

Promoting Technology and Innovation Management Expertise in Africa: The Case of NACETEM, Nigeria

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Abstract

Technology and innovation are two important elements in improving efficiency, productivity and competitiveness in organisations. The effective management of science, technology and innovation (ST&I) is now widely regarded as the determinant of competitiveness both for corporate entities, regions and countries. Technology and innovation management (TIM) as a discipline has gained wider acceptability in the developed world and has ultimately contributed to the development of those economies. Africa has again lagged behind in the build-up of expertise to ST&I management. This paper therefore examines the growth of the practice and education of TIM professionals in Africa, and Nigeria in particular, as findings suggest a near lack awareness of TIM. Until recently, only one university out over 150 universities in Nigeria offered courses in TIM, and the National Centre for Technology Management offers a professional post graduate diploma in technology management. The paper also proposes a framework for a massive capacity development drive in ST&I management expertise, so as to foster innovation for sustainable development in the continent. The methodology used for this paper was the exploratory case study approach. The exploratory research mainly uses secondary data from extant literature and other sources to underpin the theoretical and contextual frameworks within the TIM field and its education and practice in Africa. The essence of this paper was to bring to limelight, the discipline and practice of TIM on the African continent, though in some selected countries as they appear to have well-established schools or institutions that offer postgraduate courses in technology management. The evolution of this all important field was equally x-rayed. Consequently, the few universities and institutions providing TIM education and training in Africa were highlighted, though with more emphasis on the activities of the National Centre for Technology Management of the Federal Ministry of Science and Technology, Nigeria. A framework for the advancement of TIM in Africa for the better management of her human, material and other resources for sustainable development are equally canvassed. Lastly, a framework for the promotion of TIM expertise in Africa was suggested in the paper. This paper highlights the historical evolution of TIM as a discipline and its growth in Africa. It concludes that adopting the framework suggested in the paper will greatly improve the education and practice of TIM for sustainable development in the continent. However, a more detailed cross-country survey will provide broader insights into TIM as practiced by African countries.

Keywords: technological management, innovation management, sustainable development, Africa, Nigeria

INTRODUCTION

Technology and its management (TM) or the management of technology (MOT) are becoming increasingly import and pervasive in businesses and the community (Harrison and Samson, 2002) and is therefore been extensively discussed in recent research and literature (Kropsu-Vehkapera et al., 2009). In citing the works of other researchers Barney, Bartlett and others, Tingjun (2003) opined that since the latter part of last century, international companies came to realise that management of innovation and technology is essential for achieving sustainable competitive advantage. Indeed, Technology and innovation are two important elements in improving efficiency, productivity and competitiveness in organizations and what differentiates successful organizations from others is

their management of technology and innovation (Mezher et al., 2008). Many development scholars arguing have argued that successful economic and industrial development is intimately linked to a nation's capacity to acquire, absorb and disseminate modern technologies (Feinson, 2003). But social development today is determined by the ability to establish a synergistic interaction between technological innovation and human values, leading to a new set of organizations and institutions that create positive feedback loops between productivity, flexibility, solidarity, safety, participation and accountability, in a new model of development that could be socially and environmentally sustainable (Castells, 1999). Similarly, the level of technological development of a country or state is evaluated on the ability to acquire, adopt, adapt, imbibe and diffuse

technological innovation as well as technology infrastructure in place (Okafor, 2007). Whereas, in developed economies the innovation system serves the role of maintaining or improving an already established level of competitiveness and growth, unfortunately, developing countries are faced with the task of “catching-up” (Feinson, 2003). Thus, the most relevant cases in regional development bring out the important role of science and technology and convert them in fundamental elements for economical and social development (Marante et al., 2007). Understandably therefore, the management of technology and innovation is a field that is concerned with the planning, development, use and diffusion of technology as well as its application in industry and its impacts on the social, economic, cultural, political and geographical environment of a nation (Siyanbola, 2009).

