

# Strategic Approach to R and D Commercialization in Nigeria

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**Abstract**—Presently, Agencies with R&D mandate in the Federal Ministry of Science and Technology in Nigeria have successfully produced over 100 commercializable R&D outcomes in the areas of Agriculture, Industry, Engineering and Health. Translating these outcomes into successful products would mean economic empowerment for the nation and its citizenry, but then, how to achieve this feat has rather been difficult. This paper suggests an idealized situation-solution model capable of addressing these challenges through a well knitted collaboration with and networking support from other Ministries, Departments and Agencies of government, and firms.

**Index Terms**—Strategic, commercialization, R&D, Science and technology.

## I. INTRODUCTION

The role of effective policy on development of any nation cannot be undermined. Past academic works gave credence to this fact and how any attempt to ignore this could spell economic doom for such a nation. It was based on this premise that Lundvall stated that if knowledge is the most important resources, then learning is the most important process [1]. Productive learning of processes of innovation systems is better enhanced when there is interplay between firms, government agencies, universities and formal or informal organizations [2].

Over the years, there has been misguided conception on what research and development (R & D) truly is. The former is the back-end of the exercise where the researcher is in most cases not seen except at data collection stage of the exercise. Development in this case is the front end of the exercise and this is where the activities that have occurred in the back-end are brought to the fore for either display or transformation into more explicit products. At the developmental stage, the critical/ main activity here is where commercialization lies. Since the fulcrum to success and survival of any nation or organization lies in its knowledge and capability to commercialize its innovations, understanding of the basic concept of the subject is thus vital for tangible impact and transformational results. Past literatures juxtaposed organizational features with its propensity to commercialize its innovations. It was however opined that a firm's strength in commercializing innovation reflects its capacity, its human resources practices, the nature of the top management team and external environment within which the firm operates [3]. It has become pertinent to fully understand and define the

boundaries between innovation and commercialization. Both entities though have hitherto been equated as being the same; innovation however, translates to market success through the process of commercialization [4].

Nigeria, knowing the strategic importance of R&D to its development, in the 1970s created institutions for the coordination and promotion of R&D activities in Science and Technology (S&T) in the country. The first effort was the establishment in 1970 of the National Council for Science and Technology (NCST) responsible for ordering national priorities in scientific research and coordinating and supervising both basic and applied research activities. In 1971 the Agricultural Research Council and the Industrial Research Council were established, and followed by the Medical Research Council and the Natural Science Research Council in 1972 and 1973 respectively. In January 1977, NCST was replaced with the National Science and Technology Development Agency (NSTDA) with a revised mandate for the promotion and development of S&T including initiation of policy in relation to scientific research and technology. The response to the general call to make scientific research relevant to economic development in Nigeria led to the establishment of a full-fledged Federal Ministry of Science and Technology (FMST) in 1980 to take over the responsibilities of NSTDA. In 1984, FMST was merged with Federal Ministry of Education. It regained its autonomy in 1985 and was again merged with the Federal Ministry of Industry in 1992. FMST was however reactivated in 1993 with mandates to, among others, promote basic science research; scientific and technological research for agricultural, industrial, medical, and energy applications; administration of technology transfer programmes; coordination and issuance of policy guidelines to all S&T research institutes in Nigeria; advising the President on S&T matters.

## II. R&D IN NIGERIA SCIENCE AND TECHNOLOGY AGENCIES

The key to developing a vibrant science and technology ministry is to first understand the imperatives of R&D while aligning it to meet both the immediate and future needs of the country for a competitive economy capable of ensuring wealth and job creation, enterprise development, and reducing mortality rate of its population due to common diseases typical of the region. The higher educational institutions (HEIs), research institutes (RIs), private research establishments, government agencies with R&D mandates are the key players in R&D in Nigeria [5]. To support the development of R&D in Nigeria, government has made concerted effort over the years to fast track economic empowerment through the adoption of policies to guide and direct research in its public institutions and agencies. Some of these efforts are examined below:

