CHALLENGES OF DOCUMENTING AND DISSEMINATING AGRICULTURAL INDIGENOUS KNOWLEDGE FOR SUSTAINABLE FOOD SECURITY IN SOROTI DISTRICT

BY

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DECLARATION

I, **Eric Nelson HAUMBA**, hereby declare that this Dissertation is my own original work and that it has never been presented to any University or Institution of Higher Learning for any award of a Diploma or Degree.

Signature:

Date:

APPROVAL

We certify that this dissertation has been presented with our approval as supervisors.

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DEDICATION

To my dear parents Mr. and Mrs. Eric Nelson Haumba of Kachonga, Butaleja for all your support from birth up to now; my sisters Barbra, Sarah, Julie, Carol and Constance. To my two little brothers Emma and Ephraim, you have been a joy to live with.

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"A single brick can never build a house without the support of other bricks".

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For any errors or inadequacies that may remain in this work, of course, the responsibility is entirely my own.

"It took the madmen of yesterday for us to be able to act with extreme clarity today. I want to be one of those madmen. We must dare to invent the future". **Thomas Sankara**

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ACRONYMS

GDP	Gross Domestic Product
GOU	Government of Uganda
IK	Indigenous knowledge
ITK	Indigenous Technical Knowledge
КМ	Knowledge Management
LK	Local Knowledge
MGLSD	Ministry of Gender, Labour and Social Development
NAADS	National Agricultural Advisory Services
NCRL	Natural Chemotherapeutic Research Laboratory
UNCST	Uganda National Council of Science and Technology

ABSTRACT

The aim of the study was to investigate how Agricultural Indigenous Knowledge (AIK) is documented and disseminated and identified challenges faced in its management for sustainable food security in Soroti District. The objectives included: to ascertain the forms of Agricultural Indigenous Knowledge used in Soroti; to establish the existing methods of documenting and disseminating AIK, investigate the constraints of documenting and disseminating AIK in Soroti and determine the best strategies for documenting and disseminating of AIK in Soroti. An ethnographic study approach was used to collect qualitative data from a sample of 351 informants who were selected using random, purposeful and snow-ball sampling techniques. The data sources included; audio and video recordings (Interviews, discussions, conversations), pictures, structured personal Interviews, group discussions and participant observations. Field-test questionnaire was also used to collect information from farmers through the use of interpreters in Ateso and Kuman Languages. Findings reveal that despite the advent of modern farming methods, many small scale farmers in the Soroti district continue to embrace indigenous knowledge in farming such as in managing soil fertility, controlling pests and diseases, controlling weeds, soil preparation, planting materials, harvesting and storage of indigenous root crops and animals. The study concludes that indigenous knowledge is still widely used but most of it is not documented nor fully understood by some members of the community; and that the Iteso and Kumam cultures have some restrictions on who acquires the knowledge. The researcher recommends that : AIKs be recorded for future generations, AIK should be researched and be thoroughly documented and made freely available to anyone who needs it, AIK in Soroti district requires attitudinal, behavioral, and methodological changes to give it a scientific touch, Small scale farmers should be involved in agricultural extension services rather than leaving the work to formally trained officers who may have little attachment to specific cultural practices in areas they operate.

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Background to the Study

For many of years, Indigenous knowledge (IK) has been used by local people in Africa, Asia and Latin America to sustain themselves to the maintenance of their cultural identity. This knowledge is variously labeled as focal ecology, ethnology, indigenous knowledge, customary laws and knowledge of the land (Kyasiimire, 2010).

IK are forms of knowledge that have originated locally and naturally (Altieri, 1995). According to Ermine (cited in Hammersmith 2007), IK is linked to the communities that produce it. He observes: "Those natural communities are characterized by complex kinship systems of relationships among people, animals, the earth, the cosmos, etc from which knowing emanates".

This knowledge (IK) is also known by other names, and among them are what (Nyota and Mapara, 2008) refer to as traditional knowledge, indigenous technical knowledge, rural knowledge as well as ethno-science (or people's science) as suggested by Altieri (1995). According to studies, Indigenous knowledge systems manifest themselves through different dimensions. Among these are agriculture, medicine, security, botany, zoology, craft skills and linguistics as observed in the literature.

Several studies have shown that since time immemorial, farmers in the developing world have depended on IK for improved agricultural produce. The applicability of IK takes place during different farming seasons and periods. According to Nyota and Mapara (2008), this knowledge spans from clearing the land, tilling, selecting seed varieties for planting, planting, harvesting and storage and identifying weather patterns (Lwoga et al., 2010).

Based on the above assessment, it has been observed the agricultural sector needs IK and IK needs the agriculture sector. This is perhaps because developing the agricultural sector

remains a critical factor towards the achievement of sustainable food production and, indeed, global food security in the developing world. According to the World Bank and FAO, farmers in many developing countries have employed both the newly scientific methods of practicing agricultural and the traditional (Indigenous) methods. The traditional forms of carrying out agriculture are what this study refers to as Agricultural Indigenous Knowledge (AIK).

While indigenous agricultural knowledge is of immense value in improving food production, its documentation and dissemination remain a big challenge. Indigenous knowledge has an important role in global knowledge economy (World Bank, 1997). It encompasses the skills, experiences and insights of people, applied to maintain or improve their livelihood. Indigenous knowledge is developed and adapted continuously to gradually changing environments and passed down from generation to generation and closely interwoven with people's cultural values. The same Indigenous knowledge is also the social capital of the poor, their main asset to invest in the struggle for survival, to produce food, to provide shelter or achieve control of their own lives (World Bank, 1997).

Since IK is stored in people's memories and activities, it's dissemination is mainly through individual or communal expressions such as in stories, songs, folklore, proverbs, dances, myths, cultural values, beliefs, rituals, community laws, local languages, agricultural practices, equipment, materials, plant species and animal breeds as noted by (Louise, 1998).

In terms of its relevancy, Indigenous forms of communication are important to local level decision making processes and for the preservation and spread of IK. This body of knowledge has developed over generations through the process of human interaction and its continuity depends on its transmission and the ability of the young generation to acquire and practice it (Atteh, 1989).

Furthermore, Indigenous knowledge systems in traditional Africa have been used by communities to protect natural resources from unsustainable exploitation thereby averting disasters that may have occurred from such exploitation (Louise, 1998). According to Nyong et al., (2007), Indigenous knowledge has the potential of providing information for addressing current and future climatic events and building on indigenous knowledge system offer great prospect for effective integration strategies to small-scale farmers. Lwoga et al., (2010) confer that sustainable economic development depends on the indigenous knowledge (IK) of the local communities. In their study of 2010, "Understanding indigenous knowledge:

Bridging the knowledge gap through a knowledge creation model for agricultural development" Lwoga et al. stated that in developing countries, such as Tanzania, Uganda and Mali, IK is mainly used as the basis for local-level decision-making in agriculture, health care, education, and natural-resource management, amongst others. Hart (2007) agrees with this: He states that the potential role of IK in improving agricultural performance is widely recognized in developing countries since the agricultural sector is the backbone of many economies in Africa. In Uganda for example, production of local vegetables is largely based on traditional knowledge that has been accumulated by farmers.

Thurston (1990) notes that traditional farmers have their reasons for selecting certain crop production practices, which at times can be pretty strange to scientists. The author further notes that IK has been utilized in various ways by the local people and it has worked for them whether in areas of agriculture, health, food storage, processing and preservation system, environmental management, erosion control and biodiversity conservation.

Akullo (2007) stated that the indigenous knowledge of the people is very effective in meeting their food requirements, effective in areas of soil enrichment, land clearing, sowing, harvesting, weeding and mound/ridge making. She further states that their mixed farming mixed cropping, crop rotation and shifting cultivation helps tremendously in their bumper harvest.

