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Academia-Industry-Government Relationship: Experience of the College of Engineering and Technology, University of Dar es Salaam Tanzania

by

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Abstract

The three basic objectives of CoET have a very strong bearing on the relation with the industry. Achievement of these objectives hinges on the synergic interaction of the three pillars of CoET (namely the three Faculties, TDTC and BICO), the government and the industry itself. Collaboration with Tanzania Gatsby Trust (TGT) has fostered closer linkage between CoET and many technology based SMEs in Tanzania though technology development and transfer. Though the same collaboration CoET has to interact with the responsible ministries in the government to ensure our SME intervention does not contravene existing and future SME policy.

SME survey conducted throughout the country showed that the sector is largely informal and very much under-performing due to a multitude of barriers and constraints facing it. CoET in collaboration with TGT and Carnegie Foundation of New York has identified a number of SMEs to work with under business/technology incubation project aiming at improving their production and competitiveness. The project is proceeding very well and it involves also the local district government where the entrepreneurs are located. It is envisaged that graduating incubators would form or join innovative clusters to continue being competitive.

The competitiveness element required of the SMEs and Incubators goes well with the Innovation Systems and Clusters Programme in Eastern Africa (ISCP-EA), which CoET has spearheaded since 2003, with a view to fast-tracking socio-economic development in this region. The programme advocates triple helix operation for its success.

Whereas academia-industry relationship looks reasonably strong, the government-industry or government-academia relationship has not been equally strong. Government involvement in the triple helix is, however, improving as a result of a series of awareness campaign, spearheaded by CoET, through workshops, conferences, exhibitions, publications and direct interaction with responsible officials. CoET awareness campaign is now directed to the financial institutions to ensure SMEs are funded in order to be competitive.

INTRODUCTION

The College of Engineering and Technology is aimed at:

- (i) Supplying the country with sufficient middle and high level engineering human-power as agents of development and change, thus contributing to the indigenous development of infrastructure, industry and trade;

- (ii) Performing research in the interest of suitable exploitation and local processing of natural resources in Tanzania, ultimately leading to the innovation of technical products and production processes for the local industry; and
- (iii) Providing expert professional services in the form of consultancy to industry as well as public and private organisations and institutions.

Achievement of the abovementioned objectives hinges on the synergic interaction of the three pillars of CoET shown in Figure 1.

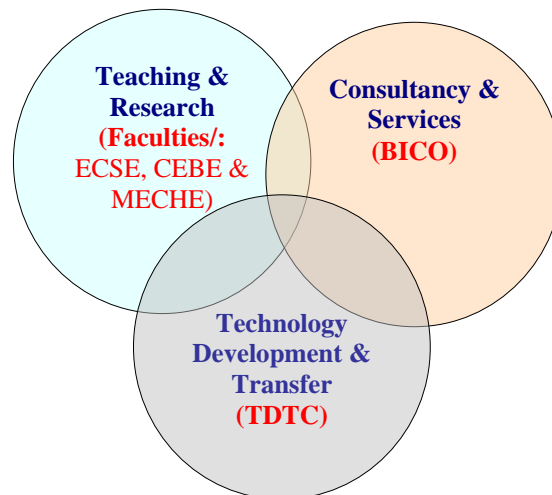


Figure 1: The synergic interaction of the three pillars, viz the three Faculties, TDTC and BICO

The three Faculties of CoET, viz. Civil Engineering and the Built Environment (CEBE), Electrical and Computer Systems Engineering (ECSE), and Mechanical and Chemical Engineering (MECHE) are responsible for academic training and research through the 13 academic Departments. All laboratories and most workshops belong to teaching Departments. Thus the three Faculties are the custodians of most of the techno-ware and human-ware available at CoET.

The College recognizes its role towards achieving national socio-economic advancement through the proper selection, adoption, adaptation and further development of technological solutions as well as development of appropriate and sustainable technologies. It is thus intended to involve all academic disciplines of the College in prototype development and technology transfer. All technology (prototype) development by College staff, technology brokerage as well as the subsequent transfer to industry is being coordinated by the Technology Development and Transfer Centre (TDTC).

TDTC aims primarily to impact on the development of SME's, on the lives of the general public through the development and dissemination of technologies that have direct relevance to the Tanzanian society.

The Bureau for Industrial Cooperation (BICO) is mainly aimed at enhancing the capability of College to contribute effectively in the industrial development of Tanzania through the provision of consultancy, expert professional services and professional advancement (or development) of engineers and technologists. Through these consultancy and professional services the college generates funds for its various activities, among which is to provide incentives to staff.

