often officially registered, by which merchants or manufacturers designate and differentiate their products. The philosophy behind intellectual property rights/law is to reward the originator of a new invention, book, musical record, clothes design, restaurant chain for his or her idea and effort. Such rights are a very important stimulus to innovation and creative work. They provide an incentive for people to search for novel ways of doing things and they reward creativity. An intellectual property right is one factor that lowers the cost of doing business and, thereby stimulates economic growth and development. For example, consider innovation in the pharmaceutical industry. A patent will grant the inventor of a new drug a 20 year monopoly in production of that drug. This gives pharmaceutical companies an incentive to undertake the expensive, difficult, and time-consuming basic research required to generate new drugs (it can cost $500 million in R&D and take 12 years to get a new drug on the market).Without the guarantees provided by patents, it is unlikely that companies would commit themselves to extensive basic research.

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

The Role of Intellectual Property Rights (IPRs), in Generating Research and Innovation.

Intellectual property rights are essential for achieving many of today's challenges related to innovation and economic growth while providing the foundation on which tomorrow's societal needs can be met. Their strength originates from the various roles they play. These include:

a) Stimulating Innovation and Spurring Widespread and Sustainable Economic Growth

Intellectual property rights are policy instruments that play an increasingly important and positive role in driving innovation and expanding information. By stimulating innovation, information and creativity, IPRs directly affect economic performance and create economic growth through increased productivity, increased trade and investment, and expanded economic activity that enhances consumer welfare.

b) **IPRs Create Incentives for Invention and Creation**:

Intellectual property rights provide an efficient mechanism to overcome traditional "market failure" problems associated with public goods, information asymmetry and innovation – especially, the imperfect appropriation of returns and uncertainty with regard to research and investment first identified by Nobel-laureate Kenneth Arrow. A principal source of market failure is the inability of individuals and firms to prevent others from making use of the new knowledge they generate. Without the incentives provided by the temporary exclusivity generated by IPR protection, there will not be sufficient incentives for business to invest in risky R&D and other value-enhancing activities because the benefits from those investments cannot be appropriated fully. In economic terms, innovation will be suboptimal. Strong and effective IPR protection is a particularly powerful incentive that will permit firms to invest in generating new technology in sectors where the returns to technological or product investment are longer term and involve significant risks, and where the invention may be easy to copy or imitate. Such protection, in turn, is a highly effective way to promote the diffusion of knowledge in the long term.

c) **IPRs promote the disclosure of inventions and pioneering information, which stimulates innovation across industries.**

Intellectual property rights are not a mechanism for hiding knowledge. They are a powerful market-based mechanism for disseminating knowledge. The diffusion of IPRs, and the bundle of rights that often go with them, can serve as a central policy tool in shaping the knowledge economy. The public disclosure of information is one of the most important functions of IPRs but, often, one of the most neglected by policymakers.

d) IPRs promote risky, uncertain and costly investments

Forward-looking intellectual property rights protection provides the incentives for firms and individuals to invest in generating new technology and new products, including incremental improvements. This is especially important where the returns from investment are longer-term, where the investment involves significant costs or risks, and where the invention or creation may be easy to copy or imitate. -IPRs enable technology transfer: IPRs increasingly facilitate the operation of markets. Strong and effective intellectual property rights are an essential tool for technology transfer. They encourage private and public enterprises to transfer technology not only through voluntary licensing and other contractual arrangements but also through the

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

development of innovative approaches for promoting technological development, direct investment, technology sales and dissemination, and cooperative ventures.

e) **IPRs help stimulate and focus the process of knowledge creation and innovation through the necessity of finding legal means to "invent around" or "reverse engineer" patented inventions:**

By providing exclusive rights to an invention, the patent system frequently spurs others to innovate by developing alternative solutions to technical problems or new and improved inventions. Innovators are stimulated to "invent around" or "design around" the original invention in order to avoid infringing the applicable patent(s). Although, in certain situations, this may lead to "mock" innovation, it frequently leads to the development of various technologies and competing ways that encourage competition and spur innovation. The by-passing of prevailing patents implies that new technological outcomes force market demand for the exploitation of existing technologies.

History has a very good account of a number of cases of inter-industry technology developments. For example, the perfume sprayer mechanisms influenced the development of the engine carburetors, while various e commerce innovations have emerged from the banking industry rather than the computer industry. Such technological integration among industries is facilitated by an intellectual property system that generates a communal pool of knowledge, enabling companies or industries to source beyond their boundaries for R&D innovation.