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The utilization of IK does not stop at farming, health and security alone. There are a number of uses that IK offers to communities who employ it. Azoro et al. (2002) observed that different types of soap were made for bathing and washing using indigenous resources such as palm oil, palm kernel, palm fibers and the leaves, and ash. This is a clear manifestation that IK usage has no physical boundaries although it's commonly seen in the agriculture and medicinal segments. Unfortunately, most of the traditional knowledge is not documented. Wall (2006) observes that IK is gradually disappearing in most African countries including Tanzania without any tangible efforts to recognize or manage it. Transfer of IK from generation to generation is mostly done through oral tradition or by demonstration. However, IK is not equally shared in the communities due to issues related to power relationships and cultural differences. This calls for urgent interventions in the management of IK to salvage the situation surrounding it (Wall, 2006). As earlier stated, IK is preserved in the memories of elders. Consequently Indigenous knowledge is steadily fading away due to memory lapses and death of the elders. According to Lwoga (2010), this knowledge has been responsible for improving agricultural productivity and ensuring food security for centuries in Uganda. However, IK is gradually disappearing in most African countries including Uganda without any tangible efforts to recognize or manage it Lwoga (2010). In agreement of that, Kumar (2010) attributes this to the fact that oral paths are being blocked and people are no longer staying in homogenous community blocks. The conviction here is that IK seems not to be appropriately documented and disseminated and even the little that is in distribution is notably under looked in favor of scientific methods.

1.1.1 Uganda's Agricultural Sector in the Spotlight

Agriculture is a basis of livelihood and development for all mankind. In developing countries like Uganda where majority of the population still depends on agriculture as a main source of income and seen from a global perspective, agriculture has become a dynamic force. Agriculture has frequently been described as the mainstay of several economies of developing nations (Amalu, 2002).

In spite of all the attempts meant to develop agriculture in Uganda, the County's agriculture sector is still in despair. By the year 2003, there were about 3 million smallholder farm households of which 80 percent had less than four hectares of farmland and the hand-hoe is the predominant technology for cultivation. According to (Ministry of Finance Planning and Economic Development, 2003), not a lot was expected to change by the year 2020. The report speculated that the condition would instead worsen due to increased population and climatic changes. The main traditional cash crops grown in Uganda are coffee, cotton, tobacco, tea and sugar cane, while the traditional food crops are mainly maize, beans, cassava, solanium potatoes, sweet potatoes, groundnuts, bananas and finger millet (MFPED, 2003).

Food crop production dominates the agricultural sector, contributing 63.8 percent of agricultural GDP (MFPED, 2003). The agricultural sector in Uganda is characterized as semi subsistence with low input and low productivity and the challenge facing Uganda is to provide the necessary support services to turn Uganda's widely dispersed small-scale subsistence agriculture into an engine of economic development. The sector has high potential if improved agricultural technologies are adopted by farmers besides their traditional methods of Agriculture (MFPED, 2003).

The big issue that needs to be addressed as "what is the problem with Uganda's Agriculture. It is often believed that systematic research is the base upon which modern agriculture is built. In attempting to solve the problems of the farmers, it is often assumed that the farmer must learn from the scientist, but seldom does the scientist think he may learn from the farmer (Williams, 1978). It is in line with this that Asiabaka (2010) agrees that the farmer's local knowledge counts more than that of the scientist. Amalu (2002) summarized the utilization of indigenous knowledge in agriculture. He asserts that Indigenous knowledge no doubt has existed

for so long a time land management, livestock management, food technology and processing among other activities. Similarly, for centuries, farmers have planned agricultural production and conserved natural resources with the instruments of indigenous knowledge (IK). The development of IK systems, including management of natural environment, has been a matter of survival to the people who generated these systems. Such systems are cumulative, representing generations of experience, careful observations and trial and error experiments (Louise, 1998).

But despite all the appealing statistics in Uganda's agricultural sector, many attempts have been made to try and salvage the loss of IK but most of the initiatives have remained on paper. The process of recognition and integration of IK was started by the Ministry of Health in their policy and strategy development in 1999. During the same period the Uganda National Council of Science and Technology (UNCST) organized the first workshop which issued the Kampala Declaration on IK for Sustainable Development.

The major issues that came out of the discussions were related to: (a) identification and technical description, (b) documentation, (c) dissemination, (d) application and (e) intellectual property rights on IK and thus benefits to the society. It was also recognized that training of various people especially in identification and documentation was critical. It was then agreed that, since IK is a functional approach, its further development has to be handled sectorially but in an integrated and coordinated manner with the concerns of traditional IK practitioners taken into account (Egeru, 2011).

1.1.2 Farming in Soroti District

Soroti district has a total population of 554,900, of which 72% live in rural areas and involved in Agriculture. Soroti, like any other districts in Uganda provides challenges for economic development and environmental management. Farming for most farmers in this area is mainly subsistence with small scale plots which are usually village based (District Information Handbook, 2007). Only a small percentage of farmers are classified as whole commercial. The need for sustainable agriculture development focuses on improving and sustaining food security and improving the quality of life for the people of Soroti and its future generations greater than ever before.

Like any other indigenous populations of the world who live in a balance and harmony with nature, the Iteso people of Soroti and the entire Teso- sub region of eastern Uganda have been unequivocally good custodians of their cultural norms. Egeru, (2011) states that over long periods of time, these people who are agro-pastoralists in the relatively dry lands area have acquired detailed knowledge about the functioning of their immediate environments including observations and insights on a wide array of issues including farming systems.

Natives in Soroti District have particular indigenous knowledge systems to foresee and cope with such challenges such as floods, droughts, diseases and pest and disease infestations. The transfer of this knowledge and associated practices has been embedded in the culture through various rites of passage such as birth, initiation into adulthood, marriage, death, twin dancing and social gatherings that include beer parties (Egeru, 2011).Unfortunately, little information is available about indigenous knowledge systems in Soroti. This study will therefore attempt to examine issues relating to the documentation and dissemination of Agricultural Indigenous Knowledge and its impacts on food security in the local communities.

1.2 Problem Statement

There is a wealth of Indigenous Knowledge (IK) in Uganda which is useful in livestock keeping, crop management, and food processing and storage as well as soil and water management (Tabuti, 2003). Unfortunately Ngulube (2002) in his paper about the Review of indigenous knowledge in Uganda points out that this IK is becoming less visible and insignificant in some communities because of the adoption of modern methods of farming. Perhaps a lot of IK has remained largely un-documented which poses a threat to its sustained utilization.

One of the bottlenecks of utilization of AIK is access to relevant and usable Indigenous Knowledge for the diverse stakeholders in the agricultural sector including farmers. The need to bridge the gap is crucial. Documenting existing IK practices is key to this (Atwooki, 2010). It seems farmers in Soroti district are adopting modern methods of agriculture at the expense of the IK because of the less perceived benefits that IK promises because crops planted using IK have often faced pests and diseases and not yielded much (Government of Uganda, 2007). The problem is perhaps compounded because of increasing population growth, land fragmentation as well as and migration into the urban places (Ebanyat et al., 2010). This phenomenon raises the question of ways in which they can be conserved.

Unless ways are found to record and preserve IK in detail, some communities risk losing major sources of AIK which is useful for the local people and in food security. In this regard, it was imperative for the study to investigate IK management practices in Soroti district to identify the challenges encountered in documenting and dissemination if AIK for sustainable food security.

1.3 Purpose of the study

The study sought to investigate how AIK is documented and disseminated and identified challenges and strategies for its proper management to ensure sustainable food security in Soroti district.

1.4 Objectives

The study was guided by the following objectives:

- To ascertain the forms of Agricultural Indigenous Knowledge used in Soroti District.
- 2. To establish the existing methods of documenting and disseminating AIK is in these areas of agricultural production.
- 3. To examine the constraints in documenting and disseminating AIK in Soroti

district.

 To propose best strategies for documenting and disseminating of AIK in Soroti.