The three basic objectives of CoET are directly linked to industry. The objectives also address the Tanzania Development Vision 2025 through which is envisioned that Tanzania will have graduated from a least developed country to a middle income country by year 2025 with a high level of human development. The economy will have been transformed from a low productivity agricultural economy to a semi-industrialised one led by modernised and highly productive agricultural activities, which are effectively integrated and buttressed by supportive industrial and service activities in the rural and urban areas. A solid foundation for a competitive and dynamic economy with high productivity will have been laid.”

For Tanzania to indeed realize this vision, all able bodied and mentally sound members of this society have to subscribe towards the establishment of the expected “solid foundation for a competitive and dynamic economy”. This assertion is based on the realization that innovations in the form of new or improved products, services and processes are the basis for sustainable growth and prosperity in today’s knowledge-based society. And the success of an innovation system is very much dependent on the triple helix relationship.

This paper underscores the importance attached to university-industry linkages in ensuring that training of engineers at the CoET impacts optimally to the development of the local industry and sustainable national development.

The case of CoET collaborations with Tanzania Gatsby Trust (TGT), Carnegie Corporation of New York and the Swedish Development Corporation (Sida/SAREC) are used to demonstrate CoET’s resolve to stimulate and promote innovativeness and growth among SMEs in the country. The paper attempts to describe a process that will provide building blocks for a strong foundation for a competitive and dynamic economy, and to contribute to the process of actually laying the foundation.

SME CONTRIBUTION TO THE NATIONAL ECONOMY

Majority of Tanzania’s population is estimated to be making their living on subsistence agriculture and Small and Medium Enterprise activities. It is estimated that SMEs contribute 35% to GDP and 20 % of the total labour force. A number of studies indicate that SME entrepreneurs in Tanzania are considered to be potential in creating jobs and contributing towards economic growth.

In addition, the government has emphasized the importance of the informal sector as part of SMEs in the war against poverty. In October 2004, a Peruvian economist, Prof. Hernando de Soto, was commissioned to prepare the ground for the implementation of a programme to formalize properties and businesses in Tanzania, popularly known by its Kiswahili acronym MKURABITA. The programme is aimed at integrating the Tanzanian informal sector into the mainstream economy.

However, it is important to highlight that the report for the first phase of MKURABITA, has indicated that 98% of all businesses and 89% of all assets, especially buildings and land of Tanzanians are in the informal sector. This gave a challenge to researchers, politicians, financial institutions and development stakeholders in general, to help in making the programme a success, in order to make the properties and businesses formal so that they could be used in fighting poverty for the majority of Tanzanians.

Highlights of the SME Survey

The College of Engineering and Technology in collaboration with the Tanzania Gatsby Trust (TGT) conducted a survey of a total of 2,225 entrepreneurs country wide. Most of these were in the food sector, textile, metal work and woodwork. On a smaller scale there were also other sectors such as construction, electrical works, agriculture, shoe makers, car seat cover makers, solar equipment, mattress makers, pottery, fishing and fishing boat makers, car garages, handcrafts, detergents, plastics, etc. Woodwork is the largest sector, holding about 30% of the SME activities, followed by metal work with 23%. Food processing is the next in line at 18% followed closely by textile having 14%. All other sectors mentioned above combined have a total share of about 15%. The dominance of woodwork as an occupation for most SMEs could be attributed to continued expansion of cities and towns that demands bigger supply of construction materials as well as furniture. The trend is also aggravated by availability of raw materials save for the environmental destruction.

The survey has also shown that almost 67% of the businesses are relatively new, having been established in the last 10 years. The longer the time from when the business was established, the fewer are the businesses that still exist. This suggests that a large percentage of businesses have failed to survive due to different reasons, and one of the reasons could be that of lack of proper business planning at the start.

With regards to the number of employees, most of the SMEs had less than 5 and out of the total number of employees, the majority of the respondents, about 40% claimed that 80-100% of them were skilled. It is also known that most of the small businesses are run by family members, but the survey found that only about 15% of SMEs had 75-100% family members, while the majority, about 35% claimed to have no family members at all working in the business.

The issue of packaging was also investigated and it was found that, only a few entrepreneurs, about 15% of the respondents, do package their products. This could be attributed to the nature of the products themselves, since some do not need packaging. When the data was filtered to analyse only those in the food-processing sector, it was found that almost 50% of the respondent food processors do package their products.

