Transferring Best Practices for Uganda Technological Innovation and Sustainable Growth

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ABSTRACT
Uganda, like many other African countries has not been developing primary science, technology and innovation Indicators and to make them accessible to public and private sector decision makers for social economic development and investment purposes. Indicators have not been given serious attention as engines of long-term development. This paper reports the results of a research undertaken to develop a set of relevant science, technology and innovation Indicators for Uganda. From a population of 7,336 firms, 300 firms were sampled for innovation surveys and 200 institutions for the Research and Development survey. The data collected were represented in tables and was grossed up. Data entry was taken in CSPRO and the analysis was done using STATA statistical software. There is a global perception that businesses in developing countries like Uganda are generally dominated by Small and Medium enterprises; and that is where most innovations were happening. This paper will discuss the core indicators of Research and Development (R&D) and Innovation; the empirical data of the state of Uganda's Science, Technology and Innovation Indicators. The paper further explores the potential benefits and the best practices in incubation process. The major conclusion is that prioritizing science and technology policy will create more opportunities and build capabilities for innovations and technology. The monitoring of industry, government and university R&D programs is crucial to successful policy making and analysis.

Keywords: Business Incubation, Innovation Indicators, Research and Development Indicators, Triple Helix, Uganda

1.0 INTRODUCTION

1.1 Background

Uganda is an agro-based land locked small open economy country with a population of about 30 million people. With its endowment of natural resources and salubrious climate, Uganda's industrial profile is still dominated by agro-industry and not innovation led. However, the government is aggressively promoting value addition, competitiveness and industrialization as a whole. Both theoretical and empirical literature shows that a high degree of efficiency in the industrial sector can contribute to increased production, product innovation, high value manufactured exports and high foreign earnings. It is through industrialization that wealth can be created and higher incomes realized from natural resources and raw materials transformation. This requires a set of core competences such as skilled human resource, technology, access to finance and infrastructure which enable competitive transformation of

inputs into outputs (products or services) which can be traded in markets. Technology offers the possibility for increased quality, productivity, speed to market and the potential for satisfying unmet human needs.

1.2 Measuring Science, Technology and Innovation Indicators

Innovation is not a one way sequence unleashed by scientific development only, but rather an interactive process that largely exceeds the boundaries of formal R&D activities. Innovation requires talent and talent is mobile which can be attracted anywhere in the world. The development of new information and communication technologies (ICTs) opens up unprecedented opportunities to ensure universal and access to scientific data and information to enhance the global knowledge pool. This new perspective of innovation process is well captured in the so called "Open Innovation" according to Chesbrough (2003).

Evaluations and policy-relevant assessments are based on relatively sophisticated combinations of statistics on R&D and innovation, such as various input, output, and process indicators. With the recently developed National Development Plan (NDP), 2010 for Uganda and her Vision of "A transformed *Ugandan society from a peasant to a modern and prosperous country within 30 years*", Uganda's industrial development can be best assessed when put in the context of global trends. Achieving the NDP strategies, the New Economic Partnership for African Development (NEPAD) Consolidated Plan of Action, etc. involves focusing on performance of outputs, outcomes and impact. The comparison can be disconcerting but without a reality check it is hard to appreciate what is at hand and the remedial strategies required.

1.3 Problem Statement

Science, Technology and Innovation Indicators are crucial for monitoring global scientific and technological development trends. Indicators are useful for formulating, adjusting and implementing STI policies. Uganda like many other African countries has not been developing primary science, technology and innovation indicators and to make them accessible to public and private sector decision makers for social economic development and investment purposes. Without indicators, little will be known about R&D activities and the status of innovation, performance and position of the state within local and global markets will be missing.

1.4 Main Objective

The purpose of this research was to develop and establish a set of relevant science, technology and innovation indicators for Uganda. It will make important contributions to both intellectual understanding and broader practical developments for STI policy.

2.0 METHODOLOGY

2.1 Study Approach

The survey followed the Frascati Manual Guidelines and Oslo Manual developed by the Organization for Economic Co-operation and Development (OECD). The survey was carried out through questionnaires for both qualitative and quantitative questions. The qualitative questions covered information about product and process Innovation as well as organizational and marketing innovation, source of information and partners in R&D and innovation activities. The quantitative questions covered the basic economic information of the institution or business, the expenditures, number of personnel, the outputs and sales, among others. Though the survey was both qualitative and quantitative, the paper has focused on the quantitative results. A population of 7,336 firms for the survey, covered years 2006, 2007 and 2008.