1.5 Research Questions.

The following research questions guided the study:

- What are the forms of AIK being used in Soroti District? This research question attempted to establish the different forms of AIK that are currently being used in Soroti District. It sought to establish the sources of this AIK as possessed by the local farmers. The research question was also intended to find out the users of AIK and how this AIK is applicable and how do they use this AIK for their farming activities.
- 2. What are the existing methods of documenting and disseminating AIK in areas of agricultural production in Soroti? This research question aimed at finding out the different methods of documenting and disseminating AIK in Soroti District. It was also to prove the different tools and both local and scientific used in the process of documenting and disseminating AIK in Soroti district. It also sought identify the benefits of using AIK over the scientific knowledge in their farming lives.
- 3. What are the constraints of documenting and disseminating AIK in Soroti? This research question sought to establish the typical challenges faced by today's local farmers in Soroti and other stakeholders especially regarding AIK documentation and dissemination. How difficult is it to disseminate local agricultural knowledge for rural farmer empowerment in an effort to motivate them to use more of this local knowledge?
- 4. What are the best strategies that can be employed in documenting and disseminating AIK in Soroti? This research question aimed at finding out the strategies that could be adopted in order to appropriately address the question of improving documentation and dissemination of AIK towards effective agriculture and sustainable food security

Answers to this research question aimed at finding out if rural farmer involvement, participative management and provision of the required tools are adequate for improving the documentation and dissemination of AIK in the rural communities of Soroti.

1.6 Significance of the Study Findings.

The study was deemed important because of the following reasons:

Practitioners: The study findings may help in the effective indigenous knowledge management and sharing strategies in Uganda, particularly the rural farming communities and this will promote agricultural productivity and sustainable food security. There are a number of challenges surrounding the utilization of IK in Uganda. One of the key challenges is lack of sufficient documentation and dissemination. This study proposed strategies that the different practitioners within the agricultural sector can employ for better utilization of IK in agriculture.

Policy-Makers: The study findings are expected to enlighten the policy makers of the different indigenous knowledge forms that are available in communities and suggest strategies they can employ to document and disseminate this body of knowledge to farmers and all the stakeholders in need of such knowledge. Furthermore, through the recommendations of the study, guidelines for the documentation and dissemination of AIK in national agricultural and research Initiatives will be provided to the policy makers as well Academia: The study may add to the contemporary body of relevant knowledge by creating awareness of indigenous/local knowledge (IK/ LK) available and document the existing methods of documenting and disseminating AIK for future scholars.

According to Sundamari and Ranganathan (2003), AIK is an unwritten body of knowledge. It is held in different brains, languages and skills, in as many groups, cultures and environment as are available today. According to Atte (1989) cited in Williams and Muchena (1991), "it covers the whole range of human experience". Hence, as AIK is closely related to survival and subsistence, it provides a basis for local-level decision making in: Food security which was the

studies point on contention, human and animal health, education, natural resource management, and various other community-based activities.

However, the existence of AIK in Soroti is threatened by the development process, and the World Bank states that indigenous knowledge systems are 'at risk of becoming extinct' (Ahmed, 1994). Kothari (2004) attributes this to the fact that oral paths are being blocked and people are no longer staying in homogenous community blocks. AIK systems in rural communities are rarely documented. Thus, should the method of preservation and perpetuation be disrupted, there is a risk that within one generation, the knowledge could be lost forever (Warren, 1993). Given that AIK is threatened with extinction, it is justified to capture and document it.

1.7 Conceptual framework



Figure 1.1: Conceptual Framework

As seen in (Figure 1.1), major issues which constitute the independent variable (IV) in the study are Documenting and Disseminating Indigenous Agricultural Knowledge (AIK) whereas the dependent variable (DV) is suitability of food security. The Food and Agriculture Organization of the United Nations (FAO) describes food security as the state when an individual, household, nation, region, or the world have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life at all times (Overseas Development Institute, 1997; Broca, 2002).

The Independent variable in this relationship is being indicated by Indigenous Knowledge Practices, Indigenous Knowledge Tools as well as Indigenous Knowledge Methods and Holders. Sustainable Food Security is indicated by food availability, food access, and food use as well as food storage. Indigenous knowledge (IK) is ideas, beliefs, values, norms, and rituals, which are native and embedded in the minds of people. It is local knowledge which is unique to a given culture or society (Warren, 1993).

This relationship is influenced by intervening variables inclusive of community involvement, level of technology development, community setting, creative, technical and skilled personnel as well as dissemination channels. The exact challenges of documenting and disseminating AIK are not known (Aina, 1995). Cultural specifics are the intervening variables that are bringing about the challenges of documenting and disseminating AIK. The value of this knowledge in enhancing household food security has not been given sufficient attention in past studies because the cultural specifics that affect documentation and dissemination of AIK have not been well understood.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of related research on Indigenous Knowledge systems to determine how other scholars have investigated IK in relation to agricultural practices. It defines and conceptualizes indigenous knowledge, examines its applications in agriculture, existing methods of documenting it and explores the related challenges and efforts in place to manage IK in agriculture. It finally identifies the study gaps in past studies and proposes new approaches for closing the gap.

2.2 Forms of Indigenous Agricultural Knowledge

Rural communities in the developing countries have an extensive base of widely available knowledge, which is indigenous knowledge (IK). This knowledge is unique to a given culture, and it is predominantly tacit and embedded in practices and experiences of the local people (Sen and Khashmelmous, 2006).

Kumar (2010) defines Indigenous Knowledge (IK) as the knowledge that has been developed over time in a community mainly through accumulation of experiences and intimate understanding of the environment in a given culture. In the authors' views, native knowledge, traditional knowledge, cultural knowledge and civilization knowledge are synonymous terms. Various sources of literature are holistically in support of this assertion. There seems to be a general consensus that IK is unique to a given culture, society or a country. "It is seen to contrast with knowledge generated within the international systems of universities, research institutions and private firms" (Aluma, 2010).

A number of other studies also looked at both IK and western Knowledge. They clearly indicate that there is a significant difference between IK and the western Knowledge which is also referred to as Modern Knowledge or Scientific Knowledge by different authors. According to Agrawal (1995), there are differences between indigenous and Western knowledge with respect to their history and distinctive characteristics. However, the author argues that the presumption that indigenous knowledge is concerned with the immediate and concrete necessities of people's daily livelihoods, while Western knowledge attempts to construct general explanations and is one step removed from the daily lives of people, does not hold water. To him, there is scarcely any aspect of life in the West today that does not bear the imprint of science.

At the same time, many writers on indigenous knowledge agree that it also encompasses 'Non-technical insights, wisdom, ideas, perceptions and innovative capabilities' (Thrupp 1989). Indeed, by what yardstick of common measure without creating completely meaningless categories-can one juxtaposes a Hume and a Foucault, a Derrida and a Von Neumann, or a Said and a Fogel" (Agrawal, 1995)

And by what tortuous stretch of imagination would one claim that there are similarities between the Azande beliefs in witchcraft and the decision-making strategies of the Raika shepherds in Western India (Agrawal 1993), or between the beliefs of different cultures on intersexuality, and the marketing activities in traditional peasant communities.

Therefore, there are striking differences between philosophies and several forms of knowledge commonly viewed as either indigenous or Western. On the other hand, Tjiek (2006) also discovered that elements separated by this artificial divide share substantial similarities, as, for example, agro-forestry and the multiple tree-cropping systems of small holders in many parts of the world agronomy, and the indigenous techniques for the domestication of crops taxonomy and the plant classification system of the Hanunoo or the potato classification systems of Peruvian farmers (Ocholla and Onyancha, 2005), or rituals surrounding football games in the United States and, to use a much abused example, the Balinese cockfight. A few indigenous knowledge theorists have argued that science is open, systematic, objective and analytical. It advances by building rigorously on prior achievements. Indigenous knowledge, however, is

closed, non-systematic, holistic rather than analytical, advances on the basis of new experiences, not on the basis of a deductive logic (Ocholla and Onyancha, 2005).

