

The management of indigenous knowledge with other knowledge systems for agricultural development: challenges and opportunities for developing countries

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Abstract

This paper seeks to establish the challenges and opportunities for managing agricultural indigenous and external knowledge in the rural areas of developing countries, with a specific focus on Tanzania. Semi-structured interview, focus groups and problem trees were used to collect primary data from farmers in the six regions of Tanzania. The findings indicated that farmers faced various challenges in managing their knowledge, which included personal, social, resources, skills, technological and external environment such as infrastructure, policy, Intellectual Property Rights (IPR), and weak linkages between research, extension and farmers. Various opportunities and recommendations are given for enhancing the management of indigenous and external knowledge for agricultural development in Tanzania.

1. Introduction

Indigenous knowledge (IK) is an important asset with regard to the social capital of local people and constitutes their main resource for their livelihoods. For instance, farmers predominantly in developing countries including Tanzania have planned agricultural production by using their IK to ensure food security and sustainable agricultural productivity over centuries (Mascarenhas 2003). Agriculture is the important sector in the economies of most African countries. In Tanzania, the economy depends on agriculture, which accounts for more than 25.7 percent of gross domestic product (GDP), provides 30.9 percent of exports, and employs 70 percent of the work force (United Republic of Tanzania 2009). The potential of IK in improving agricultural production in Tanzania can be gauged by the traditional sector which accounts for more than 90 percent of the seeds planted in the country (Mushi 2008).

At the same time, research shows that the more the local people experiment with external technologies, the more they strengthen their indigenous knowledge and practices (Lemma and Hoffmann 2005). External knowledge is a key component in improving small-scale agricultural production and linking increased production to remunerative markets, thus leading to improved rural livelihoods, improving quality and yield, food security and national economies (Asaba *et al.* 2006). Thus, sustainable agricultural development may be better served by a system that unifies both indigenous and external knowledge systems.

Nevertheless, in the formal agricultural economy, external knowledge receives more of the attention and investments than other knowledge systems in developing countries including Tanzania (Mascarenhas 2003). Lack of a cohesive approach for managing knowledge suppresses efforts of the poor to take advantage of their innovations and skills to improve their farming activities (Lwoga and Ngulube 2008). IK is mainly preserved in the memories of elders whose knowledge disappears when they die of old age, and thus IK has been lost at a high rate. At the same time, there is still a low rate of adoption of external technologies in Tanzania despite the fact that it receives most of the attention (Ngendello, Mgenzi and Schrader 2003:143) due to weak linkages between research, extension and farmers. Hence, farmers neither adopt the new technologies, nor manage their knowledge systems for improved farming

activities. There is thus a need to assess the challenges that inhibit farmers from managing their own knowledge and having access to relevant external knowledge for improved farming activities.

Information and communications technologies (ICTs) can also enhance access to relevant external knowledge and the management of IK in the local communities (Lwoga and Ngulube 2008). Despite their potential role for knowledge management (KM), ICTs can also present challenges to farmers when managing their knowledge and having access to other knowledge systems. The digital divide limits local farmers' managing their knowledge through ICTs, due to many factors, which include infrastructural, technical, regulatory, distributional, social, cultural, and economic issues (Lwoga and Ngulube 2008). Further, as local people access and use ICTs to access external knowledge, they tend to ignore their own knowledge and cultures (Lieberman 2008). The challenge is therefore to ensure that ICTs are not used as yet another way to marginalize farmers and their knowledge which has been neglected for centuries. This paper therefore seeks to establish the challenges and opportunities for managing agricultural IK and access to external knowledge both physically and through ICTs in the rural areas of developing countries, with a specific focus of Tanzania.

2. Methodology

This paper used qualitative and quantitative methods. The qualitative approach was the dominant approach because it tends to give more attention to the subjective aspects of human experience and behaviour (Powell and Connaway 2007). Six districts from six regions in six zones out of seven research zones were selected for the study due to their high agriculture production and presence of ICTs such as telecenters, community radio, and cellular phone networks. These districts were Karagwe, Kasulu, Kilosa, Moshi Rural, Mpwapwa and Songea Rural. Qualitative data was collected through semi-structured interview items, focus groups and participatory rural appraisal (problem trees), while quantitative data was gathered through closed questions which were embedded in the same semi-structured interviews. Two villages were purposively selected from each district. A total of 181 smallholder farmers were purposively selected for semi-structured interviews, for which the respondents ranged between 27 and 37 per district. Twelve focus group discussions were conducted in the selected regions, where one focus group session was held per village. One hundred and twenty eight respondents participated in the focus groups discussions, at which the study participants ranged between six and twelve respondents per session. The sampling procedure focus group discussions and interviews continued until the researcher recognised that no new additional data emerged (Teddlie and Tashakkori 2009). Quantitative and qualitative data were analyzed separately, and then they were combined to compare and validate the findings. Some of the qualitative data was also quantified in order to provide detailed assessment of patterns of responses and a deep understanding of survey responses (Teddlie and Tashakkori 2009).