The Global Competitiveness Index

Since 2001, World Economic Forum has been using the Growth Competitiveness Index (Growth CI) developed by Jeffrey Sachs and John McArthur to assess the competitiveness of nations. Then Professor Xavier Sala-i-Martin, a leading expert on growth and economic development, has developed a new comprehensive competitiveness model for the World Economic Forum. the GCI, albeit simple in structure, provides a holistic overview of factors that are critical to driving productivity and competitiveness, and groups them into nine pillars:

1. Institutions
2. Infrastructure
3. Macroeconomy
4. Health and primary education
5. Higher education and training
6. Market efficiency
7. Technological readiness
8. Business sophistication
9. Innovation

The selection of these pillars as well as the factors that enter each of them is based on the latest theoretical and empirical research. It is important to note that none of these factors alone can ensure competitiveness. The value of increased spending in education will be undermined if rigidities in the labor market and other institutional weaknesses make it difficult for new graduates to gain access to suitable employment opportunities. Attempts to improve the

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

macroeconomic environment—e.g., bringing public finances under control—are more likely to be successful and receive public support in countries where there is reasonable transparency in the management of public resources, as opposed to widespread corruption and abuse. Innovation or the adoption of new technologies or upgrading management practices will most likely not receive broad-based support in the business community, if protection of the domestic market ensures that the returns to seeking rents are higher than those for new investments.Therefore, the most competitive economies in the world will typically be those where concerted efforts have been made to frame policies in a comprehensive way, that is, those which recognize the importance of a broad array of factors, their interconnection, and the need to address the underlying weaknesses they reveal in a proactive way. The ninth pillar, **innovation**, is particularly important for countries that have reached the high-tech frontier, as it is the only self-sustaining driver of growth.

While less advanced countries can still improve their productivity by adopting existing technologies or making incremental improvements in other areas, for countries that have reached the innovation stage of development, this is no longer sufficient to increase productivity. Firms in these countries must design and develop cutting-edge products and processes to maintain a competitive advantage. This requires an environment that is conducive to innovative activity, supported by both the public and the private sectors. In particular, this means sufficient business investment in research and development, high-quality scientific research institutions collaboration in research between universities and industry, and protection of intellectual property. Given the importance of innovation for long-term growth, innovation policy is currently very much at the center of economic policy in many countries. Overall, there is consensus that simply promoting and supporting large, isolated R&D projects has not proven to be a successful strategy. Instead, cumulative small improvements, along with informal innovation, can have similar growth effects to large R&D projects.(Trajtenberg, 2005). These small innovative increments also tend to bring about additional spillover effects, such as complementary innovations, the development of specific skills, and additional investment. Thus, rather than focusing on national champions, innovation policies should aim to foster an environment which promotes entrepreneurship and innovation across the economic spectrum. Table 1 shows the 2013-2014 global competitiveness index rankings for 148 countries including Nigeria.

Expenditure on R&D

Expenditure on research and development (R&D) is a key indicator of government and private sector efforts to obtain competitive advantage in science and technology. In 2004, research and development amounted to 2.3% of GDP for the OECD as a whole. Research and development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

The R&D data obtained have been compiled according to the guidelines of the Frascati Manual. It should, however, be noted that over the period shown, several countries have improved the coverage of their surveys of R&D activities in the services sector(United States) and in higher education (United States).For Korea, social sciences and humanities are excluded from the R&D data. For the United States, capital expenditure is not covered. Since 2000, R&D expenditure relative to GDP (R&D intensity) has increased in Japan, and it has decreased

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

slightly in the United States. In 2003 and 2004, Sweden, Finland and Japan were the only three OECD countries in which the R&D-to-GDP ratio exceeded 3%, well above the OECD average of 2.3%. Since the mid-1990s, R&D expenditure (in real terms) has been growing the fastest in Iceland and Turkey, both with average annual growth rates above 10%. R&D expenditure for China has been growing even faster than GDP, resulting in a rapidly increasing R&D intensity, growing from 0.9% in 2000 to 1.3% in 2005 (Fig.1)