Knowledge Management

Many studies and authors have defined Knowledge Management in a number of ways. According to Bhojaraju (2005), Knowledge Management (KM) is the process of gathering, managing and sharing employees' knowledge capital throughout the organisation. The Gartner Group (2005) in a related voice defines KM as a discipline that promotes an integrated approach to identifying managing and sharing of all of an enterprise's information assets.

According to this group, the information assets may include things like database documents, policies procedures as well as previously unarticulated expertise and experience resident in individual workers people.

Broadbent (1997) defines KM as 'a form of expertise management which draws out tacit knowledge, making it accessible for specific purposes to improve the performance of organisation or community; about how the organization's 'know-how' should be structured, organized, located and utilized to provide the most effective action at that point in time'. Knowledge management is based on the idea that an organization's/ communities most valuable resource is the knowledge of its people. Therefore, the extent to which an organization performs well depends, among other things, on how effectively its people can create new knowledge, share knowledge around the organization, and use that knowledge to best effect.

Nonaka's Model of Knowledge Management

The knowledge creation model has three elements (i.e. SECI, or Socialization, Externalization, Combination and Internalization) which according to (Nonaka & Toyama, 2003) interact with each other organically and dynamically to create a body of knowledge. In this context, the knowledge assets of an organization are mobilized and shared whereas the tacit knowledge held by individuals is converted and amplified by the spiral of knowledge through the SECI steps

When Nonaka (1991) first introduced the SECI model at the epistemology level, he identified four distinctive interactions between tacit and explicit knowledge:

- Socialization, where tacit knowledge is shared through shared experiences, for example face-to-face conversations
- Externalization, where tacit knowledge is converted to explicit knowledge with the help of metaphors and analogies, for example, printed materials and rock paintings
- Combination, where explicit knowledge is systemized and refined, for example, by utilizing information and communication technologies and existing databases
- Internalization, where explicit knowledge is transferred to tacit knowledge, for example, learning by doing or translating theory into practice.

Knowledge Management models emphasize the creation of knowledge through the conversion of explicit and tacit knowledge and vice versa, which knowledge category model supports the Nonaka model regarding organizational knowledge as either codified or uncodified, and as diffused or undiffused. Nonaka (1995) devised the terms "explicit knowledge" and "tacit knowledge" as two main types of human knowledge as key to creation of knowledge is the way it is converted through technology. The assumptions of this model mainly comprised in the same time the degree of limits and freedom of its functionality. One such assumption is the relative consistency of knowledge as a justified true belief.

Agricultural Indigenous Knowledge Models

This model according to literature emphasizes processes which vary in different aspects specifically in sequence of knowledge creation processes inclusive of; knowledge identification, acquisition, development, storage, access as well as use. Knowledge assessment and knowledge goals in this case are branded as building blocks which are in support to the KM processes perspective that influence Knowledge Management processes in communities. According to Snyman (2005), Knowledge Management principles need to be predetermined for a successful institutionalization of Knowledge Management practices in the community. Indigenous agricultural knowledge can therefore be analyzed for its technical role in food production as it avails cultural knowledge as well as enhancing mutual understanding and identity amongst the farming groups. The Local Knowledge Cycle model is adopted as a basis for analyzing this study.

Agricultural Indigenous knowledge is explained with various models towards the application of knowledge management in developing countries. Indigenous agricultural knowledge can be approached from the perspective of critical theory, analyzing the relationship between knowledge and relations of power, with the goal of liberating indigenous farmers from forms of domination. Indigenous agricultural knowledge can as well be explained by Knowledge Management models, since they add new insights and provide a range of possible solutions for knowledge management practices. These knowledge management models are specifically employed to provide a detailed and broad explanation and as a theoretical perspective (Tella, 2007).

Indigenous knowledge in farming is valued as a base and for determining food production and labour division between gender and age groups. This knowledge system regarding farming systems, refined over generations, may be used to ensure agricultural developments are viable within the local environment.

A farming system can be defined as a unique and reasonable stable arrangement of farming enterprises that the house hold manages according to well defined practices in response to physical, biological and socio- economic conditions And with accordance to household's goals, preferences and available resources. Indigenous knowledge is considered to be cultural knowledge in its broadest sense, including all of the social, political, economic and spiritual aspects of a local way of life (Sajeev, Venkatasubramanian and Singha, 2010) Sustainable development researchers, have found the following categories of indigenous knowledge to be of particular interest: resource management knowledge and the tools, techniques, practices and rules related to pastoralism, agriculture, agro-forestry, water management and the gathering of wild food; classification systems for plants, animals, soils, water and weather; empirical knowledge about flora, fauna and inanimate resources and their practical uses; and the worldview or way the local group perceives its relationship to the natural world (Sen & Khashmelmous, 2006). Indigenous knowledge is embedded in a dynamic system in which spirituality; kinship, local politics and other factors are tied together and influence one another. Spiritual beliefs about nature may influence how resources are managed and how willing people are to adopt new resource management strategies (Sen & Khashmelmous, 2006)

Smallholder farmers still want to apply their indigenous methods and technology in farming, particularly in using their own traditional seeds suitable to their climatic conditions without application of chemicals, which are deemed hazardous to the environment and consumers. Such seeds are locally preserved and have drought tolerance and pest resistance (Tjiek,2006). They also have a superior taste and are highly accepted by the local communities. The scientific basis of many of the indigenous technologies can indeed provide new ways of solving contemporary problems. At the same time, there are many indigenous practices that may not only be totally unsustainable but even positively harmful to the environment and biodiversity. One has to therefore be sufficiently pragmatic while deciding which elements of indigenous knowledge systems should be sustained and which not. The proportion of non - sustainable practices in IKS is much lesser than in the contemporary modern life and belief systems (Taylor et al, 2008)

Broadly, there are two important types of knowledge: explicit and tacit (Nonaka and Takeuchi, 1995). Explicit knowledge is essentially that which we document. Most often, this is knowledge in our manuals, standard operating procedures, regulations, memoranda, and so on.

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Explicit knowledge is essential, but equally important is tacit knowledge. Tacit knowledge, unspoken knowledge used to make judgments, decisions or interpretations, is difficult to document because, for example, we may not readily recognize it as knowledge or the concept that we would like to document is difficult to describe. Conceptually Tacit knowledge is treated as Indigenous knowledge due to its lack of documentation and articulacy, (Ssekabembe, 2013).

Typically, Indigenous knowledge system involves the evolution of perceptions, beliefs, acquaintance, and facts through experiences, inherited sources, natural experiments, and very familiar understanding of the environment of a given culture at a particular geographical location. These Indigenous practices include agricultural practices developed by farmers such as animal husbandry, crop husbandry, natural resource management among others. These result into cultural practices, norms and values and they are owned by a given community. When it's used overtime and passed on to the next generation, it becomes a belief system (See Figure



FIGURE 2 CONCEPTUAL FRAMEWORK OF INDIGENOUS KNOWLEDGE SYSTEMS ON AGRICULTURE

Source: Own Construction (Synthesized from Literature)

According to FAO (2014), it is estimated that more than 900 million people around the world are victims of hunger while even greater numbers experience malnutrition. The majority of these people live in lower income developing countries. Strategic programmes and initiatives have been adopted at different levels to tackle the challenges of food security and prevent imminent global food crisis. International organizations, particularly the United Nations Food and Agricultural Organization (FAO) have championed some of these initiatives. In Africa, the African Union (AU) has put in place a plan to make Africa food secure by requiring countries in the continent "to allocate a substantial portion of their budget to agriculture, provide farming input subsidies, and make available affordable information and communications technology" (http://foodcrisis.foreignpolicyblogs.com).This is in apparent recognition of agriculture as the critical sector for sustainable.

