ASSESSMENT REPORT ON

INTEGRATION OF SCIENCE, TECHNOLOGY AND INNOVATION IN MKUKUTA AND MKUZA

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ACRONYMS

STI----------	Science Technology and Innovation
MKUKUTA ……..	Mkakati wa Kukuza Uchumi na Kupunguza Tanzania
NSGRP ……..	National Strategy for Growth and Reduction of Poverty (English)
MKUZA----------	Mkakati wa Kukuza Uchumi na Kupunguza Umasikini Zanzibar
ZSGRP …….. ….	Zanzibar Strategy for Growth and Reduction of Poverty, ZSGRP
MDAs----------	Ministries, Departments and Agencies
CSOs----------	Community Service Organisations
CBOs----------	Community Based Organisations
SMEs ----------	Small and Medium Enterprises
MDGs----------	Millenium Development Goals
ICTs----------	Information and Communication Technologies
PSD ----------	Private Sector Development
FID----------	Foreign Direct Investment
R & D ----------	Research and Development
OECD----------	Organisation for Economic Co-operation and Development
GDP ----------	Gross Domestic Product
AU ----------	African Union
SADC ----------	South African Development Countries
UNESCO ----------	United Nations Educational, Scientific and Cultural Organization
UNCSTD ----------	United Nations ----------
NEPAD ----------	The New Partnership for Africa's Development
CCM ----------	Chama cha Mapinduzi
KE ----------	Knowledge Economy
DPs ----------	Development Partners
UNDAF ----------	United Nations Development Assistance Framework
SC ----------	Science
PSD ----------	Private Sector Development
HQT ----------	Headquarters
KE ……..	Knowledge Economy
TOR ……..	Terms of References
NIS ……..	National Innovation System
SNI ……..	System of National Innovation
RGoZ ……..	Revolutionary Government of Zanzibar

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EXECUTIVE SUMMARY

This is an assessment report of a review which was designed to pursue a number of objectives. Key to these objectives include:

1. To examine the extent to which STI issue were integrated in to the two framework strategies; MKUKUTA and MKUZA;
2. To propose how STI issues can be adequately integrated into MKUKUTA2 and MKUZA2 in order to achieve the broad national goals of Tanzania Mainland and Zanzibar

Two main methods were used in the assessment review exercise: desk based review and interviews conducted on selected individuals in strategically located places within MDAs, CSOs, CBOs etc within Tanzania Mainland and Zanzibar.

The Review has come out with several important findings two of which are central:

1. Both Framework Strategies (MKUKUTA and MKUZA) have not adequately integrated STI issues. STI issues are however, implicitly mentioned at various levels in the two documents.

2. The limited integration of STI aspects into MKUKUTA and MKUZA is explained, in part, by an inappropriate paradigm held by many who designed the Frameworks - a paradigm which does not elevate STI issues as being the driver for growth and development of modern economies.

Based on the above findings the review proposes a number of recommendations in order to integrate effectively STI issues into the upcoming MKUKUTA2 and MKUZA2. The main recommendations include:

1. *Support the creation of a network of knowledge producers and users - National Innovation System.*

2. *Strengthen the teaching and learning of STI at all levels of the education system.*

3. *Improve the link between the NIS and SMEs and other productive Sectors*

4. *Promote International Co-operation in STI matters*

To implement the above recommendations will require a fundamental paradigm shift in the mindsets of those who design and implement Framework strategies and policies of this type for the economic growth and development of both Tanzania Mainland and Zanzibar.

BACKGROUND

Implementation of Tanzania's National Strategy for Growth and Reduction of Poverty, NSGRP, (or popularly known as **MKUKUTA** in Kiswahili;) and Zanzibar Strategy for Growth and Reduction of Poverty, ZSGRP (or popularly known as **MKUZA in Kiswahili)** is coming to an end in June 2010. Both Governments (ie The Government of Mainland Tanzania and that of the Revolutionary of Zanzibar) are, however, committed to developing successor strategies to MKUKUTA and MKUZA. To develop successor strategies based on experience and lessons learned from the implementation of the previous generation of both of these strategies, the Union Government has directed a review of their implementation. This study, commissioned by UNESCO for the Union Government, thus, fits into the overall review of the two strategies mentioned above. It must, however be mentioned at the outset that, the review is not sector-specific. Rather, it aims at determining the role assigned to science, technology and innovation broadly in MKUKUTA and MKUZA. And that the need for this assessment stems from the growing recognition of the important role science, technology and innovation plays in the growth of modern economies.

1. TERMS OF REFERENCES FOR THE REVIEW

The broad terms of references for the study appear in this report as Appendix 1. The specific TORs are, however, reproduced hereunder as follows:

a. *Carry out an assessment and desk review of the extent to which technological innovation, adoption and productivity - as a cross cutting issue - is integrated into the development frameworks and progress achieved in the United Republic of Tanzania. The assessment will describe the current use of the knowledge, technology and adopted strategies, if any, for economic development.*

b. *Interact with government officials from relevant Ministries, Agencies and Departments.*

c. *Identify important issues and gaps, if any, on STI which should be addressed during the review of the Tanzanian development strategies.*

d. *Utilize available best practices to make recommendations for the inclusion of STI into the new Framework development strategies*

2. METHODOLOGY OF THE ASSESSMENT

This study perused the composite Development Goals for the Tanzania as outlined in Development Vision 2025. It also perused the broader development goals for Zanzibar as enshrined in the Zanzibar Vision 2020. This was done in order to appreciate the goals which both Tanzania and Zanzibar set out to achieve by the years 2025 and 2020 respectively.

The study then analyzed the contents of the two strategies - MKUKUTA and MKUZA – in order to determine whether and to what extent, if at all, they have integrated science, technology and innovation. Progress reports on the implementation of the two strategies were analyzed to determine the level of impact and success of the implementation of the strategies.

Interviews were conducted with key stakeholders in different Ministries, Departments, Agencies and some development partners in both Tanzania and

Zanzibar to determine whether a common understanding exists on the role of science, technology and innovation in relation to the achievement of the intended strategic outcomes; and whether this understanding is reflected in the two strategies.

3. MKUKUTA AND MKUZA: What are they

A brief description of MKUKUTA and MKUZA is given in the subsections below. This is done in order to appreciate the development contents of these two strategies.