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### A. Funding

Funding of R&D activities in the FMST has largely been by the federal government through the yearly budgetary allocation thus resulting in poorly funded institutions [5]. The highest proportions of science and technology (S&T) activities in Nigeria are carried out by public institutions which invariably demand that it should be given more priority in the national budget. [6]. The limited funding of this ministry, in practical terms, is a reflection of low appreciation of the benefits of R&D to national development. This stands in sharp contrast to government determination to leapfrog development through the application of science and technology. Although there are funding support for projects and R&D activities from international organizations, however, much investment and support is still needed in this sector. Fig. 1 below shows the percentage budgetary allocation to the S&T ministry in Nigeria from Year 2007 and 2012. From a height of 1.04% of the national budget in 2007, allocation declined each year to a lowest point of 0.56% in 2010. Marginal increase in allocation was witnessed in 2011 with the allocation in 2012 standing at about 60% of 2007. Comparatively, Nigeria ranks amongst the lowest in S&T funding having 0.01% of GDP as against Germany, 2.5% of GDP, India 2.5% of GDP, Russia 5% of GDP, United States of America 2.8% of GDP. The current funding system whereby government is the main source of funding for R&D will not translate to the realization of the desired contribution of the sector.

### B. Agencies in the Federal Ministry of Science and Technology

Presently, there are seventeen (17) agencies constituting FMST.

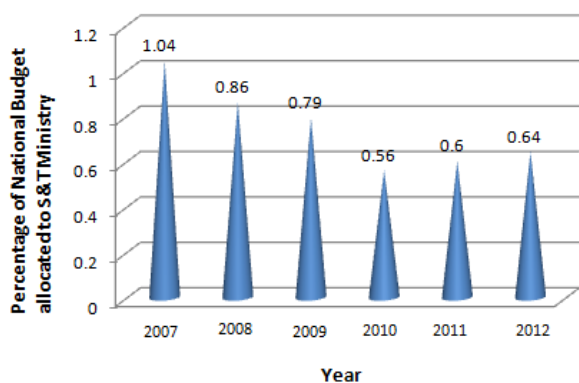


Fig. 1. Percentage budgetary allocation for S&T Ministry in Nigeria budget between year 2007 and 2012 (source: federal ministry of finance)

Fourteen (14) of these agencies are charged directly with the mandate to conduct R&D. The other three have mandates for policy research and capacity building in management of technology, intellectual property rights, and technology business incubation. National Agency for Science and Engineering infrastructure (NASeni) is charged with research in capital goods, production and reverse engineering; Federal Institute of Research (FIRO) is mandated to accelerate industrialization in Nigeria; Sheda Science and Technology Complex (SHESTCO) has the mandate to develop research results for application in areas of agriculture, health, industry and environment; National

Space Research & Development Agency (NARSDA) is vested with research in space and development. Promoting the development and utilization of Nigeria's industrial raw material is the responsibility of Raw Materials Research and Development Council (RMRDC); Nigerian Building and Road Research Institute (NIBBRI) is to ensure improvement in the quality of life of Nigerians in the areas of affordable housing; Nigerian Natural Medicine Development Agency (NNMDA) will do research, develop collate, document and promote the nation's natural medicine; Nigerian Leather and Science Technology (NILEST) is a Centre for development in the areas of Chemical and Leather technology. National Research Institute for Chemical Technology (NARICT) develops the technologies required by the chemical industry and also undertakes R&D work in areas of agriculture, mineral and other raw material conversion to chemicals; Project Development Institute (PRODA) has part of his mandate to develop the technologies required by the power equipment industry; National Biotechnology Development Agency (NABDA) coordinates, promotes and regulates the development of biotechnology in Nigeria. Nigeria Institute for Trypanosomiasis Research (NITR) is to conduct R&D for the control and elimination of Trypanosomiasis and its vectors; The Nigerian Institute of Science Laboratory Technology (NISLT) conducts research in all the areas of science laboratory technology; Nigeria Atomic Energy Commission (NAEC) coordinates R&D activities for capacity building and infrastructure development in Nuclear technology. In charge of Intellectual property and research-industry linkages are the National Office of Technology Acquisition and Promotion (NOTAP). National Board for Technology Incubation (NBTI) provides institutional infrastructure and mechanism for the development and commercialization of R&D outputs and inventions. National Centre for Technology Management (NACETEM) is mandated to provide knowledge support for the STI system in Nigeria through capacity building in management of technology, STI policy research and consultancy.

