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Strengthening Institutional Capacity for Science, Technology and Innovation in Uganda¹

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1. Introduction

The contribution of science and technology to development is well observed world over and has been repeatedly emphasised in Uganda as a development priority. This however, may not take place unless institutions that favour technological innovations and investments into science and technology knowledge systems are considered. Investing in science and technology is the global new catchword not only for individual countries but also donors, such as the World Bank. The new focus on science and technology in Uganda calls for right institutions if Uganda is to benefit from investing in S & T. I hypothesise that promotion of science, technology and innovation cannot take place unless right institutions are put in place not only to allow generation of scientific knowledge but also to allow diffusion of this knowledge. This paper is about strengthening institutions for science and technology in Uganda. The paper discusses institutions and the institutional challenges for the promotion of science and technology and proposes the nature of institutions required for S & T to transform society.

In the recent years development initiatives have centred on the role of science and technology (S&T) in promoting and sustaining development. The emphasis by Uganda's president on the need for promoting science and technology is a reminder that the world revolves around science and that scientific innovations are the ones making the world revolve. The call for developing and teaching science and technology in schools however should also put into consideration the institutional requirements for the technological development to occur. This paper discusses the different institutions that can positively contribute to the development of science and technology in Uganda.

The World Summit for Sustainable Development (WSSD) held in Johannesburg - South Africa in 2002 centred on key role of S&T in sustainable development. The United Nations Millennium Project task force on science, technology, and innovation reiterates the need to harness science and technology sustainably to accelerate development. The development distance between different countries is now being attributed to the levels of science and technology in these countries. Thus,

¹ An earlier version of the paper was presented at Pre CHOGM Symposium "Science and technology for social and economic transformation in Uganda" 13 - 15 September 2007, Lake View Hotel, Mbarara

The lessons of the last two centuries have shown the crucial difference between having and not having the science and technology capability, even for countries with vast natural resources. The difference lies in being able to exploit these resources themselves or be exploited by others. In this new century, the winner will be the one who can, with capability of science and technology and innovation, extract the most value out of them. www.logelproject.org 15/07/07

Apart from the expected or direct benefits for the promotion of science and technology, the new lending “conditionality” for developing countries is the promotion of science and technology or funding geared towards the promotion of science and technology. Therefore, recent funding requirements by donors such as World Bank is that recipient countries can only benefit from donor funds and aid if they put in place “right” institutions to promote science, technology and innovation. This requirement is based on the premise that promotion of science, technology and innovation cannot take place unless right institutions are put in place not only to allow generation of scientific knowledge but also to allow diffusion of this knowledge². The new focus on science and technology in Uganda calls for right institutions if Uganda is to benefit from investing in S & T. This paper is about strengthening institutions for science and technology in Uganda. The paper discusses institutions and the institutional challenges for the promotion of science and technology in Uganda, and proposes the nature of institutions required for S & T to transform society. The paper is guided by the following questions:

- a. What are institutions?
- b. What are the existing institutions in Uganda?
- c. What institutions are required for science and technology to develop and to transform Uganda?
- d. How can these institutions be strengthened for S and T to be effectively generated and utilised?

The paper proceeds as follows; section one conceptualises institutions of science and technology. Section two discusses the different institutional requirements for the promotion of science and technology, section three discusses the institutions for science and technology in Uganda. Section four discusses institutional challenges for the promotion of science and technology in Uganda, lastly section five draws conclusions from the discussions.

2. What are institutions?

Narrowly conceived institutions refer to structures such as research and technology institutes, universities and technical colleges set up for promotion of innovation. Broadly, institutions may be conceived as to include political habits, practices, norms and rules regulating relations and interactions among people.

