

*Full Length Research Paper*

# **Academia-industry-government linkages in Tanzania: trends, challenges and prospects**

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**This paper analyzed trends, challenges and prospects of academia-industry-government linkages in Tanzania. Using case study design, and documentary review to gather the required data, the study sought to answer three research questions: (1) what are the trends of academia-industry-government linkages in Tanzania?, (2) what are the challenges facing academia-industry-government linkages in Tanzania?, and (3) what are the prospects of academia-industry-government linkages in Tanzania? Results show that while weak linkages between academia, industry and government were a direct result of historic reasons, policy reform that ushered in the private sector, and current global trends, offered best opportunity to revitalize such linkages. The paper recommends that to speed up innovations, Tanzania should utilize bottom up innovation model (model II), approach which is market driven, participatory and problem solving in orientation, to guide its innovation endeavors.**

**Key words:** Academia-industry-government linkages, innovation.

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## **INTRODUCTION**

The role of academia in social and economic development has received fresh impetus in recent years as knowledge is widely recognized as a production factor that bears on the economy and competitiveness (Martin, 2011). However, acting in isolation, academia cannot achieve its primary goals of knowledge creation and dissemination. Synergies between academia and industry secures and influence additional resources for higher education, promote innovation and technology transfer, and ensure that graduates have the skills and knowledge required to effectively contribute to the workforce (Ssebuwufu et al., 2012). The linkages between academia, industry and government can take various forms and involve different intensities of engagement. Traditional forms of linkages include student industrial placement, staff exchanges to more complex partnerships such as business and technology incubator, industry-sponsored projects and the like. Other methods of partnership include Research and Development (R&D), training and curriculum development, and consultancy. Furthermore, enterprises may commission a specific research project, or sponsor a university chair in an area of interest.

Through prototype development, technology incubation, the creation of spin-off companies for commercialization, licensing and royalty agreements and other related-activities, universities promote technology transfer to the productive sector.

In terms of teaching and training, academia-industry activities include offering long and short term professional courses on a fee-basis to respond to the particular skill and training needs of industry. For example, we have seen in Tanzania that many higher learning institutions offer specialized training in customer care services, communication skills, project write up, to mention just a few.

Academia-industry linkages can be either formal or informal. It could be organized formally with liaison offices and technologies transfer offices and in some cases establish science parks on or near campuses to facilitate such interaction (Lundvall, 2009). Industry and the academia may set up leadership, dedicated posts, clear strategic direction, and policies for managing the effective governance of the linkages (Kruss, 2008). Informal arrangements could include guest lecture, or stakeholder

meetings to revise curriculum.

Although there is no single systematic process describing how academia-industry-government could be organized, Ssebuwufu (2012) argues that there are three models widely used as theoretical framework for understanding academia-industry-government linkages:

*The National Systems of Innovation (NIS) framework* – The model views innovation as a collective process in which firms do not innovate in isolation but within a larger system involving firms, universities, research centers, government agencies and other actors (Goransson and Brundenius, 2011). The NIS model considers all aspects of the economic and institutional structure of a country that influence the development, diffusion and use of innovations (Edquist, 2004). The model originated when Christopher Freeman and Bengt-Åke Lundvall analyzed the historical account of the rise of Japan in the late 1980s (Goransson and Brundenius, 2011).

*The Triple Helix Model*--- developed by Etzkowitz and Leydesdorff in 1997 views innovation as a product of interaction between three main actors: academia, industry and government. In this model, academia focus on establishing institutional interface structures including industry liaison/technology transfer offices, business and technology incubators, and fostering entrepreneurialism through various policies and incentives (Etzkowitz, 2008).

*Mode II Knowledge Production* --- In this model, innovation is viewed as context driven, problem-focused and interdisciplinary. Knowledge is produced in the context of application, quality control, social accountability reflexivity, and heterogeneity organizational diversity (Goransson and Brundenius, 2011). Michael Gibbons developed the model in the 1990s and distinguished it from the traditional research, which he labeled *mode I*. While in *mode I* knowledge production is investigator-initiated and discipline-based, *mode II* is problem-focused and interdisciplinary (Gibbons *et al.*, 1994).

In Tanzania, the partnership between academia, industry and government was recognized early in the formative years of the nation when it was building African Socialism (*ujamaa*). The government established and funded a number of research and higher learning institutions, aiming at producing work force with the right socialist mind, and technology innovation that would steer national development ahead. However, the linkages between such institutions were weak and the desired effect was not realized.