3.1. MKUKUTA

MKUKUTA is the Swahili short version of the National Strategy for Growth and Reduction of Poverty, NSGRP. This is a broad medium term framework strategy designed, for implementation, by the Government of the United Republic of Tanzania. Its implementation period spreads for five years - July 2005 to June 2010. MKUKUTA aims at achieving economic growth in the country and so reduce progressively levels of poverty amongst the vast majority of the Tanzanian population. The Framework is anchored on the ideals and broader national goals spelt out in Vision 2025. It also builds on the country's Poverty Reduction Strategy Paper which was implemented during the period, 2000/01 to 2002/03. In this regard, thus, Mkukuta is essentially a poverty reduction strategy – or a pro poor strategy. MKUKUTA also embodies the spirit of the Millenium Development Goals (MDGs)

On the above mentioned features of MKUKUTA, the NSGRP document notes:

> *'The NSGRP is informed by the aspirations of Tanzania's Development Vision (Vision 2025) for high and shared growth, high quality livelihood, peace, stability and unity, good governance, high quality education, and international competitiveness;'* pg 1

and that

> *'It is committed to the Millennium Development Goals (MDGs), as internationally agreed targets for reducing poverty, hunger, diseases, illiteracy, environmental degradation and discrimination against women'.* pg 1

There are further dimensions of MKUKUTA – to foster local ownership of the development process; enhance private sector development in the country

while at the same time enhancing its participation and contribution to the country's development process. On this score the NSGRP observes:

> ' …. *It strives to widen the space for country ownership and effective participation of civil society, private sector development and fruitful local and external partnerships in development and commitment to regional and other international initiatives for social and economic development.' pg 1*

Clearly, thus, MKUKUTA as a medium term Strategy framework was designed to pursue a development path which will ensure achievement of Tanzania's (Mainland) broad goals as enshrined in Vision 2025 as well as in other official policy documents. Key to these broad national goals and objectives include, inter alia:

a. *Attaining a high rate of economic development (averaging 8 – 9%) per annum and building a strong diversified, resilient and competitive economy;*

b. *Satisfying the basic needs of the people, eradicating poverty and attaining economic and social justice by availing equal opportunities to all;*

c. *Promoting good governance, democracy, rule of law, integrity and moral uprightness so as to promote and sustain peace, political stability, national unity and social cohesion;*

d. *Ensuring sustainability of the development endeavour on intergenerational equity basis;*

e. *Achieving the highest level of ingenuity, self confidence and self-esteem by building a self-reliant nation whose way of life reflects its own history, culture, resources and aspirations.*

MKUKUTA sets itself the achievement of 3 clusters of outcomes namely:

a. *growth and the reduction of income poverty;*
b. *improvement of quality of life and social well-being;*
c. *Good Governance and accountability.*

3.2. MKUZA

MKUZA, on the other hand, is the Swahili short form for the Zanzibar Strategy for Growth and Reduction of Poverty (ZSGRP) designed, for implementation, by the Revolutionary Government of Zanzibar. Like MKUKUTA for mainland Tanzania, MKUZA is a second generation Development Strategy Framework designed to implement the broad goals and objectives outlined in the Zanzibar Vision 2020; and is also in line with MDGs and other international agreed commitments and targets.

The prime focus of MKUZA is *'on the reduction of both, income and non- income poverty; and ensure the attainment of sustainable growth'*. To this end, MKUZA sets out to achieve three broad objectives and outcomes:

a. Growth and the reduction of income poverty;
b. Social services and well-being;
c. Good governance and National unity.

In detail MKUZA aspires to achieve the following goals and objectives

- *Create an enabling environment for high and sustainable growth*
- *Promote sustainable pro-poor broad - based growth*
- *Reduce income poverty and attain overall food security*
- *Ensure equitable access to demand driven quality education which is gender and environmentally responsive*
- *Improved health status – including reproductive health, survival and well being of children, women and vulnerable groups.*
- *Improved sanitation and sustainable environment*
- *Provide adequate and sustainable human settlement*
- *Improve food and nutrition security among the poorest, pregnant women, children and most vulnerable groups*
- *Strengthening and expanding social security and safety nets for the disadvantaged and most vulnerable population groups*

- *Promote and preserve historical, cultural and natural heritage and sports for social and economic development*
- *Ensure inclusiveness in the governance and in the development process*
- *Improve service delivery and institute civil service reform*
- *Enhance the rule of law and access to justice*
- *Improve public safety and security*
- *Increase the capacity of Government Institutions and actors*
- *Combat corruption and its manifestation and strengthen leadership ethics*
- *Strengthen legal framework to support economic growth*
- *Strengthen the institutions of oversight and accountability, including improving accessing to information*
- *Provision of timely and reliable information and data for monitoring and evaluation of Government activities and governance initiatives*
- *Promote and facilitate enjoyment of human rights.*

4. RESULTS OF THE ASSESSMENT AND INTERVIEWS

In respect to the integration of STI into the two Framework strategies (MKUKUTA and MKUZA), the assessment review came up with a number important findings. Key to these are briefly highlighted in the sub sections below.

4.1. Implicit recognition of the role of STI for economic growth

There is no doubt that both Framework Development strategies (MKUKUTA AND MKUTA) recognize the importance of STI for economic development in general and in particular the importance of using relevant technologies to improve efficiency and productivity of key sectors in these two economies. Likewise, both Frameworks have incorporated, in some ways, issues of STI for development. Both Frameworks make references of the importance of STI for development – in some instances even strong references and statements are made. MKUKUTA, for example, makes the following promising statement about STI and the knowledge economy:

> *'The strategy pays attention to further stimulating domestic saving and private investment response, infrastructure development, human resource development, increased investment in quality education, science and technology and use of Information and Communication Technologies (ICTs), a competitive knowledge-based economy and an efficient government.'(p2)*

The Framework further notes:

> *'One of the major conditions for poverty reduction is high economic growth. In general, growth depends on the quality and quantity of inputs including land and natural resources, capital, labour and* ***technology****. Quality of inputs implies* ***embodied knowledge****, which is a* ***basis for innovation, technological development, increases in productivity*** *and ultimately,* ***competitiveness****.' (Mkukuta p.28)*
>
> ***(Empasis ours)***

Equally, the discussion on sources of growth in the MKUKUTA Framework reveals some understanding of the importance of STI in achieving the objectives and outcomes of the strategy. On this, the Framework strategy notes:

> *'The following are identified as major sources of growth that Tanzania will need to focus on:*
>
> *(i) Investments in human capability – provision of quality education, health and nutrition to the population. Towards having an internationally competitive labour force, more resources will be channeled to improving the quality and expanding secondary, higher and technical education.*
>
> *(ii) Investments in physical capital – will focus on efficient and cost effective provision of infrastructure for transport, power, ICT, with special attention to opening up rural areas and areas with economic potentials in order to address regional inequalities.*
>
> *(iii) Increases in factor productivity – focusing on* ***technological change*** *with particular attention to rural / agricultural productivity and its associated linkages with industry……*
>
> *(v) Private sector development (PSD): domestic firms, including SMEs, will be supported and encouraged to be* ***innovative****, pay attention to* ***product development, quality and appropriate marketing strategies*** *that make them competitive and capable of responding to global market conditions. The enabling factors for PSD, which are also in line with the strategies for the TMTP2020 include:*
>
> - *Addressing* ***entrepreneurship development needs*** *for rural private producers (on farm and non - farm), agro-based*

industries, urban-based SMEs, formal and informal enterprises;