The survey has shown that most of the SMEs are not happy with the way their enterprises are running due to, among others, the following reasons:

- (a) Lack of market for their products;
- (b) Lack of capital to expand their business; many are depending on meagre personal funds;
- (c) Lack of appropriate equipment as well as technology;
- (d) Lack of awareness of sources of financing as well as technical advice;
- (e) Lack of cooperation among and networking of similar SMEs.

Compilation of survey findings from the different zones to produce a country report has been completed (CoET, 2006) and the launching of the same will be done soon.

Student Projects and Practical Training

Linkage with some of the SMEs has been continued through final year undergraduate projects, with TGT financing. So far, a total of 25 student projects have been executed, 10 projects in 2002 and 15 in 2003. In 2002, all the projects were in the food processing area. In 2003, however, the scope was widened to cover other disciplines while emphasizing stronger SME collaboration. Further, five projects (out of the 15) were specifically for low cost housing related projects. For the year 2004, 28 student projects were submitted for TGT funding, out of which 15 were selected. All the projects have been completed and a compilation of the same has been done.

An impact assessment on the 2001/2002 student projects was made and revealed that results from two of the ten projects have been adopted by SMEs. These are on Clarification of Juice/Wine Using Pectrinase Enzymes, which has been adopted by M/s Solar Innovations, and Quality of Soymilk as Influenced by the Blanching Conditions which has been adopted by M/s Abantu Food Products as well as M/s Soya Hali Foods. These two cases demonstrate some degree of success in the transfer and utilization of technology developed by CoET to SMEs.

Linkage with some of other SMEs is also maintained through students' practical training. This is an annual exercise where students are attached to various engineering firms for 8 weeks. Depending on the year of study of the students' they can do small research work of benefit to the firm.

BUSINESS/TECHNOLOGY INCUBATION

Having studied and understood SME needs from the survey, it would make no sense to end there without doing something to alleviate the gravity of the problem observed. TGT, Carnegie Corporation of New York and CoET have agreed to work on a number of interventions aimed at addressing these needs, be it directly or indirectly. The Business/ Technology Incubation Project is one of the ongoing projects under these collaborations.

Decisions regarding these interventions were reached after soliciting views from the SME stakeholders. This was done by conducting workshops, following the completion of each zonal surveys. In total, four workshops were held, one in Dar es Salaam for the Eastern zone in December 2002, a second one in Mwanza for the Western and Lake zone, in December 2003, a third one in Arusha for the Central and Northern zone in February 2005, and the last was held in Iringa for the Southern and Southern Highlands zone, in March 2005. The workshops attracted a good number of participants, which included SMEs themselves as well as relevant institutions, e.g. Small Industries Development Organisation (SIDO), Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA), Confederation of Tanzania Industries (CTI), etc.

Following the first stakeholders workshop held for SMEs from the Eastern zone, incubation was deemed to be the best intervention to be implemented in the zone. Therefore three localities were selected, namely Kibaha, Lushoto and Morogoro. Initially, Zanzibar was also selected however it was later dropped due to the fact that there already is a similar initiative in Zanzibar being undertaken by the government. Therefore, focus was placed on the three locations in Tanzania mainland.

The specific objectives of the project are as follows:

- a) To promote the concept of technology incubators
- b) To identify locations where pilot incubators could be successfully established and confirm their feasibility
- c) To establish the identified incubators
- d) To provide ongoing support to the incubator tenants
- e) To ensure business sustainability of SME after graduation from incubators
- f) To disseminate the outcome of the pilot phase

The establishment of the identified incubators, involved the following major activities:

- i) Preparing business plans for incubators,
- ii) Assisting potential tenants to prepare fundable business plans,
- iii) Establishing promotional partnerships,
- iv) Identifying mechanisms for tenants' support and corresponding support providers,
- v) Recruiting incubator management teams,
- vi) Securing physical facilities for incubator operations,
- vii) Procuring equipment and machines for the incubators, and

- viii) Preparing tenants' admission and exit criteria, and
- ix) Admitting/signing contracts with tenants.

In the year 2006, the focus of the project is in the fourth objective i.e. "to provide ongoing support to tenants". The major activities involved are as follows:

- (a) Business skills/Entrepreneurship training;
- (b) Specific tailor-made trainings;
- (c) Technology incubation;
- (d) Enterprise counselling;
- (e) Information;
- (f) Legal advice;
- (g) Internal networking to encourage business relations; and
- (h) External networking for business advice, technology support, access to finance/loans and markets.