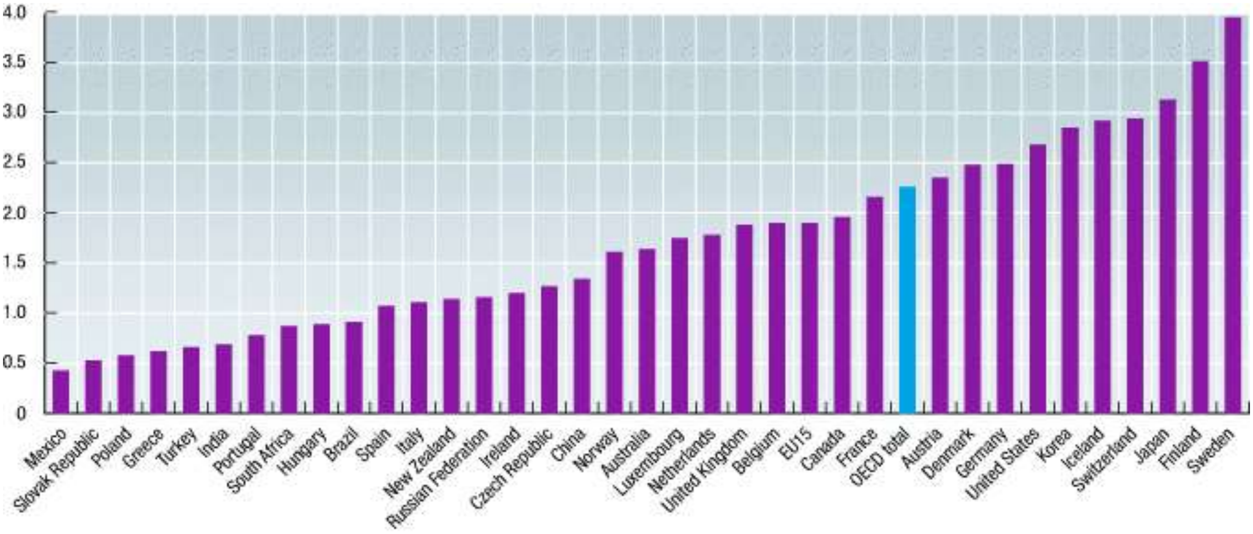


Figure 1:Gross Domestıc Expenditure On R&D as a percentage of GDP, 2005

Source: OECD

The Place of Nigeria in the Global and Competitive World

When Nigeria gained independence from Great Britain in 1960, there were hopes that the country might emerged as an economic heavy weight in Africa. Not only was Nigeria Africa's most populous country, but it was also blessed with abundant natural resources especially oil, which rose sharply in value in the 1970s following two rounds of oil price increases engineered by the Organization of Petroleum Exporting Countries (OPEC). Between 1970 and 2000, Nigeria earned more than $300 billion from the sale of oil, but at the end of this period it remained one of the poorest countries in the world. In 2000, gross national product per capita was just $300, 40 per cent of the adult population was illiterate, life expectancy at birth was only 50 years, and the country was begging for relief on $30 billion in debt. The Human Development index compiled by the United Nations ranked Nigeria 151 out of 174 countries covered. What went wrong? Although there is no simple answer, a number of factors seem to have conspired to damage economic activities in Nigeria, majorly a paucity of activity in training research and innovation.

Globally, the world has continued to witness the advancement of knowledge society and its principal engine, the knowledge economy. This new era has offered great hope and certainly ground-breaking developments that have occurred is often facilitated by ICT access. Despite the large population of Nigeria estimated at about 160 million people and high earnings from crude oil export, Nigeria ranks low in terms of investment in Science Technology and Innovation and its higher education sector, one of the foundation areas for science, technology

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

and innovation research. Its higher institutions have over time degenerated in quality, forcing many of its citizens to seek for higher knowledge outside the shores of the country. Its commitment to STI is perceptibly extremely low.

Research and Development in Science, Technology and Innovation (STI) activities has not been given a serious attention by Nigeria government. The poor devotion of government expenditure to R&D has been linked to the abundant natural resources in the country. Akinwale*et al*.(2012), reported that Nigeria shifted from agrarian economy in the 1960s to the current petroleum economy. Petroleum accounted for approximately 97% of the country's foreign exchange and 76% of the total government revenue (CBN, 2010) and this has prevented the country from engaging in R&D exploitation believing that the revenue of the petroleum products is sufficient for the government.

Nigeria's R&D allocation is US$ 0.582 Billion (PPP) in 2007 which is approximately 0.0004% of the World's expenditure on R&D as at 2011(Akinwale *et al*., 2012). This figure represents 0.2% of R&D expenditure as percentage of the national GDP (AIO, 2010). Nigeria is currently ranked 120th out of 148 countries assessed in the 2013-2014 Global Competitiveness Report (Table 1) and has no university in the world's top 2000 (Table 2).

Applied and basic researches constitute the large proportion of the R&D activities in Nigeria. This also implies most of the inventions carried out in the academic laboratories and research institutes have not been patented and commercialised for industrial usage for onward transfer into the market.

Challenges to Research & Innovation in Nigeria.

Several factors have been cited for the poor level of research and innovation in Nigeria, such as:

1. Neglect of the education sector.
2. Lack of emphasis on science and engineering courses.
3. Most manufacturing firms were government owned and does not engage in productive R&D to develop new products and processes that would enhance its competitiveness since they were mostly finance by government subventions:
4. The few privately owned firms are in most cases subsidiaries of foreign multinationals and does not encourage local R&D,they only implement production strategies and policies emanating from head-office which in most cases does not favour the development of local research development.
5. Poor funding of research institutions.