- *Ensuring access to resources (finance, land, water);* ***technological and managerial skills*** *including marketing; market information and contacts;*
- *Facilitating linking-up of domestic producers with local and foreign* ***R&D institutions;***

- *Creating fair competition to ensure level playing field; a smooth and stable administrative and regulatory framework, guaranteeing personal and property rights and security and enforcement of contracts;*

- *Provision of basic infrastructure such as utilities, water, power, transport and ICTs at competitive prices in rural and urban areas.*

(vi) Domestic trade: domestic trade has been liberalised and inter-regional/ district barriers removed. However, domestic traders need to develop competitiveness prowess, innovativeness, adherence to schedules and standards, and confidence to venture into neighbouring country markets and oversees' ***(Emphasis Ours)***

Likewise, MKUZA reflects some understanding of STI as a prime source of the growth process in Zanzibar. On this, MKUZA notes:

> *Key sources of growth that Zanzibar would give priority to during the implementation of the strategy include: investments in human and physical capital, increases in factor productivity, Private Sector Development (PSD), Domestic Market Investment (DMI), and Foreign Direct Investment (FDI)' pg34*

Understanding of STI in the growth process in MKUKUTA is further revealed in examining some of the interventions proposed in the strategy. For example in the Agricultural sector, a key intervention proposed is ***'increasing productivity in existing agricultural activities through the adoption of and investment in more productive technological packages ……..'***. In the

Mining sector, one of the interventions proposed is: to: ***'Develop small – scale mining technologies';*** while in the Manufacturing sector, one of the interventions proposed is to: ***'Review the establishment. Acts of R&D institutions which focus on technological innovation to support manufacturing*; promote environmental best practices techniques in processing and production; improve adoption of technology by the private sector'**

Furthermore, in setting up the strategy goals, MKUZA makes some references on the importance of STI for development as indicated in the concept narrations introducing some of the strategy goals. For example in introducing Goal 1: Create an Enabling Environment for growth MKUZA the framework acknowledges, *'poor business infrastructure and related services, low investments ….. and low capacity in human resources …..'* are major challenges in achieving this goal. MKUZA also realizes that achieving Goal 2: Promote Sustainable Pro-Poor and Broad Based Growth, will entail, *'improving agricultural production and productivity…….. Infrastructure and service …'*
It is also acknowledged, in MKUZA, that promoting Sustainable pro poor and broad based growth will require, inter alia: *'……..increasing agricultural productivity and market accessibility, ……..production of high quality goods that meet the standards of export markets,*
…….developing domestic capacity to produce and supply high quality products and services'.

Likewise, at the level of strategic interventions designed to achieve the Framework's goals and outcomes, MKUZA in some ways, makes some occasional references on the use of STI for achieving its objectives. For example the Framework suggests that in achieving the objective of promoting sustainable pro-poor and broad based growth amongst the strategic interventions include, inter alia:

' iii) Improving agriculture extension, supporting research services.

iv) Promoting agro-processing and strengthening agricultural market intelligence and information system.

…….

xiv) Improving quality control mechanism for exported commodities

xv) Developing entrepreneurial skills among women and youth

In respect to achieving Goal I (Cluster II) MKUZA identifies a number of operational targets that relate to STI issues, as for example:

'…..D: Science, Information and Technology

- *Enhanced teaching of Science, Mathematics and technology in schools,*
- *Promote the use of information and Communication Technology*
- *Expanded access to ICT for education development*

F. Vocational Education and Training

- *Enhanced entrepreneurial skills among the youth,*

G. Tertiary Education

- *Increased proportion of graduates from tertiary education institutions.*

H. Quality Education

- *Improved quality of education at all levels*

I. Institutional Reform

- *Improved efficiency in the delivery of educational services'*

Under this same Cluster (II) and goal (I) MkUZA has identified several important and strategic interventions with STI content. Some of these interventions include, inter alia:

'… ..('Ii) Increasing investment for appropriate infrastructure facilities and training of teachers in order to improve quality of education. Training is particularly crucial for science, mathematics, technical and vocational education.

iii) Providing laboratory facilities, equipment and textbooks.

iv) Designing incentive schemes that are needed to attract potential teachers

into science fields

v) Support research and development (R&D) in order for Zanzibar to catch up and keep pace with advances in science and technology.

vi.) Developing appropriate curriculum at all levels

vii) Introducing alternative means of delivering education, including the use of ICT.

It is evident from the above that, within the two Framework Development Strategies (MKUKUTA and MKUZA) there was mention and recognition of STI for achieving the objectives and outcomes outlined in the strategies. That recognition was made at various levels within the implementation phases of the Frameworks - at the level of stating the clusters, goals, operational targets and strategic interventions. However, that recognition appears to be IMPLICIT rather than EXPLICIT. It also appears patchy. What is even more basic is the fact that the recognition does not appear to be founded on a sound and informed understanding of the pivotal role of STI in the development of modern and competitive economies in a fast globalizing world.

Evidently, in both Framework strategies, STI aspects were simply stated - oftentimes without giving the context within which they emanate from and relate to. They were simply 'dropped'. Additionally, the recognition was not elaborated and detailed through in the majority of cases. Consequently, those statements lacked an operational handle for facilitating their implementation. As a result, they remained and continue to be mere statements of intent. They were not operationalised and implemented.

4.2. STI Human Resources Capacity Development

Sustained growth and development of STI human resources in the form scientific, engineering, and managerial skills, expertise, experiences and competence is key to both advances of STI and their subsequent efficient and productive use for economic development of any country. Poor development of STI human resource in Tanzania Mainland and Zanzibar necessitates that any serious discussion on enhancement of STI for economic development, would raise the issue of STI human resource development up in the agenda.

But this is not the case with both of the two framework strategies reviewed here. The two documents do not give prominence to STI Human resource development as a key dynamic for developing, acquiring and using STI productively for the eventual development of competitive economies of Zanzibar and Tanzania. Admittedly, both Frameworks mention the concept 'quality education' at some levels. But, they do not prioritize the teaching of STI in general and STI management and entrepreurship disciplines in particular. Capacities (especially skills expertise and experiences) in STI management and entrepreurship are particularly in Tanzania and Zanzibar as indeed in other parts of the Developing world. The concept of 'quality education' as used in these Frameworks is undefined; and there has been no effort in the Frameworks to clarify what it takes to achieve and sustain the brand of 'quality of education' referred to. The documents provide no hints on the strategies and tactics to achieve what is described here as 'quality education' nor do they provide clues on how to engage the skills and expertise to be acquired from 'quality education' productivity for sustainable and competitive economic development in both Tanzania Mainland and Zanzibar.

