

Science, Technology And Innovation (STI) Policy And The Technological Development Of Nigeria: Prospects And Challenges.

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ABSTRACT

Across the globe, the link between science and technology in bringing about innovation and indeed development, cannot be over emphasized. While science explains a systematic process of acquisition and organization of knowledge, technology refers to the application of the acquired knowledge for the production of goods and services, for the utmost good of humanity. In pursuance of science and technology for innovation and development, different countries therefore formulate policies geared towards domesticating and harnessing the benefits of science and technology. In Nigeria, we are yet to see meaningful innovations and development anchored on science, technology. Despite the huge investment in the area of science and technology in Nigeria, we have not felt appreciable impact of such investment. Against this backdrop therefore, this paper examined science, technology and innovation (STI) policy and the technological development of Nigeria: prospects and challenges. In other to address the above subject matter, this paper raised three research questions: What are the objectives of STI policy towards technological development of Nigeria? What are the challenges militating against STI policy towards technological development of Nigeria? How can STI policy be enhanced towards technological development of Nigeria? The paper relied on qualitative sources of data. Data presentation and analysis was done hypothesis by hypothesis. The paper found that the foundation of science, technology and innovation policy in Nigeria was faulty in that it aimed at complying with international system. The paper recommended increased linkages between applied and academic research in the productive sector and increased national effort.

Key Words: *Science, Technology, Innovation, Development and Policy*

Introduction

The intimate connection between science and technology has a long history. In the context of development, science and technology has impacted such economic areas as poverty reduction, brought about healthier and more productive lives, rapid improvement in agriculture and economic growth. In the light of this, it has been critical to the growth in agriculture, energy, improved environmental and health conditions, among others. Ravetz (2004) called science the powerhouse of civilization. To extricate itself from the dark tunnels of underdevelopment, a country rich in natural resources needs to develop the required technology to drive both the depth and diversity of its revenue, promote job creation, and ultimately improve the living standards of its citizens (Colucci-Gray et al., 2006).

Meeting the goal of development, in the short, medium and long terms would require conscious efforts on the part of policymakers to deal frontally with how to incorporate science and technology in the framework of national development. Otherwise, efforts geared towards

improving productivity in all strata of the economy as a means of providing an enabler for economic stability would be self-defeatist. Nigeria is rich in human and natural resources. However, being rich in natural resources is not enough to be a wealthy country. The resource curse paradox deals sufficiently with this phenomenon. The economic history of mankind is illustrative of the fact that resource abundance is simply a plus factor in development. It may be a necessary but not a sufficient condition for development.

The success stories of Japan and Singapore speak eloquently of the imperatives of other dimensions of non-natural resources in the development trajectory. A technology-rich society will in the end tend to be richer than a natural resource-rich country. However, a country, rich in both natural resources and technology can literally attain the heavens of development. The cardinal objectives of accelerating development, competitiveness and creation of wealth for all Nigerians mark the beginning of Nigeria's intent to formulate and implement the National Vision 20:2020 Economic Transformation Blueprint (NV20:2020). Achieving the objectives of this Vision will be anchored on three pillars of optimizing the nation's key sources of economic growth, guaranteeing the productivity and well-being of Nigerians and fostering sustainable economic development.

The STI policies in Nigeria have over the years undergone many reviews, changes and modifications in line with the changes in time and technological development. However, this policy has continued to be plagued by several challenges. The latest review which produced the 2012 Science, Technology and Innovation (ST&I) Policy was designed in tandem with the objectives and pillars of the NV20:2020 so as to resolve practically the long standing disconnect between economic planning, and science and technology. The new policy on ST&I thus has as its core mission the evolution of a new Nigeria that harnesses, develops and utilizes ST&I to build a large, strong, diversified, sustainable and competitive economy that guarantees a high standard of living and quality of life to its citizens.

With the year 2020 just some weeks away; Nigeria's vision 20:2020 seems an impossibility than a reality. Therefore the thrust of this work is to examine the science, technology and innovation (STI) policy and technological development of Nigeria with emphasis on its challenges and prospects.

Conceptual Clarification

Science, Technology and Innovation Policy

Science, technology and innovation (STI) policy explains one of the public policies that promotes appropriate funding to advance scientific and technological research and education, studies the impact of science and technology upon its citizenry, and prescribes regulation, if necessary. Those involved in a nation's science and technology policy analyze and often provide in-depth studies to determine the plans, programs and policies of the government and their effects on domestic and international affairs. Since many political issues have a scientific component, most developed countries have specific agencies, ministries, or offices that deal with science and technology policy. In Nigeria, the federal ministry of science and technology is responsible for making policies that will promote the nations technological development.