One of the strategies for developing the agricultural sector is to harness the potentials of indigenous agricultural knowledge (AIK) which has gained recognition through many initiatives including the 1992 United Nations Conference on Environmental Development (CIESIN Thematic Guides) and whose potential contribution towards achieving the millennium development goals, particularly the eradication of poverty and hunger has been acknowledged.

AIK is valuable not only to those who depend on it in their daily lives, but to modern industry. Warren (1991) notes that AIK has had a remarkable impact to crop production by poor farmers. Okuneye and Ayinde (2004) cited in Anyira (2010) add that small scale resource farmers have good reasons for sticking to their local knowledge and farming practices, because modern technologies can only be successful and sustainable if indigenous knowledge is taken into consideration. Agricultural production in the Africa region is constrained by limited water resources and fertile land, extremely low and variable precipitation, exposure to extreme weather events, land degradation and desertification. Water is becoming increasingly scarce in several countries in the region. The availability of

renewable water has fallen, on a per capita basis, by more than 70 percent since 1950; a further 40percent decrease from present levels is expected by 2050. These constraints hamper efforts to maintain current levels of self-sufficiency in food production. On the other hand, the continent struggles to ensure local production of fresh and nutritious foods (red meat, poultry, dairy, fish, fruits and vegetables) is adequate to meet a large part of domestic demand. Despite constraints in production and marketing, the crop and livestock sectors make a significant contribution to the rural economy (Adelowo, 2003).

Farmers in local communities' employ various indigenous practices most of which cut cross among the crops grown. One of the pillars for indigenous as well as improved farming methods practiced is early planting which is especially important in the agro-ecological communities where agriculture is rain-fed. Farmers take advantage of the early rains which also reduce the incidences of pest and disease leading to high yields (Ssekabembe, 2003). He further notes that as some farmers' burn grass or trash in their farms, they prefer planting / sowing green vegetables or even millet in it. The ash in this case is seen as a source of nutrients and also burning is believed to kill crop pests.

Farmers also in some local communities plant lab-lab around their farms with a belief that it prevents night dancers from intruding in their gardens among other related cases of witchcraft (Akullo et al. 2007). They also practice selection of clean planting materials to control pests and diseases as in the case of formal research whereas for cassava, they ensure that the cuttings are not damaged prior to planting and that nodes face downwards to encourage effective sprouting and root growth. Farmers rely on crop rotation to rejuvenate the soil whereby many farmers in tobacco growing areas prefer planting root crops in plots that originally had tobacco to specifically control pests (Adelowo, 2003).

In southern Sudan for example, women are directly responsible for selection of all sorghum seeds saved for planting each year. They cull seeds and preserve a spread of variety of

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conditions that may arise in any given growing season (Easton and Ronald, 2000). This ensures food security. Women in the Kalasin region of northern Thailand use their indigenous knowledge in managing the interface between wild and domesticated species of edible plants. In northern India, an elderly woman farmer puts the matter succinctly as she selects seeds for storage; it takes a sharp eye, a sensitive hand and a lot of patience to tell difference between the seeds. But these are not the things that are honored any more (Easton and Ronald, 2000). Also, women in the Dalwangan and Mammbong communities, Bukidnon province, Mindanao (the Philippines) have played an active role in constituting a "memory bank" of indigenous germplasm with agricultural researchers, because they share the concern for diversity.

Many other voices are in support of this. For instance, Farm Radio Network (2003) also noted that women possess an enormous amount of knowledge about food production and processing, medicine, child rearing and other survival skills. In Tonkere village in Ife Central Local Government (Southwest Nigeria) research carried out by Adebobola (1999), revealed that 86% of the rural women of this area are herb sellers, the farming activities in the upland regions is majorly the "slash and burnt" type of bush clearing. This proves that women have their indigenous means of detecting the viability of seeds for example by selecting the sinking ones soaked in a standing pot of water. In Dehra Dun, India for example, Local women are able to identify several species of trees and their uses; forestry (Shiva and Dankelman, 1992). In neighboring Sudan, many ferment food products prepared by women and this forms an important part of people's diet (Dirar, 1991). Apparently, fermentation adds to the nutritional content of food. Using this process, women majorly have been able to produce nutritious food from substrates as bones, leaves, and caterpillars and cow urine. The practice of fermentation has aided society to manage food shortage and famine in the past. This Indigenous knowledge is used to develop survival strategies. An example of Yazd, the "desert capital" of the Islamic

Republic of Iran is cited here. It is believed that women have devised a number of highly sophisticated technologies for agricultural production, such as food production in a tunnel constructed underground.

In Uganda, women used indigenous vegetable to ensure food security. Though rural women are responsible for feeding their household, yet they have limited access to resources. Household gardening offer women an important means of earning income without overtly challenging cultural and social restriction on their activities (Rubaihayo, 2002).

2.3 Existing Methods of Documentation and Disseminating of AIK

The documentation of AIK has become an inevitable initiative to talk. This has led to a number of studies and initiatives in the field on KM all over the globe. Many methods have been suggested by different authors for the proper documentation of AIK. However, the most unfortunate part is that most of these methods remain on paper as suggested by different studies especially in the developing world. Latest studies indicate that the methods of documenting AIK are more applicable and effective in the developed worlds. In the developed world like USA for example, Warren et al. (1993) notes that AIK studies have been archived in national and international centres in the form of databases. The information in these databases is systematically classified. Warren et al. (1993) further proposes that the collection and storage of indigenous knowledge should be supplemented with adequate dissemination and exchange among interested parties, using newsletters, journals and other media.

As it has been noted, IK has been an important component of development in the developing world. This has been more evident in the agriculture sector. In support of this, (Tabuti, 2012) observed that farmers' knowledge has been responsible for improving agricultural productivity and ensuring food security for centuries in Tanzania. The situation is not any different from that in Uganda. In a related development, many studies recommend the use of Information Communication Technologies (ICTs) in the documentation and dissemination of

AIK. According to Lwoga and Ngulube, (2008), ICTs are important tools in enabling the management and integration of indigenous and exogenous knowledge in developing countries. However, Malhan and Gulati, (2003) seem to have a different view from this. To them, the issue of the digital divide hinders the effective use ICTs in the management of AIK. They noted that the digital divide continues to grow so wide that many farmers do not have the opportunity to transform into knowledge driven communities in the Sub-Saharan African countries. The technological, economic and educational implications of disparities in the distribution of digital technology contribute to this situation (Malhan and Gulati, 2003). Malhan and Gulati, (2003) further argue that documenting and disseminating IK through ICTs contributes to the degradation of indigenous cultures and indigenous peoples' loss of intellectual property rights. They recommend that African governments must improve ICT infrastructures, and formulate appropriate Intellectual Property Rights (IPR) and policies that will protect IK for its effective management through KM practices.

But Aluma, (2010) has got an entirely different view of AIK documentation. He notes that documentation of IK related to medicinal plants, herbal concoctions and the diseases treated (human and livestock), crop protection and food preservation has been ongoing but in ad hoc ways. He further notes that large basic data has been collected, "as is" from the practitioners view point with witness proofs of IK that has worked. However no funds have been secured to publish these for sharing with others (Aluma, 2010). This throws the debate on AIK documentation in open air as different writers have got different views about the management of AIK. But according to the literature reviewed, most of the notable AIK documentation Initiatives is taking place in the developed world. The Center for Indigenous Knowledge for Agriculture and Rural Development (CIKARD), states that some centers have become involved in looking at IK as a key component of sustainable agricultural practices; others have been in
charge of researching and cataloguing existing IK. The Center for Indigenous Knowledge for Agriculture and Rural Development (CIKARD), established in 1987 at Iowa State University, is an example of the latter. CIKARD which is a USA based organization "focuses its activities on documenting and preserving the indigenous knowledge.