Clearly and expectedly, the neglect of a concerted approach to deal with STI human capital development is bound to prove a major stumbling block in Tanzania's capacity to acquire, use productively and subsequently upgrade STI for its competitive economic growth and development.

4.3. STI and SME Development

In both Frameworks, there is no informed discussion on how STI can stimulate productivity improvements in SMEs and other productive sectors and activities with high growth potential in Tanzania Mainland and Zanzibar. For example, under Private Sector Development, MKUKUTA states:

> *Domestic firms, including SMEs, will be supported and encouraged to be innovative, pay attention to product development, quality and*

appropriate marketing strategies that make them competitive and capable of responding to global market conditions."

It continues to identify the following enabling factor that is relevant to science, technology and innovation but gives no indication of a strategic intervention to implement these enabling factors:

- *Facilitating linking up of domestic producers with local and foreign R&D institutions*

There is however, no indication of how the SME's will be empowered and encouraged to be innovative and whether any mechanisms will put in place to promote innovation. Nor is there an indication to encourage and entize SMEs to use productively the products of innovation, if performed, to enhance their productivity and competitiveness. Similar shortfalls are self evident within MKUZA

4.4. International Collaboration in STI matters.

As indicated earlier both Framework strategies suggest that STI capacities in mainland Tanzania and Zanzibar are weak and inadequate to meet the challenges of competitive economic development in the two economies. The frameworks also point to the urgent need to upgrade the STI capacities to meet the development challenges faced in the two economies. However and curiously, the two framework strategies have lost sight completely of the strong potentials that international collaboration (in the form of multilateral and bilateral) collaboration and co operation have for STI capacity building for both Mainland Tanzania and Zanzibar. The frameworks have not examined the real potentials and possibilities that exist for international collaborative arrangements through which Tanzania and Zanzibar can fruitfully benefits in the area of human resource capacity accumulation and development. Such arrangements can be made multilaterally and/or bilaterally. To give examples, such collaborative potentials exist within Regional Bodies in Africa (SADC, AU

etc) as well as with international Bodies (eg UNIDO, ILO, UNESCO etc). Likewise, ample collaboration opportunities for STI capacity development for both Tanzania and Zanzibar exist between countries within Africa (eg with South Africa), other Developing Countries within South- South Co-operation (eg Brazil, India, Malaysia, Cuba etc.); and also within industrially advanced countries (eg Britain, USA, France, Italy, Canada etc). Simply the two frameworks have not explored these opportunities.

5. Framework Strategy Formulation and Paradigm Shift

A few thoughts on formulating a sound Framework Strategy; Paradigm Shift; and International Experiences are given below. These are informed, partly at least, by the main findings of the review.

5.1. Main findings of the assessment Review

This assessment review has revealed that STI have been integrated in both Framework Strategies - MKUKUTA and MKUZA; but only implicitly and in patchy manner. Additionally, that integration is not based on a profound understanding of the role of STI in the development of modern knowledge-based and innovation - driven competitive economies in a fast globalizing world. It appears issues of STI have just been 'dropped' into the two frameworks. In consequence, there is little reason to believe that in the context of implementing the two framework strategies, STI will assume and play the lead and imperative role, as a key driver, in achieving the strategy objectives and outcomes.

5.2 Formulating a Sound Framework Strategy

A sound Framework strategy must incorporate a number of attributes. Key to these includes:

- Direction: must have a clear and straight forward long term goal and direction. In turn the direction should serve as a rallying point around which, efforts and resources are marshaled for its achievement and its subsequent up gradation and development.

- Resources mobilization and concentration: must have ways and means of raising and marshalling adequate resources (finances, material, human capital, structures, assets and more importantly STI resources etc) productively for the consistent pursuit of the declared and agreed objectives and direction.

- Consistence: A sound strategy also requires progressing in the desired direction consistently - and without wavering. Making

steady progress in the right direction in a focused manner is a major attribute of a sound and viable strategy.

In the assessment, we found out that there was no clarity and consideration on how the identified Framework objectives and outcomes would be achieved satisfactorily. There was even more ambiguity on how resources and assets (especially STI resources) would be harnessed, mobilized and used productively to achieve the immediate objectives, outcomes; and even more ambiguous, in the context of achieving long-term national goals: building robust, resilient and competitive economies in both Tanzania Mainland and in Zanzibar. In this sense, thus, we are compelled to say categorically that STI aspects are not well enough integrated into the two Framework Strategies - MKUKUTA and MKUZA

5.3 The New Paradigm of STI and the Economy; and International Experience

Given the above (as under 6.1) we propose that adequate and effective integration of STI into a Framework strategy would require, as a necessary condition (through not sufficient in itself) a **PARADIGM SHIFT** - that is a major shift in the conception of the role of STI in the process of economic development. PARADIGM is here defined as our conception and interpretation of the events and happenings around mankind or some part of it (eg a community, country, society etc) based on our previous experiences, learning, teaching etc.

A PARADIGM SHIFT will therefore be a radical change in our perception, conception, interpretation, point of view - of how we see and view things and the world around us based on our new conviction, understanding and perspective.

In recent years, there has developed a new perspective and thinking regarding the growth and development of modern economies – oftentimes referred to as **KNOWLEDGE ECONOMIES** (OECD,.: California Space Authority, 2008; amongst others). According to this new and emerging thinking, growth of

Knowledge Economies is fueled by the continuous production, distribution, sharing and productive use of knowledge and information for economic purposes. These economies tend towards more 'highly skilled labour and high productivity gains'. Knowledge economies are also characterized by networks of knowledge production and use - recently known as National Systems of Innovation (NSI) or National Innovation System (NIS). In the context of this review NSI or NIS is here defined in ht same sense as in Lundvaal (1992):

> *'---- a network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies. It is made up of units that interact through linkages and are shaped by various factors'.*

In the case of Tanzania, the NSI consists of stakeholders who include, inter alia, research institutions (public and private), institutions of higher education, Private Sector, MDAs, Venture Capital etc. These networks master an enormous amount of expertise and disseminate tacit knowledge or know-how required for continued production and use of new knowledge. National Systems of Innovation are also linked to international networks and collaborate internationally for achieving maximum productivity. Science, Technology and Innovation Systems play key functions to knowledge production, sharing, transmission, use and transfer. According to the OECD, the transformation towards a knowledge-based economy and the creation of the national system of innovation "results from a fuller recognition of the role of knowledge and technology in economic growth." This 'fuller recognition' in turn arises from a paradigm shift – a radical change in the conception of knowledge as just a component of economic growth to a view that looks at it as a key driver of economic growth and development. Hence modern economies to day are 'increasingly innovation - driven and interconnected'. In this sense, then, a Knowledge Economy, in the words of a Word Bank Institute report (2004), is:

> *'….an economy that creates disseminates and uses knowledge to enhance its growth and competitiveness. Contrary to some beliefs, it is not necessarily about high tech or IT. The application of new techniques to subsistence farming can increase yields significantly, or the use of*

information and logistical services can allow traditional craft sectors to serve much wider markets than before. These are both examples of KE in action'.