Following policy reform in the 1990s, Tanzania witnessed proliferation of science, technology and business research and training institutions and reorganization those established earlier. Private sector, which was discouraged under *ujamaa*, started to flourish and became the engine of the economy. However, much of the productive sector was still dominated by Small and Medium Enterprises (SMEs) with very little capital to

invest in research and development. The much-anticipated Foreign Direct Investment (FDI) has increased yearly from USD 645 million in 2009 to over USD 700 million per year in 2010 (Ngowi, 2012). The inflows have been concentrated largely in mining and tourism, hence it is yet to incorporate domestic processing and service systems in its value chains, and indeed do not have strong linkages with the academia.

The private sector, however, has managed to increase the number of university and higher learning institutions in Tanzania from only two in the late 1980s, to over 61 in 2013<sup>1</sup>. Although these higher learning institutions have managed to increase enrollment rates marginally<sup>2</sup>, and indeed graduates, the quality of its output and ability to steer innovation is still questionable as argued by Makulilo (2012). Using case study strategy, this paper therefore, investigated trends, challenges and prospects of academia-industry-government linkages in Tanzania. It aims at answering three research questions:

1. What are the trends of academia-industry-government linkages in Tanzania?
2. What are the challenges facing academia-industry-government linkages in Tanzania?
3. What are the prospects of academia-industry-government linkages in Tanzania?

## MATERIALS AND METHODS

The present paper used case study design and documentary analysis in collecting the required data. Case study is an empirical inquiry that investigates a phenomenon within its real-life context. Tanzania was chosen as a case study in analyzing trends, status, and challenges of academic-industry-government linkages. Tanzania is a typical country in Africa, that is still struggling to enhance innovation through the use of existing academia infrastructure and emerging productive sector. Data collection was mainly through secondary sources analysis.

## RESULTS AND DISCUSSION

### Trends of academia-industry-government linkages in Tanzania

The collaboration between academia, industry and government in research and innovation could be traced back to German colonial rule in the then Tanganyika<sup>3</sup> in the early 1900s. The German colonial government established

<sup>1</sup> <http://www.tcu.go.tz/index.php/register-of-universities>

<sup>2</sup> According to UNESCO (2008), the Gross Enrollment Rate (GER) for Tanzania in 2004 was around 1% compared to 3% for Kenya and Uganda and 5% for sub-Saharan Africa. The GER indicates the total enrolment in a specific level of education, regardless of age, expressed as a percentage of the official school-age population, corresponding to the same level of education in a given school year.

<sup>3</sup> Tanganyika united with Zanzibar in April 26, 1964 to form the present day Tanzania

research centers in Amani near Tanga in northern and Mpwapwa in central Tanganyika to experiment with varieties of crops and animal health. Although government funded the researches and experimentations, the output of innovation in terms of seeds, animal breeds, and pesticides found its way into settler farms all over Tanganyika. When the British took over Tanganyika under UN Trusteeship in 1919, continued with the tradition and expanded the research capability in terms of scope and infrastructure. By the time of Independence in 1961 there was a network of agricultural research stations and sub-stations which covered the entire country, but favored export commodities such as sisal, cotton, tea and coffee. Independent government, in collaboration with other regional actors had to re-organize agriculture researches to include food crops.

In 1967, government decided to adopt African socialism popularly known as *ujamaa*. The new policy, among other things, focused on agricultural transformation and rural development. The government therefore, intensified its agricultural research funding and expansion in order to support subsistence farming and rural development in general. However, while government continued funding agricultural researches, one major actor, the private sector, was absent in the picture. This was because private sector was deliberately discouraged in bid to build socialist economy. Innovations from the academia, was therefore utilized by the government itself or the cooperative sector. The arrangement created some problems as collective and government run enterprises were bureaucratic, inefficiency and lacking entrepreneurship vigor to take up innovations. The introduction of *ujamaa* policies, therefore, slowed down the pace of innovation, and indeed collaboration between academia, industry and government.

With regard to higher learning institutions and universities, its development could be traced back to the 1940s when Makerere College in Uganda served as an inter-territorial college for entire East Africa. At independence in 1961, there were three separate university colleges in East Africa, namely Makerere, Nairobi and Dar es Salaam. The three university colleges negotiated special relationships with the University of London. Subsequent attempts to rationalize courses between the three colleges resulted in the establishment of a federal institution, the University of East Africa in 1963. Each college was allocated specific disciplines: Makerere was allocated Medicine and Agriculture, Nairobi Architecture, Engineering, and Veterinary Science while Dar es Salaam Law.

