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# THE RELATIONSHIP OF INDIGENOUS KNOWLEDGE AND TECHNOLOGICAL INNOVATION TO POVERTY ALLEVIATION IN TANZANIA.

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## Overview

The paper presents the possible relationship of Indigenous Knowledge (IK) and Technological Innovations (TI) to poverty alleviation in Tanzania. It also, identifies the types of Indigenous Knowledge exist in rural areas; the mechanisms through which IK and TI are exchanged and diffused; the challenges of IK and TI adoption and application to poverty alleviation. Finally, recommends the strategies in improving IK and TI adoption and application for sustainable development and poverty alleviation.

## 1 Introduction

### 1.1 Definitions of Indigenous Knowledge

Indigenous knowledge is the local knowledge – knowledge that is unique to a given culture or society. IK contrasts with the international knowledge system generated by universities, research institutions and private firms. It is the basis for local-level decision making in agriculture, health care, food preparation, education, natural-resource management, and a host of other activities in rural communities. (Warren 1991; World Bank, 1998). Indigenous Knowledge is the information base for a society, which facilitates communication and decision-making. Indigenous information systems are dynamic and are continually influenced by internal creativity and experimentation as well as by contact with external systems.(Flavier et al. 1995: 479). According to the 1998/99 World Development Report, knowledge, not capital, is the key to sustainable social and economic development. Building on local knowledge, the basic component of any country's knowledge system, is the first step to mobilize such capital. Rajasakeran, (1992) refers to a systematic body of knowledge acquired by local people through the accumulation of experiences, informal experiments and intimate understanding of the environment in a given culture. Msuya (2007) seen as local or traditional knowledge that is unique to every culture or society. The knowledge influences planning as well as decision-making in local areas.

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### 1.2 Indigenous Knowledge and Technological Innovation for development

Indigenous Knowledge (IK) and Technological Innovation (TI) have throughout history been extremely important to community development (Lengisugi, 2006) and act as a fundamental mechanism for developing countries in the process of poverty alleviation (UNESCO, 1998). Roling and Engel (1990:102) have shown that rural people make rational resource use and management based on that knowledge. IK practices facilitate integration into development work, provides problem solving strategies for local communities especially poor (World Bank, 1998) and acts as a significant basis for local level decision making in all areas relevant to development, including agriculture, health practices and prevention (medical technology), food preparation, education, natural resource management (World Bank, 1998; Msuya, 2007) local governance, crisis prevention, social development and host of other development and community activities (Rueger, 2006). IK and appropriate technoblending have given valuable insights into how people use their own locally generated knowledge to change, improve their livelihood and provide opportunities for designing development projects. IK and TI are important parts of the lives of the poor and is main asset to invest in the struggle for survival, to produce food, to provide for shelter or to achieve control of their own lives and helps to shape local visions and perceptions of environment and society. IK and technoblending practices to the local setting can help to improve agriculture production and sustainability of development assistance. Most importantly, investing in the exchange of IK and its integration into the assistance programs of the World Bank and its development partners can help to reduce poverty (World Bank, 1998).

Reij (2001) recognizes farmers' capacity to innovate and use IK as the crucial component of success, and provides Participatory Rural Appraisal (PRA) and Participatory Technology Development (PTD), identification, analysis and verification of farmer innovators. According to World Bank Report (1998) confirms that most importantly, investing in IK integration into the development can help to reduce poverty, but are underutilized resources in the development process include poverty alleviation strategies. In the same vein, Reij (2001) argues that there is little use made of indigenous knowledge and innovation among smallholder farmers in the process of food production and to improve their livelihood. It gradually evolved modern technical innovations which were developed did not meet the diversity of conditions local farmers had to cope with. Better knowledge of indigenous production systems would lead technological innovations to be better accepted by smallholder farmer. Charyulu, (n.d) found that development efforts that ignore indigenous knowledge, local systems of knowledge and the local environment generally fail to achieve their desired objectives.