Therefore, the effective management of science, technology and innovation (ST&I) has now been widely regarded as the determinant of competitiveness both for corporate entities, regions and countries. This underscores the relevance of ST&I management to the needs of government policymakers, industry leaders and business management students (Harrison and Samson, 2002). Consequently, as TIM is an interdisciplinary field, its effects stretch out to reach the individual, the organisation and the nation; on the individual level, it promotes and improves one’s social standing; on the organisation level, it helps firms maintain a competitive edge; on the national level, it contributes to the shaping of public policy (Mezher et al., 2008). Observably, in the industrially advanced countries, technology policy and management are now a fundamental part of government strategy for international and industrial competitiveness. However, most developing countries especially in Sub-Saharan Africa are yet to fully appreciate the critical and pivotal role of Science, Technology and Innovation Management in the overall development process. This situation is evident, as their a few universities in Africa offering courses in TIM and related disciplines, which perhaps accounts for the lack of awareness of this discipline and practice on the continent.

Interestingly, one the writers of this paper never saw any job advertisement that directly or conditionally mentioned the position of a technology manager, except for a few cases where the mention of the position of engineering manager, in his near two year job search through some highly recognized recruitment firms in the Republic of South Africa after acquiring an honors degree in technology management from the University of Pretoria. Surprisingly too, since its inception, it was only in 2009 that NACETEM made a direct mention of

preference for degrees in TM in certain key positions in its latest recruitment drive.

This paper looks at the evolution of Technology and Innovation Management as a discipline, its practice and the education/training of its practitioners in Africa, but looks at the Nile University in Egypt, the University of Pretoria in South Africa and most importantly, NACETEM in Nigeria. The paper also proposes a TIM capacity building framework for Africa in the light of low level of awareness currently experienced by the discipline by the continent of Africa.

CONCEPTUAL FRAMEWORK

As stated earlier, the effective management of technology as a source of competitive advantage is of vital importance for organisations and countries alike. It is necessary to understand, communicate and integrate technology strategy with marketing, financial, operations and human resource strategies; which is of particular importance when one considers the increasing cost, pace and complexity of technology developments, combined with shortening product life cycles (Phaal et al., 2001). Also, according to (Harrison and Samson, 2002), realising that most and competitors within their industry have acquired the same level of competence in other areas of management, such as operations, human resources, marketing, strategy, and the like, many firms have begun to look to innovation as a key differentiating factor for competitive advantage. Scientific breakthroughs and technological innovations have resulted in profound societal change, and science and technology have been major instruments of economic growth and human development and societies that lack the technological know-how or capacities for scientific breakthroughs have difficulties in meeting the increasing needs of their people (Babalola, 1998). Equally, awareness is growing among policymakers of the catalytic essence of innovative activity for the economic progress and well-being of nations as well as a potential instrument for solving the global environmental and health challenges (OECD, 2007) as the character and content of today’s science and technology demand massive investments in R&D and training with the ultimate objective of generating technological innovation which has become the key to global competitiveness (FMST, 2008).

The last two paragraphs greatly underscore the importance of the concepts of science, technology and innovation in shaping the discipline of TIM and this fact will be expatiated subsequently.

Evolution of TIM as a Discipline

There is ongoing discussion in the scientific community about what really, is the content of TM as the practitioners in industry are setting different practices for managing technology thereby making

the situation more complicated in real management situations (Kropsu-Vehkaperä et al., 2009). However, TM is said to becoming an established academic discipline since two decades ago and located within management field instead of economics or public policy Pilkington and Teichert (in Zaidi and Othman, 2011).