In 1970, Dar es Salaam College became a fully fledged university with power to award its own degrees. The university expanded by adding units that offered a broad range of disciplines including Faculties of Arts and Social Sciences, Science, Medicine and Agriculture. Other Faculties, such as Engineering and Commerce were added later. The University of Dar es salaam remained

the only university in Tanzania until 1984 when its Faculty of Agriculture, located in Morogoro, about 200 kilometers west of Dar es Salaam, was upgraded to an autonomous institution, the Sokoine University of Agriculture (SUA). SUA came into being following recommendation from a Presidential Commission on Education, which suggested the establishment of the university to address challenges associated with agriculture in the country. The two remained the only universities until the mid-1990s when higher education was liberalized, paving the way for the establishment of private universities.

For the better part of 1960s and 1970s linkages between academia, industry and government was guided by *Education for Self Reliance Policy* which emanated from the Arusha Declaration<sup>4</sup>. The policy stressed the need for curriculum to reflect practical life skills. Unfortunately, practical skills were equated to rural life. Innovation in science and technology did not feature prominently in the policy and practice. The government<sup>5</sup> admits that in early years of independence, well until the 1970s, Tanzania had no deliberate strategies or plans for appropriate selection, acquisition and transfer of technology for effective integration of imported technologies with local capacity for R&D. Serious consideration on the possibility of broader academia to participate and contribute in the development and transfer of technology, came about in the 1980s, when the first National Science and Technology policy was enacted in 1985 and revised in 1995. The major thrust of this policy was to establish relative priorities programs for generating new knowledge and to determine strategies for the application of science and technology development in Tanzania. The broad objectives of the Science and Technology Policy<sup>6</sup> for Tanzania are therefore to:

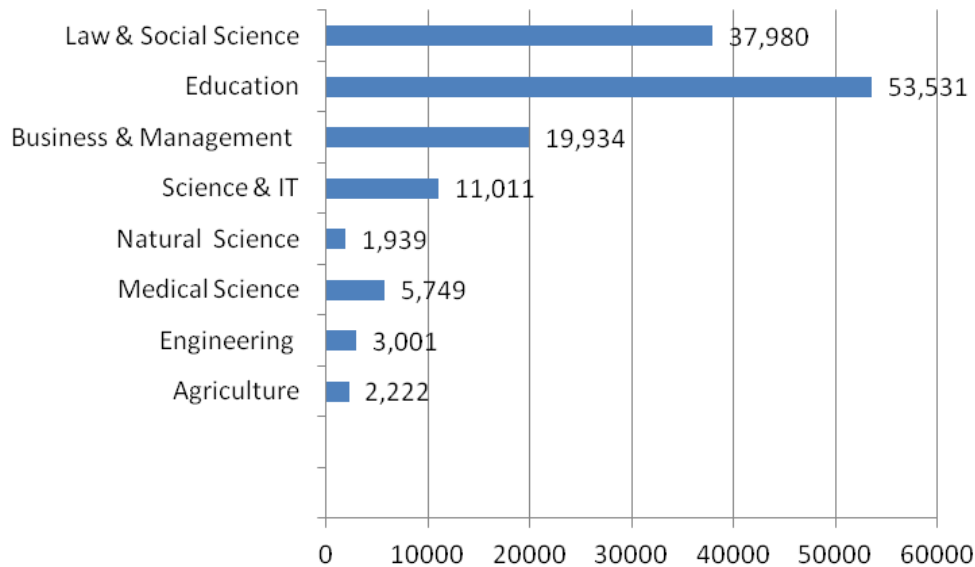
1. Promote science and technology as a tools for economic development
2. Promote scientific and technological self-reliance in support of economic activities through the upgrading of R&D capabilities
3. Promote and encourage the public and private productive sectors in developing science and technology
4. Promote active participation of women in science and technology.
5. Establish and/or strengthen national science and technology institutions

Following science and technology policy, a number of institutions geared toward coordinating innovations were established or re-organized. Tanzania Commission for Science and Technology (COSTECH) was established in

<sup>4</sup> *The Arusha Declaration* was official announcement about commencement of implementation of African socialism (*ujamaa*) policies in Tanzania. It was declared in February 1967 in the northern city of Arusha

<sup>5</sup> [http://www.tanzania.go.tz/science\\_technologyf.html](http://www.tanzania.go.tz/science_technologyf.html)

<sup>6</sup> [http://www.tanzania.go.tz/science\\_technologyf.html](http://www.tanzania.go.tz/science_technologyf.html)



**Figure 1.** Tanzanian university students' enrollment by specialization, 2010/11. Source: Tanzania Commission for Universities (TCU).