Development

Development is a well-accepted and all-embracing concept. It is the dream and vision of individuals, organizations, groups and countries all over the world. Every phenomena predisposes itself to development, which is a process involving integral transformation from its current stage to a more functional, productive and result oriented sustainable state. Development therefore, has seemingly become one of the most sorts after condition by everyone both at the individual, organizational and national levels. Obodoechi (2006) stated that development entails a shift which is upward from one point to another over a period of time, especially where the movement is a positive one. Obodoechi (2006); sees development as consisting of the process of bringing out of the capabilities or possibilities of a phenomenon to a more advanced or effective state. Development involves progression, movement and advancement towards something better. It is an improvement on the material and non-material aspects of life.

Statement of the Problem

With the introduction of the Science, technology and innovation (STI) Policy in 1986 and its subsequent reviews in 1997, 2003 and 2012, it was assumed that the policy will fast track and accelerate Nigeria's technological development and place the nation on the map of technologically well-to-do countries, but over the years, Nigeria has continued to lag behind in the area of science and technological development. This is evident in the nation's present state of underdevelopment and its status as a consuming rather than a technologically producing society. The reason for this is largely attributed to the nation's failure to develop a sustainable technological base which accounts for her continuous reliance on the importation of industrial products. This was aptly captured by the former president of Nigeria Dr. Goodluck Jonathan on May 31st 2012 at the commissioning of Nigeria's first locally built warship known as NNS ANDONI. According to Jonathan, Nigeria has remained backward due to failure of past successive governments to develop technology in the country (Oladipo, 2012). For a nation, that prides itself as the giant of Africa, it is embarrassingly disappointing that while most advanced and some developing countries are making greater inroads into science and technological development such as space exploration amongst others, Nigeria is still celebrating the commencement of pencil and toothpick production in the country. Again, some weeks ago, the minister of Transportation Rotimi Amaechi was in China to inspect the "Ultra-Modern" trains, ready to be delivered to Nigeria. As much as this is a laudable effort, to boost the transportation sector, Nigerians legitimately ask why can't these technologies be domesticated so as to minimize cost and more importantly promote homegrown technology.

It is an established fact that the major problem confronting policy makers in Nigeria is how to translate what is on paper into realities and that is implementation. The STI policy is not an exception in this case. Subscribing to the views of Abiodun (1999), The performance of policies formulated to guide the industrial and technological development of the country cannot be judged without an examination of the way and manner those policies were formed, the sources from which they emanated, and the obstacles that prevent their successful application. It is against this backdrop that the following research questions have been raised:

- i. What are the objectives of STI policy towards technological development of Nigeria?
- ii. What are the challenges militating against STI policy towards technological development of Nigeria?
- iii. How can STI policy be enhanced towards technological development of Nigeria?

Objectives of the study

The general objective of this paper is to know how Science, technology and innovation (STI) policy has helped the technological development of Nigeria, with special look at the prospects and challenges. Specifically, this paper aims to:

- i. Examine the objectives of STI policy towards technological development of Nigeria?
- ii. Ascertain the challenges militating against STI policy towards technological development of Nigeria?
- iii. Establish how STI policy can be enhanced towards technological development of Nigeria?

Methodology

The data of this study were generated through a painstaking review of existing literature on the subject under study. This literature includes journal, textbooks and internet materials. In order to analyse the data collected for the study, the researcher was guided by the research questions. The researcher applied qualitative analytical method. By this, we mean the technique used for systematically describing written, spoken or visual communication or information in social research.

Data Presentation And Analysis

Research Question 1. What are the objectives of STI towards technological development of Nigeria?

The 1986 Science and Technology Policy

The guidelines of the 1986 S &T policy recognized the fact that scientists and technologists in Nigeria had over the years engaged in their work without well-defined national direction (FMST, 1986). Researches were carried out without much effort made towards commercialization, apart from publishing them in journals (Abubakar, 2004).

Furthermore, no conscious policy was established to galvanize S&T efforts into a coherent activity for use to promote self-sustaining economy. Also, the existing entrepreneurs were averse to risk and as such, were not willing to commercialize viable research findings. This situation which was considered unsatisfactory informed the establishment of an S&T policy framework for ensuring national technological development.