It's also very important to bear in mind the quality of IK that is managed. AIK that has already been documented needs to be evaluated to confirm its efficacy and utility. This helps to eliminate any possible doubts about the efficiency of this IK. For instance many potential users of traditional medicine are dissuaded from using it because they are doubtful that it is efficacious and safe to use. A key challenge to IK development and promotion through documentation and validation is that by reducing indigenous and traditional practices to the knowledge dimension and stripping away their cosmological context (the so-called backward beliefs), we risk losing a major source of IK meaningfulness for the local people and consequently lose IK in the community (Fisher et al., 2001).

Lwoga et al. (2010) on their part noted that one of the best modern approaches to preservation of traditional knowledge is documentation in some permanent form and public accessibility. In addition to preservation, documentation and dissemination of agricultural indigenous practices provides an effective tool for research and innovation. Perhaps this is a primary role of special libraries. However, Lwoga et al. (2010) observed that research libraries have not been particularly active in documenting AIK. Nakata and Langton (2005) emphasizes that libraries must consider indigenous knowledge not simply part of a historical archive, but a contemporary body of relevant knowledge.

The IIRR also reported that AIK could be documented in the form of descriptive texts such as reports, inventories, maps, matrices and decision trees; audiovisuals such as photos, films, videos or audio cassettes as well as dramas, stories, songs, drawings, seasonal pattern charts, daily calendars and so on. Indigenous knowledge could also be stored in local communities,

databases, card catalogues, books, journals and other written documents, audiovisuals and museums (IIRR, 1996). All this is the work of libraries and documentation centers.

Therefore, since indigenous knowledge is essential to development, it is often suggested that it must be gathered and documented in a coherent and systematic fashion (Brokensha et al. 1980; Warren et al. 1993). This IK can therefore be easily tapped and accessed by individuals from various sectors like health and agriculture. It has been observed that more studies of indigenous knowledge have become available and therefore its relevancy to development will have inevitably become self-obvious.

2.4 Constraints of Documenting Agricultural indigenous knowledge systems

There are a number of challenges associated with the documentation of AIK. No wonder Ngulube (2002) contended that the main challenges to the management and preservation of AIK are issues related to methodology, access, intellectual property rights and the media and formats in which to preserve it.

However, it has been observed that most of the knowledge management approaches in Africa are inclined towards the scientific methods. Ngulube, (2002) notes that the prevailing information management approach in Sub-Saharan Africa, like in many other parts of the world, is based on acquiring and documenting explicit knowledge, which is largely generated by researchers, laboratories and universities. To him, such approaches leave little room for IK of the local communities to be integrated into the exogenous knowledge system. Even if some of the IK is preserved in the global, regional and national repositories, local farmers can only access these databases through an intermediary (that is, researcher, extension officer, or any agricultural actor) that can afford to access and use these systems.

Generally, IK is preserved in people's minds and local practices, which may be eroded by failing memories and death. IK is shared and communicated orally and through traditions and culture. However, its distribution is always fragmentary, due to gender dynamics, politics, power, culture, conflicts, resistance, religious beliefs and government policies (Mudege, 2005). Since IK is essential for agricultural development; it must be managed and preserved in the same systematic way as external knowledge. It is thus pertinent to determine a model for managing agricultural IK before much of it is completely lost.

Furthermore, IK is disappearing because of increasing barriers that affect its transmission between community members. There are many examples of such loss of IK in Uganda. For instance, people of the present-day Kaliro District have forgotten how to manage traditional food plants to ensure that such plants are available to future generations, (Tabuti et al., 2004). Previously, people managed species such as Dioscorea bulbifera by cultivating them. The barriers to AIK transmission include inadequate documentation of AIK and the secrecy of custodians of AIK.

Sighn and Rajoo (1993) observed that one important challenge in documenting AIK mentioned is about the contradiction between the idea of transfer of knowledge from one place to another and the need to maintain and develop cultural diversity of a locality. Moreover, several studies point out that a knowledge system is most often specific to a particular physical, economic, and cultural environment. This view was supported by Karter (1993) who advised that IK is rooted in a given socio-cultural environment. From this perspective, this implies that it is difficult to transfer location-specific knowledge from one place to another. Further, it is stressed that questions of property rights and markets are relevant to the transfer of knowledge (Karter, 1993). He gives an example of a blacksmiths who may be reluctant to forego property rights of their knowledge and promote its transfer. Besides, the acknowledge system is often operational in areas where markets for a particular product exist. Rather, it was argued, that institutions such as community-based associations be promoted to record, preserve, and upgrade a knowledge system within its natural environment (Karter, 1993). Consequently, Karter (1993) highlights the importance of creating awareness among bearers of indigenous knowledge systems.

According to Grenier (1998), there are other specific limitations regarding the applications of indigenous knowledge. As with scientific knowledge, however, indigenous knowledge has its limitations. Grenier (1998) further explains that indigenous knowledge is sometimes accepted uncritically because of naive notions that whatever indigenous people do is naturally in harmony with environment. highlighted the idea there is historical the He that and contemporary evidence that indigenous peoples have also committed environmental 'sins' through over-grazing, over-hunting, or over-cultivation of the land. It is misleading to think of indigenous knowledge as always being 'good, 'right', or 'sustainable'.

For example, a critical assumption of indigenous knowledge approaches is that local people have a good understanding of the natural resource base because they have lived in the same, or similar, environment for many generations, and have accumulated and passed on knowledge of the natural conditions, soils, vegetation, food and medicinal plants etc. (Grenier, 1998). However, under conditions where the local people are in fact recent migrants from a quite different ecological zone, they may not have much experience with the new environment. In these circumstances, some indigenous knowledge of the people may be helpful, or it may cause problems (e.g., use of agricultural systems adapted to other ecological zones).

Therefore it is important, especially when dealing with recent migrants, to evaluate the relevance of different kinds of indigenous knowledge to local conditions.

Wider economic and social forces can also erode indigenous knowledge. Pressure on indigenous peoples to integrate with larger societies is often great, and as they become more integrated, the social structures, which generate indigenous knowledge and practices, can break down. The growth of national and international markets, the imposition of educational and religious systems and the impact of various development processes are leading more and more to the 'homogenization' of the world's cultures (Grenier, 1998).

Consequently, indigenous beliefs, values, customs, know-how and practices may be altered

and the resulting knowledge base incomplete. Thrupp (1989) on the other hand observed that sometimes indigenous knowledge that was once well adapted and effective for securing a livelihood in a particular environment becomes inappropriate under conditions of environmental degradation (Thrupp, 1989). Agea et al. (2008) summarized the major limitations of using AIK in Ugandan context. These were; AIKs lacks documentation, the lack of proven scientific procedural explanations, AIK is restricted only to those who have the knowledge, its believed to be obsolete and out of date, some unsupportive cultures and some local practices/technologies are time demanding.

Although indigenous knowledge systems have a certain amount of flexibility in adapting to ecological change, when change is particularly rapid or drastic, the knowledge associated with them may be rendered unsuitable and possibly damaging in the altered conditions(Grenier, 1998). Finally, an often-overlooked feature of indigenous knowledge, which needs to be taken into account, is that, indigenous knowledge unlike scientific knowledge; sometimes the knowledge, which local people rely on, is wrong or even harmful (Thrupp, 1989). Practices based on, for example, mistaken beliefs, faulty experimentation, or inaccurate information can be dangerous and may even be a barrier to improving the wellbeing of indigenous people, (Thrupp, 1989).

Likewise, Agea et al. (2008) also identified a number of factors limiting the use of indigenous practices and technologies in enhancing household food security in Ugandan context. One of the major limiting factors to the use of indigenous knowledge in enhancing food security was lack of documentation. Other limitations included lack of proven scientific procedural explanations, young peoples' perception that indigenous knowledge is obsolete and out-dated compared with western scientific knowledge and practices. The study recommended that there is a need to build strong awareness programs by extension agents on indigenous knowledge systems in order for farmers to appreciate its role in enhancing household food security in

especially rural areas where the factors of production is scarce. With the rapid environmental, social, economic and political changes occurring in many areas inhabited by indigenous people the danger is that the indigenous knowledge they possess will be overwhelmed and lost forever (Singh, 2006).