Onwualu (2006) identified some of the limitations of innovative science and technology practice in Nigeria to include, Inadequate research orientation, Non-availability of Information on commercializable inventions and Rand D results, Poor technological entrepreneurial culture, Inadequate infrastructure, Inadequate motivation for the commercialization of inventions/research results, Inadequate patent education and ineffective enforcement of intellectual property rights, Absence of effective linkage between research organizations and industry and Preference for foreign technology.

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

These identified weaknesses and constraints has motivated the Nigeria government through the Ministry of Science and Technology to develop a more concise, robust and workable Science, Technology and Innovation (STI) policy which is expected to respond to the dictates of globalization, changing business environment and new/emerging technologies and thus provide for effective funding of R&D.

Several stakeholders in the Nigerian STI sector have expressed concern over these developments. Director General/Chief Executive Officer of National Centre for Technology Management (NACETEM), Dr Willie O. Siyanbola, quoting another source said: “Resources available for R&D are too thin and are spread on numerous researches running concurrently. For instance, in OAU (ObafemiAwolowo University), records show that grants were allocated to about 46 research projects between 1998 and 2002, and 87 research projects between 2003 and the first quarter of 2007. Unfortunately, most of the projects are either surveys, impact analyses, appraisals, evaluation studies or analytical studies, while only about 1% is innovative and/or interdisciplinary,”. This is the general picture in most of the Universities and other tertiary Institutions and Research Institutes in Nigeria. In another equally practical terms, the Director General of Zaria-based National Research Institute for Chemical Technology (NARICT), Prof. Idris M. Bugaje expressed the lean budget for STI and the deep sense of frustration thus: “You wouldn’t believe our budget as a research institute last year and it was so poorly implemented that we got only 40% of N250 million for all our projects. The budgetary allocation for the whole ministry was just about N36 billion in 2012 (Security took N946 billion) and out of the N36 billion the average of 40% implementation was achieved. It is also worth mentioning that since the Ministry of Science and Technology was created, there is no specific line budget for research alone.

In general African nations spend very little on STI. In his report on state of STI in 19 African countries including South Africa and Ghana but excluding Nigeria, titled 'Science, Technology and Innovation in Africa’s Regional Integration - From Rhetoric to Practice,' John O. Mugabe, researcher on Africa's STI scene noted that “national systems of innovation of most African countries are relatively weak” although the report observed on a positive note that “commendable efforts are being made, and more needs to be done to enable the Africa continent to seize the grand opportunities that exist at the moment.”

Mugabe and many other African scientists believe that the time has come for Africa to leapfrog its economy and resolve some of its challenges through STI. But this can only happen if Africa first resolves its weak STI infrastructures. Africa is exposed to a wide range of technological opportunities to address its human development challenges. Technologies such as information and communication technologies, biotechnology and nanotechnology can be harnessed and applied to increase food production, fight diseases such as malaria, tuberculosis and HIV/AIDS, and increase economic competitiveness of the continent. However, Africa’s ability to tap the opportunities is undermined by relatively weak national innovation systems. Most African countries lack the requisite scientific and technological capabilities to effectively engage in the application of science, technology and innovation for development.

Last year in Nigeria, government opted to create the National Science Research Technology and Innovation Fund (NSRTIF) for the development of science and technology in the country. The NSRTIF is the fallout of the National Science Technology and Innovation Policy earlier approved for the country by the government as a way of addressing the shallow funding for STI. The policy is fostered on a similar policy for the IT sector which eventually laid the foundation for the creation of the National IT fund fed by law by 1% of after profit

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

contributions of all operating IT companies in the country. If eventually backed by an Act, the NSRTIF would source funding for STI in much similar way as the National IT fund. The need for the creation of the NSRTIF was championed by organised science related bodies including the Nigerian Academy of Science and the National Office for the Technology Acquisition and Promotion (NOTAP).

Prospects of Nigeria's economic revitalization through STI

For Nigeria to achieve macroeconomic development and assume its rightful position among the committee of emerging economies, it needs to reorder its priorities by committing more funds to R&D activities to meet UNESCO standards of having at least 1% of GDP committed to R&D as well as faithfully implement the National R&D Fund. It is worth noting that South Africa spends 8.5 times more on R&D than Africa's most populous country, Nigeria. As a result of few or no R&D activities in the business sector in Nigeria, it is assumed that government and higher education sector performed 35.1% and 64.9% of the national R&D respectively (AIO, 2010). Also, government provides funds up to the 96.4% for national R&D while the business sector and higher education only provides 0.2% and 0.1% respectively.