Establishment of a With-Wall Incubator at the University of Dar es Salaam

The University of Dar es Salaam through CoET, in collaboration with TGT are considering establishing an "incubator with walls", to be based at the University. This is envisaged to be the hub of all the incubators of the University. Following agreement reached in the TGT - UDSM Committee meeting held in July 2005, regarding the establishment of the incubator with walls at the University of Dar es Salaam, preparatory plans are being made to decide on the mode of the incubator, the costs involved as well as the financing mechanism for the whole venture. A proposal for the undertaking is being prepared for submission to possible financiers. Gatsby Charitable Foundation (GCF) has offered to support this initial phase in terms of expertise, while NEPAD has also shown interest and may avail some funds for the purpose. The University of Dar es Salaam has agreed to provide land for the incubator.

INNOVATION SYSTEMS AND CLUSTERS

Innovation can be defined as the capacity of a nation to adapt to worldwide changes in nature, technology and economics as well as influencing them. In this connection, population growth will trigger search for new solutions towards better chances of survival.

In a world characterized by globalisation and competition, continuous innovation is a necessary condition for every country. Absence of innovation in a country means that domestic producers will continuously lose market shares to others who are continuously innovating. As a result such countries that are not innovating will in the end also lose incomes and are therefore prone to poverty.

The fundamental factors for development of innovations include skills, the exchange of knowledge and opportunities for mutual learning as part of the interaction

between businesses, research institutions and political bodies. Research produces new knowledge, but in order to promote growth it must be converted into innovations which produce new and improved products, services and processes for which there is clear demand.

The innovative potential of a nation is determined by the following, among others:

- i) The intellectual infrastructure of the population;
- ii) The technical infrastructure, i. e. the capacity to transform theoretical scientific findings into technically feasible solutions;
- iii) The historically developed tradition of skilled trades and technical know-how in large sections of the population;
- iv) A well-coordinated education system and a consensus between educational institutions, science, the economy, and society; and
- v) People's basic mental attitude towards the development of science and technology.

Thus, an *innovation system* is constituted by interaction between production, diffusion, and use of new and economically useful knowledge. *An innovation system serves as a framework for the creation of capabilities for firms in a variety of sectors and activities.* Further, the concept of innovation systems focuses on the mechanisms that promote the synergy for generating innovations, including both the overriding macro framework and incentive structures between institutions that are highly specific for innovation. Innovation is about adapting to changing circumstances and making new things in new ways. As new ways to do things always emerge locally, the need for an innovation system hinges on the desire to stimulate adaptation to changing circumstances.

Clusters

Clustering is generally defined as a process of firms and other actors co-locating within a concentrated geographical area, cooperating around a certain functional niche, and establishing close linkages and working alliances to improve their collective competitiveness. Joint strategies and actions motivated by the anticipation of mutual benefits are greatly important in clustering. It follows from this that clusters are geographically proximate groups of interconnected companies and associated institutions in a particular field linked by commonalities and complementarities. Clusters encompass an array of linked industries and other entities important to competition including governmental and other institutions such as; universities, standard setting agencies, vocational training providers and trade associations.

Whereas all clusters may have properties that serve to speed up innovation, some can be observed to perform particularly well and hence be classified as *innovative clusters*. An innovative cluster innovates in the broadest sense of the definition, where the innovation can emanate from improvements in the way actors organize themselves, products are developed, produced, commercialised, distributed, etc.

The innovative cluster is, in principle, evolving constantly, learning from experience and able to adjust to changing circumstances. It is likely to be well-positioned to explore new opportunities beyond its present boundaries and, at the same time, combine flexibility with inner strength, stability and a sense of direction to achieve the following:

- Continuously changed traditional boundaries to knowledge generation and diffusion, by establishing linkages to wider and alternative sets of knowledge inputs;
- Re-conceptualised products and markets;
- Upgraded mechanisms for seed-funding, risk-taking and entrepreneurship;
- Transformation of old institutions and organizations through learning as well as unlearning of earlier habits and practices.

Cluster development has attained considerable attention over the last decade, not least as an operational means to enhance the competitiveness of firms and regions. This is largely due to its responsiveness to the demands of the new economy for; speed, quality, flexibility, innovation, networking and building critical mass. Thus, early establishment of the clustering behaviour is particularly important in supporting the development of competitiveness of emerging industries, and hence laying of a solid foundation for a competitive and dynamic economy with high productivity. Through clustering, even SMEs can gain the necessary critical mass to service world markets.

