Research Development and Publications: Tools for Technological Development in a Developing Economy*

By

Godwin A. Chukwu,** Ph.D., P.E

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Abstract
Increased emphasis on research and development in many developed and some developing countries following the results of research outputs in human capital accumulation have been reported in recent time. The new ideas and technologies that have resulted from the research findings are the necessary tools that have led to economic growth. Industrialized countries that have good governance and economic strength to deliver goods and services to their citizens usually place high premium on research and development. In the United States, technological advancement has been identified as a major driver of economic growth. Some countries in the Far East, including India and South Korea are emerging as Economic Superpowers because of years of deployment of research findings in socio-economic planning and development. Although Africa is has 15 percent of the world's population, it produces less than 1.5 percent of the world's scientific knowledge, as measured by articles in peer reviewed international journals[1]. According to recent report, sub-Saharan Africa contributes about 2.3% of the global GDP but records only 0.4% of global research and development expenditure.[2]This paper discusses the significance of research as a tool for development, and as a catalyst for economic growth and advancement in African sub-continent and specifically a developing economy like Nigeria.

Introduction

The Greater effectiveness of strategic planning and management systems of some of the more technologically advantaged African countries like South Africa is partly negated by high rate of generation of new problems that can be partly addressed by Science and Technology, and appropriately implemented management systems. The complex web of interactions among factors that determine the quality of life and peaceful co-existence of nations requires knowledge, advanced analysis and presentation of data and facts to decision making organizations and government entities.

Industrialized nations that have good governance and economic strength to deliver goods and services to their citizens usually put strong emphasis on tertiary education, technology diffusion through research findings, and the appropriate policy mix that encourages innovation. Ironically, the African leaders have re-iterated the importance of Science and Technology as the bed rock of economic sustainability, but the implementations and positive dividends from such "calls" have been far-fetched. The importance of science and

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** Professor and Interim Director, Petroleum Engineering Program, African University of Science & Technology (AUST), Abuja, Nigeria and Professor Emeritus, University of Alaska Fairbanks, USA

[1] Hassan, Mohammed H.A.: "Promoting Science Technology and Innovation for Sustainable Development in Africa" Executive Summary of Paper Presented at the First Session of the *Committee on Development Information, Science and Technology (CODIST-1), Addis Ababa, Ethiopia (April 28-May 1, 2009)*

[2] Mutume, Grumisal; "Africa aims for a scientific revolution: More funding needed for research institutes and universities", *African Renewal, Vol. 21, No. 3,* October 2007

technology in socio-economic and technological advancement of nations has taken high priority in national development plans. Among the 33 decisions adopted by the Executive Council (Heads of State) of the African Union Summit of January 23-30, 2007 in Addis Ababa, Ethiopia include.[3]:

- declaration of 2007 as the launching year of building constituencies and champions for science, technology and innovation (STI) in Africa.
- call for member states to promote Africa's research and development (R&D) and to develop innovation strategies for wealth creation and economic development by allocating at least 1% of GDP by 2010.
- agreed to revitalize African universities, many of which have declined due to dwindling support over the last few decades.
- Agreed to promote the study of science and technology by young people.

Strengthening the decisions stated above and according to Abwao[4], the executive director of the Nairobi-based African Academy of Sciences (Stephen Agong) said: "Declaring the year for science innovations is an important beginning but will require strong backing so that good show cases and practical scientific work is brought to the people's attention".

Most African leaders have leaved short of transforming their political pledges into feasible programs for science-led development. According to Mutume[5], Sub-Saharan African contributes about 2.3 % of world gross domestic product but is responsible for only 0.4% of global expenditure in research and development (R&D). He continued that "with 13.4% of the world's population, the continent is home to only 1.1% of the world's scientific researchers. It has about one scientist or engineer per 10,000 people, compared with 20-50 in industrial nations". Although Africa is home to more than 15 percent of the world's population, it produces less than 1.5 percent of the world's scientific knowledge, as measured by articles in peer reviewed international journals.[6]

Social Stressors in Developing Economy

Many African and other developing countries, as well as organizations such as the World Bank, United Nations, and African Union are developing frameworks and investing resources to counter social stressors such as unemployment, diseases, poverty, hunger, regional and international conflicts, illiteracy, environmental pollution, and social inequity. Low to mid-income countries in Africa are particularly vulnerable to stressors because of the inadequacy of risk management systems such as regulations, policies, technical support systems, data generation/research/educational support systems and enforcement capacity. The predictable results are that unemployment and lack of other socio-economic support systems constrain millions of people to slums, shanty towns and ghettos that are characterized by hazards.

[3] Eight African Union Summit - *Briefing Note*, *Volume 7 Issue 2*, Wednesday, 7 February 2007

[4] Abwao, Knnedy K.: "2007 to be Africa's scientific innovations year", Science and Development Network News, views and Information about Science, technology and the developing world, January 30, 2007.