In the past, rural development efforts usually focused on technical interventions relying on the use of external inputs. The potential contribution of IK and technoblending to development is becoming manifest at a time when current development models have proven not too successful. Today, hundreds of millions of marginalized people all over

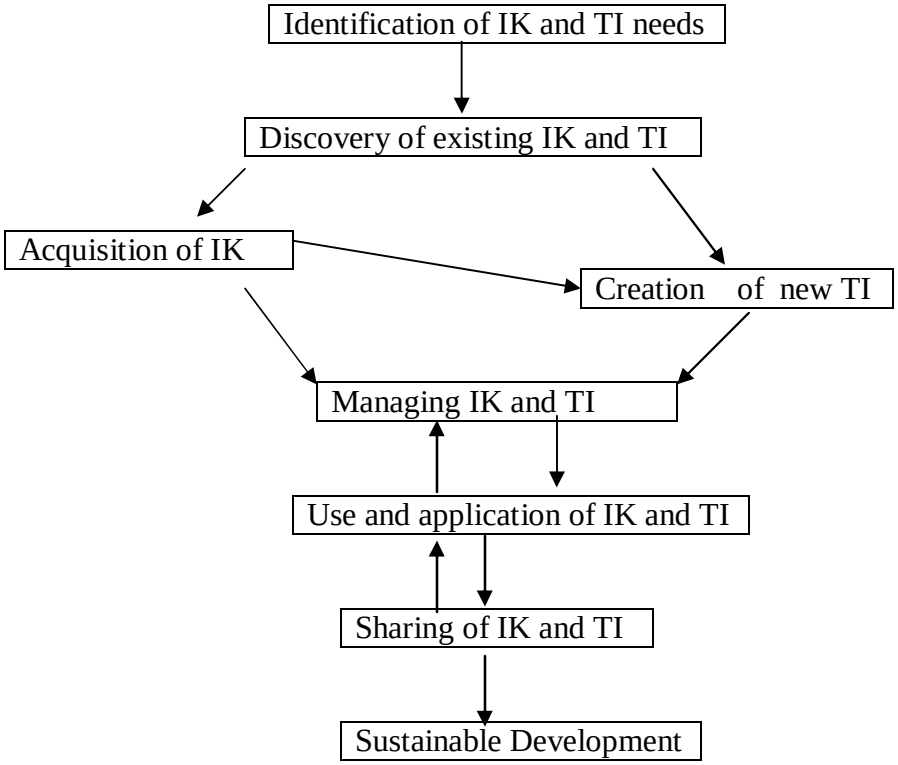
the world are still being excluded from the mainstream of development. These people have not benefited from development efforts that have mostly been based on a top-down development model, with the maximization of productivity as its major target (UNESCO, 2007). These efforts generally failed to improve the farming and livelihood systems of the poor. Most of the introduced technologies were inappropriate for rainfed farming under marginal conditions such as dry or mountainous areas. In such settings, the key ingredients for sustainable resource management are not external inputs but rather the farmers' knowledge and management capacities and their skilful manipulation of the locally available resources (Ann Waters-Bayer and Laurens van Veldhuizen, 2005***)***. Dommen (1988) assets that, the drive to achieve an intervention development without taking into account of indigenous knowledge systems and sustainable practices of innovations have proved socially, economically and environmentally unsuccessful.

IK is underutilized resource in the development process and activities include poverty alleviation strategies (Scoones and Thomson, 1994; World Bank, 1998). In the same vein, Reij (2001) argues that there was little use made of indigenous knowledge and IT among smallholder farmers in the process of food production and processing. It gradually evolved modern technical innovations which did not meet the diversity of conditions local farmers had to cope with. There is little empirical evidence and comprehensive baseline data on the IK and TI for development process. Charyulu, (n.d), Scoones and Thomson (1994) suggest that there is a need to be intensively and extensively studied, and incorporated into formal research and extension practices in order to make agriculture and rural development strategies more sustainable.

### 1.3 Conceptual Framework of IK and TI for Sustainable Development.

The underlying idea of the conceptual framework of indigenous knowledge and technological innovation is identification of IK and TI needs for sustainable development. Also, involve discovery of the existing IK and TI, acquisition of IK, creation of new technological innovation, organization, storage and management of IK and IT, use, apply and share appropriate IK and TI for sustainable rural development. Application and use of IK and TI for sustainable rural development depend to national policy and institutional framework. All these will make IK and TI more appropriate and relevant to the poor society.