3. Research findings and discussions

This section discusses study findings according to the challenges and opportunities for managing agricultural IK and accessing external knowledge both physically and through ICTs in the rural areas. The respondents' demographic characteristics are also presented.

3.1 Profile of respondents

In the semi-structured interviews, 181 smallholder farmers participated in the study, where 112 were men and 69 were women. The mean age of the respondents was 48. The study mainly involved smallholder farmers, with the average farm size of 4.9 acres, where the majority of the crop farmers (n=65; 38.7%) had farm sizes below two acres. Most respondents 152 (84%) had some level of formal schooling and about 163 (91.2%) could read and understand simple instructions. Among those with formal schooling, male respondents dominated the higher education category. Male respondents accounted for 95 (62.5%) of those with primary school education, 14 (9.2%) with secondary education, and 5 (3.4%) with post-primary education (that is, 4 college diplomas and 1 university bachelor degree). On the other hand, 128 smallholder farmers participated in the focus group discussions, where 65 (50.8%) were male, and 63 (49.2%) were female. A total of twelve focus groups were held in 12 villages.

One focus group session was held per village. The study participants ranged between six and twelve respondents per session depending on their availability. The mean age of the respondents was 45. One hundred and fourteen (89.1%) respondents had some level of formal schooling and 116 (90.7%) could read and understand simple instructions. Similarly, more male respondents dominated in the higher education category than female farmers.

3.2 Barriers that inhibit the acquisition of agricultural indigenous knowledge

The findings showed that the major problems that faced farmers when acquiring agricultural IK were poor recognition of IK and resistance to change, with a score of 121 (66.9%) each. Other major problems as identified from the findings were lack of IK records, 120 (66.3%), poor knowledge sharing culture, 116 (64.1%), lack of a resource centre, 112 (61.9%), and lack of trust, 102 (56.4%). Overall, barriers to IK acquisition can be categorised at three levels which include: personal, social and external environment.

Personal barriers were related to the poor recognition of IK; lack of trust; the selfishness of farmers in not sharing their knowledge; agricultural indigenous inputs were time demanding; differences in age, gender, social, and economic status; illiteracy; some indigenous techniques not being effective to solve farmers' problems; IK being suspected of being linked to witchcraft; and low income from agricultural activities. Social barriers were related to poor recognition of IK; poor knowledge sharing culture, and the disappearance of culture that would influence knowledge acquisition in the communities, such as team working in farming activities. Social barriers were also associated with the disappearance of vernacular languages, the difficulties in knowing IK holders due to the lack of an established structure to identify them, conflicts at family level, existence of traditional structures, and customs and taboos that inhibited knowledge acquisition in the local communities, the disappearance of plant species, and small-scale farming. Other problems were related to the external environment, which included the inadequate government efforts to recognise and record IK, to establish rural knowledge resource centres, and to improve the existing intellectual Property Rights (IPR) system. Other problems which can be solved by the government were the low number of extension officers; public extension officers being more concerned with conventional approaches and thus not being helpful sources of IK; exclusion of IK in the formal education system; and low priority was given to the agricultural sector by the government. These results show that while some problems can be solved by the communities, other problems would require public and private sectors to improve the acquisition of agricultural IK in the local communities. The problem trees from the focus groups established that poor recognition of IK was the major barrier in the communities that inhibited acquisition of IK in the communities, followed by exclusion of IK in the formal school curriculum and lack of trust. Other challenges were: poor knowledge sharing culture; difficulties in identifying IK holders; IK was suspected to be linked to witchcraft; agriculture was not an income earning sector; resistance to change and learning from other farmers; and extension officers were more concerned with conventional approaches and thus they were not helpful sources of IK.