According to Chanaron and Grange (2006) 'since the founding documents of the IAMOT, the international Association for Management of Technology, adapted from the reflections of an ad hoc committee of the National Research Council in 1987 and the American National Science Foundation, and a few exploratory articles by Barrand and Jolly, Chanaron and Jolly, Chanaron, Jolly and Soderquist, a literature search provides a few references, most of which are limited and devote only a few lines to the matter'. They maintain that most of the actors bidding claim to management of technology carefully sidestep the precarious exercise of proffering an academic definition. Like many other disciplines, TIM seems to be a discipline that is fragmented among certain core themes, as each university or institution decides on a name each prefers. Hence, the many faces (names) of the discipline – engineering and technology management, systems engineering and management, industrial engineering and management, technology management, management of technology, technology and innovations management, management of innovations and technology, innovations and creativity management, innovations management and entrepreneurship, and the list is in-exhaustive. But unfortunately, according to Johnston (1991) fragmentation only hinders the full advance of knowledge, because it creates parts without wholes, disciplines without cores.

Teece (1998) posits that, as research advances, it ought to be especially sensitive to preserving, and building upon, the already significant literatures on the management of technology, entrepreneurship, innovation, and business strategy and if properly understood, the knowledge management umbrella can be a convenient rubric for integrating important work in accounting, economics, entrepreneurship, organisational behaviour, marketing, sociology and strategy, but that, each of these fields provides important insights into one aspect or another of knowledge management; but stand-alone, none provides an integrating framework. Equally, Chanaron and Jolly (1999) concluded in their paper that TM requires competencies in a broad spectrum of functional areas from R&D to marketing, finance and all other traditional managerial activities. It does require an interdisciplinary vision and therefore a multidisciplinary background. Accordingly, technology and innovation management can now be classified as an umbrella discipline that can be a convenient rubric for integrating other sub-fields or

themes like, technology management, engineering management, innovations management, systems engineering, project management, and other management related fields like, operations/productions management, entrepreneurship and creativity, strategic management, marketing management, logistics and supply chain management, financial management, life-cycle management, among others. After all, Cetindamar, Can and Pala (2006 as cited in Zaidi and Othman, 2011) had earlier identified various TM processes/activities into eleven activities consisting of technology utilisation, knowledge management, technology acquisition, R&D management, technology integration, technology protection, license/patent purchasing, technology transfer, technology planning and forecasting, technology strategy, technology assessment, and technology commercialisation and marketing. From forgone, the field of technology management has been approached from other management paradigms and areas of science (Kropsu-Vehkaperä et al., 2009). Shaping an emergent field of endeavour requires understanding the boundaries of the specific activities contained within that field (Amadi-Echendu et al., 2007), and in a world of constant and increasing rates of change, one of the most prevailing trends and traits is that of convergence as technologies converge to create new technologies and products; concepts converge to form completely new concepts; people converge into new local, global, and virtual communities; and professional skills converge to create new professions and that these convergences pale in comparison to the implosion of learning, working, and capturing knowledge, and the management of their sum total; and these previously disparate and relatively independent activities are converging to become one, producing unimaginable amounts of creativity, innovation, productivity, and performance (Hodgins, 2002). In the same way, TIM should be viewed as the convergence of the core fields and the sub-themes highlighted in the last two paragraphs, which form the boundaries of the specific activities contained within the TIM discipline, with TIM entailing the management of their (core fields and sub-themes) sum total.

According to the Obafemi Awolowo University (2009) with the exception of the U.S.S.R. and Japan, the development in technological capacity took place largely as an autonomous process with dispersed initiatives provided often by the accident of circumstances, and following the experience in Japan and U.S.S.R., Technology Management or Management of Technology has emerged in recent years as a new field of inquiry. However, the beginning of MOT can be traced to the 1950s when research and development (R&D) management ideas were developed (Narayanan, 2001). This position seems to be corroborated by findings from an

ongoing survey conducted by the Portland State University which shows that the establishment of TM and related disciplines took place in the 1950s, although the Rensselaer Polytechnic Institute, USA is seen to have established a program in Industrial and Management Engineering (IME) as early as 1932 (Portland State University, 2009).