**IK and TI integration processes**




Through the experiments, farmers will be involved in ongoing processes of local knowledge creation through site-specific learning, which, in the short term, results primarily in small adaptations to farming practice and, in the long term, contributes to the development of new farming systems (Okali, and Sumberg, 1997) and reduce grass-root poverty, especially among poor without changing cultural food patterns in Africa (World Bank, 2006).

### 1.3.1 IK transfer and technoblending

Fundamentally, integrating IK with other forms of knowledge first begins with knowledge creation and development processes that can be viewed in six steps, all of which are recognized by the World Bank (See Indigenous Knowledge for Development; a Framework for Action (1998) (Ocholla, 2007). The first step or process include recognition and identification, in that IK has to be recognized, identified and selected from a multitude of other knowledges. Some IK may be embedded in a mix of technologies or in cultural values, rendering them unrecognizable at first glance to the external observer(technical and social analyses may, therefore, be required to identify IK. Step two involves IK's validation/affirmation by identifying its significance, relevance, reliability, functionality, effectiveness and transferability. This signifies an ability to support problem solving. This invited a number of IK experimentations, most of which have not been validated (i.e. tested over time and used for problem solving) culminating in disasters in many cases. There are also interesting IK developments and practical achievements that are worth considering. Step three involves codification/recording / documentation. Explicit knowledge thrives because of its tangibility, sharability,

transferability and storability, all of which originate from knowledge recordal system. Although there are some contestations to the recording of IK - the argument being that IK owners easily loose moral and material ownership of their intellectual property or capital, which is renegade to third parties - explicit knowledge thrives because of its visibility, access and use, but recording and documentation is a major challenge because of the tacit nature of IK (it is typically exchanged through personal communication from master to apprentice, from parent to child, generation to generation and village to village. In some cases, modern tools could be used while in other circumstances it may be appropriate to rely on more traditional methods (e.g., taped narration, drawings). The fourth step consists of the storage of IK for retrieval. This requires the creation and development of IK repositories requiring taxonomies, databases, recording, indexing, and preservation for easy access and use. Storage is not limited to text document or electronic format; it could include tapes, films, story telling, gene banks. The fifth step involves transfer**,** this step goes beyond merely conveying the knowledge to the recipient; it also includes the testing of the knowledge in the new environment. Pilots are the most appropriate approach in this step. Sixth step is about dissemination of IKs to a wider community adds the developmental dimension to the exchange of knowledge and could promote a wider and deeper ripple impact of the knowledge transfer and technoblending. Exchange of IK and TI is the ideal outcome of a successful transfer and dissemination. This is essentially a learning process whereby the community where an IK practice originates, the agent who transmits the practice, and the community that adopts and adapts the practice all learn during the process (World Bank, 1998; Ocholla, 2007). Effective exchange, adaptation and use of IK and TI will lead to poverty alleviation in rural community in developing countries.

### 1.3.2 Empowerment of IK and TI in rural development projects

Bell (1979) argues that, the underlying principle of the theoretical framework for sustainable development is that the ultimate solution for rural development is not the dumping of more scientists upon rural people to make exogenously-generated technologies more adaptable and in line with people's problems, but to strengthen, empower and legitimize indigenous capacities for identifying problems and developing solutions for these problems. The empowerment of the indigenous knowledge/technology system (however difficult that may be politically) so that it has equal footing with Western knowledge may well be the most important step in a strategy of enabling the people in the developing countries themselves to alleviate their poverty.

## 1.4 Research methodology

This study employed qualitative descriptive survey designs. Purposive sampling was adopted in the selection of the key informants. The survey used a combination of methods to collect data to ensure reliability and validity of data collected. Interview protocol,

participant observation and document analysis were used. Most of the data collected through desk review, consultation of stakeholders, Policy Analysis, National Strategy for Economic Growth and Poverty Reduction Analysis.