### C. Intellectual Property Right in Nigeria

Intellectual Property Rights (IPRs) of innovators and industrialists in Nigeria are generally governed by Patent and Design Act Cap 344 of 1990, Trademarks Act Cap 436 of 1990 and Copyright Act of 1998 [7]. Managing Intellectual Property Rights and technology transfer issues (See Table. 1) in Nigeria has been part of the core mandates of the National Office for Technology Acquisition and Promotion (NOTAP). This agency has been operating in compliance with the Trade Related Aspects of Intellectual Property Rights (TRIPS) of the World Trade Organization (WTO) which set the minimum acceptable standard for member countries. To ensure a link between R&D activities carried out in the country and the market, and facilitate the process of commercialization NOTAP has established over twenty-three (23) Intellectual Property and Technology Transfer Offices (IPTTOs) in tertiary institutions across Nigeria and assists innovators to prepare and file applications for property rights. Though the greatest percentage of R&D activities are carried out in public RIs with proven results as evidenced by the number of commercializable results reported, Table 1 here showed that,

number of applications for rights protection filed by public RIs between 1999 and May 2012 was about 42% of applications received from private innovators. In terms of the number of patents granted during the same period, private innovators nearly doubled the number of patents granted to public RIs. That the public RIs appeared to be

less interested in rights protection points to equal less interest in commercial exploitation of their research results. Establishment of the IPTTOs is one of government’s responses to address the problem of commercialization of research outputs in public RIs.

TABLE I: PATENT APPLICATION BETWEEN 1999 - MAY, 2012 (NOTAP, 2012)

YEAR	Number Filed to Patent Registry			Under Evaluation			Number Granted		
	Public	Private	Total	Public	Private	Total	Public	Private	Total
1999	-	-	0	-	-	0	1	-	1
2000	1	4	5	-	-	0	4	6	10
2001	-	1	1	-	-	0	5	3	8
2002	-	-	0	-	4	4	1	-	1
2003	-	-	0	-	-	0	5	1	6
2004	-	-	0	11	6	17	1	10	11
2005	-	-	0	-	6	6	5	12	17
2006	-	-	0	1	10	11	-	8	8
2007	-	6	6	2	8	10	-	2	2
2008	3	2	5	6	18	24	1	3	4
2009	3	4	7	3	11	14	6	3	9
2010	2	5	7	7	18	25	1	2	3
2011	1	2	3	28	25	53	-	1	1
2012	-	-	0	1	6	7	-	-	0

D. Policy on S&T Review

Increased, sustainable economic growth is a primary goal of any government policy. The Vision 20-2020 program of government designed to pitch Nigeria among the top 20 economies by year 2020 has identified S&T as one of the key drivers for the actualization of the Vision. This is succinctly captured in the program’s vision statement which is “to build a science, technology and innovation system that will drive a competitive knowledge economy towards 20:2020 [8]. Whether it is in using science to create technology that will address Nigeria’s many problems or in shopping for, and using existing technologies, the role of the government is central [9]. This key point brings to the fore need for a new evidence-based policy that will guide S&T activities in the country. The first attempt at a national S&T policy was in 1986. This policy which was reviewed in 1997 to include new sectors of S&T considered germane to national economic development at the time. The third policy document was produced in 2003. Work on the present Policy (STI Policy) commenced in 2010. The major thrust of this new policy which has differentiated it from the previous S&T policies is the recognition of innovation as the ultimate end of public R&D activities and a fundamental element to foster interaction among the elements of the national innovation system for the much needed rapid and sustainable economic development. Interestingly, Malaysia’s first National Science, Technology and Innovation Policy was formulated same year as Nigeria’s in 1986 to achieve the same objective of accelerating economic growth, industrial development and creating high-tech society. In Malaysia serious commercialization effort kick-

started with the precipitation of the Sixth Malaysian Plan (1991-1995) where emphasis was geared towards making public R&D programs in the country more market oriented by exploiting commercialization of research and technology [10]. Serious efforts at commercialization of government funded R&D activities in Nigeria became a matter of policy almost three decades after its first S&T policy. RIs in Nigeria’s FMST cannot be said to have failed in a very important facet of their work by not progressing up to commercialization of research results. Unlike their Malaysian counterparts, neither the instruments establishing them nor the S&T policy placed such demand on them. While the establishing instruments have not be amended to incorporate commercialization as core mandate of RIs, the new policy on science, technology and innovation promotes and supports commercialization of R&D results by institutes.

III. COMMERCIALIZATION

Findings from literatures on commercialization have identified commercialization as being complex to implement as the word itself [11], [12].