To this end, it is thus imperative to investigate how AIK can be managed and protected for sustainable agricultural practices in the local communities. The sharing and documentation of IK would enable the local communities to guard against its disappearance and misappropriation by checking to determine whether it is new or has always existed and, therefore, cannot be patented.

2.5 Strategies for Documenting and Disseminating AIK

Universities are helping to promote indigenous knowledge in agriculture through integrating traditional with formal scientific knowledge, for example, the Faculty of Agriculture and Natural Resources of the Africa University seeks to promote a holistic approach to life and recognition for the inviolability of the environment. It intends to achieve this by establishing a dynamic community of learning committed to teaching, research and extension that addresses the challenges of food production to meet the dietary requirements in Africa, encourage income generation to improve the quality of life of current and future generations through improved agricultural practices and the sustainable management of natural resources (Chisita, 2011).

According to Chisita, (2011), libraries in Higher and Tertiary Education have a critical role to play as the engine that drive the natural processes by which members acquire knowledge skills and attitudes and attitudes appropriate to their local life. This is in line with Mbeki, (2005) in his in augural speech at the Association of African Universities conference "…higher education has an important role to play in the economic, social, cultural and political renaissance of our continent and in the drive for the development of indigenous knowledge

systems (IKS)"

Furthermore, modern technology is an important aspect in repackaging information because Information and Communication Technologies (ICT's) are free from the fetters of time and space. Studies indicate that Libraries need to utilize modern technology to promote access to indigenous knowledge with regards to promoting a culture of knowledge sharing amongst farmers. Tsiko (2004) suggests an alternative to the repackaging of indigenous knowledge through documentation. The author states that this is critical at a time when traditional knowledge is being marginalized by high culture resulting in assimilation and cultural genocide. With due consideration to intellectual property rights, it is imperative to document this knowledge that has practical uses in agriculture, forestry, health and sustainable development.

Libraries need to be proactive and promote community publishing, so that communities are able to document their experiences and market as well as share with others. Programmes to repackage traditional knowledge will also help to integrate Western and indigenous knowledge to generate knowledge to tackle the environmental challenges with regards to land management .Community libraries working with communities and other stakeholders can encourage research, recording and documentation and use of hereditary knowledge system to showcase how these can be used in managing natural and cultural elements, for example , Public libraries use of storytelling sessions helps to unlock the great potential encapsulated in indigenous knowledge systems (Chisita, 2011).

2.6 Research Gap

Literature on indigenous agricultural practices (traditional agriculture and IK) in Uganda is scanty which makes it imperative for more research to be carried out in this area. Whilst not much has been done in this area, studies that were carried out on indigenous farming practices in Uganda have not applied a systems approach. Most of the early studies on the role of indigenous knowledge have largely been restricted to environmental conservation (NARO, 1997). Very few studies have examined the challenges of managing AIK. Agea *et al* (2008) for instance focused on the role of indigenous knowledge in enhancing household food security in Mukungwe, Masaka District, and Central Uganda using a small sample of 60 households which were randomly selected. The value of documenting and disseminating this knowledge has been sufficiently tackled in real sense.

This study therefore examined the challenges of documenting and disseminating agricultural indigenous knowledge for sustainable food security in Soroti district. The use of purposeful sampling together with a larger sample size (N=351) aimed to enhance the validity of the findings. Also unlike Agea *et al* (2008) who used SPSS to generate simple descriptive statistics, this study used content analysis to determine the presence of certain concepts within data. This method analyzes the presence, meanings and relationships of words and concepts, and to make inferences about the messages within the culture and time of which these farming communities are a part of. The attributes were captured in terms of ethnographic methodology and ethnographic decision trees in order to relate AIKs to the cultural systems. Agea et al (2008) also focused on a single area in central Uganda while this study will collect data from two different agro-ecological zones.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used in collecting and analyzing data. It includes the research design, area of the study, study population, sampling method, data collection methods and instruments, data analysis and presentation, the ethical considerations, data quality control and the limitations of the study.

3.2 Research Design

The study adopted a descriptive design that was qualitatively driven. This design entailed ethnographic methodology that allowed for content review using analytic induction and ethnographic decision trees. According to O'Leary (2004), ethnography is the systematic study of people and cultures. It's designed to explore cultural phenomena where the researcher observes society from the point of view of the subject of the study. The ethnographic approach was preferred because IK is unique to specific cultures and has elements of the linguistic and sociological traditions, thus the need to analyze the cultural content and the patterning of narrative about the sufficiency of indigenous knowledge systems and its contribution to sustainable agriculture amongst the two major tribes in Soroti; the Itesots and Kumams. The unit of analysis was a single homestead. Food security is the dependent variable while IK Practices, IK Tools, IK Methods, IK holders, community involvement, level of technology development, community setting, and dissemination channels are independent variables.

3.3 Area of study

The study was carried out in Soroti District in two sub-counties of Arapai and Asuret. Soroti district is located in Eastern Uganda. It is 228 kilometers from Kampala via Tororo and 322 kilometers from Kampala via Tirinyi respectively. *(District Information Handbook, 2007)* Soroti district is predominantly occupied by the Itesots by tribe and Nile hermits by ethnicity.

The choice of Soroti district was informed on the basis of the fact that Soroti is endowed with vital natural resources such as abundant land with fertile soils, enormous forest and vegetation composed of diverse plant species and ample perennial water resources. The Itesots and Kumams base their livelihood on these natural resources. Shifting cultivation alongside gathering wild forest foods, raising livestock (mainly goats, cows and chicken) and local market exchange form major sources of the subsistence system. These communities have special relationships with their lands and the environment. They possess knowledge about their natural resources and environment based on observation and experience. Indigenous knowledge is important to the Nile-Hermite's systems of natural resource management and it can be best understood along with their traditional belief systems.

3.4 Population

According to the Uganda National Bureau of Statistics District Population Report, (2011), Soroti district has a total population of 554,900, of which 72 % live in rural areas and involved in Agriculture. The District is occupied by the mainly *Iteso* and *Kumam* who are all Nile-Hermites. There are three languages commonly used in Soroti namely; Ateso, Kumam and Swahili. According to the *District Information Handbook, (2007),* there exist 4146 ordinary rural farmers from within the (2) sub counties of Asuret and Arapai in Soroti district from whom a total sample size of 351 respondents were targeted with the use Yamane's sample determination formula. They included traditional healers, local farmers, community leaders, family units and the elderly (above 60 years) who were purposively selected because

they were believed to possess sufficient information about utilization of IK in agricultural production as they had lived long enough to witness the changes in utilization.

3.5 Sampling

A combination of sampling techniques were used to arrive at a sample size of (N=351). They included purposive, snowball and stratified sampling techniques. Stratified sampling technique was used to select farmers because it reduced the chances of sampling bias, thus enhanced data reliability and study's validity. Purposeful and snowball sampling techniques helped to ensure that respondents with exemplified AIK characteristics were identified and included in the study. Snowball technique was also used to identify the most suitable farmers with the AIK. The categories of respondents included local farmers, community leaders, family units, traditional healers and elders all of whom are believed to be better custodians of IK because of their age and experience.

3.5.1 Sample size

Data was collected from 4146 target key informants, from the targeted sub counties of Asuret and Arapai in Soroti district.

3.5.2 Purposive Sampling

The study adopted purposive sampling in selecting the sample. This technique was used because it enabled selection of participants based on their role in the communities and the farmers' interests within the sampled sub counties. This method was deemed considered economical because only a part of the population that has vital knowledge to the area of study was sampled. Using this technique, the Elders, traditional doctors, Community leaders and rural farmers were selected.