1986 to take over activities of the National Research Council (UTAFITI). The Centre for the Development and Transfer of Technology (CDTT) came about in 1994. The two institutions aimed at instituting workable mechanisms for the coordination of capacity building in the selection assessment, negotiation, adoption, research and development, information exchange and extension services. Policy thrust and economic reform of the 1990s witnessed growth and expansion of research and higher learning academic institutions. As such, Tanzania is teemed with a good number of science, technology, and business education infrastructure and R&D institutions in many sectors of the economy.

#### **Current status of academia-industry-government linkages in Tanzania**

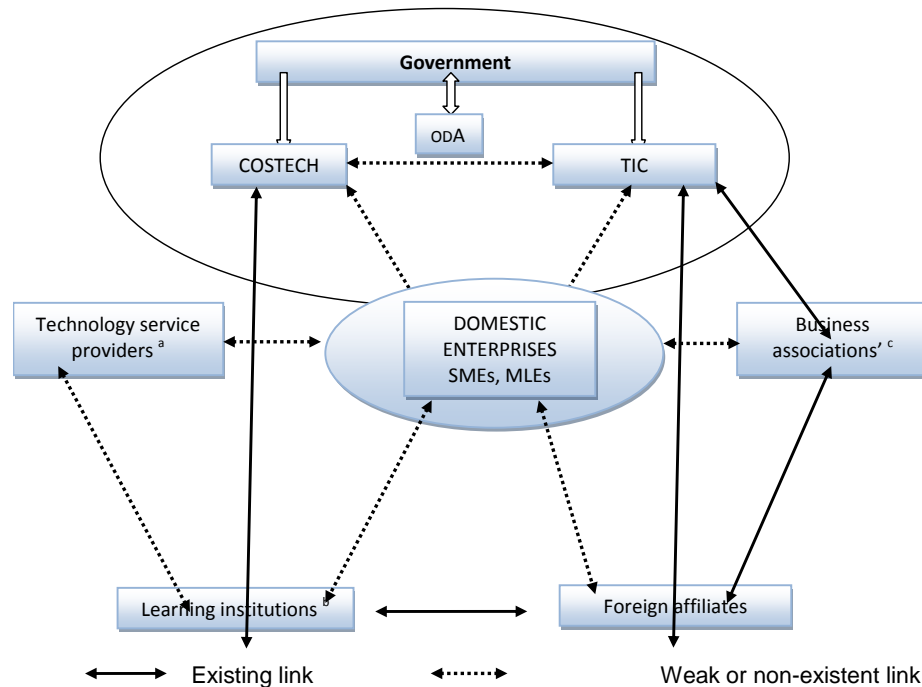
Despite the ideals envisaged in the 1985 National Science and Technology policy as revised in 1995, still no strong linkage between academia, industry and government to speak about. Serious academia-industry linkages are low and are concentrated in public universities and agricultural research institutions. Weak linkages between the academia, industry and government manifest in a number of ways. One of such is large volumes of research outputs not accessed by the intended users (Limbu, 1999). Apparently, the academia invents in isolation from real life problems. The trend points out to the situation whereby the academia concentrates in the development of the innovation and leaves transfer of the output to other agents (such as

extension officers). In this model, researchers are detached from the real life problems.

In some extreme cases, curriculums of some programs were not informed by relevant requirements of the industry leading to production of graduates with skills that are not desired by the productive sector (Makulilo, 2012). For example, while Tanzania is in critical need of science and technology personnel, majority of the students enrolled in higher learning institutions opt arts courses. Figure 1 indicates that education, law, social sciences and business courses accounted for 83% of the entire students enrolled (135,367) in the 2010/11 academic year, while science (agriculture, engineering, medicine, natural science, and information technology (accounted for only 17%). The figures not only show misplaced priorities, but inability of the academic to respond to the needs of the productive sector.