3.3 Barriers that inhibit the sharing of agricultural indigenous knowledge

The study findings showed that poor recognition of agricultural IK, 119 (65.7%) was the major barrier which inhibited farmers from sharing their IK. Other major barriers that inhibited the sharing of agricultural IK in the local communities were a poor knowledge sharing culture, 116 (64.1%), lack of a knowledge resource centre, 111 (61.3%), lack of trust, 104 (57.5%), and social-economic status, 76 (42%). Other challenges were lack of appropriate IPR 69 (38.1%), disappearance of traditional seeds and plant species 31 (17.1%), and disappearance of culture and practices that would influence IK sharing 20 (11%). On the whole, these barriers that inhibited sharing of IK can be categorised into four levels, which include personal, social, technological, and external environment.

Personal barriers included the following: a poor recognition of IK; poor knowledge sharing culture; lack of trust; selfishness; differences in social-economic status in the local communities; preparing some of local herbs was time demanding; and illiteracy. Social barriers were related to the poor recognition of IK; a poor knowledge sharing culture; disappearance of culture and practices that could influence knowledge sharing; occurrence of conflicts within the families; presence of traditional structures,

customs and taboos that inhibit knowledge sharing; some IK holders insisted on being paid in order to share their knowledge; disappearance of vernacular languages; IK was suspected of being linked to witchcraft; lack of markets for organic products; and lack of commitment from village leadership to encourage knowledge sharing activities in the communities. It is thus important for the knowledge intermediaries to work closely with village leaders to nurture a knowledge sharing culture, mutual trust and relationship building to enable local people to openly learn and share their knowledge. Other problems were related to the external environment, which included the following: the failure of government to recognise and preserve IK, to establish rural knowledge resource centre, and relevant IPRs. Further, knowledge intermediaries inadequately recognised IK, and thus they had undermined the sharing and use of IK in the local communities. At the technological level, the present generation was more interested in listening to music and tales from TV and radio broadcasts rather than attending the traditional folklore activities.

The problem tree from the focus groups discussions confirmed that poor recognition of IK was the major problem that hindered farmers to share IK with their communities, followed by poor knowledge sharing culture, and selfishness. Other barriers were: some IK was shared within specific clans and through inheritance, and thus it was not accessible to the public; lack of trust and jealousy; IK was suspected to be linked to witchcraft; advancements of technologies such as TV and radio had replaced oral culture; the disappearances of useful cultures that would influence knowledge sharing; lack of a system to compensate IK holders when they shared their knowledge; village leaders who did not encourage knowledge sharing activities in the communities; and lack of IPRs that recognised IK. Other barriers included: preparing some of the local herbs was time demanding; lack of clear prescription; illiteracy; the dominant use of agricultural external knowledge over IK; and a lack of markets for organic products. Overall, these barriers to IK sharing may also fall under the Holsapple and Joshi (1999) knowledge sharing barriers categories, which include: management (leadership), resources (financial, human, material, and knowledge), and environment (markets; ICTs; time; and government, economic, political, social, and educational climate). In a similar study in Uganda, Akullo *et al.*, (2007) found that formal education, disappearance of local inputs, large scale farming, government laws, lack of clear prescription, ignorance, and selfishness inhibited sharing of agricultural IK in the local communities in Uganda. Thus, these problems require government, knowledge intermediaries, community and personal efforts to improve the sharing of agricultural IK in the communities.

3.4 Barriers that hinder the preservation of agricultural indigenous knowledge

The study findings further highlighted that poor recognition of IK and lack of efforts to preserve IK were major barrier for preserving agricultural IK in the communities, accounting for 117 (64.6%) and 116 (64.1%) of the respondents respectively. Lack of records on IK was the major limiting factor to the use of IK in Uganda (Agea *et al.*, 2008). Other major barriers were a poor knowledge sharing culture 106 (58.6%), lack of trust 96 (53%), and social status 78 (43.1%). Other challenges were 72 (39.8%), disappearance of traditional plant species 31 (17.1%), difficult to know IK holders 18 (9.9%), and exclusion of IK in the formal education systems 13 (7.2%). Based on the study findings, problems related to knowledge loss were also classified at the following categories: personal, social, and external environment.

Personal barriers included the following: poor recognition of IK; poor knowledge sharing culture; lack of trust; and personal characteristics (that is, age, gender, status). Social barriers were related to the poor recognition of IK; a poor knowledge sharing culture; disappearance of traditional seeds and plant species; the difficulty of knowing the IK custodians; disappearance of IK holders; the dominant use of contemporary technologies; traditional structures, customs and taboos that inhibited sharing of IK; high illiteracy level of the early IK custodians; and disappearance of oral culture such as folklore. Further, the problems at the external environment level were related to the inadequate efforts by the government to recognise IK in its policies and plans; lack of appropriate IPR; exclusion of IK in the formal education system; and lack of professionals, such as extension agents to recognize and manage IK. It is thus important to consider these factors at different levels (personal, social, external) in an effort to prevent IK loss in the surveyed local communities.