The evolution of TIM as a discipline has been so dramatic with observed shifts in the management theme and focus over the decades. For instance, Fig. 1 shows how it originated as a result of the management of R&D efforts in the 1950s to management of innovation in the 70s. This same figure shows us how management focus later shifted to strategic technological issues in the 80s to a value-based management focus in the 90s (Narayanan, 2001). However, with the concept of sustainable development gathering international prominence in the late 90s, and with the threat of global warming and climate change, businesses are more and more held accountable for their actions or inactions with respect to the effects of their businesses, technologies, and others on the environment and society; and sustainability is also a factor of the survivability of such businesses (Bubou et al., 2009). It only therefore makes sense that today's technology managers or strategists must find a convenience between managing science, technology and innovations for competitiveness and economic progress on the one hand, and the well-being of all as well as solving the environmental challenges that may be likely occasioned by technology on the other hand. Koshijima et al (2004) equally proposed a sustainability oriented value-chain which can be seen as tacit introduction of sustainable development to the value-based management focus. Hence, the writers consider the latest theme and focus of management of TIM as that of ST&I management for sustainable development, as seen in Fig 1.

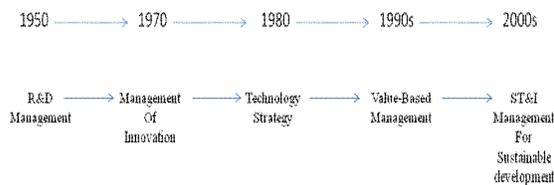


Figure I: Evolution of Technology and Innovations Management. Source: Adapted from (Narayanan, 2001)

Definitional issues

Smith (2009) expressed his frustration when he saw the difficulty in arriving at a consensus definition of the Chief Technology Officer thus, “it is unlikely, if not impossible, for one definition to meet the needs of all of these organizations”. Similarly, it may be unlikely, if not impossible for one definition of the

discipline of MOT as there are many fragmentations or variants of the discipline. Again, because of the interdisciplinary evolution and the nature of technology management, and lack of commensurable frameworks, there are several typologies and approaches for defining technology management (Kropsu-Vehkapera et al., 2009).

However, according to Narayanan (2001), National Research Council defined TM in 1987 as “management of technology links engineering, science and management disciplines to plan, to develop, and to implement technological capabilities to shape and accomplish the strategic and operational goals of an organizations”. To Khalil (in Zaidi and Othman, 2011), TM is multi-disciplinary field that is bridging between the sciences and engineering disciplines to the business disciplines Khalil (in Zaidi and Othman, 2011). Analysing the above definition further, Narayanan (2001) views value creation as the primary goal of TM in corporations; that focusing on the development of technological capabilities and its implementation or deployment in products and processes; and that TM within an organisation is linked to other management activities like manufacturing and marketing.

Zaidi and Othman (2011) cited the definition of TM by Task Force on Management of Technology, 1987 as: “a process, which includes planning, directing, control and coordination of the development and implementation of technological capabilities to shape and accomplish the strategic and operational objectives of an organisation”. However, this definition has two major shortcomings. Firstly, it narrows the scope of management of technology to the organisational level. This is contrary to Chanaron and Grange’s (2006) contemporary vision of TM which considers both the macro-economic level (region, nation, etc) whereby TM involves the mobilising resources to create and implement individual and collect knowledge and know-how on markets; and the micro-economic level (the company) where TM implies managing what adds value to products and services on the market to create wealth (managing application of knowledge and know-how in order to generate value. After all, Zaidi and Othman themselves maintained that TM is also studied at the national level. Secondly, the definition seems to ignore vital component of innovation. Here also, Chanaron and Grange (2006) support the view the a definition of TM should include innovation when they proposed that the strategic management of technology and innovation should embrace two social paths, vis-à-vis, innovation and the scientific and technical creation of new applications.