### 1.5 Key issues

#### 1.5.1 Types of Indigenous Knowledge

Most of agricultural indigenous knowledge in Tanzania is in form of tacit knowledge rather than explicit knowledge. Tacit knowledge gained through experience that allows individuals to make decisions without referring to rules or principles (example knowing how to perform different activities, knowing how to make decision). In Tanzania excellent example of tacit and explicit indigenous knowledge and innovations are used in crop breeding, grafting against pests, water harvesting, food processing, medicines, fruit processing, soil and land classification, soil management, conservation and treatment of seeds.

#### 1.5.2 Exchange and transfer of IK and TI

In most cases agricultural indigenous knowledge and innovations in rural areas in Tanzania are been orally transmitted through imitation and demonstration which passed from generation to another generation, person to person and village to village. In the same vein, Nwokeabia (2006) contends that local knowledge and innovations which passed for generations from person to person. Some forms of traditional knowledge are expressed through stories, legends, folklore, rituals, songs, and even laws. Community based structure may organize forms of gathering including the “meeting under tree” and rituals have been a key source of indigenous knowledge transfer for centuries. Exchange of modern knowledge and technological innovation about agriculture, health and environment management in Tanzania are made available to rural poor in form of community based information centres or telecentres which are supported by United Nations Scientific and Cultural Organization (UNESCO), Food and Agriculture Organization (FAO), United Nations Development Programme (UNDP), World Health Organization (WHO), Council of Science and Technology (COSTECH), International Telecommunication Union (ITU) and International Development Research Centre (IDRC) (Emmanuel and Lwoga, 2007). In effect, it is possible for village and community to capture and exchange knowledge or develop indices of IK and TI on “what works” and “what does not”, Part of the index can be exchanged informally, but this can also be available for consultation within and beyond the given community. In Tanzania, tele-centers are increasingly becoming as the most important platforms for capturing, transfer and exchange of indigenous knowledge and modern innovations. Also, Sokoine National Agriculture Library (SNAL) indeed acts as a source of empowerment and knowledge exchange by enabling young people, old, employed and unemployed, rural and urban, local and international user to exchange traditional and modern knowledge and create platforms for interaction among various groups. In the process of recognition and identification, validating, recording and documenting, storage, transfer, dissemination

and exchange of IK and TI, the CO, NGO, CBO, Local community, Libraries, resource and information centers, private sectors, donor community and research institutions can play a major role and act as a building blocks of IK and TI

### 1.5.3 Possible relationship of IK and TI to poverty alleviation

Results revealed that there is possible relationship of IK and TI to poverty alleviation in Tanzania. An effective and appropriate use of IK and TI will improve productivity and generate livelihood, significantly towards poverty alleviation and sustainable development. The possible contribution of IK and TI to the rural communities include the following opportunities: (20%) said it can provide an employment, (17.8%) improve productivity, (15.5%) cost effective, (13.3%) stimulate technological innovations, (11.1%) encourage self sufficient economy, (6.7%) encourage community participation and (4.4%) said determine the long run socio-economic growth path

**Opportunities of IK and TI**

| Opportunities | Percentage |
|---|---|
| Employment opportunities | 20 |
| Improve productivity | 17.8 |
| Cost effective-low cost | 15.5 |
| Facilitate knowledge and technological innovations | 13.3 |
| Encourage self sufficient economy | 11.1 |
| Increase local community participation development process | 6.7 |
| Determine long run socio-economic growth path of the country | 4.4 |
| Total | 100 |

#### 1.5.3.1 Employment opportunity

Indigenous knowledge and local innovations represent an important contribution to the social and economic development process. Tanzania has been using IK and other local innovations as a basis for solving problems in agriculture, health care, food preservation/processing, natural resources management and culture. These provide income and employment opportunities to a number of rural and urban populations.