The report further notes:

'A successful KE requires a strong and robust economic and institutional regime, a well educated and skilled population, an efficient innovation system and a dynamic information infrastructure'

The Africa Competitive Report 2009, states that at this stage no African country can be said to have moved completely to a knowledge-based economy but are at various stages towards that end

A Report from the U.S. Embassy in Beijing published in December 1996 documents China's reflections as it grappled with the shifting of its paradigm from the conception of S&T as a sectoral matter for national prestige but with limited economic impact. It notes China's regret of the time wasted during the 10 years of chaos in the Cultural Revolution when the other Asian tigers were mobilizing their STI systems and resources for the creation of knowledge-based economies within their countries. It also points out China's decisive change of stance towards STI and its determination to move towards a knowledge-based economy. China identified the following lessons relevant to science and technology that it acquired in the 45years preceding 1996:

- STI work should be directed towards the needs of the economy; *economic construction should actively support STI*
- *STI workers should expand links with the people in all sectors of the society.*
- *Hold fast to the lines "Cherish knowledge and cherish talent" and "Let a hundrerd flowers bloom and a hundred schools of thought compete."*
- *Create more links between Chinese science and international science. Stay up to date on international science developments and use them to serve the needs of Chinese science and the Chinese economy.*

China resolved to boost its ability to create its own science and technology and to effectively absorb foreign technologies. China also decided that the contribution of S&T to economic growth must be steadily increased to ensure China's future competitiveness in world markets. Thirteen years later, China's unprecedented economic growth attest to the paradigm shift and China's resoluteness and commitment in this regard. China's Spark program stands out as a success story in the efforts to address rural development through STI while the Torch program is responsible for China's competitiveness in the high-technology fields. The lesson from China is a paradigm shift as described should be accompanied by a strategic development of programs for the strengthening of the National System of Innovations and a systems-wide investment in, and utilization of, S&T for increased efficiency, productivity and competitiveness.

In the interviews with some of the stakeholders of both Framework strategies, we experienced the above stated uncertainty and un-clarity about the role of STI in economic growth. Happily though, the interviews also provided an opportunity to reconsider individual positions about the role of STI and at the end of the interview to reach an apparent shift of paradigm – in favour of looking at STI as a key and strategic driver for **continuous improvement and competitiveness.**

6 INTEGRATING SCIENCE AND TECHNOLOGY IN MKUKUTA-2 AND MKUZA-2

As indicated in the previous sections to this assessment report, MKUKUTA Framework is a medium term Strategy designed to achieve Vision 2025 broad national goals of Tanzania. One such prime national goal of Vision 2025 is to build:

> *'… a strong, diversified, resilient and competitive economy which can effectively cope with the challenges of development and which can also easily and confidently adapt to the changing market and technological conditions in the regional and global economy'*

Likewise, MKUZA is a medium term Framework strategy which targets to achieve Zanzibar goals outlined in the Zanzibar Vision 2020. A major goal of Vision 2020 is to develop:

> *' …. a strong, diversified, resilient and competitive agriculture, industry, tourism and other productive socioeconomic sectors to cope up with the challenges of the changing market and technological conditions in the world economy '.*

Both Tanzania and Zanzibar are committed to continue pursuing the main objectives outlined in their Vision Statements in the next phases of MKUKUTA and MKUZA. Pursuing the goals of building strong, resilient and competitive economies in Tanzania and Zanzibar would entail the enhanced use of knowledge and STI resources in both cases.

Clearly, thus, the design and implementation of the immediate next phases of MKUKUTA and MKUZA (that is, MKUKUTA 2 and MKUZA 2) will have to be based on the new paradigm which elevates STI to a very high and strategic position as the key driver for economic modernization and development. Production and use of **KNOWLEDGE** and **INNOVATION** must constitute the prime sources of growth and competitiveness in the implementation of

MKUKUTA 2 and MKUZA 2. In practical terms, then, MKUKUTA 2 and MKUZA 2 **MUST:**

6.1 Support Creation of a network of knowledge producers and Users – National Innovation System

A coordinated approach to the introduction of technologies to the various sectors of the economy would be taken. An important and necessary function of the NSI is not only the development of new knowledge but its dissemination, sharing and productive use across all productive and service sectors in the economy. The NIS would take responsibility for the diagnoses of STI-related problems in the economy across all sectors, identification and evaluation of available technologies to solve the problems, and liaise with the relevant MDAs for the acquisition and productive use of these technologies. The NSI would also be responsible for the subsequent absorption, assimilation, adaptation, and internalization and subsequent up gradation of the technologies to the local environment. Additionally and in partnership with Trade and Industry Ministry, support the introduction of technologies into the SMEs and open opportunities for the development of new SME, other sectors with high growth potentials and improved technologies.

6.2 Strengthen the Teaching and Learning of STI and Mathematics at all levels of the education system

An important lesson from Finland which is one of Europe's most efficient knowledge-based economy is that "education is the key element of a knowledge-based and innovation-driven economy. It affects both the supply and demand for innovation". The Finnish system is organized onto an exemplary National System of Innovation. It invests about 3.5% of its GDP on science and technology. The system is coordinated at the highest level by the Science and Technology Policy Council, which is chaired by the Prime Minister of the country, consists of Ministers whose portfolios are related to science, technology and the economy, including the Minister of Education. The Finnish education system thus places emphasis on quality education that

promotes the teaching and learning of knowledge, science, technology, mathematics and innovation.

African Ministers of Education under the auspices of the African Union have identified the teaching and learning of mathematics, science and technology as an important priority in the Second Decade of Education for Africa. At the January 2007 Summit, African Heads of State and Government also adopted the recommendation of Ministers responsible for science and technology to enlarge STI constituencies by encouraging more youth and women to participate in science and technology. The Summit also endorsed the Ministers' recommendation that AU member states should invest at least 1% of their GDP on science and technology. AU member states are thus making efforts to highlight the importance of mathematics, science and technology education in their various countries.