The inability of the academia to respond to the needs of the industry exist despite the fact that TCU requires all new programs to be established after industry analysis, and should be geared toward addressing industry challenges. For example, in the journalism and mass communication, there is almost consensus among researchers that qualities of fresh graduates do not meet the industry requirements (Ulimwengu, 2008; MCT, 2007; Kilimwiko, 2002). This happens at a time when there is high proliferation of journalism and mass communication training schools than at any other time in history of this country.

In attempting to understand the academia-industry-government linkages in Tanzania, UNCTAD (2002) developed the framework in Figure 2. The framework



**Figure 2.** Status of academia-industry-government linkage in Tanzania. a. National Centre for Development and Transfer of Technology (NCDTT), Centre for Agricultural and Rural Technology, Tanzania Bureau of Standard (TBS), Tanzania Engineering Manufacturing and Design Organization, Tanzania Industrial Research and Development Organization (TIRDO), Tanzania Industrial Studies and Consulting Organization (TISCO), etc; b. Universities, university colleges, and higher learning institutions; c. Tanzania National Business Council (TNBC), Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA), Confederation of Tanzanian Industries (CTI), and Tanzania Private Sector Foundation. Source: UNCTAD (2002).

shows that there is a strong linkage between government, academia, and foreign affiliates, but weak linkage between academia and industry

Due to the above named weaknesses, the most dominant forms of university industry linkages in Tanzania have remained traditional. They include internship, where students are attached to an industry for specified period to get hand on experience, consultancy services, where at least in each major university staff is engaged in one form as another of research and consultancy from the government, governmental agencies, private sector or non-government sector. Other forms of common but basic academia-industry linkages include inviting guest lecturers from the industry to talk about a specific technical issue from an experience point of view.

### Challenges facing academia-industry-government linkages in Tanzania

Analysis of the literature and field observations reveals that weak academia-industry-government linkages in Tanzania could be explained in part by historical factors,

such as the centralized economic and education system, which prevented establishment of private institutions and overemphasized the role of the government. Elsewhere, private sector has been the engine of innovation, and entrepreneurship. This means, absence of the private sector, weakened innovation path of the country in many ways. That is why there was renewed hope that academia-industry-government linkages could once again flourish following policy liberalization in the 1990s. This is because there was unprecedented growth of higher learning institutions from only two in the 1980s to more than 61 in 2012, and massive flow of Foreign<sup>7</sup> Direct Investments (FDI).

However, despite policy changes, still there is no serious academia-industry-government linkage in the country. This could be because of historical factors such as discouragement of private sector for about 23 years since 1967. Since the sector was allowed back in the

<sup>7</sup> Tanzania has recorded an 8.5% increase of FDIs in 2010. The inflow of the FDIs in Tanzania increased from \$645 million in 2009 to \$700 million in 2010 (Ngowi, 2012).

1990s, majority are still small or medium sized, meaning that they do not have financial muscles to partner with the academia. With regard to FDIs, although they have flooded the productive sector with capital and foreign technology, nevertheless, multinationals are not interested in investing or collaborating with local academia, as they perceive them poorly prepared to handle challenges presented by the knowledge economy (Goedhuys, 2005). With regard to newly established private high learning institutions and universities, the linkage with the productive sector is the weakest. This is because most of them are young having started in either 1990s or 2000s. Their relatively young age coupled with challenges in finance and basic infrastructures, explains why majority have remained teaching university rather than research and outreach centers. Makulilo (2012) argues that the newly established universities lack buildings, qualified staff, and some look like profit oriented because they are concerned much with collection of fees and making profit than anything else. In some instances, Makulilo states that some do not have a single research or consultancy to show off, apart from students theoretical papers. Indeed, they have become what Prof. Nicolas Bangu<sup>8</sup> calls 'very good high schools' meaning that they do not measure up to the university tradition of research, consultancy and outreach.

Other factors limiting private universities and higher learning institutions to engage in meaningful linkages with the industry include lack of experience, poor leadership, and huge number of students, which constrain academic staff to undertake any other activity apart from teaching. For example, majority of the newly established universities are owned by religious institutions, and its management is derived from among the clerics who have no background in academic leadership.

However, despite the aforementioned challenges, two oldest public universities in Tanzania, namely Sokoine University of Agriculture (SUA) and University of Dar es salaam (UDSM), have good examples of well crafted linkages with the productive sector that are comparable to the world standards as correctly argued by Martin (2012).