#### 1.5.3.2 Productivity

Indigenous knowledge and technological innovation could be considered complementary to scientific and technological efforts to solve problems in socio-economic development include agriculture and industry. In the same vein, In launching a book entitled; Indigenous Knowledge: Local Pathways to Global Development, in Dar es Salaam-

Tanzania, the second phace president Benjamin William Mkapa argues that "IK has all along been and continues to be the primary factor in the survival and welfare of the majority of Africans and the first hand experience of the benefits" (Myovela, 2008). African indigenous knowledge and innovation are unique knowledge among the local producers that can contribute to help make hunger and malnutrition history (World Bank, 1998). The availability and application of local knowledge resources and appropriate provision for facilitating and sharing innovations. Improve productivity and generate livelihood choices with or without value addition. At the grassroots level will contribute significantly towards poverty alleviation (IFAD, 2007). In Tanzania, for instance, the informal agriculture sector, mostly using indigenous methods and techniques provide income for rural communities. Scaling up the use of indigenous knowledge in innovation development appears more important in improving agricultural and economic performance.

#### 1.5.3.3 Cost effective

Farmers' innovations and indigenous knowledge do not only provide low cost or no cost solutions across regions and sectors but also is readily available in extending frontiers of science. Allen (2001) found that use of IK and local innovation is cost-effective, sustainable and locally manageable, deployment and mobilization is not expensive. Reduction in the cost and enhancement of the sustainability, multi functional innovations have an important role for small farmers (Gupta, 2000). These become a means of survival, and thus documentation of these solutions for their dissemination after validation among other communities might improve the livelihood options right away at very low cost. In the same vein, Charyulu (n.d) found that indigenous knowledge systems and innovation are found to be socially desirable, economically affordable, and sustainable which involve minimum risk to rural farmers and producers, and above all, they are widely believed to conserve resources. Learning from IK can improve understanding of local conditions and provide a productive context for activities designed to help the communities. In addition, the use of IK 'assures that the end user of specific agricultural development projects are involved in developing technologies appropriate to their needs' (Warren 1993). Warren (1989) notices that IK and TI in development, especially in agriculture and rural development offers a relatively low- cost approach with potentially high benefits. It can also serve as the basis for new initiatives and practices. Indigenous agricultural innovations have continued to be important as most of the locally-grown food for local consumption **(**World Bank, 2006). The integration of appropriate IK systems into development programs has already contributed to efficiency, effectiveness, and sustainable development impact (Gorjestani, 2000).

#### 1.5.3.4 Innovations and technological development

Indigenous knowledge provide problem-solving strategies for local communities and will always remain a powerful means of generating grassroots innovations, improvised traditional knowledge, shaping local visions and perception of environment, society and

functions of solving production problems (World Bank, 1998). These help to better integrate global technologies to solve the problems facing local communities (Lengisugi, 2006:591) and the means to the attainment of economic self-determination and self-reliance. Floris (2005) argues that every aspect of human activity in terms of the use of knowledge and innovations is becoming a vital component of scientific and technological development.

#### 1.5.3.5 Participatory approach

Indigenous knowledge and appropriate technological innovation play an important role in facilitating participatory approaches to sustainable development. Other studies (Nanda, 1999; Friis-Hansen, 1999; Simpson, 1999; Rosenblum et al., 2001; Marschke and Nong, 2003) conclude that the use of indigenous knowledge in innovation development led to a number of surprising successes in which (Brodt, 2002) stresses that both forms of knowledge constitute the ends of a continuum in development process. Reij (2001) recognizes farmers' capacity to innovate as the crucial component of success, and provides participatory rural appraisal (PRA) and participatory technology development (PTD), identification, analysis and verification of farmer innovators.

#### 1.5.3.6 Self sufficient economy and national long run economic path

Indigenous knowledge holders and innovators encourage economic self-sufficiency for Indigenous peoples, and also provide incentives for the conservation and sustainable uses of enviroment. In the same vein, (Adam, n.d ) notices that, it is the only treasure you can give entirely without running short of it. It has been the basis for local level decision making in agriculture, health care, food preparation, education, natural resource management and a host indigenous knowledge stimulates economic development which catalyzes for new technologies and businesses; and creates joint ventures, and other income generating activities (Nwokeabia 2006). Using indigenous knowledge and contemporary grassroots innovations improve other activities. World Bank (1998) reports that most importantly, investing in the exchange of IK and IT into the development can help to reduce poverty, Allen (2001) also argued that in indigenous technological advances, imitations and innovations determine the long-run economic growth-path of a country. Growth of technological knowledge produces useful outputs, and technological advances define the values of resources and the rates of utilization, hence impacting sustainability in a sector such as African agriculture. Incubating local agricultural innovations can help to unlock the secrets of the economic and cultural transformation of these societies. The technological and secular approaches to innovation systems into the public domain achieve a scale effect and increasing the productivity of the poorest.