Chanaron and Grange (2006) thus defined technology management as the management of innovation, whether it be a product, a process or an organisation,

from its conception to its diffusion, and therefore to its implementation within the company, including the consequences, advantages and disadvantages for all of the variables and actors involved in running the company. However, they maintain that we can finally retain a definition that encompasses all of these dimensions: technological management can be defined as a managerial approach based on optimising the permeability and plasticity of the productive and entrepreneurial system with respect to technological dynamics. In reactive mode, it is structured around the flexible appropriation of technological evolutions. In proactive mode, it contributes to the emergence of alternative forms of technical process.

White and Bruton (2007) the management of technology is defined by the text as linking “engineering, science, and management disciplines to plan, develop, and implement technological capabilities to shape and accomplish the strategic and operational goals of an organization”. Also, the management of innovation is defined as “a comprehensive approach to managerial problem solving and action based on an integrative problem-solving framework, and an understanding of the linkages among innovation streams, organizational teams, and organizational evolution”. White and Bruton (2007) actually provide a useful insight into the management of technology and innovation, suggesting that TIM as an applied discipline and not just a theoretical one.

In a related note, Chanaron and Grange (2006) organisations governing public policies in research and development (R&D), grants or innovation baking, technological management also offers fields of thought and investigation which are complementary to those of companies. Thus they highlighted such as management of research – innovation process; scientific and technological scanning – technology forecasting; scientific and technological politics – technological assessment, sustainable development and technical change; technology and civil society, methods and tools to encourage private R&D, etc. Based on the foregone, and because of the emphasis laid on the two words, technology and innovation, and their fundamental relevance to the discipline under discussion, the authors wish to suggest the name Technology and Innovations Management to be the preferred title of the discipline. Though TIM has been inter-used with TM and MOT in this paper, in each case, they mean one and the same thing.

Consequently, the writers will like to operationally define TIM thus “technology and innovations management is a discipline that harnesses science, engineering and technological innovations with expertise drawn from managerial sciences to improve

the competitiveness of individuals, corporate entities, nations and regions with the resultant positive impacts on the social, economic, cultural, political and geographical environment of all concerned”.

OBJECTIVES AND METHODOLOGY

The primary objective of this paper is to establish a conceptual framework of the technology and innovation management field of knowledge. The secondary objectives are to x-ray the practice and education of TIM in Africa through the three selected countries, and also to introduce a framework for the propagation of TIM as a discipline in the continent.

The methodology used for this paper was the exploratory case study approach. Therefore, the methodology adopted the (Cooper and Schindler, 2003) suggested exploratory research which mainly uses secondary data from extant literature and other sources to underpin the theoretical and contextual frameworks within the TIM field and its education and practice in Africa. This was also predicated upon difficulty of getting information from most African universities more so, on the discipline under discussion. However, as expected, the researchers also used qualitative inductive reasoning to draw inferences for this work which is the hallmark of exploratory case studies. This is a position supported by many other researchers (Cooper and Schindler, 2003; Page and Meyer, 2000; Saunders et al., 1997). Based on the findings from the exploratory studies, evolution of TIM as a field of study has already been detailed, while the education and training of TIM in Africa among other things are provided below.

TIM in Africa

TIM as a discipline and practice is seen to have gained broader awareness in Africa after the United Nations Educational, Scientific and Cultural Organization (UNESCO) organized ‘Second Conference of Ministers Responsible for the Application of Science and Technology to Development in Africa’ (CASTAFRICA II). CASTFRICA II was a response by UNESCO to the request of the Organization of African Unity (OAU). The General Conference of UNESCO, at its twenty-third session held in Sofia, Bulgaria in 1985, authorized the Director-General to prepare and implement a special programme of assistance to Africa in the fields of scientific and technological research and of research and development with one of the aims been that of promoting, projecting and propagating technology management in Africa (UNESCO, 1987). NACETEM was a direct fall out of this conference.