The policy framework was expected to provide direction and coordination for scientific and technological activities as well as development of manpower, creation of science culture in the society; intensification of basic and applied research, the application of research findings to developmental activities in agriculture, healthcare, industry defence and security and to provide employment opportunities for the citizens (Abubakar, 2004).

Abubakar (2004) observes that the national objectives in 1986 as captured in the fourth development plan include among others, the achievement of self-reliance through:

- acquiring enough technical know-how, skills and materials to defend the integrity and security of the nation;
- being technically self-reliant in the production of capital and consumer goods and raw materials, and
- Maintaining a flourishing national export capability of goods and services.

S &T are expected to play a significant role in achieving the national objectives (FMST, 1986).

The objectives of the 1986 S&T policy are enumerated as follows:

- increasing public awareness in science and technology and its role in national development and well-being;
- directing S&T efforts along identified national goals;
- promoting the translation of S&T results into actual goods and services;
- creating and maintaining an increasing indigenous S&T base through research and development;
- motivating creative output in S&T;
- increasing and strengthening theoretical and practical scientific base in the society, and
- increasing and strengthening technological base of the nation.

The policy document addressed the following key sectors of the national life:

- **Educational System:** The policy stipulates that “educational system shall emphasize science at all levels.
- **Mass Movement:** The policy states that “there shall be mass movement for science and technology development in the country.”
- **Motivation:** The policy states “that individuals engaged in S&T development projects shall receive special incentives and/or remunerations.”
- **Capital Goods:** The policy thrust was to encourage the “production of machinery/equipment and spare parts based on local inputs”.
- **Materials:** The policy states that “the exploitation, processing and utilization of the nation’s material resources shall be programmed in such a manner as to promote self-reliance and enhance export.”
- **Energy:** The policy states that “the nation’s energy resources shall be developed, protected and optimally harnessed in the overall interest of the nation.”
- **Technology:** “The policy stipulates “that in all aspects of the day-to-day activities of the nation, advantage must be taken of technological development.”
- **Military Science:** The policy states that “there shall be a fully developed military science and technology complex”.
- **Environment:** The policy states that “the activities of the nation shall be conducted in a manner to ensure sound environmental management culture”.
- **International Exchange and cooperation in S&T:** The policy states that “the nation shall actively engage in bilateral and multilateral exchanges and cooperation in S&T”.
- **National System of S&T:** The policy stipulates that the country shall be committed to S&T development and shall set up a National Council for Science and Technology (NCST).

- **Financing S&T Development:** The policy states “that S&T development activities in the country be financed through a funding system involving the Federal Government and its Parastatals, the State Government and the Private Sector.
- **Research, Development, Application and Marketing:** The policy states “that products of research shall be actively promoted and dispersed throughout the national socio-economic system”.

According to Abubakar (2004), concerted efforts were made to implement these policies by successive Ministers of Science and Technology. However, considerable progress was made more in the area of establishing institutional frameworks to implement the policies. The performance and achievements of these institutions varies as well as the impact of their activities. However, it could not bring the desired technological development of the country. It is important to note however, that successes were recorded in the field of agriculture. Within the life span of this policy, achievements were recorded as follows:

- development of improved varieties of crops by the agro-based research establishments leading to improved yields per hectare;
- increased seed multiplication and distribution to end-users of hybrid maize and other crops;
- provision of better storage and preservation facilities;
- better management and nutrition, genetic selection and breeding of animals and fish, including fish fingerlings for fish farming;
- improving the flowering of valuable timber species e.g. Obeche and Terminaliaivorensis;
- devising a new technique for chemically treating the heart-wood of Gmelinaarborea to make it more durable.
- development of animal poultry vaccines and sera for combating animal diseases in order to boost animal production;
- development and production of farm implements such as harvesters, milling machines, cassava pelleting machines, graters, etc;
- development of malted sorghum for brewery and confectionery industry;
- development of composite flour for bread;
- design and development of prototype Nigerian car by PRODA;
- increased awareness for and development in coal utilization,,solar energy and other alternate sources of energy such as biogas.