### 1.6 Challenges in integrating IK and TI systems in development projects

#### 1.6.1 IK and TI Sharing Mechanisms

In Tanzania, there is little knowledge sharing due to lack of records and the appliccation of technological innovations in isolation. Indigenous innovators face uncertainties because of a lack of organizing framework include laws, institutions, customs and regulations. The consequence of the lack of an organizing framework is that innovators mostly become indifferent in diffusing their knowledge, and not utilizing potential scale effects, efficiency and productivity gains from their innovations. Nwokeabia (2006) argues that an important obstacle in sharing indigenous knowledge in Africa, particularly in the low-income sector of agriculture, is the absence of a sharing mechanism. People on a certain community may have certain indigenous knowledge and innovation on a certain aspect, the problem however, is that, in some cases they are not conversant on how that knowledge works, scientifically. For example (Msuya, 2007) found that, in the Usambara area of North Eastern Tanzania, and indeed in many other parts of Africa, there is sound knowledge of traditional medicine men who prevent thieves from stealing properties such as cattle or any other form of wealth. This is believed to be true and practicable. The issue here, is the science behind this knowledge. How does it operate scientifically? With this type of IK, it is difficult, though it really works. In Tanzania, there is an existing gap between researchers involved in indigenous knowledge systems and agricultural development practitioners in investigating the IK and TI for sustainable development.

### 1.6.2 IK and TI Methodologies

Although indigenous knowledge is nowadays commonly used in agricultural innovation, methodologies are still far from becoming mainstream, which some argue to be even impossible and counterproductive. Nwokeabia (2006) attributes this with lack of enough information that makes the indigenous innovators to adopt an indifference attitude, mostly leading to indirect restriction of the innovation, among the innovators and producers. The result is a deficit in the (incremental) technological progress. Mainly, the lack of a sharing network the central factor contributing to asymmetric information among active agents, and hobbling secular economic and social development in indigenous agricultural activities relates to poor local knowledge sharing networks. IK has traditionally not been viewed in the business sense as ‘capital.’ It has tended to be exclusive at times, susceptible to suspicion, and at times to abuse. Thus, IK has not effectively been managed like scientific knowledge which is well managed because it is taken as knowledge that can be interpreted as capital valued or taken as profit (Kaniki and Mphahlele, 2002; Msuya, 2007).

### 1.6.3 National Policy and Strategy for Economic Growth Implications

In Tanzania, the national policy does not determine the intensity and direction of people's innovative activities and the impact of innovation on the efficiency and productivity of innovations. The institutional arrangements and policy alternatives for future growth of IK and TI do not provide incentives (Gupta, 2005). Public policies, strategies, laws, institutions, customs and regulations - factors that affect a knowledge sharing network - determine the intensity and direction of people's innovative activities and the impact of

innovation on the efficiency and productivity of innovations (Nwokeabia, 2006). National Strategy for Growth and Reduction of Poverty (NSGRP) is better known by its Kiswahili acronym of "MKUKUTA" (Mkakati wa Kukuza Uchumi na Kuondoa Umaskini Taifa) pays greater attention to further stimulating domestic saving and private investment response, infrastructure development, human resource development, increased investments in quality education, science and technology and use of Information and Communication Technologies (ICTs), a competitive knowledge-based economy and an efficient government. The strategy does not provide the clear framework for adopting and using IK and IT in development process and sustainable development of its people. This makes no comprehensive baseline data and empirical evidence of the adoption and use of IK and TI for sustainable development: poverty alleviation. As a result, it is not well understood the potential contribution and roadblocks for application of IK and IT for sustainable development strategies. World Bank, (1998) noted that knowledge as an instrument of development has not received the needed attention in developing countries in general and in Africa in particular. This is changing. As the awareness of the importance of knowledge in the development process grows, the next logical step would be for the country authorities to begin elaborating specific policies in support of acquiring, absorbing and communicating knowledge with particular attention to indigenous knowledge. The partners should encourage this process through financial and technical support