NOTAP has recently introduced a new initiative, the NOTAP-Industry Technology Transfer Fellowship (NITTF) scheme that encourages industry to fund and nurture new crop of highly skilled and industry-driven young academic researchers for the Nigerian university system. In addition NOTAP established Intellectual Property and Technology Transfer Offices (IPTTOs) in universities and institutions of higher learning in order to link education to industry and promote Intellectual Property (IP), innovation and demand driven research. This is highly commendable and should be sustained and supported by government so as to promote the technology value chain in Nigeria

CONCLUSION

Innovation can originate anywhere. Increased education and economic growth haveimproved the capacity of developing countries to offer new products and services. Moderncommunications and transportation technologies allow these countries to share advances withconsumer across the globe.As a result, great ideas-regardless of where they originate-are lesslikely to be lost in our increasingly interconnected world.In the most fundamental sense, there are only two ways of increasing the output of theeconomy: (1) you can increase the number of inputs that go into the productive process, or (2)if you are clever, you can think of new ways in which you can get more output from the samenumber of inputs. And, if you are an economist you are bound to be curious to know which ofthese two ways has been more important - and how much more important.

It is not a coincidence that countries such as USA or Japan are the world's top economies because their allocation of resources into creating innovation is massive. It obviously indicates that innovation is the key driving growth and prosperity. Approximately 50% of US annual GDP growth is attributed to increases in innovation. For the past two centuries, the US has been the world-leader in developing innovative products and services. Innovation therefore is the engine for the economic growth as it makes a great contribution in economic growth and development in an economy or the world as a whole. In the words of American Entrepreneur

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

and Apple co-Founder(Steve Jobs**), "Innovation clearly distinguishes between a leader and a follower".** We humbly and completely concur to this.

The paradox of Nigeria in trailing this train of development was recently well captured by the President of the Nigerian Academy of Science, Prof. Oyewale Tomori during the Launch of the Book written by Former Minister of Science and Technology, Prof Turner Isoun. "To continue to use high technology as a tool of our development, all aspects of our nation, from political will, attitude and commitment must run in tandem. No aspect must be learning to walk, while the others are running… It is not the fear of the unknown that makes Nigeria not to excel, but the fear of the known. It is because we know ourselves very well that we can swear by our predictability as a nation. This knowledge kills our initiative, murders our creativity, slaughters our resourcefulness and exterminates our ingenuity. We actually give up before we start. We fear to venture because we can predict what we will do and are redesigned to accepting the things in our national life that serve as impediments, hindrances and stumbling blocks to merit, distinction and quality.

Prof. Isoun had on P. 91 of his great book stated that it is the objective of Nigeria to produce a Nigerian astronaut by 2015, launch a Nigerian manufactured satellite by 2018, from a launch site in Nigeria, on a launch vehicle made in Nigeria. Prof. Oyewale rhetorically continued "If your son or daughter is the astronaut in the Nigerian space ship, you will not want the PHCN to cut power at any time to the ground control base, neither will you hope that the telecommunication system will ever report network busy, during which there will be no communication with the satellites and space ships. You will expect the President to submit the budget on time and that the House and senate to approve the allocation to the Space programme on time and effortlessly without hassle and when it is time to appoint the Director of the Space programme, he or she will be the best relevantly qualified and experienced expert and not one emerging from an undue process".

On whether Nigeria remains a follower or a leader in using research and innovation as a tool for global economic competitiveness and technological growth relies heavily on these reflections.

REFERENCES

Adeoti, J.O. and Olubamiwa, O. 2009. Toward an Innovation System in the Traditional Sector:
The Case of the Nigerian Cocoa Industry.*Science and Public Policy* 36, no. 1 (2009): 15–31.
Adeoti J.O and, Odekunle, S. O. and Adeyinka, F. M. *Tackling InnovationDeficit: An Analysis of University-Firm Interaction in Nigeria* Ibadan, Nigeria: Evergreen, 2010 .
Audretsch, D. B. and M. P. Feldman (1996) "R&D Spillovers and the Geography of Innovation and Production," American Economic Review, Vol. 86 (3), pp. 630-640.
Business and Industry Advisory Committee to the OECD , Creativity, Innovation and Economic Growth in the 21st Century,pp.6-13
Freeman, C., Soete, L. (1997), The Economics of Industrial Innovation, 3. Edition, London.
Gurría,A. (2007),Lecture, OECD Secretary-General at the Copenhagen Business School Copenhagen, Denmark.
Hill W.L.Charles(2005).International Business:competing in the global market place 5th edition. The Mc Graw-Hill companies,Inc.Ltd.

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

Jaffe, A. R. Henderson, and M. Trajtenberg (1993) "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations," Quarterly Journal of Economics,August, pp. 577-598.