The Technology Planning and Development Unit (T.P.D.U.) of the Faculty of Technology, Obafemi Awolowo University, Nigeria seems to be the only one that may have predated CASTAFRICA

II as it was said to have been established in 1974, primarily as a policy research unit and became a postgraduate department in 1984. The unit now offers courses in Technology Management both at the undergraduate and postgraduate levels (Obafemi Awolowo University, 2001). While the specific number of individuals who have graduated from the program cannot be exactly ascertained from the university, it is estimated that over a thousand persons may have benefitted from the trainings provided by the Obafemi Awolowo University.

The University of Pretoria started its TIM program in 1987 with the establishment of a Chair for Engineering Management. This marked the commencement of a master's program in engineering management (MEM) with the first group of 45 students admitted in 1989. Building on the success of the start-up years, a formal separate department was created in the then Faculty of Engineering in 1994, the first and only of its kind in South Africa. The Department of Engineering and Technology Management today offers a variety of engineering- and technology management-related programs. Several individuals from industry are also involved on a part-time basis, mostly as extraordinary professors; and in 1995 the management of technology (MOT) honors and master's (dissertation) program were also launched. Subsequently, a master's program in project management (MPM) was established in 1999.

A Graduate School for Technology Management was established as a fourth school in the Faculty of Engineering, Built Environment and Information Technology in January 2007. The Department of Engineering and Technology Management resides within this School and offers the Master's in Engineering Management (MEM) and the Master's in Project Management (MPM) as well as the Honors in Technology Management (MOT), the Master's in Technology Management (MTM), Dissertation and doctoral studies that address different needs in the field of Technology Management, Project Management, Engineering Management, Life Cycle Management and Asset Management. A total number of 1325 students is said to have graduated up to the September, 2009 graduation ceremony, while about 900 postgraduate students are said to be currently registered for different programs in the Graduate School of Technology Management.

In order to extend its reach in the provision of education and training in TIM beyond its immediate borders, the University of Pretoria has collaborated with the University of Port Harcourt in Nigeria in setting up a new Institute for the Management of Engineering, Technology and Innovation (METI) to be housed in the University of Port Harcourt. METI was established to provide postgraduate courses at

masters and doctoral levels as well as specialized professional training courses in related areas. The first set of students for this programme commenced studies in September, 2010. Another university found to be having programs in TIM in Africa is the Nile University of Egypt which has a Graduate School of Management of Technology, Policies and Procedures that offers masters and doctoral degrees. While a few universities were seen to be running courses in engineering management and project management, especially in Nigeria, their impact is not farfetched, more so, when one considers the magnitude of universities in Africa, with Nigeria alone having about 150 universities and degree awarding colleges and polytechnics.

Besides, the formal educational training in the discipline of TIM provided by the universities, the continent have also witnessed some level of awareness generation in recent times by way of professional conferences. For instance, the African edition of PICMET was held in Cape Town, South Africa in 2008. Similarly, the International Association for Management of Technology (IAMOT) will be holding its second conference in Cairo, Egypt, by March, 2010, with first held in 1999 the city and country. Worthy of mention here also, is the efforts of the United Nations University – Maastricht Economic and social Research and training centre on Innovation and Technology (UNU-MERIT) which has been providing training in TIM for developing countries. It has strong collaborative links with public research institutes and universities across Africa, with most such institutions sending students to UNU-MERIT to pursue doctorate degrees in TIM. UNU-MERIT has equally been providing specialized training under its “Design and Evaluation of Innovation Policy in Developing Countries (DEIP)” workshop/training course, one of which was mounted at Abuja, Nigeria with another one coming up in Addis Ababa, Ethiopia in February, 2010.

With the forgone, momentum is gathering for awareness generation in the field of TIM and nothing needs to be spared in making it as popular and acceptable in Africa, as it is elsewhere.