### 1.6.4 Intellectual Property Rights

Intellectual property right issues is another challenge for using indigenous knowledge and innovation. The intellectual property rights of the individuals and communities have to be protected and benefits have to be generated for the innovators as well as local communities (Adam, 2003). In Tanzania, indigenous and local communities often do not have strong traditions of ownership over knowledge that resembles the modern forms of private ownership. Gupta (2005) argues that, many have clear traditions of custodianship over knowledge, and customary law may guide who may use different kinds of knowledge at particular times and places, and obligations that accompany the use of knowledge.

### 1.6.5 IK and TI Management

In developing countries in which Tanzania falls have a valuable, but largely untapped, reservoir of indigenous agricultural and natural resource. In the same vein Msuya (2007) points that, most of indigenous knowledge in Africa is not in written form. It is mainly in practice and transmitted from one generation to the next orally. This renders it difficult in preservation. Education in Africa has traditionally been transmitted orally from one generation to the next. In this case, IK and innovations have followed the same pattern.

Worse still, the transmission has mainly been family based or in small ethnic groups. Other study (Nyabundi, 2006) found that, for many decades lots of valuable indigenous knowledge have been lost and can no longer be traced especially applicable to developing economies in which Tanzania falls. Major factors contributing to this situation include low level of education and literacy among small holders farmers, exposure to variable indigenous knowledge and technological innovation, price shocks, limited investments and weak institutional arrangements. According to Nyabundi (2006) argues that the main factor poor application of IK is colonial legacy where colonists' first strategy to succeed was to demonize IK by making local people to believe that IKs is primitive, irrelevant and out of tune in modern society.

### 1.7 Conclusion

The study concludes that progressive IK and TI will be impossible if the government of Tanzania will only depend on the knowledge from the developed countries without making an effort in identifying, capturing, preserving, disseminating and using a worth and valuable untapped locally available knowledge. However, the sustainability of IKs and TI to benefit the small farmers and other entrepreneurs depends on the knowledge and skills of using it. In most cases the IK and TI to the small farmers are not effective when they are not accompanied by effective training and sensitization progammes on indigenous innovation and technological innovations in improving farming and enhance living standards. The vision of a truly Indigenous Knowledge and Technological Innovation partnership will be realized only when the developing countries participate as both contributors to and users of knowledge.

### 1.8 Recommendations on adaptation and use of IKs and TIs

Since poverty reduction is sensitive to growth. Strategy must be put in place to ensure proper adaptation and use of IK and TI for higher socio-economic growth and sustainable development. To complement the indigenous knowledge and innovative achievements of African local agriculturists, a mechanism is needed to promote indigenous knowledge

#### 1.8.1 National Policy and Strategy for Economic Growth

Tanzania government should formulate the appropriate national IK policy and sub policies and practices that allow a wider use and integration into development projects. Lengisugi (2006) recommends that, the national policies should allow a wider use of application of indigenous forms of learning knowledge and innovations. Policy actions should give attention to actively innovations, growth, documentation, preserving, disseminating it (Adam, 2003; Msuya, 2007) by creating awareness and supporting projects among local populations (Sampath and Banji, 2007). The policy should addresses institutional frameworks for supporting indigenous knowledge systems,

academic and applied research issues, systems for capturing indigenous knowledge and the promotion of networking among stakeholders (Adam, 2003).

### 1.8.2 Participation of IK and Innovation Stakeholders

There should be a full involvement of primary stakeholders in all key aspects of IK and innovation in Tanzania. This participation should be a continuous process. With participatory public support, a sharing and additive system of innovation among the lowest-income producers will enhance proper application of IK. Greater efforts therefore should be undertaken to strengthen the capacity of local people to develop their own knowledge base and to develop methodologies to promote activities at the interface of scientific disciplines and indigenous knowledge (UNESCO, 1998).