2.2 Sampling Method

The sampling frame was the VAT register, formal sector firms. The average annual turnover was the stratification variable for size. The sample for R & D had a sectoral coverage of 9 sectors: Agriculture and Fishing; Mining and Quarrying; Manufacturing; Electricity, gas and water; Trade; Transport; Finance and Insurance; Real estate and business services; Community, social and personal services. A total of 300 businesses were sampled for Innovation surveys while a total of 200 institutions including, Government, NGOS, Higher education & Research Institutions, and business sector/Private companies were sampled for the R & D survey. For Government both budgetary and non-budgetary institutions were sampled.

2.3 Data Collection

Three different questionnaires were designed to cover the following; Business, Government, NGOs and Public Institutions, Universities and Research Institutions for Research and Development survey. For Higher institutions of learning, questionnaires were administered to specific selected faculties in both public and private universities and research Institutions. The approach to measuring innovation and Research and Development indicators was based on empirical survey results from public and private sectors and academia with structured questions including size of the firms, technological innovation, expenditure on R&D, source of funding, researchers by sector and factors constraining innovations. Stakeholder workshops were also conducted in 2009/10.

2.4 Data Analysis

Questionnaires were checked for completeness and consistence and information was requested from respondents where further clarity was required. Data entry was taken in CSPRO and the analysis was done using STATA statistical software. The data collected were represented in tables and was grossed up. Once data was analyzed, it was matched with the available data from other administrative data sources and this was the first major innovation and R&D survey in the country.

3.0 RESULTS

The following paragraphs summarize the results of the investigation through surveys.

(a) Innovation Survey Indicators

(i) Number of Innovative firms by employment size

Table 3.1: Number of Innovative firms by employee size

Employment Size	Innovative Firms			Non-innovative firms		
	2006	2007	2008	2006	2007	2008
Between 1-9	904	996	936	674	396	316
10 - 49	928	952	1,103	1,375	1,447	1,813
50 - 249	382	489	526	1,614	1,713	505
➢ 250	108	110	110	0	52	182

(ii) Percentage share of firms that introduced innovations and performed R&D among innovators

Table 3. 2: Percentage share of firms that introduced innovations and performed R&D among innovators

	Product Innovation	Process innovation	Service Innovation	Performed R&D
Percent share of firms that introduced	28.2	7.5	11.8	9.5

(iii) Totally new to the Ugandan market (product, service and process) by year

Table 3. 3: Percentage share of firms that introduced totally new to the Ugandan market and their turnover by year

Year	**2006**	**2007**	**2008**
Share in percentages	45.3	50.2	68.4
Percentage Turn Over (UGX) of Innovative businesses	53% (out of 1.6 bn)	48% (out of 2.8bn)	60% (out of 2.5bn)

(b) Research and Development Survey Indicators

(i) Gross Domestic Expenditure on R&D (GERD) as an Indicator of R&D Activities-in Uganda (2007)

Table 3.4: Gross Domestic Expenditure on R&D (GERD) as an Indicator of R&D Activities-in Uganda (2007)

	Total	Business Sector (BERD)	Government Sector (GOVERD)	Higher Education (HERD)	Private Non-Profit (PNPERD) incl. donors
(GERD) by Sector of Performance	359.8	14.8	165.5	179.5	-
Percentage Shares	100.0	4.1	46.0	49.9	-
By Source of Funding	100.0	4.2	37.1	46.0	12.8
Researchers by Sector of Employment	100.0	4.7	50.2	45.1	-
R & D personnel by Occupation Total (HC)	1768	89	889	790	NA

(ii) GERD by Type of R&D:- Basic Research 10.2%, applied research 59.3%, Experimental research 30.5%

4.0 DISCUSSION

Survey results and analysis revealed that Uganda needs to do much more in supporting research and technological innovations. Uganda is grossly deficient in technology and lacks adequate indigenous capability of technological masterly. There has been little attention paid to the generation of minimum level of indigenous technology necessary to absorb technology from foreign sources and adapt them to gain comparative advantage in the market. Observed also is cultural deficiencies in entrepreneurship, low level of competitiveness, concerted policy making efforts notwithstanding. There are other bottlenecks that must be addressed, like inadequate infrastructure, limited access to credit, weak industrial support institutions, etc (GOU, 2008)

In respect to measuring science, technology and innovation indicators, there are now many indicators of activities such as, knowledge creation (R&D performance and funding), knowledge transfer (invention, innovation,), knowledge use (diffusion of knowledge, technologies and practices), and knowledge infrastructure and governance (the development of human resources for all of these) (NEPADOST, 2006).

The common core indicators of Research and Development are: (i) Researchers (head count); (ii) Gross Domestic Expenditure on Research and Development (GERD) activities by source of funds, performance sectors and type of research; (iii) R&D personnel by level of qualification and function (iv) Researchers by gender and field of study; (v) Government, higher education and business enterprise expenditure on R & D (OECD, 2002).