Technological knowledge is crucial to development. However, designing the right institutions to absorb, retain, advance and sustain knowledge, has turned out to be much more challenging. The efficiency with which knowledge is created and diffused depend on a variety of institutions promoting innovation. It is worth mentioning that the failure to

² It is not the intention of this paper to discuss science and technology as a new lending conditionality for developing countries, but to appraise the institutional requirements for the success of technology as conditionality.

innovate and promote benefits of science and technology is often due to failed institutions. This failure is further compounded by the gap between scientific knowledge generation systems and diffusion mechanisms. Scientific knowledge is erroneously seen as that generated in laboratories. Little attention is paid to the modes and mechanisms of diffusion and how this knowledge and skills could fit into existing systems. Thus, Chataway, Smith and Wield (2005: 3) argues that,

capacity building in science and technology enables innovation that can enable countries meet their development goals and improve people's lives. But innovation is not something that happens in sophisticated research laboratories, it can happen also by developing new and effective approaches and institutions.

The process of innovation is not only confined to formal arrangements, it involves significant elements of informal collaboration, learning and exchange of knowledge between individuals, organisations and across disciplines (Joanna Chataway, Smith, & Wield, 2005b). Science and technology should be understood as far from the conventional sense of building stocks of research infrastructure and trained scientists. Science and technology designed to work as self-contained activities are insulated from the very systems they seek to influence. This gap between science and its market is rooted in old thinking that equates science and technology generation through formal research with innovation. This conventional view promoted the mistaken notion that scientists and technology specialists, through their research organisations, were the innovators and producers of new knowledge. Research and emerging global challenges such as environmental, diseases, climate change and poverty however, show that scientific innovations cannot provide solutions if insulated from other disciplines. Thus, Nightingale and Scott (2007), point out that the justification for public funding of the biological sciences is "... largely at odds with the outcomes because major causes of illness, such as poverty, lack of education, and poor housing and healthcare are social and political issues that are poorly addressed by the current science-intensive research systems". Thus we need to draw on more inter and multidisciplinary research and take into account that science and scientists do not exist and may not work in isolation, they do so within a network of other actors and require a supportive environment. A look at the collaborative and coordinating institutions becomes crucial for successful science, technology and innovation.

For the promotion of science and technology, we need to create different institutions that facilitate innovation, diffusion of knowledge and change, in addition to formal institutions for science, technology and innovation. Thus we need to create coordination, reward systems, accountability and governance institutions. The discussion that follow, focuses on different institutions necessary for the promotion of science and technology in any given country or community.

2.1 Institutions for coordination

There is need to build institutions that allow proper exchange of knowledge between different systems and actors. Whereas innovation is crucial for development, it is noted above, that diffusion of knowledge is much more required for sustainable development. There is therefore, a need for the existence of strong institutions to coordinate different actors and to promote proper integration of scientific knowledge into development goals. It is in this light that the Uganda National Council for Science and Technology (UNCST) was established. Thus, one of the objectives of the UNCST is coordination of all scientific and technological activities

in the country through national programme geared to the national socio economic development and one of the strategic goals of the institution is to “improve or streamline national science and technology policy environment to foster scientific and technological innovation” . <http://www.uncst.go.ug/index.php/about-us.html> accessed on 27/10/2011

2.2 Governance and accountability

For the promotion of science and technology, enormous funding for research and human capacity is required. However, funders are attracted to organisations whose governance structures are clear and solid enough to ensure monitoring of results and financial accountability. The strengthening of governance systems will allow organisations to redirect funders from funding specific projects to providing funding for a wide range of projects and programmes. In addition governance and accountability institutions will observe that funds and research grants are utilised in a transparent manner and according to set goals, standards and that researches conducted are in tandem with national development goals and priorities.

2.3 Need for local systems that enhance the capacity to innovate

One of the most pressing needs in Africa in general and Uganda in particular, is to build local systems that enhance the capacity to innovate. Local systems to generate and apply knowledge and information are necessary to build absorptive capacity, accelerate poverty reduction, manage natural resources, better boost productivity, compete in local and export markets and improve well being.

To make the above a reality, there is a need to take into account local needs and contexts. The understanding of local needs and local context includes taking account of local abilities to find solutions. Local citizens should be involved in providing solutions for problems and challenges they face. Consultations with local communities should be made to find out if there are alternative technologies at the local level which can be improved instead of imposing new technologies on them. In addition, science and technology should be demand driven so as to address local needs.