NACETEM and ST&I Management capacity building

Historical background of NACETEM

Among the many institutions established by the Nigerian government to promote and enhance the science and technology endeavor for the development of the country is the National Centre for Technology Management. As an agency under the Federal Ministry of Science and Technology, it is vested with the mandate of training and developing middle-to-high level manpower and conducting policy research in the areas of Science, Technology and Innovation Management for all tiers of government and the

private sector. This is aptly captured in its vision statement “to be an internationally recognized centre of excellence in science, technology and innovation management for sustainable development” (NACETEM, 2009). Established in January, 1993 with headquarters in Obafemi Awolowo University, Ile-Ife, NACETEM is an outcome CASTAFRICA II. In November 2005, resulting from the on-going reforms of the ST&I system in Nigeria, the original mandates of NACETEM were expanded to cover activities in the sub-region and beyond with the merger of former Regional Program for Technology Management (REPTEM) with NACETEM. The new NACETEM was mandated to establish a zonal office per geopolitical zone. Consequently, REPTEM, located in Lagos, was re-designated as the NACETEM South West Zonal office.

NACETEM is expected to run a six-zonal office structure as the country has six-geopolitical zones. Currently, three zonal offices have become operational (South-West, North Central, and South-South) and North-Western zonal office is expected to commence operations by first quarter of 2010 while the remaining two zonal offices will come-up before the end of 2010.

NACETEM's Mandates

The primary mandates of NACETEM are to:

- ❖ Serve as a training Centre for the development of middle-to-high level manpower in Science, Technology and Innovation (STI) Management for all tiers of Government and the private sector;
- ❖ Conduct policy research, evaluation, and review with a view to making policy recommendation for dynamic technology-based development;
- ❖ Establish, maintain and provide access to databanks on STI research outputs and facilitate activities towards their commercial exploitation;
- ❖ Design and run postgraduate courses/programs in STI management in conjunction with appropriate departments/units of the Obafemi Awolowo University and other University/Institutions;
- ❖ Assist the various tiers of government (Federal, State and Local) in the country in STI policy formulation and strategies for utilizing such for development; and
- ❖ Collaborate with other countries, especially African countries in S&T training, policy research and consultancy (NACETEM, 2009).

Capacity Building Activities of NACETEM

Capacity building activities designed in a way to address the knowledge gaps existing within the national ST&I system (NACETEM, 2009). NACETEM approaches its capacity building in ST&I

from three perspectives. The PGD in technology management program is designed to develop in participants a deep understanding of how S&T can be harnessed for economic development; to enable participants to comprehend the role of technology within the framework of business strategy and objectives; and to develop in participants' skills to manage technological change in various sectors of the Nigerian economy. This 12-month part-time program was run concurrently in three of zones in 2009. Over 250 mid-to-high level personnel have been trained since the inception of the program. About 150 students so far have already enrolled for the program at four study centers (Ile-Ife, Lagos, Abuja and Yenagoa-Bayelsa) for the current 2010 session. NACETEM's short-term courses are aimed at developing and harnessing human resources needed to promote, project and propagate technology management in Nigeria, and in Africa as a whole. NACETEM's workshops and conferences are directed at policy makers at the Local, State and Federal levels of Government, to ensure that they are well-informed for effective decision making.

In the last eight years, NACETEM has mounted over 80 short-term relevant courses specifically geared towards national manpower development in ST&I management with the resultant training of over 1000 middle-to-high level manpower in some the courses that included:

- ❖ Corporate Planning & Strategic Management of Technology for Chief Executives;
- ❖ Technology Entrepreneurship and SMEs Management;
- ❖ Planning, Programming and Budgeting for S&T;
- ❖ Intellectual Property Rights Protection and Management;
- ❖ Application of Engineering Economy Methods for Project Evaluation;
- ❖ Research, Development and Innovation Management; and
- ❖ Science and Technology Project Management among others (NACETEM, 2009).