The problem trees confirmed that lack of national efforts to record IK was the major problem which limited farmers in the preservation of their knowledge. Other major barriers were the disappearance of IK holders; poor recognition of IK by the government; farmers' ignorance; and some of IK holders had migrated to urban areas because agriculture was not an income earning sector. Other problems were lack of professionals to manage IK, disappearance of aspects of an oral culture such as folklore, and researchers and NGOs who conducted research on agricultural IK did not disseminate their findings back to farmers.

3.5 Opportunities for effective management of IK

It was evident from the focus groups that the major interventions needed for effective management of IK were to enable the village leaders and public and private institutions to document IK and encourage knowledge sharing culture among farmers. Other interventions included: identification of IK holders who can practically share their knowledge to other farmers; motivate and empower IK holders with adequate facilities so that they can teach others; establish IK policy and IPR; strengthen traditional ways of sharing IK, such as folklore and apprenticeships; include IK in the formal school curriculum; improve IK through research; and improve awareness and dissemination of IK to improve agricultural activities. It is clear that farmers are eager to learn, share and preserve their knowledge for improved farming activities in the rural areas.

3.6 Barriers that hinder access to agricultural external knowledge

The findings indicated that major problems that limited farmers from accessing agricultural external knowledge were poor extension services, 143 (79%), lack of access to information materials, 133 (73.5%), lack of a knowledge resource centre, 131 (72.4%), and low level of literacy, 118 (65.2%). Similarly, Adomi, Ogbomo and Inoni (2003) reported that lack of visitation by agricultural extension officers, absence of a nearby library, and illiteracy were major factors that hindered farmers from accessing agricultural information in Nigeria. It is thus important to improve extension services, access to printed information materials and literacy levels in the communities.

Other barriers were related to farmers who were exposed to the extension services, but they were not willing to share their knowledge due to selfishness, and memory lapses. Similar findings were reported in another study of rural farmers in Ethiopia (Dixon 2002). Other related problems from the present findings were related to: resistance to change; poor knowledge sharing culture; social-economic factors (such as age, gender, status); village leaders not encouraging farmers to share their knowledge; and the infrequent occurrence of village meetings. These findings show that there is a need to foster a knowledge sharing culture in the local communities. Other problems were related to farmer groups which included the following: no beneficial effects perceived by farmers who had joined farmer groups; lack of awareness on the importance of farmer groups; resistance to join farmer groups due to old age; lack of sensitization and encouragement from the village leaders; wrong perceptions about farmer groups; and late delivery of inputs. Other problems included: unavailability and/or high cost of inputs; agricultural input suppliers and middlemen were not reliable sources of knowledge; lack of funds to purchase information materials; access to irrelevant knowledge; lack of awareness of the available information services; distant location; lack of a bookshop and agricultural shops; and ineffectiveness of some of the conventional inputs; poor recognition of agricultural practices by the government; low awareness on the part of farmers to demand their rights for adequate access to knowledge; and exclusion of agricultural subjects in most of the primary and secondary schools.

The problem trees in the focus groups confirmed that poor public extension services and inadequate access to printed information materials were the major problems that hindered access to external knowledge in the communities. Other major problems were poor knowledge sharing culture among farmers, and lack of funds to purchase information materials or to pay library membership fees. Other barriers were: selfishness; lack of awareness of the importance of farmer groups; inputs and funds for farmer field schools were delivered late by the government; access to irrelevant technologies; and village leaders did not encourage farmers to share their knowledge. Other barriers included the following: illiteracy; lack of agricultural shops in Kilosa (Twatwatwa Village), and Karagwe (Iteera and

Katwe Village); agricultural input suppliers were not reliable sources of knowledge because their extension services were market oriented; middlemen used to provide wrong information on market prices in order to buy farmer' produces at low prices; resistance to change; village meetings were not frequently organised; poor recognition of agricultural practices by the government; low awareness on the part of farmers to demand their rights such as adequate access to agricultural knowledge; extension officers and researchers did not adequately involve farmers in technology development and dissemination; and the exclusion of agricultural subjects in most of the primary and secondary schools in the country. On the whole, these findings indicate that barriers that limited farmers from accessing external knowledge were related to skills, literacy, distance, relevancy of technology, knowledge sharing culture in the communities, management of farmer groups, inputs, and village leadership commitment.