Since 2001 South Africa has been running annual Science Weeks for the purpose of focusing the attention of the nation on the importance of mathematics and science education. SADC countries have also taken the decision to introduce an annual SADC Science Week.

Following the examples given above, MKUKUTA-2 and MKUTA-2 may wish to support a national campaign for the promotion of mathematics, science and technology education especially to bring in more women into the science and technology system. The training of mathematics, science and technology teachers could also receive attention. All these efforts would ensure the required supply of researchers, policy designers and implementers, policy makers, and other knowledge workers required for a knowledge - based and innovation-driven economy.

6.3 Improve Synergies amongst the National Innovation System, SMEs and other productive sectors

An organic link between SME's and other productive sectors on the one hand and STI system on the other, would be created through the commercialization of products of research and innovation thereby opening up opportunities for

new SME's and other productive and service sectors. The NSI could support the introduction of technologies in the SME's by identifying and evaluating their appropriateness to the local context – in terms of type of resource use, market size type of products and services to produce etc.

6.4 Promote International Cooperation

According to the OECD, international cooperation for the purpose of knowledge production, sharing, dissemination, productive use as well as improving national debates on on the subject and related issues is an important hallmark of a knowledge–based economy. MKUKUTA-2 and MKUZA-2 could make provision for international cooperation both at the bilateral and multilateral levels. As Juma(2007) states in his article Reinventing Growth:

> *'The challenge is building international partnerships needed to align government policy with the long-term needs of Africa'.*

International cooperation can occur bilaterally between individual African countries or other countries in the world. The United Republic of Tanzania could invest in bilateral collaboration with another African country for mutual benefit. Tanzania's relations with development partners could also be fashioned to include collaboration in STI such that as Juma(2007) states:

> '*Foreign direct investment is used as a vehicle for carrying tacit knowledge as well as assisting enterprises at the frontiers of world technological learning'.*

International collaboration can also take place multilaterally through UN fora such as UNESCO and UNCSTD. African multilateral cooperation is facilitated through the different fora of African Union. For example, Ministers from AU member states periodically meet to discuss common African problems in their various AU Technical Councils. These discussions can illuminate national problems and contribute to the national stock of ideas and knowledge for solving problems. The NEPAD Office of Science and Technology manages a programme of collaborative research among African researchers. This programme focuses on solving regionally identified problems and it provides a

platform for enhancing researchers' skills and exposing them to international trends.

The SADC Ministers of Science and Technology are actively promoting collaborative research under the NEPAD auspices. SADC has developed Cooperation Protocols for education and for Science and technology. These Protocols provide opportunities for the exchange of researchers and other expertise but also makes room for SADC students to study in other countries. These opportunities can be fully exploited for the development of STI capacity in Tanzania.

Since many of Africa's problems straddle national boundaries, Development assistance and Foreign Direct Investment could invest not only in the development of national STI capacity but also support the development of regional capacity to solve common regional problems. This kind of investment would take advantage of expertise available in other countries in the region and lead to the development of a regional system of innovation which would in turn buttress and enhance national systems of innovation. A collaborative approach to finding solutions of Africa's problems is not only entirely sensible but cost-effective as well.

7 CONCLUDING REMARKS

A very recent World Bank Paper, '***Finland as Knowledge Economy – Elements of Success and Lessons Learnt'***, summarizes key elements that contributed to the Finnish success in transforming itself from a resource-based (timber-based) economy to an efficient knowledge-based economy. Finland took a number steps to facilitate the recent transformation of its economy. One such steps taken was the heavy investment in science, technology, innovation and education (especially higher education) in the 1990s when it was going through a very deep economic depression. Finland showed immense confidence in its STI to come up with solutions to pull the country out of its economic crisis. The Finnish experience brings out a number of important lessons for other countries – including those in the developing World, Tanzania included. On this score, in the foreword of the Report, the Vice –President of the World Bank Institute - Mr Leautier – has this to say:

> *'The Finnish experience shows that it is possible to make significant structural changes in a relatively short time. It also shows that long-term decisions that shape research and education are also possible and indeed necessary during short-term economic crisis, since they provide guidelines for longer-run growth and help to create a sustainable competitive edge'.*

The authors of the Report point out, on the other hand, that:

> '*Finland has many specific characteristics that cannot be replicated easily by many other countries. One of these characteristics encompasses two attitudes: an independent spirit of self-reliance and a "can-do" mindset that have been tempered by the weather, geography and occupations. Before national independence in 1917, long periods under the rule first of Sweden and then Russia also contributed to the independent spirit and strong national spirit of self-reliance with the will to overcome difficult odds'.*

The question now is: does Tanzania have a matching attitude that the authors say cannot be easily replicated in other countries? The challenges facing the Tanzanian economy as regards the utilization of STI for economic growth are bigger than those that Finland faced. Does Tanzania have the attitudinal

strength to face its challenges? The history of Tanzania points to a resounding **YES!**

Tanzania went through a valiant struggle to free itself from colonial rule under British rule. Soon after independence Tanzania became the strongest supporter of other African Liberation Movements and at the founding of the OAU, Tanzania was chosen as the headquarters of all African Liberation Movements and became a front runner in the liberation of the rest of Africa. Tanzania succeeded in forging a unified nation with Zanzibar and further created homogeneity through one national language thereby avoiding the intractable problem of tribalism and disunity which plagues even the most economically successful African countries. In 1967, through the Arusha Declaration, Tanzania committed itself to follow a growth path along the ideals and spirit of Socialism and Self reliance. Following a sustained period of unprecedented economic crisis in the country during the late 1970s to early 1980s, Tanzania had to experience a paradigm shift from the socialist economic approach to a market-driven approach since the mid 1980s. A series of sustained structural reforms since then (mid- 1980s) have enabled the economy to achieve an appreciable level of macro economic stability. Partly as a result of this, since 2004 Tanzania's economy has recorded an average growth rate of 6% per annum. This means that Tanzania has successfully managed to mobilize its strength and resources to rise up to its various challenges. We believe if the same strength can be used to mobilize the paradigm shift towards a more effective use of science, technology, innovation (and higher education) towards economic growth, then Tanzania will ultimately show more commonalities with Finland than just the ability to overcome vicissitudes.

Yet on a further positive note, though, it has to be said that Tanzania has shown very strong commitment, preparedness and readiness towards building a dynamic, knowledge - based and innovation - driven economy at a very high level of political leadership. For example, in a speech inaugurating the Fourth phase Parliament on 30 December, 2005, the then newly popularly elcted President of the United Republic of Tanzania - HE Jakaya Mrisho Kikwete,

expressed the commitment of his Government to building a modern economy in Tanzania. On this HE the President said:

> *'According to the 2005 CCM Election Manifesto, the central task of the Fourth Phase Government is to engender faster economic growth in order to increase the incomes of our people and enable them to live a better life';*

And he added,

> *'I will constitute a government that will prioritize the creation of a modern, sustainable and growing econo*my'.