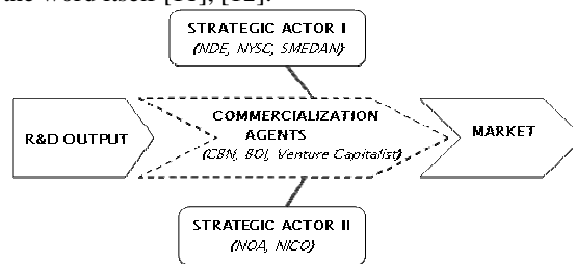


Fig. 2. Idealized situation-solution model.

While it has worked for some countries in Asia (Malaysia,

China, Taiwan, and South Korea) most African countries do not seem to get it right. Different scholars have advanced reasons for this situation. [13] Opined that appropriate approach to commercialization depend upon factors such as competition, market, funding and nature of the technology. Commercialization failures could result from weakness in R&D institutions to design R&D activities and marketing plan, lack of interaction among the elements of innovation system, poor/no incentives from government to drive industry to utilize local technology or research results [14]. For African countries to experience success in commercialization of R&D results and make noticeable progress in their bid to catch up with their Asian counterparts and rest of the world, active management of technology transfer that identifies technical needs of the end-user must be identified, developed and delivered timely [15]. It is also critical to have a virile national innovation systems (NIS), individual re-orientation, institutional re-arrangement, functional government-university/research institutes-industry linkage through networking and effective Technology Transfer model [5].

#### A. Commercialization Model

Presently, over 100 commercializable R&D outcomes in the areas of Agriculture, Industry, Engineering and Health have been successfully produced by agencies with R&D mandate in the FMST in Nigeria. Translating these outcomes into successful products would mean new jobs creation and economic empowerment for the people. But then, how to achieve this feat has rather been difficult. There are numerous types of models for commercialization in S&T. They include model of H. Randall Goldsmith designed to provide mechanism for commercializing new products and processes, model of Rothwell and Zegveld which explains that R&D and commercialization components interact to create technological opportunities and satisfy the demands of the market. However, these models are not suitable and logically adaptable for the purpose of commercialization in Nigeria context as there seems to be a peculiar situation that needs a peculiar solution.

As a result, a well-structured strategic approach is needed for commercialization of R&D outputs currently abundant in the agencies of the S&T ministry in Nigeria. A simple idealized situation-solution model is suggested here as a way-out (See Fig. 2). The model, like other models acknowledges the role of networking and collaboration among key stakeholders in the commercialization process. The model is put together as follows:

*R&D Outputs* are contained in a database of all the research outputs from various agencies in the Ministry stating their status, industry where they could be exploited, agency responsible for the research and other important information that may be associated with the output (design standard and specification, etc). This element in the model supply inputs for the commercialization process to other elements.

*Commercialization Agents* are group of experts who connects the R&D outputs with the market. They are the middle-men in the model drawn from other institutions which participation addresses the obvious gap in the commercialization process that have led to repeated failures

in the past. These experts are made of economists, policy makers in S&T, finance experts drawn from commercial banks, Bank of Industry (BOI), Central Bank of Nigeria (CBN), Nigeria Import and Export Bank (NEXIM), Manufacturers Association of Nigeria (MAN) as well representatives of cognate Ministries like Trade and Investment. The involvement of financial institutions is not only important but strategic as lack adequate and appropriate finance windows has been identified as impediments to successful commercialization of R&D in most countries of Africa. The two attachments to the commercialization agents; strategic actors I and II are the enablers to the commercialization process.

*Strategic Actor I* comprise of actors that will make use of R&D outputs and process them into finished products. The aim is to create micro and small industries providing jobs and creating wealth for youths while promoting of local content. These actors include the National Directorate of Employment (NDE), National Youth Service Corps (NYSC) and Small and Medium Enterprises Development Agency (SMEDAN) as well as other Agencies of government for the promotion of employment creation.

*Strategic Actor II* will be responsible for sensitization and advocacy on patronizing goods produced in Nigeria. Nigerians continue to express strong preference for foreign goods to detriments of local industries. The foreign exchange used to support consumption of foreign goods thus become unavailable for development of critical infrastructure required for economic growth. So, National Orientation Agency (NOA) and National Institute for Cultural Orientation (NICO) both Agencies of Federal Ministry of Culture and Tourism; Federal Ministry of Information and National Orientation will work better as Strategic Actor II.