[5] Op. Cit

[6] Hassan, 2009, Op. Cit

Research Tools for Advancing Technology

In order to experience the desired impacts across major domains of the economic sector, academic and research programs are designed to cover a critical mass of supporting science and technology disciplines and issues. There is a need for curriculum reforms that emphasize new methods of teaching and learning inquiry-based instruction and problem solving research. Advancement in science and technology is built on well planned and effective capacity building process resulting from good governance and efficient leadership. Capacity building can be achieved through three-legged but interrelated approaches,[7] namely;

1. ***Primary approach:*** This involves education through teaching and instruction to train and retrain middle man power.
2. ***Secondary approach:*** This involves man power development through research. Effective research outputs can be achieved by imitation followed by perfection.
3. ***Tertiary approach:*** This involves implementation of effective research results and effective leadership.

Figure 1 illustrates the three-legged approach for successful implementation efficient capacity building process.

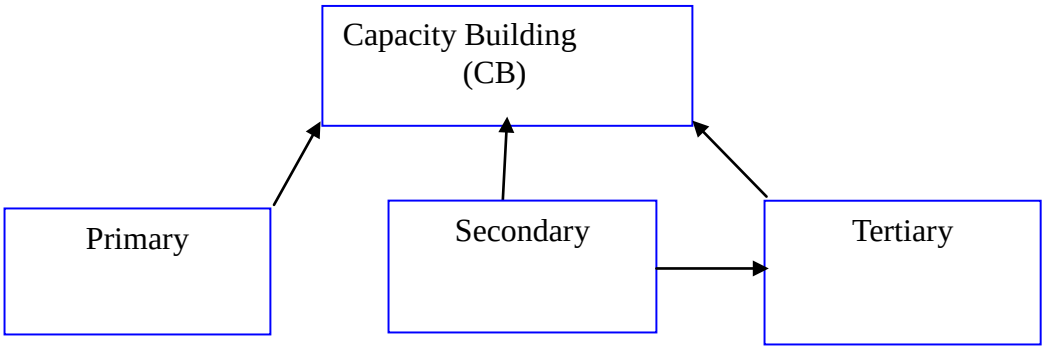

Figure 1: Three-legged capacity building approach (Chukwu, 2010)

Each of the approaches has its own task requirements and support instruments as shown in Table 1.

[7] Chukwu, G.A.: "Research and Human Capital Development in Nigeria", Paper presented at the *International Conference on Education and Vision 20-20-20 (Diamond Lecture Series)*, International Conference Centre Abuja, November 2, 2010.

Table 1: Task Requirements and Support Instruments for Each Approach

TASK REQUIREMNTS	SUPPORT INSTRUMENTS	LEVEL OF APPROACH
• Recruitment and Training of students of great potential in adequately equipped facilities	• Setting of appropriate admission processes • Fundraising for facilities development • widely cast advertisement of academic programmes • early engagement of industry on curricula	Primary
• Recruitment and support of the best researchers, educators and administrators into an effectively managed organization	• Use excellence as base-level criterion • Target diasporans, locals and others • Provide incentives in addition to salary • Delegates responsibility and empower leaders	Secondary
• Intensification of research alliances internally and externally, and elevation of the quality and quantity of research output	• Target major issues with centers • Create leadership role through early involvement • Publish in high-quality journals and lead major conferences • Develop high utility models, products and technology	
• Engaged of policymakers, agencies, corporate organizations and foundations within and outside Africa	• Avoid ivory tower mode of operation • Create on-campus events for their participation • Develop projects of common interest • Develop contacts list of relevant players	Tertiary

The main stream of a nations technological breakthrough is the establishment of well equipped, efficient running and well structured research centres that focus on critical issues that result to national and regional economic growth. The main mechanism for research productivity from such centres will be measured by research grants, publications in high quality scientific journals, patents, policy impacts, and quality of research facilities. The centres will serve as an avenue for man-power training and development at lower, middle and upper class labour force. These centres when fully operational, can serve as both national and regional research hubs for scientific excellence. It is through such centres that interdisciplinary research cooperation that can eventually involve researchers from all disciplines of science and engineering will emerge. Interdisciplinary team effort is the secret of technology breakthroughs and advancement and hence, growth and enhancement of capacity building. Technology breakthroughs are not achieved by

single-discipline interest groups or experts but by combined teams of contributors with varied interest and background. Nigeria and any other nation can only achieve desired success in effective technology advancement and application by integration and team efforts other than by individualization and non-approach mechanism.

RESEARCH SUSTAINABILTY THROUGH LINKAGES

Mechanisms that are needed to accomplish the desire to advance the nation's economic growth through science and technology should go beyond pure research and class room instruction, to engagement in professional/outreach activities, centre to centre or university linkages, and mutual cooperation with both internal and external stake holders.
Creation of inter-university, inter-agency, industry-academia linkage programs to collaborate on research and technology development through research findings will enhance research productivities. Such linkages can result to; joint publication of research findings in widely accepted media for critical and professional review; support for staff/student/faculty research activities to avoid duplication of efforts; creation of effectively controlled and accessible database of experts, research interests, and research funding organization.

Conclusion

Effective integration of research findings and practical application are strategic tools for economic growth. Reforming, efficient financial support of universities and research centres represent critical steps in achieving technological breakthrough that can revitalize a nation's economy. Capacity building and development, and economic growth can be achieved through training, research linkages and cooperation under effective leadership and management system. Following this, individuals can be empowered with knowledge to build and provide tools to enhance technology other than being provided the tools as a finished product.