The core indicators of innovation include: firm general information; product and process innovations; organization and marketing innovations; innovation activities and expenditures; sources of information and cooperation; effects of innovation and factors hampering innovation activities; and intellectual property rights (OECD, 1997)

Comparing the innovative performance with respect to the employment size as in Table 3.1and 3.3, as a general observation most innovative firms had fewer than 50 employees according to the survey. There is a global perception that businesses in developing countries like Uganda are generally dominated by Small and Medium enterprises . Some of the countries such as those in North and South America, European Union, China, Asian tigers, and South Africa that have promoted Research and Development, incubation and growth of innovative firms, have realized the benefits of technological innovation, science and technology development. This can be observed in the World Economic Forum reports, the Global Competitiveness Index reports, and the NEPAD Africa's Science and Technology Consolidated Plan of Action of 2005.

Uganda, although the results are still low, it is progressively increasing support to science and technology development. This can be explained by the number of foreign direct investments that has increased in Uganda since 2005, and also by the government's policy on liberalization and improvement of the conditions of doing business in the country and the recent support from the government to research and development as indicated in Table 3.4.

With respect to R& D indicators in Table 3.4, such as No. of R& D personnel agrees with the data given by the Uganda National Council of Science and Technology; and United Nations Educational, Scientific and Cultural Organization (UNESCO), in S&T database 2007 indicated that GERD as %age of GDP for Uganda was in range of 0.00- 0.25; Researchers per million inhabitants was between 0 – 100. , As reported by the World Economic Forum, Uganda has some good scientific research institutions geographically concentrated in and around Kampala. Also from the data, in the Ugandan situation, the product and service innovators share of firms was found higher than the share of firms that introduced process innovation. This analysis concurs well with the Global competitiveness Index 2007 where Uganda's economy was ranked fairly well in innovation (position 73,) and in market efficiency (position 85). (Wagner *et al*, 2008).

In respect to transferring best practices, traditionally Uganda's universities were involved in education and basic research, but have recently become engaged in supporting business development activities, such as business/technology incubators. To increase entrepreneurial talent and support outstanding ideas, they have undertaken curriculum development for courses on entrepreneurship, coordinated business plan competitions as well as providing entrepreneurial outreach programs. This is part of triple helix in problem identification,

solving and strategic brokering that characterize technology transfer, collaboration and open innovation.

To guide government support measures, the most relevant policies in respect to technological innovation and industrial sustained growth that have been put in place include; the National Industrial Policy-2008; Science, Technology and Innovation Policy-2009; Trade Policy-2007; Energy Policy, harnessing and utilization of Information and Communication Technology, Uganda has in addition adopted the African Science, Technology and Innovation Indicators Initiative under African Union coordinated by the New Economic Partnership for African Development (NEPAD).

Based on the definition of Open Innovation "*that valuable ideas can come from inside or outside the firm and can go to market from inside or outside the firm as well as they look to advance their technology*" (Chesbrough, 2003), to foster innovation and promote entrepreneurship development in business incubators for open innovation, the potential benefits are from: interactive and dynamic capabilities through knowledge, technology and market exchanges unbounded and at low cost from users, employees, suppliers, customers, researchers, etc. New knowledge, skills and services will be incorporated and diffused in a more significant way. Different firms during the survey had differing capabilities for interaction and this resulted into minimizing the risks, maximizing innovation outcomes, skills enhancement, and collaboration

Business incubators relate to internal and external logistics, commercialization systems and support services which respond to requirements of job creation, improved productivity, rapid product introduction, entrepreneurial development, industrialization and economic development.
The study shows that the best practices in incubation process include but not limited to; selecting good location and planning functional buildings; building a dedicated, trained management team; selecting potential entrepreneur tenants; identifying strong sponsors; mobilizing investments for incubators and tenants; Adding value through quality services for tenant companies; creating strong linkages to professional and business communities; monitoring performance and assessing impact; and a clear mission and strategic planning for the future.

5.0 CONCLUSIONS

From the research findings and analysis, it can be concluded that this aim of developing indicators has been achieved and can be improved upon by a series of other surveys. The information compiled can be used to improve the existing policies and STI strategies. For Uganda to build incremental domestic technology capacity and local innovators,

- it will rely on the development of a robust public-private partnership domain for sufficient funding.
- Adopt best practices in technology transfer, such as the use of indicators, and the reports to cover indigenous innovation status as well
- To improve on the awareness and the quality of the data for international comparisons, publish and disseminate the results
- There is need for adequate financial resources for technical, statistical and analytical capacity and tools to aid planning, management and monitoring of the sector based on sound evidence. It will also be possible to jointly monitor and analyze the relationship between R&D, innovation, productivity and other dimensions of firm performances.

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