Goh, L.S.A.(2004) The Innovation Journal: The Public Sector Innovation Journal, Volume 10(3), article 34.pp.23, innovation.cc/volumes-issues/goh_innov_driven_econo2a.pdf

Legge, John, M, (1993). 'Economics and Innovation: Old Theories and New Directions', 1-13, 4th ENDEC World Conference on Dynamic Entrepreneurship Proceedings.

Lehtoranta,O.(2005) Determinants of Innovation and the Economic Growth of Innovators,pp.9, http://www.vtt.fi/inf/pdf/

Lopez-Claros, A. and I. Mia. 2006. "Israel: Factors in the Emergence of an ICT Powerhouse." The Global Information Technology Report 2005–2006. Hampshire: Palgrave Macmillan. 89–105.

Nely, A., Hii, J. (1998), Innovation and Business Performance: A Literature Review, Centre for Business Performance, The Judge Institute of Management Studies, University of Cambridge.

Onwualu, A.P. 2006. Innovative science and technology for raw materials development and utilization in Nigeria: a challenge for industrial development. Proceedings of the Second National Conference on Science and Technology. 10-13 October 2006.

Palmberg, C., Niininen P., Toivanen, H., Wahlberg, T. (2000), Industrial Innovation in Finland, First Results of the Sfinno Project, *Working Papers* 47/00, VTT Group for Technology Studies, Espoo.

Romer, P. 1987. "Growth Based on Increasing Returns Due to Specialization." American Economic Review 77(2): 56–62

Sandven, T. (2000), Innovation and economic performance at the enterprise level, *STEP report*10. STEP, Oslo. 32

Scherer, F. M (1999) *New Perspectives on Economic Growth and Technological Innovation*, Brookings Institution Press, Washington, D.C.

Smith, A. (1776) *An Inquiry into the Nature and Causes of the Wealth of Nations*, Modern Library edition, NY, NY,1937.

Solow, R. M. (1957), "Technical Change and the Aggregate Production Function," Review of Economics and Statistics, Vol. 39, pp. 312-20

Statistics Canada - Innovation, growth theory, and the role of knowledge spillovers Innovation Analysis Bulletin – Vol. 4, No. 3 (November 2002) ,page:3

Trajtenberg, M. 2005. "Innovation Policy for Development: an Overview." Paper prepared for LAEBA, Second Annual Meeting. Tel Aviv University.NBER and CEPR. November

Tether, B.S. (2001), Identifying Innovation, Innovators and Innovative Behaviours: A Critical Assessment of the Community Innovation Survey (CIS), *CRIC Discussion Paper* No 48, The University of Manchester.

World Economic Forum - Global Competitiveness Report (2006-2007)pp.5 ,www.cesifogroup. de/pls/diceguest/download/Performance/glo-comp-ind-ranks.pdf

WEB SITES CONSULTED:

http://www.changemakers.com/?gclid=CIHmmNWn2bkCFcaWtAodnWsAvg

http://qsilver.queensu.ca/~agrawalA

www.itedgenews.com/analysis.htm

http://www.imf.org

http://www.oecd.org

http://www.tubitak.gov.tr

http://www.worldbank.org

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

European Journal of Business and Innovation Research
Vol.6, No.1, pp.58-77, February 2018
Published by European Centre for Research Training and Development UK (www.eajournals.org)

APPENDIX

Table 1: The Global Competitiveness Index 2013-2014 rankings				
© 2013 World Economic Forum | www.weforum.org/gcr				
	GCI 2013-2014		GCI 2012-2013	
Country/Economy	Rank	Score	Rank	Change
Switzerland	1	5.67	1	0
Singapore	2	5.61	2	0
Finland	3	5.54	3	0
Germany	4	5.51	6	2
United States	5	5.48	7	2
Sweden	6	5.48	4	-2
Hong Kong SAR	7	5.47	9	2
Netherlands	8	5.42	5	-3
Japan	9	5.40	10	1
United Kingdom	10	5.37	8	-2
Norway	11	5.33	15	4
Taiwan, China	12	5.29	13	1
Qatar	13	5.24	11	-2
Canada	14	5.20	14	0
Denmark	15	5.18	12	-3
Austria	16	5.15	16	0
Belgium	17	5.13	17	0
New Zealand	18	5.11	23	5
United Arab Emirates	19	5.11	24	5
Saudi Arabia	20	5.10	18	-2
Australia	21	5.09	20	-1
Luxembourg	22	5.09	22	0
France	23	5.05	21	-2
Malaysia	24	5.03	25	1
Korea, Rep.	25	5.01	19	-6
Brunei Darussalam	26	4.95	28	2
Israel	27	4.94	26	-1
Ireland	28	4.92	27	-1
China	29	4.84	29	0
Puerto Rico	30	4.67	31	1
Iceland	31	4.66	30	-1
Estonia	32	4.65	34	2
Oman	33	4.64	32	-1
Chile	34	4.61	33	-1
Spain	35	4.57	36	1
Kuwait	36	4.56	37	1
Thailand	37	4.54	38	1