2.4 Reward systems

There should be continuous support of scientists and researchers in the field of technology by rewarding excellent scientists and innovative researches. In its objectives, UNAS aims at establishing “a regular award scheme for recognition of outstanding achievements in science that are pertinent to the prosperity of Uganda”. The presidential award scheme for best scientists was put in place to recognise science and innovation.

2.5 Ethical, legal and Quality Assurance (QA) institutions

Ethical considerations consider the way research is conducted, protection of research subjects and use of other people’s research. In some instances this may be influenced by the existing legal systems. In this regard, one of the challenges facing researchers is the assurance of protection and patent rights. Uganda still remains miles far from granting patents to its renowned researchers. Therefore, sharing of researches and innovative knowledge is still limited. Individual scientists are not free to pronounce/share the process of their researches to

fellow scientists, because of lack of protection of their rights. Legal institutions are meant to create an enabling environment for innovation and technological diffusion.

In the agricultural sector, access and use of technology depends on an enabling environment, thus, “the ability of the agricultural innovation system to be able to access, use and diffuse knowledge embedded in agricultural technologies depends on the presence of an enabling framework that supports the emergence of technological capabilities by strengthening existing linkages, promoting new linkages and fostering inter-organisational learning that leads to capital accumulation and technical change. Such an enabling environment, by definition, is one that strengthens the absorptive capacity of local actors while protecting their interests through a policy framework that recognises their legal rights and privileges, linkages, socio-cultural norms and historical context” (Bartel 2010 at <http://www.atdforum.org/journal/html/2009-34/11/> accessed on 26/10/11). An enabling environment for technology and innovation in agriculture is defined as one that provides the actors, skills, institutions and organizations required to promote the use, dissemination, diffusion and creation of knowledge into useful processes, products and services. This is one that promotes right laws, structures and systems; systems that allow innovation for example systems that allow patent rights and promotes individual initiatives by being recognised as sole claimants to their efforts and contribution to technological innovation.

Apart from legal and ethical institutions, the quality assurance institutions should be in place to promote science and technology. For example, the Uganda National Bureau of Standards (UNBS) not only challenges the quality of products, but also challenges the processes of production and the technology used in the production. Ministry of education is in charge of observing quality of teaching science and technology in schools. For example, it is a requirement that every secondary school to get registration as a teaching institution should have science laboratories. And to qualify this requirement, physical science subjects - biology, physics and chemistry were made compulsory for all students.

2.6 Policy institutions and sub-systems

Developing an appropriate science and technology policy requires the involvement of multiple stake holders and to put into consideration the overall development programme. In addition, developing a sound S and T policy takes a number of stages ranging from policy agenda to policy evaluation. These stages require different institutions which must be well coordinated. A sound policy will depend on the extent stake holders are involved in the whole process of policy formulation. To what extent people who technology intends to benefit, participate in the design of the policy remains the key question? Often policy designs come as blue prints; it is a top-down process with limited participation of the people the policy is intended to benefit or the implementers of the policy.

Note: The description and categorisation made above is for analytical purposes and is not a blue print. Institutions are functional and may combine different functions; reward, coordination and control, and quality.

3. Strengthening institutions for science and technology in Uganda

Uganda has gone through stages of transformation; Pre-colonial, colonial, post colonial up to the late 1980s and present day. All these stages have their own characteristics for science and technology

The pre-colonial Uganda was characterised by progressive technological innovations. Scientific knowledge and innovation can be exhibited in blacksmithing and food preservation. Setting granaries some meters above the ground protected food from dump and rodents. This is still practiced in villages. In traditional Ankole and Kigezi, some families/clans specialised and were known for their skill, innovation and technological advance in pottery making, basket weaving and black smith. Technological advance and innovations in these areas was a preserve of such families and clans. We well know of specific families called “Abahesi” literary meaning blacksmiths in Ankole and Kigezi. These families, made hoes, knives, spears and other tools, from smelt iron. Although such families continue to exist in societies in Uganda, they play a limited role in science and technology and innovation and are less recognised in the process of progress.

Their contribution to science, technology and innovation was affected by colonialism which killed family initiative through importation of the foreign hoe, china plates to replace locally made clay-pots and plates. During colonialism, institutional arrangements to foster development in Uganda did not in any way emphasise technology and science (Akampumuza, 2005). Colonial economic interests were the primary focus of institutions to foster “development”.