The policy lacked effective implementation mechanism as well as evaluation and monitoring strategies. Consequently, most of the research results could not be translated to commercially oriented activities. Research results were therefore left on the shelf without commercialization. Due to lack of national indicators in addition to effective monitoring and evaluation, research orientation was not targeted at the productive sector. The private sector felt alienated from the S&T community despite the government policy compelling them to contribute to the national S&T fund. Instability in the existence of the Ministry affected also, the implementation of the policy. This perhaps, explains why it took 17 years before the policy was reviewed and updated in line with global trend in the development of S&T. This time lag confirms the fears expressed by the then Honourable Minister of Science and Technology, Professor E. U Emovon in his

foreword to the 1986 policy document which reads that “I hope this Blueprint will need to be updated from time to time with changing circumstance...” (Abubakar, 2004).

The 2003 Science and Technology Policy

The Federal Ministry of Science and Technology in realizing the changing global policy on S&T and emerging frontiers of knowledge, embarked on a review of the 1986 S&T policy document. The Ministry noted that S&T are becoming more important than ever to raise the standard of living of the Nigerian people, consolidate a modern economy and participate as a significant partner in an increasingly integrated global world (FMST, 2003). It is in recognition of the changing global landscape of S&T that a new policy framework was articulated to:

- stimulate initiative and creativity of the S&T community while establishing strong links between their works and requirements of the economy, the educational system and of society at large;
- make S&T truly international while strengthening the country’s educational and S&T capabilities;
- encourage the mobility of scientists and researchers to network and explore best opportunities and alternatives in the country and abroad for use and improvement of their competence.
- increase the share of the productive sector in the national effort for scientific and technological development especially by supporting greater R&D activities in the productive sector.
- build strong indigenous competence in order to participate as an equal in international negotiations in areas such as protection of intellectual property and rights of access to information, biotechnology and biosafety, environmental control and establishment of technical standard in international communication networks.

The revised policy therefore emphasized on the need for a coherent, systematic and comprehensive approach to the determination of technological programmes and their implementation taking into account; domestic productions in agriculture and rural development, energy and environment, health, food security, biotechnology, industrial manufacture, infrastructural facilities including those for information and communications technologies (ICTs) and space exploration (FMST, 2003).

The new policy expanded the frontiers of S&T as contained in the 1986 policy document by identifying three core areas where national capabilities should be built. These include information and communication technology (ICT), biotechnology and space technology. The policy statements on core subject areas are briefly highlighted:

- **Information Technology:** The policy states that the nation shall ensure an enhanced IT capability to become a key player in an emerging information society. The information technology policy holds greater potential for societal development as information is power. The need for information technology policy is to improve coordination among various S&T institutions and those from the private sector in order to satisfy the country’s information technology need. The successful implementation of IT policy is hinged on the political will of the policy makers and the provision of adequate IT infrastructures. The ability of the nation to take a number of imaginative and pioneering

decisions in bringing the use of information technology to bear on the development of the resources of the country will guarantee the success of the IT policy.

- **Biotechnology:** The policy states that the Nation shall urgently initiate appropriate steps to explore the use of biotechnology for the benefit of Nigeria. The initial effort made in implementing this policy was to establish an institutional framework which is the National Biotechnology Development Agency (NABDA). Preliminary steps to get legislation on the biotechnology bill are being taken with an earlier approval given by the Federal Executive Council.
- **Space Research:** The policy states that the nation shall vigorously pursue the attainment of space capabilities as an essential tool for its socio-economic development and enhancement of the quality of life of its people.
- **Linkage of FMST with Universities, National and International Research Institutions:** The policy states that a mechanism shall be put in place for coordinating science and technology R&D efforts in such a way that link the Federal Ministry of S&T with Universities, National and International Research Institutes in a productive manner.
- **Human Capacity Building and Transfer of Technology by Multi-national Companies:** The policy states that “the nation shall through R&D create the necessary environment, incentives and penalties for promoting technology transfer by the multinationals, while at the same time promote the provision of necessary infrastructures for technology absorptions by Nigerians”. This policy is an attempt to address the issue of technological capability in the implementation of past “national projects” that could have served as a launch pad for technological development of the country. Through this policy the issue of “local content” in the implementation of core and strategic national projects could be addressed.
- **Energy Research and Development:** The policy states that the nation’s energy resources shall be developed and utilized on a self-sustaining basis through appropriate tools of research and development and the profitable application of relevant results. It is important to carry out need assessment on the energy requirements of the country and fashion out research policy in this sector to address the needs. Emphasis on research on renewable energy resource should be made as it will have far reaching impact on the rural populace. The evaluation and monitoring of the energy research policy is imperative to determine impact.
- **Cooperation on Implementation and Funding of S&T:** The policy states that the nation shall strive to address the missing link in ensuring adequate funding and proper coordination of S&T related projects while ensuring the understanding and cooperation of all stakeholders at all levels of governments. Prior to now, the FMST has been criticized as not promoting effective linkage with other related government agencies whose activities are affected by emerging developments in the field of S&T.
- **Empowering SMEs through Appropriate Technologies:** The policy states that the nation shall facilitate and ensure the emergence of a large pool of technologically empowered SMEs as a means of achieving sustainable economic growth, eradicating poverty and play a key role in the global economy.
- **Engineering Materials Research and Development:** The policy states that the nation shall ensure effective utilization of the knowledge of materials science, engineering and technology to establish a pervasive mastery of materials development and applications for the transformation of Nigeria from a primarily natural resource-based economy to a