Innovation Systems and Clusters Programme

The CoET has spearheaded Innovation Systems and Clusters Programme in Eastern Africa (ISCP-EA) since 2003, with a view to fast-tracking socio-economic development in this region. The programme advocates triple helix operation for its success. In this endeavour CoET has been collaborating with the Faculty of Engineering at Eduardo Mondlane University in Mozambique and the Faculty of Technology at Makerere University in Uganda. In February 2004, CoET organized and hosted the 1st Regional Conference on Innovation Systems and Innovative Clusters in Africa, and in March 2005 the Faculty of Technology in Uganda organized and hosted the 2nd Regional Conference on the same theme.

In September 2005, with the support of Sida/SAREC of Sweden, weeklong and intensive training courses on the development of Cluster Initiatives (CIs) were held in Bagamoyo, Tanzania and Jinja in Uganda. The training drew participants from the triple helix, namely academia, government and the industry. Following success of the training, which was reflected by the enthusiasm and momentum exhibited by course participants, eight pilot CIs each composed of members from the triple-helix were established in Tanzania and seven in Uganda. Each of the eight CIs in Tanzania prepared action plans for a low budget implementation of the initiatives, which were harmonized in a workshop held in Dar es Salaam on February 09, 2006. These

clusters will present their progress in the third Regional Conference on Innovation Systems and Clusters in Africa slated for September 2006.

Programme Objectives, Purpose and Expected Outputs

The ISCP-EA programme has five major objectives, namely:

- (i) Research and innovation systems policy reviews;
- (ii) Implementation of pilot innovation systems and/or cluster initiatives;
- (iii) Awareness creation and publications;
- (iv) Competence building;
- (v) Coordination and follow up forums.

The intervention programme is expected to stimulate and facilitate the development of innovation systems and innovative clusters in Eastern Africa. The achievement of this purpose will be measured in terms of; enhanced innovativeness among firms and farms, enhanced competition and cooperation among firms and farms within clusters and sectors, and acquisition of competitive mindset.

The expected *outputs*, among other things, are:

- (a) A network of capable individuals interested in innovation systems and clusters formed;
- (b) Innovation systems and clusters identified and characterized for possible in-depth study (mapping of clusters and innovation systems);
- (c) In-depth study of selected clusters and innovation systems carried out, including:
 - o Assessment of extent to which they are innovative and bottlenecks for growth;
 - o Determination of mechanisms that will make innovation systems in the various sectors stronger and sustainable, and clusters innovative and sustainable.
- (d) Consolidation of potentially innovative clusters stimulated;
- (e) Innovativeness of firms and farms within pilot existing and new clusters and innovation systems stimulated;
- (f) Various advocacy initiatives implemented;
- (g) Short and long-term training in innovations, and innovation systems and clusters established;
- (h) National Steering Committees (NSC), National Coordinating Offices and a cluster development monitoring system established.

Expected Impacts

The expected impacts arising from the implementation of the proposed programme can be summarised as follows:

- (i) **Poverty reduction**

With acquisition of competitive mindset and adoption of the innovative cluster approach, productivity will increase, quality of products and services will improve and Small and Medium Enterprises (SMEs) will grow thereby generating more jobs and employment. These developments will trigger national socio-economic growth which will enable Tanzania to cope with the rigours of international competition accompanying globalisation. The resulting financial empowerment will lead to acquisition of adequate nutrition, clothing, housing, etc. and thereby subscribe to poverty reduction.

(ii) Enhanced value addition of local agricultural products and natural resources

Through enhanced innovativeness and acquisition of competitive mindset, value addition will be applied to all agricultural products and other natural resources, including minerals, before they are exported abroad. Foreign currency earnings will thus be boosted and the economy will grow.

(iii) Preservation of the Environment

Entry into international markets demands consciousness of various environmental aspects as echoed by the World Summit on Sustainable Development in 2003. Thus, enhanced innovativeness and competitiveness that qualifies for entry into international markets, will also lead to more environment friendly products and services.

(iv) Gender

Farming and nearly all home-care activities are mainly done by women. Further, most small scale food processing is also done by women. Thus, value addition of agricultural products, cheap and readily available energy saving and alternative energy sources will lead to financial empowerment of rural women and facilitate the growth of their businesses, thereby enhancing gender relations in rural communities.