The post-colonial Uganda faced many challenges in which teaching of science and was confined to laboratory teaching. Studying science and technology was left as an individual choice with limited carrier or professional guidance. Schools operated without laboratories and science equipments, and sometimes without science teachers.

The National Resistance Movement (NRM) government which came to power in 1986 was the first government to institutionalise science and technology, research and innovation and to integrate them in the overall development planning. To streamline teaching of science and technology, the Uganda National Council of Science and Technology (UNCST) was established.

4. Uganda National Council of Science and Technology (UNCST)

The Uganda National Council of Science and Technology (UNCST) was established by an act of parliament in 1990 with its line ministry of Finance Planning and Economic Development. The UNCST was established as a semi-autonomous institution with the mandate to develop and implement strategies for integration of science and technology in the national development process. And to advise government in formulation of policies that enhances and fosters the integration of science and technology in Uganda’s social, economic and cultural development.

4.1 Functions of UNCST

- Provide advice to government and coordinate formulation and management of an explicit science and technology policy in all fields of science and technology.
- Promote the application and development of science and technology to serve the national socio economic development needs.
- Develop strategies and carry out activities that ensure sustainable integration of science and technology in the national development process.

- Strengthen and promote the development of human resource capacity in science and technology.
- Coordinate all scientific and technological activities in the country through national programme geared to the national socio economic development.
- To coordinate and guide national research and development

The UNCST works hand in hand with different research organisations responsible for developing different technologies in various fields. The National Agricultural Research Organisation for example, is responsible for the coordination of research in agriculture and to develop appropriate technology and plant varieties.

4.2 Research and professional bodies

There are a variety of professional bodies aimed at not only protecting the rights of scientists but also to voice new needs and requirements for technological improvements and innovation. These bodies and institutions include; national medical research council, the Association of Uganda Engineers, National Agricultural Research Organisation (NARO), Uganda National Academy of Science (UNAS) and other autonomous bodies. Each of these bodies is geared towards promoting science and technology. For example NARO coordinates research in agriculture, food and science and technology, UNAS takes a multidisciplinary approach and brings together scientists from physical, biological and behavioural/social sciences. Objective number four of UNAS is to “encourage, stimulate, design and coordinate interdisciplinary and trans-disciplinary scientific research and development. Objective number five is to “get involved in planning, convening and coordination of scientific education programmes and help in the development and nurturing of high-level scientific and technological manpower in Uganda.

4.3 Institutions of learning and innovation

The role of learning is fundamental to the development of technology, merging knowledge bases, and to maximize benefits from science and technology innovations. There is a need therefore, to create institutions to promote learning, research and innovation. Creation of education systems for innovation is crucial for science and technology capacity building and technological diffusion. I contend that there cannot be a viable science and technology policy if it is not underpinned by well designed measures for addressing issues such as, learning, technology diffusion and transfer, research and development. The need therefore to make the teaching of science in schools compulsory and the setting up different institutes that could directly link with local communities is the beginning of addressing the above challenge.

The teaching of science in schools in Uganda is a long-time practice but since the 1990s, this has received a lot of emphasis. Science subjects are emphasised and made compulsory at secondary education level, while, state funding for higher education especially in public universities is more inclined towards supporting students who excel in science subjects than counterpart arts subjects.

Universities are teaching science and technology tailored to local needs and to address development challenges. Mbarara University of Science and Technology (MUST) for example, has a variety of community oriented programs in medicine, science and

development studies. This is a move away from conventional way of teaching science and technology restricted to laboratories. Problem-based learning takes place in communities.

In the field of research, Mbarara University has had innovative researches addressing local needs. For example, in 2006, in the faculty of science, they found out that in semi-arid areas of Kashari County, the water dams without water run-offs get bacterial contamination during the dry season and are using “Mringa”-a local herb to purify water, making it safe for cattle consumption (discussion with a lecturer in faculty of science).