knowledge-based economy within a decade. This policy is wide, covering engineering materials development and value addition to natural resources through application of technology. The policy should have separated engineering materials from value added transformation of commodities for ease of implementation and impact assessment.

- **Science and Technology Data Banks:** The policy states that the nation shall ensure that S&T are managed with a view to optimizing the use of natural resources including human capital and to facilitate decision-making at national and international levels.
- **Intellectual Property Rights:** The policy stipulates that the nation shall create a conducive environment for the generation of new commercializable ideas, technologies and applications that would help catalyze national efforts at wealth creation and poverty alleviation. Intellectual property right awareness is lacking in the country as well as the desired infrastructure. The existing institutional framework for technology acquisition could be strengthened to handle IPR policy. For successful implementation of the policy the enabling environment must be created.
- **Traditional Medicine Development:** The policy stipulates that the nation shall employ the machinery of R&D to promote growth and development of natural medicine and its practices throughout Nigeria with a view to facilitating their integration into the nation's health care delivery system. The bio-resource potentials of the country which include resources of medicinal plants are not effectively being explored and exploited. Therefore, the use of herbs in the treatment of illnesses is still confined to tradition. A policy on the development, utilization and promotion of use of herbs in treatment of diseases will complement the orthodox medical practices. Considerable research works on medicinal plants need to be carried out. The policy need commitment and serious government support for it to succeed. A public-private sector approach to its implementation is advocated.

The 2012 Science, Technology and Innovation (STI) Policy

The 2012 Science, Technology and Innovation (STI) Policy was presented in the following words:

I present to Nigerians, the New National Policy on Science, Technology and Innovation, a Policy which I believe will crystallize the effort of my administration at bequeathing a lasting legacy to the present and future generations of Nigerians...-Goodluck Jonathan (FSMT, 2012).

The above excerpt is drawn from the presidential statement on the 2012 new national policy on Science, Technology and Innovation produced by the Federal Ministry of Science and Technology (FSMT, 2012). According to the then Minister of Science and Technology Prof. Ita Okon Basse, "The new ST &I policy, taking advantage of the experiences in the design and implementation of S&T policy in the last two decades and a half, is a product of a novel, all-inclusive, participatory policy making; involving consultative meetings with various stakeholders across the length and breadth of the country as well as International Development Partners. The participatory approach to the design of the policy has heightened awareness and provided opportunities for various actors to articulate their views and make inputs into the new policy. The approach also promoted collective ownership of the policy by all stakeholders". One notable feature of this policy is the emphasis on 'innovation', which has become a global tool for

fast tracking sustainable development. This policy is a clear demonstration of the country's renewed commitment to ensure that our R&D engagements enhance new business development, encourage employment generation as well as wealth creation through the proliferation and growth of Small Scale Enterprises (SMEs), that are ultimately translated into goods and services in the market place (FMST, 2012).

The 2012 Science, Technology and Innovation (ST &I) Policy was designed in tandem with the objectives and pillars of the NV20:2020 so as to resolve practically the long standing disconnect between economic planning, and science and technology. The new policy on ST &I thus has as its core mission the evolution of a new Nigeria that harnesses, develops and utilizes ST &I to build a large, strong, diversified, sustainable and competitive economy that guarantees a high standard of living and quality of life to its citizens. Specifically, the new ST &I Policy is designed to provide a strong platform for science, technology and innovation engagements with the private sector for the purpose of promoting sound economic transformation that is citizen-centered (FMST, 2012).