(v) Capacity building

Local capacity building will result through:

- o Enhanced internal research capacity;
- o Strengthened national innovation systems and enabling policies;
- o Postgraduate training in innovations, innovation management and related aspects.
- o Enhanced innovativeness and competitiveness of businesses.

This programme component is intended to establish the extent to which innovation systems and clusters, and innovation policies exist in Eastern Africa. The programme component shall also establish deficiencies of existing innovation systems and

clusters. Finally, an attempt will be made to establish the extent to which firms and farms are innovative in the three countries.

Implementation of Pilot Cluster Initiatives

Cluster initiatives are organized efforts to increase the growth and competitiveness of respective clusters that involve cluster firms, government and the research community. Thus, doing research and identifying gaps in the systems of innovation and clusters is not an end in itself. The ultimate goal is to have a system within which firms and farms are innovative. This programme component is to conceptualize and support, improve, or introduce innovation systems for specific sectors or clusters in a practical way, showing short-term results, while fitting into a national long-term innovation policy framework. This programme component actually seeks to put in place systems that are innovative, and initiate innovative clusters. It will also serve as a practical learning process on what works and what does not. This entails getting teams of competent and committed individuals representing the whole triple helix sphere to facilitate respective cluster initiatives.

The selection of the eight pilot Clusters Initiatives in Tanzania was based on presentations of various potential clusters during the Stakeholders Workshops held in January 2005. They were subsequently discussed and approved for implementation. The following criteria were used for the selection:

- ◇ Current activity level,
- ◇ Availability and potential for effective use of resources (human and physical),
- ◇ Existence of actors committed to bringing about change,
- ◇ Responsiveness to expressed needs from the society,
- ◇ The strategic idea and its growth potential (e.g. job creation),
- ◇ Existence of future market potential,
- ◇ The ambition for renewal within the initiative,
- ◇ Potential for collaboration between academia, business and political bodies (including the government) within the initiative,
- ◇ Geographical focus, viz. the functional region of the initiative

The following are the eight pilot Cluster Initiatives in Tanzania:

- 1) Bagamoyo cultural heritage tourism cluster,
- 2) Eastern region mushroom cluster,
- 3) Morogoro metal works and fabrication cluster,
- 4) Morogoro small scale fruit and vegetables food processors cluster,
- 5) Arusha seeds and seedlings cluster,
- 6) Sisal cluster,
- 7) Zanzibar seaweed cluster, and
- 8) Nutraceuticals cluster.

Competence Building and Research

Technology development is one of those things that cannot be left to be stirred by market forces alone because of the possible occurrence of the market failure phenomenon and other externalities, which are beyond the control of innovating firms and farms, especially for the less developed countries. There is, therefore, a

need to inhibit market failure effects by putting in place policies for technology development. Proper policies in turn require prior investment in policy research. This programme component intends to contribute to this through capacity building in various aspects of innovation, including innovation studies. Innovation is a dynamic and context specific concept, and the different strategies that can be adopted by countries or sectors in those countries depend on their own specific development advancement and other in-country factors as well as on developments in innovation systems in the global economy to which the national economy is increasingly linked. It therefore calls for continuous researching, and capacity building in the area to achieve a critical mass of experts in innovation research.

Establishment of short-term and long-term (MScs and PhDs) training on innovations and related aspects is one of the key specific objectives of this programme component.

TRIPLE HELIX STATUS IN TANZANIA

A quick look at Tanzania's Triple Helix constellation (academia, industry and government relationship) reveals a number of issues that need to be addressed in order to facilitate economic development drawing on an increased university-industry interaction but also on how policy can feed into the discussion and stimulate industrial innovativeness. Economic reality has made consultancy linkages the main communication channel between university and industry.

Starting with industry and its present status, regardless of the criteria chosen for analysis, there has been little progress over the last decades. Tanzania remains basically a non-industrialized country heavily reliant on agriculture. The ongoing transformation has had little effect on business start-ups and expansion in the SME sector whereas the parastatal sector has literally been phased out. The low level of technological capabilities is a key bottleneck to responding positively to ongoing liberalization.