Expressing his Government's commitment to Science and Technology, in that same speech, the President confidently said:

> *'We strive for a modern economy, and that entails the use of science and technology. The Fourth Phase Government will encourage and facilitate the use of science and technology, and promote investment in science and technology. We will also find ways to cooperate with the private sector in channeling more resources to institutions dealing with the development and application of science and technology. The National Fund for Science and Technology will be strengthened by enhancing government support and encouraging other stakeholders to contribute'*

Additionally, upon the request of President Jakaya Mrisho Kikwete, UNESCO is assisting the Government of Tanzania in carrying out a major reform, revitalization and repositioning of Tanzania's Science, Technology and Innovation (National Innovation) System. The prime objective of the reform and revitalization process is to enhance the contribution of STI to the country's economic development process.

Clearly, thus, there is strong commitment and preparedness, at least at the level of the country's top leadership, to make STI the imperative for economic development in the country. And this realization is born out of the realization that to push the growth ceiling beyond the limits currently provided for by the level of macro economic stability attained in the country would require 'raising the stake of STI' in national development efforts as indeed a recent World Bank Institute report on Tanzania's growth path notes:

'Sustaining and accelerating economic growth in Tanzania will require greater attention to the acquisition and use of new technology to increase productivity in all sectors of the economy. In particular, Tanzania needs to develop strategies to use existing and new knowledge to improve performance in traditional sectors, exploit opportunities for leapfrogging and develop competitive new sectors. These developments require Tanzania to assess its current global standing and learn from the experiences of other countries. A priority in the battle against poverty will be the creation of a greater range of sustainable income generation and employment activities, including more export opportunities. More effective sharing and use of knowledge could contribute significantly to the creation of new economic activities by, for example, increasing farm productivity, identifying of new markets for farm products, creating new enterprises based on traditional craft industries and diversifying of rural economies. With its rich endowments of natural resources and with government committed to achieving higher levels of growth and development, Tanzania is well placed to benefit from the global KE, ……..'

One major challenge Tanzania faces now is to generalize a comparable level of commitment across all sectors and at all layers and levels of decision making and policy formulation and implementation in MDAs in the country. This is a necessary requirement for STI to become and remain the KEY DRIVER for achieving sustained and competitive economic development and poverty reduction in both Tanzania and Zanzibar. In turn, to achieve this will require, amongst other things:

a. massive and sustained efforts in STI popularization campaigns in all walks of life throughout Mainland Tanzania and Zanzibar

b. implementation of focused STI training programs, learning by doing schemes, apprenticeship and internship programs etc for human capacity building at various levels of decision making, policy formulation and implementation in MDAs, Private Sector, CBOs, CSOs, FBOs etc in both Mainland Tanzania and Zanzibar.

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APPENDIX I: TORs FOR THE ENGAGEMENT IN MKUKUTA-MKUZA REVIEW

AN ASSESSMENT STUDY AND DESK REVIEW OF THE EXTENT TO WHICH TECHNOLOGICAL INNOVATION, ADOPTION AND PRODUCTIVITY, AS A CROSS - CUTTING ISSUE, IS INTEGRATED INTO DEVELOPMENT FRAMEWORKS AND THE PROGRESS ACHIEVED IN TANZANIA

I. Introduction

UNESCO has been requested together with Finland to undertake two studies within the Thematic Group of Innovation and Technology of the Dialogue Structure of the Government of Tanzania (GoT) and Development Partners to support the review of the Development Strategy documents, the MKUKUTA for mainland Tanzania and MKUZA for Zanzibar. The studies focus on the theme of science, technology and innovation and their application to development in Tanzania. The two studies as presented in the Resident Coordinator's Notes are:

1. Priority AAA:	B.1.4. Application of ICT and STI in improving livelihoods of the poor and in supporting growth in general
2. Priority CCC:	A.2.2 Assessment of the extent to which technological innovation, adoption and productivity, as a cross - cutting issue, is integrated into development frameworks and progress achieved.

The Finish Embassy has agreed to fund and source for experts for the first desk study and review namely, "Application of ICT and STI in improving livelihoods of the poor and in supporting growth in general" through their technical assistance programme for Tanzania and UNESCO is expected to carry out the second assignment

II. Rationale and Background of the Assessment Study and Desk Review

(a) Development Strategies (MKUKUTA/MKUZA) Review

The Governments of the United Republic of Tanzania and Zanzibar have been implementing their MDG-based development strategies (MKUKUTA and MKUZA) from 2005/06. However, these strategies are now due for review and have to pave the way for the next generation of MDG-based strategies towards poverty reduction and economic growth.

The UN roadmap to the review of MKUKUTA/MKUZA articulates: (i) how the UN will engage in the review process at the most strategic entry points within existing Government institutional arrangements, as well as the DPs; (ii) how the UN support will be provided in a coherent and cohesive manner to the government's review priorities, and (iii) time line for the UN activities e.g. development of the next UNDAF and agency-specific country programmes of assistance - anchored on the national development frameworks and calendar.

(b) Science, Technology and Innovation system Reform

In 2007, the President of the United Republic of Tanzania wrote to UNESCO to assist the country in the Reform & Repositioning of the Science, Technology and Innovation system of the United Republic of Tanzania. In response to this request, UNESCO has engaged the UN system through the Delivering as One programme for the programmes and activities to respond to the President's request.

Despite the desires of the GoT expressed in the Vision 2025 and the expression of desire for the reform of the science, technology and innovation system of the country, there is presently no strategy for the application of science, technology and innovation for economic development of the country in the development strategies MKUKUTA/MKUZA.

(c) New Thematic Group of Innovation & Technology in GoT/Donors Dialogue Structure

Recently in order to address gaps in the developmental process, the GoT with Development Partners have expanded the Sectors and Thematic groups within the Division of Labour in the Dialogue Structure between government and the donors. With this development, a new Thematic group on Innovation and technology has been created and UNESCO has been nominated as the lead UN Agency with Finland as the Deputy for the Thematic area.

The science, technology and innovation system of Tanzania is very weak and disconnected from the economic system. Annex 1 shows some of the indicators of the Tanzanian system, drawn largely from the 2007 Global Competitiveness Report. Therefore a massive investment is required in the long-term that will enable the country to use advances in STI to attain about 20% of its GDP growth within the next ten years.