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

Indonesia	38	4.53	50	12
Azerbaijan	39	4.51	46	7
Panama	40	4.50	40	0
Malta	41	4.50	47	6
Poland	42	4.46	41	-1
Bahrain	43	4.45	35	-8
Turkey	44	4.45	43	-1
Mauritius	45	4.45	54	9
Czech Republic	46	4.43	39	-7
Barbados	47	4.42	44	-3
Lithuania	48	4.41	45	-3
Italy	49	4.41	42	-7
Kazakhstan	50	4.41	51	1
Portugal	51	4.40	49	-2
Latvia	52	4.40	55	3
South Africa	53	4.37	52	-1
Costa Rica	54	4.35	57	3
Mexico	55	4.34	53	-2
Brazil	56	4.33	48	-8
Bulgaria	57	4.31	62	5
Cyprus	58	4.30	58	0
Philippines	59	4.29	65	6
India	60	4.28	59	-1
Peru	61	4.25	61	0
Slovenia	62	4.25	56	-6
Hungary	63	4.25	60	-3
Russian Federation	64	4.25	67	3
Sri Lanka	65	4.22	68	3
Rwanda	66	4.21	63	-3
Montenegro	67	4.20	72	5
Jordan	68	4.20	64	-4
Colombia	69	4.19	69	0
Vietnam	70	4.18	75	5
Ecuador	71	4.18	86	15
Georgia	72	4.15	77	5
Macedonia, FYR	73	4.14	80	7
Botswana	74	4.13	79	5
Croatia	75	4.13	81	6
Romania	76	4.13	78	2
Morocco	77	4.11	70	-7
Slovak Republic	78	4.10	71	-7
Armenia	79	4.10	82	3
Seychelles	80	4.10	76	-4

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

Lao PDR	81	4.08	n/a	n/a
Iran, Islamic Rep.	82	4.07	66	-16
Tunisia	83	4.06	n/a	n/a
Ukraine	84	4.05	73	-11
Uruguay	85	4.05	74	-11
Guatemala	86	4.04	83	-3
Bosnia and Herzegovina	87	4.02	88	1
Cambodia	88	4.01	85	-3
Moldova	89	3.94	87	-2
Namibia	90	3.93	92	2
Greece	91	3.93	96	5
Trinidad and Tobago	92	3.91	84	-8
Zambia	93	3.86	102	9
Jamaica	94	3.86	97	3
Albania	95	3.85	89	-6
Kenya	96	3.85	106	10
El Salvador	97	3.84	101	4
Bolivia	98	3.84	104	6
Nicaragua	99	3.84	108	9
Algeria	100	3.79	110	10
Serbia	101	3.77	95	-6
Guyana	102	3.77	109	7
Lebanon	103	3.77	91	-12
Argentina	104	3.76	94	-10
Dominican Republic	105	3.76	105	0
Suriname	106	3.75	114	8
Mongolia	107	3.75	93	-14
Libya	108	3.73	113	5
Bhutan	109	3.73	n/a	n/a
Bangladesh	110	3.71	118	8
Honduras	111	3.70	90	-21
Gabon	112	3.70	99	-13
Senegal	113	3.70	117	4
Ghana	114	3.69	103	-11
Cameroon	115	3.68	112	-3
Gambia, The	116	3.67	98	-18
Nepal	117	3.66	125	8
Egypt	118	3.63	107	-11
Paraguay	119	3.61	116	-3
Nigeria	**120**	**3.57**	**115**	**-5**
Kyrgyz Republic	121	3.57	127	6
Cape Verde	122	3.53	122	0
Lesotho	123	3.52	137	14

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

Swaziland	124	3.52	135	11
Tanzania	125	3.50	120	-5
Côte d'Ivoire	126	3.50	131	5
Ethiopia	127	3.50	121	-6
Liberia	128	3.45	111	-17
Uganda	129	3.45	123	-6
Benin	130	3.45	119	-11
Zimbabwe	131	3.44	132	1
Madagascar	132	3.42	130	-2
Pakistan	133	3.41	124	-9
Venezuela	134	3.35	126	-8
Mali	135	3.33	128	-7
Malawi	136	3.32	129	-7
Mozambique	137	3.30	138	1
Timor-Leste	138	3.25	136	-2
Myanmar	139	3.23	n/a	n/a
Burkina Faso	140	3.21	133	-7
Mauritania	141	3.19	134	-7
Angola	142	3.15	n/a	n/a
Haiti	143	3.11	142	-1
Sierra Leone	144	3.01	143	-1
Yemen	145	2.98	140	-5
Burundi	146	2.92	144	-2
Guinea	147	2.91	141	-6
Chad	148	2.85	139	-9