ST&I Policy-Oriented Research at NACETEM

At NACETEM, policy research projects are aimed at assisting policy makers in ST&I management and related activities and necessary advice in the formulation of ST&I policies for sustainable development (NACETEM, 2009). Similar to the approach adopted for capacity building, the agency adopts a three pronged approach in discharging its mandates and meeting its objectives. Part of mandate of NACETEM also includes the conducting of policy research, evaluation and review with a view to making policy recommendations for dynamic technology-driven, knowledge-based development. Therefore, in line with that mandate, as the S&T policy training and research agency Nigeria, it

conceived an ‘Experts Forum on ST&I Management’ primarily to sensitize key players at the highest level of government to the strategic importance of S&T in national development, and maiden edition was successfully hosted in August 2006 (NACETEM, 2009); and it has now become a regular event of the agency. This capacity building program targeted at equipping legislators serving on S&T Committees in the National Assembly (the highest law making body of Nigeria) of their day-to-day deliberations and oversight functions in respect of science and technology activities. According to (NACETEM, 2009), the forum exposes such legislators to issues relating to S&T policy formulation and evaluation, funding and budgeting, monitoring and control, guidelines for the implementation of oversight functions and forging partnerships with international organizations for S&T development among others.

NACETEM has collaborative arrangements with universities both national and international alike. As a credible, innovative and effective technical resource organisation, NACETEM is poised to assist governments at all levels institutions and organisations to strengthen their institutional, organisational, management, and technical capacity with respect to capacity building, management consulting, training and management research in ST&I, in order to increase their sustainable effectiveness and impact to the citizens of Nigeria, the African sub-region and beyond.

TIM Capacity Building in Africa

Oyelaran-Oyeyinka (2005) made a fundamental statement with respect to capacity building in Africa thus: -

“One of the most pressing needs in Africa is to build local systems that enhance the capacity to innovate: local systems to generate and apply knowledge and information necessary to build absorptive capacity, accelerate poverty reduction, manage natural resources better, boost productivity, compete in local and export markets, and improve well-being. The strengthening of key organizations (public and private) is vital”.

Hence, with the vital importance of the discipline and practice of TIM already stated and the near lack of awareness of TIM identified, a framework for massive capacity building on the expertise of TIM in Africa. Such a framework, see Figure II is expected to first, the continuous training and retraining of academia and practitioners in TIM in the already establishment universities and through the collaborative arrangements with foreign universities and institutions known to be providing the desired education in TIM. More universities are to be encouraged to establish Professorial chairs in TIM. Stakeholders galvanize to organize themselves into

national and regional groupings to share and exchange idea in TIM related discourses, as well attracting high caliber international conferences like – IAMOT, PICMET, International Conference for the Management of Innovation and Technology. Africans can organize themselves around themes like Africa Association for the Management of Technology (AFRAMOT) or African Conference for the Management of Innovation and Technology (AFRICMIT) as we have in Europe, China and elsewhere.

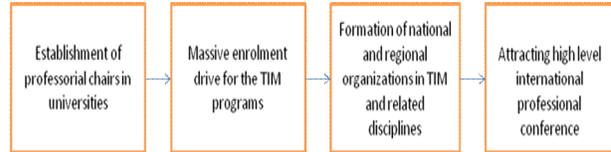


Figure II: TIM capacity building framework for Africa

CONCLUSION

The essence of this paper was to bring to limelight, the discipline and practice of TIM on the African continent where all countries are still classified as developing countries. The evolution of this all important field was equally x-rayed. The disciplines has evolved from different backgrounds, disciplines, themes and sub-themes, and subjects, sometimes disparate, but have converged into what one can conveniently called today as technology and innovation management. Consequently, the few universities and institutions providing TIM education and training in Africa were highlighted, though with more emphasis on the activities of the National Centre for Technology Management of the Federal Ministry of Science and Technology, Nigeria. A framework for the advancement of TIM in Africa for the better management of her human, material and other resources for sustainable development are equally canvassed. Above all, we hope our paper, by stimulating and promoting that critical honest step of re-examination of TIM as a field of study, provide a useful roadmap for the promotion, projection and propagation of technology and innovation management in Africa and beyond.

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