The review of the MKUKUTA/MKUZA presents an opportunity for the inclusion and alignment of the science, technology and innovation system to the developmental strategies and goals of the government of the United Republic of Tanzania. UNESCO and Finland have been requested to prepare by way of assessment/studies analytical reports that would form part of the documents that would guide the review process of the MKUKUTA/MKUZA.

III. Objectives of the Assessment Study and Desk Review

The objectives of the assignment are:

- To carry out an study/assessment of the extent to technological innovation, adoption and productivity, as a cross - cutting issue, is integrated into development frameworks and progress achieved in the United Republic of Tanzania;
- To indicate best practices from other developing and developed nations on how STI has been included into development strategy documents;
- To make recommendations to the Government of Tanzania on potential entry points into the new development strategies for

science, technology and innovation into the development strategy document.

IV. Expected results of the Assessment study and desk review

1. A REPORT containing findings of the study with recommendations to the Governments of the United Republic of Tanzania and Zanzibar for ways of incorporating ST&I issues into the new MKUKUTA/MKUZA ;

V. Duration of the Assessment Study and Desk Review

The study/Assessment is expected to last a maximum of 6 (six) weeks.

Terms of Reference of the Assessment Study and Desk Review

Within the framework of the Delivering as One Programme of the United Nations System in Tanzania, and the Joint Programme 4 "Capacity for Development Management" and within UNESCO's approved program 226URT2000, "Strengthening capacities for managing the science and innovation system of Tanzania," in consultation with the UNESCO Dar es Salaam Office, the Section for Science Reform of SC/PSD, UNESCO HQ, and in consultation with the National Consultant for the Reform Programme of Tanzania's Science systems undertake an assessment study and desk review of the level of integration of science, technology and innovation into the economic strategies of the United Republic of Tanzania and Zanzibar, more specifically, the Consultant shall:

1. Carry out an assessment study and desk review of the extent to technological innovation, adoption and productivity, as a cross - cutting issue, is integrated into development frameworks and progress achieved in the United Republic of Tanzania. The assessment will describe the current state of use knowledge, technology and adopted strategies if any for economic development.

2. Identify important issues and gaps if any on science, technology and innovation which should be addressed during the review of the Tanzanian development strategies the MKUKUTA/MKUZA.

3. Utilize available international best practices to make proposals/recommendations for the inclusion of science, technology and innovation into the new development strategies to be enshrines in the MKUKUTA/MKUZA.

4. Submit to UNESCO, for approval, the full paper (mentioned in paragraph 1 above) of about 100 pages not later than 30 August 2009 and a detailed signed financial report showing the utilization of the total funds contributed by UNESCO. The report, to be submitted in hard copy and also on CD-Rom, shall contain the full-length document, the main conclusions and recommendations.

Annex I

Countries Rankings from Global Competitiveness Report 2007 ***(131 countries)***

Country/Economy	Overall Rank	Technological Readiness	Innovation	Higher Education & Training	Infrastructure
United States	1	9	1	5	6
Germany	5	21	7	20	1
Singapore	7	12	11	16	3
Korea, Rep.	11	7	8	6	16
Malaysia	21	30	21	27	23
Iceland	23	2	20	8	22
Slovenia	39	29	30	24	37
Namibia	89	91	108	107	39
Nigeria	95	97	66	109	119
Kenya	99	92	46	88	93
Tanzania	**104**	**99**	**70**	**123**	**105**
Zimbabwe	129	124	107	102	88
Chad	131	130	127	131	131

Details for the Ranking of Tanzania (out of 131 countries)

5th pillar: Higher education and training

Secondary enrolment (hard data)	130
Tertiary enrolment (hard data)	128
Quality of management schools	112
Quality of math and science education	110

12th pillar: Innovation

Capacity for innovation	102
Utility patents (hard data)	89
Availability of scientists and engineers	87
Company spending on R&D	61
Government procurement of	57

Internet access in schools	106
Extent of staff training	92
Quality of the educational system	86
Local availability of specialized research and training services	81

University-industry research collaboration	56

Comparative R&D Data for countries in Africa

	Researchers per million inhabitants* 1999	**Articles per million inhabitants** 1998**	**Patents applications per residents 1999*****
Algeria	100	8	34
Egypt	230	120	536
Nigeria	40	4	-
South Africa	350	72	116
Tanzania	**70**	**6**	**0**
Zimbabwe	30	16	1

** Source: « Science in Africa at the Dawn of 21st century », IRD, 2000*

*** Source: Science Citation Index*

****Source: World Intellectual Property Organization*

APPENDIX 2: LIST OF PEOPLE INTERVIEWED FOR THE REVIEW

TANZANIA - MAINLAND

Name	Organisation/position
Dr. Hassan M. Mshinda	COSTECH
Mr. Eliab S.M.Chijoriga	COSTECH
Dr. Dujovhilu Mafunda	
Dr. Raphael L.M.Isongo	
Mr. Joseph Shega	
Mr. George S. Shemdue	
Ms Neema Tindamanyire	Programme Officer Environment
Mr. Pantaleon Chuwa	Biotechnology Bioses
Mr. Charles Yongelo	Agriculturalist
Mr. Rogers Alfayo	Energy and Environment
Dr. Evarist Makene	
Ms. Samantha Dodd	
Dr. Manege Ludovick	TIRDO
Mr. Salvary Mumy	LOSZOch
Mr. Mudith B. Cheyo	Economist, MOFEA
Dr. Raphael Chibunda	Assistant Director, R&D, MCST
Mrs. Anna Mwasha	Director,Poverty Eradication and Economic Empowerment, MOFEA
Dr. Flora Kessy	Senior Research Fellow, Ifakara Research Institute
Dr. Dennis Rweyemamu	Senior Research Fellow, REPOA
*Eng. Dr. Zaipunah Yahanal	Director, ICT, MCST
Mr. Donald Mmari	Senior Research Fellow, REPOA,
Mr. Vedastus Manumba	Prime Minister's Office,
Mr. J. R. Mboya	Prime Minister's Office,
ZANZIBAR	
Mr. Khamis M. Omar	MOFEA- PS/Chairperson
Ms. Amina Khamis. Shaaban	MOFEA-DPS (EA)
Mr. Mwita M. Mwita	MOFEA
Mr. Idrissa A. Shamte	MOFEA
Ms. Maryam D. Khamis	MOFEA- MKUZA Coordination
Mr. Ahmed M. Haji	MOFEA- MKUZA Coordination
Ms. Jamila A. Seif	MOFEA- MKUZA Coordination
Mr. Deodratias Shayo	MOFEA- MKUZA Coordination
Dr. Zakia M. Abubakar	State University of Zanzibar (SUZA)
Mr. Mohammed A. Jiddawy	State University of Zanzibar (SUZA)