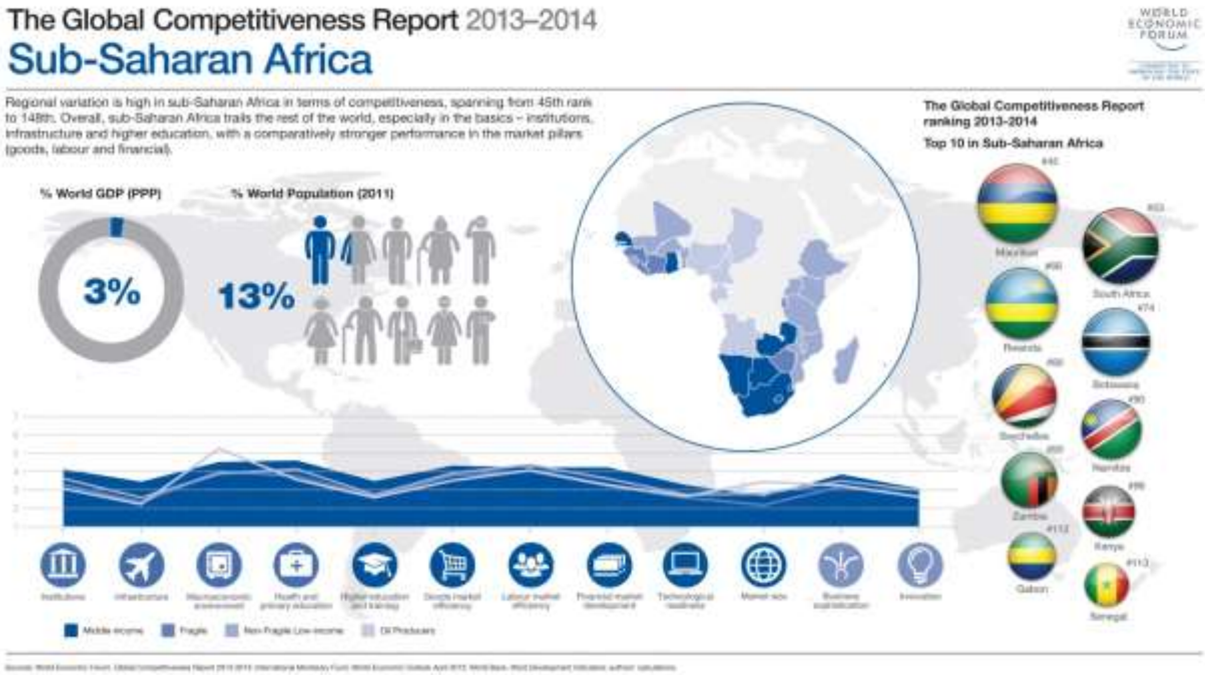
Table 2: WHERE NIGERIA STANDS – Excerpts of Universities Ranking

AFRICAN RANK	UNIVERSITY	COUNTRY	WORLD RANK
1	UNIVERSITY OF CAPE TOWN	SA	324
2	UNIVERSITY OF PRETORIA	SA	507
3	STELLENBOSCH UNIVERSITY	SA	540
4	UNIVERSITY OF THE WITWATERSRAND	SA	699
5	UNIVERSITY OF KWAZULU NATAL	SA	727
6	RHODES UNIVERSITY	SA	1,083
7	UNIVERSITY OF THE WESTERN CAPE	SA	1156
8	UNIVERSITY OF SOUTH AFRICA	SA	1221
9	MAKERERE UNIVERSITY	UG	1256
10	UNIVERSITY OF JOHANNESBURG	SA	1395
63 (61)*	OBAFEMI AWOLOWO UNIVERSITY	NGA	5756 (5834)*
42 (66)*	UNIVERSITY OF JOS	NGA	4087 (5882)*
58 (68)*	UNIVERSITY OF LAGOS	NGA	5936 (7601)*
20	UNIVERSITY OF ILORIN	NGA	2668 (5484)*
54	UNIVERSITY OF NIGERIA, NSUKKA	NGA	7170

Adapted from Akinwale*et al*., (2012).

ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)

Fig 2: Global competiveness report for Sub-Saharan Africa for 2013-2014.



ISSN: ISSN 2053-4019(Print), ISSN: ISSN 2053-4027(Online)