Secondly, industrial firms' relations to other firms and/or organizations are not optimised for knowledge transfer and joint learning. A strict division of labour between firms in the value chain is in most cases absent leading to poor specialization. In recognition of the fact that it would have been difficult and impractical for each industry to establish its own Industrial Research and Development unit, the Government decided to set up specialized Industrial Research and Development Institutions. The Industrial R&D institutions were entrusted with the noble objective of providing support services to industry through research and knowledge dissemination. The institutions include, among others Tanzania Industrial Research and Development Organisation (TIRDO) established in 1979, Centre for Agricultural Mechanization Rural Technology (CAMARTEC) established in 1981, Tanzania Engineering and Manufacturing Design Organisation (TEMDO)

and SIDO. However, the level of industrial R&D is still low because the Government spending on industrial R&D is very limited, which has left the few R&D institutions in an insecure situation having to rely on consultancy, training, and services offered to industry. These revenues do not cater for R&D activities but solely meet operational costs of the institutions.

On realising the importance of SME contribution to the economy, the Government approved the Small and Medium Enterprise Development Policy in 2003. The policy comes up with a number of interventions in support of the SME sector, including the improvement of the legal and regulatory framework, addressing issues related physical infrastructure, improving access of financial and business development services to SMEs as well as putting in place a supportive institutional set-up for the sector. However studies have shown that policy is not linked to any financing mechanism; a situation which business analysts say might hamper its implementation. This is due to the fact that the implementation of various portions of the policy was left to government ministries and agencies, parastatal organisations, NGOs and associations. The study also revealed that the policy did not adequately address issues of the poor infrastructure, high cost of utilities and communication system, all of which are crucial for the development of SMEs. It is also true that the taxes imposed on SMEs are numerous and high, thus deterring SME development and growth.

In another move the Government launched the National Trade Policy in August, 2003 whose main objective is to facilitate Tanzania's smooth integration into the Multilateral Trade Systems (MTS) so as to take advantage of opportunities inherent in the free flow of resources in the current wave of globalization. This policy has identified the need to utilize innovative industrial clusters of Export Processing Zones as an effective policy instrument of building robust export driven growth of the economy. The outcome of this is yet to be seen.

Despite all the government efforts, there is neither appreciable innovation nor an innovation systems policy in Tanzania, but there are various government policies that emphasize the role of Science and Technology (S&T) in development. Thus, S&T is discussed in the National Science and Technology Policy of 1995 issued by the Ministry of Science, Technology and Higher Education. But what is probably more relevant to the development of innovative clusters is government's awareness and dedication to build a scientific platform that may contribute to industrial progress.

A clear derivative from the aforementioned is that there is dire and urgent need for change if Tanzania is to achieve what is envisioned in Vision 2025. Peoples' mindset has to change towards a competitiveness mindset, enhanced quality consciousness and enhanced productivity. To facilitate these, there is also need to develop a mechanism for change.

Need for a Competitive Mindset

Competitive mindset is one that equally welcomes competition and cooperation, and seeks to build competitive advantage. It also entails strategic thinking that leads to a strong distinguished position on a global scale, identifying the needs and wishes of clients, developing products and production processes, and finally employing high international standards when assessing the performance of institutions.

The world economy has entered an era of total competition. There are many examples around the world where the traditional sources of comparative advantage, like natural resources, are less valuable than initially perceived for the development of a strong competitive economy.

At the firm level, competitiveness is the ability to provide products and services more effectively and efficiently than relevant competitors. At the industry level, competitiveness is the ability of the nation's firms to achieve sustained success versus foreign competitors, without protection or subsidies. And, at the national level, competitiveness means citizens ability to achieve a high, and constantly rising, standard of living.

Competitiveness in some industrial segments allows productivity improvement through higher specialization in the respective industries and segments. Consequently exports volume increase for that specific segment in which firms are relatively more productive than firms in other countries.

Competitive advantage grows out of the way firms organize and perform discrete activities. Of course, activities vary in their importance vis-à-vis competitive advantages from industry to industry. All activities contribute to buyer value. Hence, firms create value for their buyers through such activities. The ultimate value a firm creates is measured by the amount buyers are willing to pay for the product or service offered. A firm is profitable if this value exceeds the collective cost of performing the required activities. To gain competitive advantage over its rivals, a firm must either provide comparable buyer value, but perform activities more efficiently than its competitors (lower cost), or perform activities in a unique way that creates greater buyer value and commands a premium price (differentiation).