A research on African universities by Ssebuwufu (2012) shows that African and Tanzanian universities, in particular, are indeed taking initial steps to stimulate and deepen linkages with industry and the productive sector. However, the initiatives need to be scaled up and supported.

### **Challenges of creating linkages between academia-industry-government in Tanzania**

There are many challenges facing linkages between

<sup>8</sup> Remarks made by Prof. Nicholas Bangu, the Provost of Tumaini University at Iringa in 2002 during a graduation ceremony

academia-industry-government in Tanzania. First, the economy is very low and factor driven. *Factor driven economy*, according to World Economic Forum (2010), is the lowest stage of economic development where basic factor conditions such as low-cost labor and unprocessed natural resources are the dominant basis of competitive advantage and exports. Tanzania is a typical factor driven economy, mainly based on subsistence agriculture, which accounted for 27.1% of GDP in 2012 while industry accounted for 24.1% of GDP, including an important share of mining activities, and service 48.7% of the GDP<sup>9</sup>. Although following the 1990s reform, there is a substantial Foreign Direct Investment (FDI), putting Tanzania among the major FDI recipient countries of Africa (UNCTAD, 2002), such investments mainly concentrated in manufacturing, especially in the food and beverages industry. Along with FDI, an injection of capital, investment and a transfer of technology, skills and improved management were expected.

Factor driven economies are highly sensitive to world economic cycles, commodity prices, and exchange rate fluctuations. Other stages, according to World Economic Forum, are *Efficiency-Driven Economies* where a country's advantage comes from producing more advanced products and services highly efficiently, and the highest stage being the *Innovation-Driven Economies* where the country has an ability to produce innovative products and services at the global technology frontier using the most advanced methods.

However, as some studies indicate, the scale of technology diffusion from foreign firms to local firms is still limited. Transfer of know-how, design, and R&D capabilities is not observed (UNCTAD, 2002). This trend, according to Goedhuys (2005), is essentially due to two factors. First, foreign firms entering a developing country market are not typically interested in establishing an R&D entity in the local affiliate, but rather come to take advantage of local resources or demand to produce a product developed elsewhere. Secondly, human resources and technological capabilities remain poorly developed in Tanzania. To complicate the situation further, Wangwe (1995) argues that the educational and training systems have been insufficiently oriented towards science and engineering generating managerial and technical skills. Enrolment statistics from the Tanzania Commission for Universities (TCU) in 2010/11 academic year, for example, indicates that only 2% of the students opted for engineering courses. By any standards, these figures are too low to accumulate pool of innovation-ready manpower in the economy.

The second limiting factor for strong academia industry linkages is the age of most higher learning institutions. The majority of the universities came about after 1990. They are too young to engage seriously in research and innovation endeavors. Innovation is defined as adding

<sup>9</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/tz.html>

values to products and services, stimulating sales growth, exploiting new markets and formulating new organizational methods. They are still grappling with the questions of survival such as lack of operating capital, staff, basic infrastructure and management challenges as argued by Makulilo (2012). Infrastructure, here include laboratories, science parks, technology incubators and testing facilities, that could attract productive sector in seeking partnership. In such a situation, they are not expected to venture into serious engagement with the productive sector, although such an attempt could help address some of the financial challenges.

Furthermore, because of age, most of the academia do not have strong network with productive sector. This limits them to access partners and new ideas

Related with age also, is the issue of qualified staff. Snap surveys across universities in Tanzania show that the majority have critical shortage of qualified staff. The situation, however, is a little bit better in old public institutions such as University of Dar es salaam, and SUA, which commands the arguably largest share of PhD holders in the country. In other institutions, staff are too junior in terms of qualification and experience to ponder about complex but productive academia linkages such as incubators. Makulilo (2012) and other researchers, have indicated that the majority of academic staff in the newly established private and public universities are tutorials and assistant lectures. In additional, even established universities like SUA and UDSM, face challenges because their staff are sustaining other smaller universities in teaching because they are hired as part timers. Consequently, the entire academia is constrained in terms of adequate staff in some forms.

Furthermore, the academia is not proactive and develops innovation in abstract. Although one of the missions of universities is to research at theoretical level, experience elsewhere (Martin, 2011) has shown that such approach does not lead to intended innovation. Alternatively, the university and the entire academia should engage in research aimed at solving specific real life problem. This approach known in literature as *Mode II* tends to attract users immediately or during the design stage. Indeed, most of the industry and government would like to fund or be associated with an innovation that is likely to solve some problem

The academia-industry-linkages therefore, are marred by myriad of challenges that require multi-faced solution. The following sections attempt to suggest a useful framework in which such partnership could be improved and pursued on sustainable manner.