3.7 Opportunities for effective access to external knowledge

It was clear from the focus groups that farmers would like to have the following interventions in order to enhance access to external knowledge in their communities: improvement of agricultural extension and training services; reliable markets; village leaders should encourage knowledge sharing activities among farmers; improved delivery of inputs; increased access to printed information materials; extension services should involve farmers in knowledge development and dissemination; and there should be improved access to rural finance. It is thus evident that issues related to skills, resources, culture, finance and infrastructure need to be addressed for effective access to external knowledge in the local communities.

3.8 Barriers that inhibit the use of ICTs to manage indigenous and external knowledge on farming systems

The results from the interviews indicated that high cost of ICTs was the predominant problem that limited farmers from managing agricultural indigenous and external knowledge through ICTs, accounting for 152 (84%) of the respondents. Other major problems were lack of electricity, 129 (71.3%), lack of local and relevant content, 122 (67.4%), lack of awareness, 119 (65.7%), ICT illiteracy, 114 (63%), and poor telecommunication infrastructure, 104 (57.5%), while lack of a nearby telecentre 83 (45.9%) was the least cited problem. Similar observations were made in Nigeria (Kari 2007). Another barrier was related to the radio and television broadcasts, such as poor timing, broadcasts not being participatory, the short period of time allotted to the programs, programs not being consistent and poor quality. These barriers were also identified in other similar studies in Eritrea (Garforth 2001), and Rungwe District in Tanzania (Mwakaje, Mwakipesile and Nyakisinda 2009). Delivery of incorrect knowledge from traders also limited farmers from accessing knowledge through cell phones. Similar observations were made in Eritrea (Garforth 2001). Personal barriers also limited access to knowledge through ICTs, which included age, gender, poor attitude towards ICTs, and social and economic class. Other problems were inadequate ICT services to cater community needs (such as telecentres and community radio), language barriers, lack of follow up from professionals, theft, and lack of assistance on the use of ICTs to market farmers' produce.

Although interview results showed that high cost of ICTs was the major barrier, the problem trees indicated that inadequate access to local content through ICTs and lack of electricity were the major problems that hindered farmers to access knowledge through ICTs. Other major barriers were high cost of ICTs, and lack of awareness on ICTs. Despite the discrepancies, a clearly discernible pattern can be drawn that the high cost of ICTs, inadequate access to local content through ICTs and lack of electricity were the major problems that inhibited farmers in using ICTs to manage IK and access external knowledge in the local communities. Other problems as shown in the problem trees included the following which are arranged in descending order of importance: poor telecommunication infrastructure; access to inaccurate information from middlemen through cell phones; ICT illiteracy; and poor delivery of radio and television broadcasts. Other problems were lack of access to cheap power sources such as solar power; some cultures and customs limited farmers from accessing knowledge through ICTs; and inadequate ICT services that cater for community needs, such as community radio

and telecenters. Overall, the findings show that factors that limit farmers from accessing indigenous and external knowledge through ICT include infrastructure, funds, relevancy, skills, language, theft of ICTs, and follow up from professionals.

3.9 Opportunities for effective use of ICTs to manage indigenous knowledge and access to external knowledge on farming systems

Increased access to inexpensive ICTs was the primary concern for farmers wishing to enhance KM activities through ICTs in the surveyed communities. Other major requisites were rural electrification, provision of reliable marketing information, and provision of relevant local content through ICTs. Other interventions were: improved telecommunication infrastructure; increased access to affordable power sources such as solar power; enhanced access to rural finance; improved ICT training and awareness programmes; establishment of telecenters; and village leaders should encourage farmers to exchange knowledge through ICTs. Thus, issues related to infrastructure, resources, culture and skills were major concerns for farmers to enhance their KM activities through ICTs.

4 Conclusions

The findings showed that managing external knowledge which is mainly explicit knowledge is not sufficient to promote continuous innovation and improved farming activities. There is a need for public and private institutions and the communities to engage together in an effort to recognize the power of IK which is mainly tacit, and the importance of managing and merging it with external knowledge for improved farming activities. This knowledge should not be separated from the individuals who hold it, instead efforts should be made to enable the communities to innovate, create and manage their own knowledge, and to adapt other knowledge systems for sustainable agricultural development in developing countries. It is also pertinent for the government, private institutions and the communities to address the following issues for improved KM practices and farming activities in the rural areas: culture, resources, capacity building, content, technological and external environment such as infrastructure, policy, IPR, and linkages between research, extension and farmers.

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