*Market* is whole essence of all the activities starting from the laboratories and through the other actors in the commercialization process. Large market exists in Nigeria. According to a report by the Global retail newspapers [16], Nigeria was ranked eleven (11) with respect to global markets by opportunity. This is as a result of growing number of consumers and market opportunities in Nigeria. Porter also alluded to the huge and growing consumer market in Nigeria and the opportunities such presented for business in Nigeria [17].

#### IV. CONCLUSION

The new national policy on STI provides effective frameworks for research-industry-market linkage with a view to of facilitating commercialization of research outputs of public RIs. There is urgent need, however, to revisit the legal instruments creating the RIs which hitherto make no provision for RIs to engage in commercialization activities. While admitting that the commercialization process is much more complex than the simple Idealized Situation-Solution Model presented here, it is ideal for the commercialization of simple research results appropriate for the creation of small scale producing units for S&T graduates.

REFERENCES

- [1] B. A. Lundvall, Ed. *National System of Innovation: Towards a Theory of Innovation and Interactive Learning*, London Printer, 1992, ch. 4
- [2] D. S. Kemmis, "Innovation systems in Australia," *ISRN 6<sup>th</sup> Annual Conference Working Paper 1*, 2008
- [3] L. E Nsa, "An analysis of the management of research and technology organizations in Nigeria," PhD. Thesis, Dept. Management, St. Clements University, 2003.
- [4] P. Drucker, *Innovation and Entrepreneurship: Practices and Principles*. New York: Harper and Row. 1985, ch. 3
- [5] W. O. Siyanbola, O. O. Isola, A. A. Egbetokun, and C. M. Adelowo, "R&D and the challenges of wealth creation in Nigeria," *Asian Research Policy 2*, pp. 20-35, 2011.
- [6] UNESCO, "Science, technology and governmental policy," A Ministerial Conference for Europe and North America (minespol II), UNESCO Science Policy Studies and Documents, no. 44, pp. 52-55, 1979.
- [7] U. J. Ukpabi, "Potential of protected local institutional innovations in catalyzing Nigerian agro-Industrial development," *Journal of Agricultural Biotechnology and Sustainable Development*, vol. 1(3), pp. 62 - 68, December, 2009
- [8] Nigeria Vision 2020 Program (2009) "Report of the vision 2020 national technical working group on science, technology and innovation."
- [9] O. Osita, "How can science and technology policy aid Nigeria's reconstruction?" *Techno Policy Brief 8, African Technology Policy Studies Network (ATPS)*, 2004.
- [10] V. G. R. Govindaraju, "R&D commercialization challenges for developing countries: The case of Malaysia," *Tech Monitor*, Nov-Dec pp. 25-30, 2010.
- [11] B. A. Courtois. "Commercialization." *Information Technology Association of Canada*, May (2004). pp.1. [Online] Available: [http://www.itac.ca/pdf/04may\\_issue\\_commercialization.pdf](http://www.itac.ca/pdf/04may_issue_commercialization.pdf)
- [12] D. Avimanyu, "An Integrative model to explain the ability to commercialize innovations: Linking networks, absorptive capacity, ambidexterity and environmental factors," *Journal of Management and Strategy*, vol. 2, no. 2, pp. 2-22, June 2011.
- [13] D. Morberg and G. Moon, "Technology commercialization – The choices facing researchers," *IEEE Canadian Review – Summer/Ete Industry*, pp. 5-8, 2000.
- [14] A. Syahrul, E. Aminullah, and M. Simamora, "Commercialization of public R&D in Indonesia," presented at National Workshop on 'Sub-national Innovation Systems and Technology Capacity Building Policies to Enhance Competitiveness of SMEs', Jakarta, April 3-4, 2007.
- [15] G. K. Nicholas, "Commercialization of research and technology," Paper submitted to USAID on Policy, Analysis, Research, and Technical Support Project.
- [16] Global Retail News Letter, (2008). [Online] Available: [http://www.globalretailnews.com/ldi/08mai\\_uk.pdf](http://www.globalretailnews.com/ldi/08mai_uk.pdf)
- [17] M. Porter. (2009). On creating a competitive Nigeria: Towards a shared economic vision. *Presentation to Federal Ministers, Lagos, Nigeria*. [Online] Available: [http://www.isc.hbs.edu/pdf/20090723\\_Nigeria.pdf](http://www.isc.hbs.edu/pdf/20090723_Nigeria.pdf)



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