### 1.8.3 Fund

There is a need to develop the approach to revolving funding and cost-sharing mechanisms for mainstreaming local knowledge and innovations to be considered important. This process of enablement will include decentralisation measures, timely capacity-building programmes and genuinely participatory monitoring and evaluation systems (Rajasekharan, 1993; IFAD, 2007)

### 1.8.4 Global Knowledge

Adaptation and assimilate with new alien or modern scientific and technological changes in an approach often termed technoblending by global knowledge of best international practices to the local setting. Local knowledge and science can be merged into an effective development strategy (Lengisugi, 2006:591). To design mechanisms that help integration of IK into operations of public and private sectors of health and agriculture

### 1.8.5 Resource Centres

Establishing and strengthening national indigenous knowledge resource centres by strengthening the capacity of training, researching and developing IK networks and sharing for community development (Msuya, 2007). This may strengthen the documentation of IK and exchange among communities at community level through establishment of community to community based IK resource centres in districts. Establishing and strengthening national indigenous knowledge resource centres is essential to strengthen the capacities of agricultural research and extension systems. Adam (2003) found that, multipurpose community centres are increasingly becoming the main venues for organizing IK and disseminating it. Access to indigenous knowledge databases, audio and video footages can be made to members of communities through tele-centers and other resource centres. Participatory videos and radio programming initiatives can be launched at community centres to capture indigenous knowledge and exchange within and beyond the communities.

### 1.8.6 Libraries and Information Professionals

Libraries have shown strong tendency towards preserving local culture in digital and paper format and promoting exchange of information in many countries. Libraries could help in collecting, preserving and disseminating indigenous knowledge and innovation. Librarians and information professionals may publicize the value, raise awareness on the contribution, importance and protection of indigenous knowledge to both non-indigenous and indigenous peoples.

### 1.8.7 Intellectual Property Rights

Developing intellectual property rights protection systems on IK and TI. It is argued that one factor in the loss of local innovation is the 'lack of clear property rights governing ownership and access to it. To address this, in many cases better specification of property rights can encourage the holders of such rights to be responsible and accountable for the sustainable management of the resources in their control. Tanzania government should recognize the principles of intellectual property right to ensure the proper protection of IK; thereby enabling participants to take control of their own development and promote their local knowledge and innovations. By validating farmers' experiments will create an environment which leads to the increased participation and empowerment of local people (Gakuru**,** 2006). Analytical framework needs to be developed to facilitate further strengthening of these institutions and better analysis of their working needs to be created with the purpose of identifying peoples' knowledge and creativity efficiently and linking it up with formal science and technology, on-farm and on-station testing and building a whole value chain around global knowledge (IFAD, 2008).

### 1.8.8 Education Curriculum

Incorporating IK into an educational environment can help students feel ownership of the knowledge they bring to learning environments. In Pedagogy of the Oppressed (Friere, 1970) suggests that, allowing students or individuals to have ownership of their knowledge is equivalent to respecting their culture, tradition, and identity. He writes that educators can avoid teaching students as if they are "empty vessels [and] abandon the education goal of deposit-making." When education is not taught merely as "banking" information, students have the opportunity to understand the relevance and meaning of the knowledge they are being taught. Indigenous Knowledge (IK) can act as a powerful tool in a learning environment to teach students. Educators can further this type of education by combining appropriate pedagogical techniques. IK needs to be addressed and integrated into educational programs settings or learning environments, students better connect to material taught can become a major knowledge source for their community's sustainable development (Srikantaiah, 2005). Stimulating the flow of indigenous knowledge in schools, colleges and universities to increase awareness on innovation and traditional knowledge.

### 1.8.9 IK Capacity Building

Building local capacity to capture, store and evaluate the efficacy of IK for integration in the national development process is necessary. Capacity building in IK documentation and information management at both national and community level through training of trainers, community leaders and other stakeholders. This may enhance advocacy and awareness raising on IK and its role in poverty alleviation among the communities and public seminars and field visits.

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