General Policy Objective

Build a strong Science, Technology and Innovation capability and capacity needed to evolve a modern economy.

Specific Policy Objectives

The specific objectives of the 2012 STI policy are to:

- i. Facilitate the acquisition of knowledge to adapt, utilize, replicate and diffuse technologies for the growth of SMEs, agricultural development, food security, power generation and poverty reduction.
- ii. Support the establishment and strengthening of organizations, institutions and structures for effective coordination and management of ST &I activities within a virile National Innovation System (NIS).
- iii. Encourage and promote creation of innovative enterprises utilizing Nigeria 's indigenous knowledge and technology to produce marketable goods and services.
- iv. Support mechanisms to harness, promote, commercialize and diffuse locally developed technologies for the production of globally competitive goods and services that intensively utilize Nigeria's raw materials.
- v. Facilitate and support the creation and maintenance of up-to-date, reliable and accessible database on Nigeria's ST &I resources and activities.
- vi. Promote activities that enhance effective ST &I communication and inculcation of ST &I culture in Nigerians.
- vii. Create and sustain reliable mechanisms for adequate funding of ST &I activities in Nigeria.
- viii. Initiate, support and strengthen strategic bilateral and multilateral co-operations in science, technology and innovation activities across all sectors of the economy (FSMT, 2012).

Research Question 2.: What are the challenges militating against STI towards technological development of Nigeria?

Ajoku (2004) rightly observed that science and technology policies are generated by both the internal stakeholders (S&T family) and the external stakeholders (end-users of S&T), while the successful implementation depends on the cooperation of all, including the greater society. The role of the institutional framework for policy implementation is very critical in determining impact of the policy on the user subsystem. It is obvious that the second subsystem (Research and Development institutions) must be able to play a key role in terms of institutional support to the productive sector and the society at large which form the user subsystem. If the second subsystem is weak or unable to discharge its functions effectively, the impact of the first subsystem (policy framework) cannot be felt and even measured (Ajoku, 2004). It is imperative therefore that the subsystems should interact on a continuous basis to achieve the desired impact. According to Sani, Amina and Abdu (2014), there are some fundamental challenges which have militated against STI towards technological development of Nigeria. These challenges include:

1. The very foundation upon which S&T started in Nigeria was faulty. The foundation was laid during the colonial period to put in place structure that very much satisfies the international system and the country remaining as peripheral dependent economy, exporting raw materials and importing manufactured goods from the large industrial countries of the world. The country is to serve as source of raw materials for foreign enterprises and to enjoy limited industrialization to produce a few basic consumer goods. These schemes of development generated no local scientific and technological demand. Invariably, there was no stimulus for development of technological research, with basic research mainly related to few disciplines with social demand such as medicine and agriculture.
2. The reduction of resources for most existing S&T programmes largely as a fallout of declining national resource base.
3. Lack of perspective for new projects and initiatives even when multilateral assistances which require matching funds were concerned.
4. Institutional and financial instability. At certain point in time, the agency established for S&T development changed name and status several times;
5. Budget allocated to S&T institutions fluctuated and actual delivery of the funds was not guaranteed.
6. Lack of consensus in government, public opinion or international agencies about the importance and role of scientific research.
7. S&T agencies have limited capacities to grant resources for research projects.
8. The administration of some federal agencies for S&T suffered from the effects of over bloated bureaucracies, low salaries, low morale and political militancy of employees reflected in terms of number of labour strikes or work-to- rule (Ajoku, 2004). Some agencies were under-staffed and unable to recruit competent persons to fill the vacancies. Operational activities were paralyzed by lack of resources and incentives.
9. Emigration of skilled researchers from Nigeria in search of greener pastures. It has been reported that “there are as many Nigerian Scientists in the West as expatriate living and working than there are Europeans in Nigeria (Ajoku, 2004, Khalil, 2002).
10. The public institutions which were mainly funded by the Nigerian government were poor payers compared with the private sector or even the private universities. This situation resulted in the flight of skilled and experienced researchers to the private sector and private universities, leading to what is termed “internal brain drain”.