## RECOMMENDATIONS AND SUGGESTIONS

Challenges facing academia-industry-government are many, hence requires multidimensional solutions. Each stakeholder has some internal weaknesses that translate

into challenges when it comes to partnership. Further, even in established linkages such as Eastern Asia, Vogel (2012) cautions that although the concept of government, academia and industry collaboration is attractive, but its operation is always challenging. This however, is not to say that, linkages should not be pursued; rather it should be nurtured and constantly re-evaluated and re-energized. Drawing from the literature and Tanzanian experience, this paper suggests the following:

*Collaboration from within the academia itself should be enhanced*---Due to young age, most of the universities and higher learning institutions lack infrastructure such as laboratories, testing facilities, qualified and experienced staff, and experience. However, the situation is not uniform across the academia; some have well furnished facilities, but lack staff or experience. In this regard, collaboration among institution may offset these challenges. They could share the existing facilities, organize joint research and development, exchange experience and strategize together. The collaboration could be extended to training. For example, they could mount joint innovative programs as it is done in the European universities under Erasmus Mundus<sup>10</sup> program.

*Academia should grow with business enterprises*---majority of business and enterprises in Tanzania are small and medium enterprises. These entities do not have capital to invest in research and innovation. On the other hand, the academia fraternity also is small and growing. This situation should be looked upon as an opportunity for the academia to design small collaboration initiatives that would grow to serious engagement. Such small collaboration should involve little resources, but should have room for growth. It could be for example, to require finalist undergraduate students, assisted by their teachers, to study and come out with appropriate solution to a real life technology or business problem near the university. Such initiatives could grow to include postgraduate students, and even PhD candidates. The SMEs could be oriented to utilize the solution, free of charge. Later on, when such SMEs grow, such partnerships should include fees.

*Establishing a technology fund* is another way of stimulating and enhancing sustainable collaboration between academia-industry and government. The fund, possibly established by the government, should be availed to the academia and used to co-finance R&D on 50-50 basis. UNCTAD (2002) proposes that the Technology Fund should provide resources as a conditional loan, to be repaid by successful ventures. While this raises the risk of losses if a large proportion of the projects fail, experience, as documented by the UNCTAD,

<sup>10</sup> **Erasmus Mundus** is a cooperation and mobility program in the field of higher education that aims to enhance the quality of European higher education and to promote dialogue and understanding between people and cultures through cooperation with Third-Countries.

in other countries suggest that the risk is quite small. In addition to stimulating R&D activities by enterprises and the benefits that they would drive from it, enterprises would not deliberately take the risk if they were required to put up half of the capital required to initiate the project.

UNCTAD (2012) proposes that the private sector can make education more relevant to the job market, and can actively participate in curriculum development, especially in areas such as entrepreneurship. The private sector can also support educational and training provision by employing and offering sponsorship to graduates, and providing apprenticeships and assistance with projects. These private sector initiatives need to be supported by appropriate policies, including fiscal incentives.

Other recommendations include:

1. Advocacy for increased funding and support for strengthening the capacity of Tanzanian academia to develop partnerships and linkages with industry and the broader productive sector by targeting multiple stakeholders
2. Support for training, entrepreneur-in-residence programs, exchanges, and other means to develop entrepreneurial skills among academic staff
3. Venture into establishment and management of science parks and technology incubators for the purposes of technology transfer. Enhance training of faculty in requisite business and management skills to run the science parks and technology incubators

## Conclusion

Although historical factors created weaknesses in academia-industry-government linkages, reform of the 1990s and global drive for innovation and competitiveness presents right conditions for sustainable partnerships in Tanzania. In addition, despite the current challenges, Tanzania has relatively established science, technology and business infrastructure for research and development. To put the infrastructure into good use, the country need the right theoretical framework that is market driven, participatory and problem solving in orientation. In this way, the academia will attract the productive sector and government. The efforts should go hand in hand with parallel efforts at strengthening university research governance and management, science and mathematics education, and graduate training at doctoral degree level. Strengthening university capacity should entail collaboration and sharing scarce resources among the academia fraternity. The productive sector needs to be brought on board at the inception stage as active partners, while government needs to take responsibility for designing a national innovation system with appropriate frameworks.

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