4.4 The family/community and utilisation of Indigenous Knowledge (IK)

As noted in the introduction, the family is an important institution in the development of science and technology in Uganda. Families utilise indigenous knowledge to process food such as making of ghee and pasteurised milk. They also use indigenous knowledge to control pests and disease; for example, the combination of cattle urine and ash to kill banana weevils, or the use of ash to protect seeds from weevils. Warren (1991) argues that development projects cannot offer sustainable solutions to local problems without using local knowledge. In fact to ignore local people’s knowledge is almost to ensure failure in development projects (Brokensha *et al.* 1980). Global science recognises the relevance of indigenous knowledge, and the world conference on science recommended that scientific and traditional knowledge should be integrated in interdisciplinary projects dealing with links between culture, environment and development in areas as conservation of biodiversity, management of natural resources, understanding of natural hazards and mitigation of their impacts. “In Ethiopia, the absence of effective linkage between indigenous knowledge and conventional ones has been identified as one of the major problems that hinder the effectiveness of the development of agriculture in general and of agricultural research and extension systems in particular” (Fenta, 2006). In agriculture and climate change mitigation, IK is very important and may be a cheaper option than modern scientific knowledge. Indigenous knowledge is most effectively used in development projects as source of innovative solutions because of its perspective of being intensively local and long term (Huysamen, 2003). Affirming use of traditional approaches to improve agricultural production is effective and relatively cheap in addition, it preserves people’s culture and tradition, and their dignity, and therefore they are easily embraced and owned by people.

It should be noted however that the traditional approaches have not received much attention at the national and international level. Most climatic change policy documents hardly recognise the use of traditional methods and approaches. In 2007 at the UN conference in Bali, indigenous people voiced concern about their exclusion from ongoing climate change debates, this was mostly done during the protests on 7 December 2007.³ In the Sahel region, the local populations in their indigenous knowledge systems have developed and implemented extensive mitigation and adaptation strategies that have enabled them to reduce their vulnerability to past climate variability and change which exceed those predicted by models of future climate change. However this knowledge is rarely taken into consideration in the design and implementation of modern mitigation and

³ http://portal.unesco.org/science/en/ev.php-URL_ID=6550&URL_DO=DO_TOPIC&URL_SECTION=201.html

adaptation strategies (Nyong F, Adesina, Elasha O. 2007). Speaking at the launch of the report of the minority rights group international in 2008, David Pulkol (a former Ugandan Minister) noted that, "There is no integration of indigenous knowledge into development planning, and so people are becoming more powerless."⁴ He further noted that the lack of interaction between the state and informal leaders is a hindrance to dealing with climate change emergencies such as drought. IK therefore, can be crucial for debates on agricultural change and climate change adaptation strategies. This knowledge need to be utilised during the process of technology development and innovation, policy and change.

4.5 Governance institutions

As earlier mentioned, these are institutions responsible for observing that there is transparency in the way research and award of research grants are utilised. Further, these institutions are responsible for observing that researches are inline with development goals and national priorities. These institutions include the committee of parliament on science research and technology.

5. Institutional challenges for science, technology and innovation in Uganda

Coordination and collaboration is limited. There is often duplication of services and activities

Diffusion of technological knowledge is still a challenge. There are also budgetary constraints. Often there is little funding available to support science and technology institutions which act as centres for research, innovation and knowledge dissemination. For example the amount of funding going to universities is far small compared to that going to administration and primary education.

6. Conclusion

This paper has argued that science and technology are crucial for development. However, the paper has emphasised that scientific and technological knowledge is only effective if diffused. There is need to create institutions that can facilitate the diffusion of technology and enable its integration in the overall development goals. The paper has argued that for the promotion of science and technology in Uganda, there is a need for the existence of institutions that would ensure that research is done in a transparent manner, and that the teaching of science and technology are in tandem with national priorities and goals. Above all the paper has argued that scientists need to be motivated not only through availing them with research funds, guaranteeing the protection of their rights as researchers but also through acknowledgement and recognition of their distinct scientific works. Despite the long history of lack of institutionalised framework for the promotion of science and technology in Uganda, since the 1990s, different institutions to promote science, technology and innovation have been established. Finally, the paper discusses that the Uganda still faces a challenge of technological diffusion and coordination of different researches and research organisations in the country.

⁴ Same as foot note 3

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