Need to Develop a Mechanism for Change

Firms gain competitive advantage by conceiving new ways to conduct activities, employing new procedures, new technologies or different inputs. A firm is more than the sum of its activities. The value chain of a firm is an interdependent system or network of activities, connected by linkages. Linkages occur when the way in which one activity is performed affects the cost or effectiveness of other activities. Linkages often create trade-offs in performing different activities that must be optimised. For example, a more costly product design, more expensive

components, and more thorough inspection can reduce after-sale service costs. A firm must resolve such trade-offs, in accordance with its strategy, to achieve competitive advantage. Thus, strategy guides the way a firm performs individual activities and organizes its entire value chain.

Linkages also require that activities are coordinated. The coordination of linked activities reduces transaction costs, allows better information for control purposes, and substitutes costly operations in one action with less costly ones elsewhere. Coordinating linked activities is also an important way to reduce the time required to perform them, which is increasingly important to ensuring competitive advantage. Careful management of linkages can be a decisive source of competitive advantage.

Creating competitive advantage requires the management of the value chain as a system rather than a collection of separate parts. Reconfiguring the value chain by relocating, reordering, regrouping, or even eliminating activities is often at the root of a major improvement in competitive position. The value chain provides a tool for understanding the sources of cost advantage. A firm's cost position represents the sum of all costs incurred for performing all the required activities relative to competitors. Cost advantage can occur in any activity. Gaining cost advantage usually requires optimising the linkages among activities, as well as close coordination with suppliers and distribution channels. The value chain also exposes sources of differentiation.

CONCLUSION AND THE WAY FORWARD

Given the fact that the majority of the industries in Tanzania fall under the SME category, the SME needs/expectations as shown above are the ones that have to be addressed in order to enhance the performance of these industries. The University-Industry link therefore needs to be stronger than ever. The College is already working on ways to address the SME needs by the establishment of incubators and SME clusters to serve those SMEs which need that kind of support, mostly starting-up enterprises and those that are still in need of assistance. However for much larger industrial set-ups, the College can deliver support services through its two organs, viz. BICO and TDTC, depending on the need.

To sum-up, the University has continuously strived to have a functional linkage with industry. Despite some failures experienced in the past, the goal now is to have a link that will serve all levels of industry, from the micro ones to the largest scale that we may have in the country and even beyond our borders.

The Tanzanian SME sector is, at present very weak and underdeveloped. However, it present a high potential for growth, leading the nation to industrialisation. The existing government policies, legal and institutional infrastructure is comprehensive enough. The intervention measures that have been initiated so far, including those

which are under the CoET - TGT collaboration project are seen to be very supportive and in the right direction towards developing SMEs. However, the resources that are available at present are grossly inadequate to cover the whole country and the needs of SMEs.

It is recommended that continued and stronger collaboration between CoET, TGT and other stakeholders in order to solidify and extend the efforts that have already been started in some parts of the country as described in this paper.

The Innovation System and Clusters Programme initiated by CoET promises provision of the mechanism for change of mindset in favour of competitiveness, enhanced quality consciousness and productivity, among SMEs.

There is, therefore, need to support the eight pilot Cluster Initiatives, established through the financial support from Sida/SAREC, so as to enable them succeed and pave way for establishment of others.

There is also need to mobilize resources to finance implementation of the other components of the Innovation System and Clusters Programme conceived by CoET.

In recent years, the overall policy environment has being more supportive to enterprise development as well as private sector development. The Small and Medium Enterprise Development Policy approved and launched last year comes up with a number of interventions in support of the SME sector, including the improving the legal and regulatory framework, addressing issues related physical infrastructure, improving access of financial and business development services to SMEs as well as putting in place a supportive institutional set-up for the sector. The SME Policy recommends development of industrial clusters as one of the strategies for steering enterprise development.

On the other hand, successful development of industrial clusters depends on a number of other interventions including putting in place an effective Industrial Research and Development infrastructure. As elaborated above, Innovative Industrial Research and Development is a core function which must be done to facilitate the development and dissemination of industrial technologies and innovations. Developing countries, like Tanzania, need to put emphasis and devote resources to IR&D activities if they seriously need fast and sustainable rate of industrial growth. Given the central role of engine of growth assigned to the industrial sector in Tanzania in transforming and revolutionizing the agricultural sector the Government established a number of IR&D Institutions for supporting the industrial sector. These institutions are expected to play an important role in facilitating the development of clusters in Tanzania.

It should also be emphasized that development of industrial clusters should be a collaborative task involving developers of physical infrastructure, financial and non financial service providers as well as the prospective entrepreneurs.

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