11. General lack of capacity of S&T personnel in Nigeria in the art of translating research and development results and patents into commercializable products and services. There is thus a strong disconnect between the S&T institutions and the wider consuming society, especially the organized private sectors in the country.
12. Inability of S&T institutions to carryout researches that are supportive to the emerging industries or even adopt technologies developed abroad contributed to the current declining international competitiveness of the local industry (Abubakar and Ajoku, 2001).
13. National S&T policies largely aim towards creating a scientific and technological system which will only help to solve minor problems without putting the system itself in question as much of what is in place is not utilized or even patronized. Gulma (1999) observed that though Nigeria is well endowed with human and material resources, including technologists and engineers, it is however, deficient in technology as the human and material resources are not properly utilized. For instance, in the area of power generation, of the 8 power plants established after independence, both hydro, steam and gas turbine, all the suppliers of the equipment were foreign vendors from UK, Sweden, Japan, Austria, USA, Switzerland and Germany. Apart from minor maintenance work, all other works including civil and electro-mechanic were carried out by foreign experts (Gulma, 1999). Furthermore, in 1973, the Federal Government of Nigeria set up 6 centres for vehicle assemble which include Mercedes at Enugu, Volkswagen at Lagos, Leyland at Ibadan, Peugeot at Kaduna, Fiat at Kano and Steyer at Bauchi. Unfortunately, these vehicle assembling plants had limited local content, despite the ambitious goal of achieving 90 per cent of local sourcing of component within 10 years of operation. The petrochemical industries, refineries, steel rolling mills, the aluminum smelting plants, paper mills, steel complexes, machine tools, etc are core strategic national projects that could have launched Nigeria into technology development (Abdullahi and Ajoku, 2001). The major S&T players in these sectors are till today largely foreign. Other projects like Kainji, Zobe and Bakolori dams and Lake Chad projects, Nigeria Communications Satellite Project, Aerostat balloon project (Ile-Ife) and the Nigerian Radar Project on Vegetation Mapping (NIRAD) present similar examples. Furthermore, the \$3 billion iron and steel sector was established at Ajaokuta Steel Plant without planning for technological capability building.
14. No serious effort is made towards seriously prioritizing technology transfer. South Korea used the instrument of technology transfer to develop her capabilities in the technologically mature sectors such as the labour-intensive textile sector and heavy chemical industries. Today many of the vehicles used around here, for instance, are made in Korea. These are developmental realities in Nigeria (Sani, Amina and Abdu, 2014). The major indicators for this are:
 - S&T are much closer to industry and markets than before. Industries are externalizing for the development of new management skills, processes and products. The fallout of these are increase in R&D investments, the setting up of specialized laboratories and research departments and search for new linkages with universities.
 - The pace of technical innovation and competition in industry accelerated, requiring from firms a permanent capability to change its organization, absorb new technologies and processes and generate new products.

- Science is now more global than ever, as the speed, quality and low cost of international information flows brings researchers and research sites into immediate contact. It is now much easier to have access to the international scientific community than in the past.
- There is an emergence of scientific enterprises which is compelling R&D to be market-driven.
- There is a change in the old system of S&T development that starts with basic research to applied research/invention and terminates with entrepreneurial innovation; thereby creating new products and processes which can later be diffused through imitation or reverse engineering. The current situation is more complex with scientific discoveries assuming the context of application. The consequence of this changing landscape is the loss of support for basic research if it is not linked to identifiable products and results.
- New patterns of international scientific cooperation are emerging resulting in the establishment of large scale international ventures. Examples include human genome project, biotechnology and genetic engineering, global research activities in fields of meteorology, global climate change, renewable energy, etc. Such cooperation is characterized by large scientific installations and networks of scientists and research groups.
- Resulting from the above, considerable number of new activities and disciplines linked to scientific assessment emerged in areas such as technological forecasting, technology assessment and evaluation of environmental effects of innovation.

Recommendations

In order to make the STI policy more effective, result oriented and accelerate Nigeria's technological growth and development, there is need to:

- To increase the linkages between applied and academic research with the productive sector, and to increase their share in the national effort for scientific and technological development. This requires a significant increase in private investments in R&D;
- To promote research and development through the application of appropriate system of rewards and incentives for scientists, appropriate career structures and increased public support for S&T;
- To invest considerably in the development of innovative capabilities of the productive system through incentives, extension services and strengthening of the national infrastructure for S&T;
- To make government agencies for science and technology more flexible and predisposed to peer review procedures in order to track the impact of S&T activities.
- To encourage and stimulate S&T institutions as well as research groups to search for opportunities for collaborative research and partnerships from different sources including the private sector, non-governmental organizations so as to reduce the dependence on government.

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