3.6 Data Collection Methods

Data was collected through, in depth interview, document review and Participant observation.

3.6.1 Participant Observation

Participant Observation (See Appendix A2) was used get an insider's view of what is their traditional belief systems within the communities being studied (Glesne, 1999). Observation entailed the systematic noting and recording of events, behaviors, and artifact (objects) in the social setting. Involvement in the setting enabled the researcher to hear, to see, and to begin to experience reality as the participants do.

Additionally, the researcher had spent a significant amount of time in the setting (eight months), learning about daily life there. This provided the opportunity to learn directly from own experience. Personal reflections are integral to the emerging analysis of a cultural group, because they provide the researcher with new vantage points and with opportunities to make the strange familiar and the familiar strange. Through participant observation, the researcher sought first-hand information about the forms of IK that were practiced in the rural agricultural setting where the IK systems occur regularly. Such observation confirmed the nature of IK systems practiced in rural areas. Observation also involved going to the gardens and tilling the land with the farmers, looking after animals and treating crops and animals using local methods and local herbs. The researcher also spent significant amounts of time sitting and discussing with rural farmers in the evenings and afternoons in the local bars.

3.6.2 In-depth Interview method

Unstructured interviews is one of the primary qualitative data collection methods because of its ability to enable respondents to use descriptive mode in giving details, feelings and views on the issue being investigated. The unstructured interviews were used to collect the data. An interview guide (See Appendix A1) was used to conduct an in-depth interview. This method was considered, because it supported the researcher to judge the superiority of the responses from the respondents to be unquestionable in his answers. Visual signs like nods, smiles were noted. The researcher interviewed the community leaders, elders, traditional healers and rural farmers to

gain their personal experiences and opinions on the adequacy of indigenous knowledge to their daily farming lives.

3.6.3 Focus group discussions

Focus group discussions involved organized dialogue with a selected group of individuals to gain information about their views and experiences of a topic. This study employed focus group discussions with focus group interviewing as it was particularly suited for obtaining several perspectives about the AIK. Focus group discussions were used because the researcher was able to gain insights into people's shared understandings of AIK and the ways in which individuals are using the knowledge in a group situation. The discussion was moderated by an extension agricultural farmer from Arapai.

3.6.4 Document Review

A review of documents on Indigenous knowledge systems and all traditional agricultural systems in Soroti district was undertaken. This was done to supplement primary data (**See Appendix A3**). The review included documents such as dairies, photographs, publications, letters, autobiographical writings, local directories, and special ethnic publications.

3.7 Research procedure

An introductory letter was obtained from the College of Computing and Information Sciences, Makerere University, introducing the researcher to the institutions where research was carried out. Permission was then sought from the local administration in Asuret and Arapai sub-counties in partnership with the District Security Officer (DISO), Gombolola Security Officers (GISO) of the two Sub-counties and the NAADS Coordinators of the areas studied. A recruitment and training of research assistants was then carried out. Pre-testing of data collection instruments was done to ascertain their validity before actual field visits.

3.8 Data quality control

3.8.1 Validity

The validity of interviews was ensured through formulating relevant questions in the interview guide and pilot testing on a population almost similar to those intended in the research. This was done to ensure the questions are not miss-leading or vague and flow in a logical manner. Rigorousness was applied during the interviews to ensure the most accurate response was attained. In case the answers to the same question differ, the researcher called the attention of the respondent to the anomaly and the question asked again until the truth was established.

3.8.2 Reliability

Reliability of the interview and focus group interview was censured by asking the same questions to different people to ensure the answers are the same. Probe questions and rephrasing similar questions were used to cross check the validity of responses.

3.9 Data Analysis and Presentation

Analysis was done using of cognitive mind mapping, thematic areas and content analysis for data display and conclusion drawing. Analysis of data was based on the themes derived from the objectives. Data collected was transcribed from the audio tapes, videotapes and films to theoretically saturated activity. The analysis was broken down into two parts, namely; conceptual analysis and relational analysis. In conceptual analysis, concepts were chosen for agricultural indigenous examination. This were; forms of knowledge, methods of documenting and disseminating AIK, constraints of documenting and disseminating AIK and strategies for documenting disseminating AIK. The unit of analysis was a and of single farmer's house unit.

The analysis involved quantifying and tallying the presence of the concepts following a predefined set of categories. The focus was on looking at the occurrence of selected terms within the recorded interviews, pictorial information and video recordings. Induction and ethnographic decision trees were used to understand trends in AIK utilization by local farmers and conclusions and recommendations made according to the study's four objectives. This was done by hand, i.e. reading through the text and manually, watching the video clips and listening to audio recordings and writing down concept occurrences. Coding was done manually since it enabled the researcher to recognize errors more easily.

The five broad thematic areas of AIK were;

- Effectiveness of various AIK methods
- 4 Sourcing of Indigenous Knowledge and its dissemination within the community
- Managing soil fertility /Controlling pests and diseases
- Controlling weeds/Soil preparation
- Planting materials /Harvesting
- Storage of food crops and animals

Coding was developed for specific words, such as "love/like", "very good/not good/bad" "available/not available", "usually/rarely/never" and for sets of words or phrases, such as "useful/unhelpful", "it happens/does not happen", "it is possible/ not possible", "natural", "natural modified", "artificial" "expensive", "appropriate", "cheap", "time consuming", "easy", "don't know", "well known", "possible", "impossible", etc-etc.

Figure 3: A detailed framework for description of observations using content analysis



Qualitative Data on AIK in Soroti District

3.10 Ethical considerations

It was considered that the information collected was unique to a given community therefore it was prudent to observe the following ethical issues:

3.10.1 Honesty

The principle of honesty was observed throughout the research process whereby works of other people cited in the research was properly acknowledged and the finding reflected the originality of data collected from the field.

3.10.2 Informed Consent

The study sought the respondents consent to be part of the study by informing them what the study was all about as well as assuring them of their right to participate or not to participate in the study. They were also informed of their right to withdraw from the study before their responses in the study were to be recorded.

3.10.3 Confidentiality

The respondents were not required to reveal their names or besides general personal identity and their responses were confidential. This helped protect subjects' interests and personal rights. However, some of the respondents were freely disclosing their names as they had no problem with the study.

3.10.4 Disclosure

The researcher provided some information about their study to potential subjects before data collection to help them decide whether or not they wish to participate in the study.

3.11 Limitations of the study

a) Availability of respondents

Some interviewees were very busy people considering the nature of their occupations therefore; it was a challenge to mobilize them for prolonged interviews. This limited the scope of in-depth interviews and ethnographic observations as key methods. This was overcome by keeping strict appointments to fit in their busy schedule as well as repeating the same interviews for short periods over a period of days.

b) Reliability of information

This study was qualitative in nature and therefore inferences were made from data upon interview or documentary evidence. It was hard to prove that an event occurred through observation. Efforts were made to remain objective during the interviews to ensure the reliability of the data collected.

c) Bureaucracy

Some component of bureaucracy and internal policy made it difficult to acquire relevant documentation for secondary data. Some public officials (like the DISO, GISO and the District Agricultural Officers) hindered the process by insisting on unnecessary procedures.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSION

4.1 Introduction

This chapter presents and discusses the findings of the study aimed at establishing the forms of AIK used by farmers in Soroti District and the challenges involved in documenting and disseminating AIK. The chapter discusses the study's findings in relation to the literature reviewed. The findings are presented and discussed objective by objective.

4.2 Objective 1: Forms of Agricultural Indigenous Knowledge

The first objective sought to ascertain the forms of Agricultural indigenous knowledge in Soroti District. The findings have been summarized and represented in **Figure 1**:

Figure 4: Shows the three major forms of AIK used in Soroti District



From Figure 4, findings show that there are three major forms of AIK used in Soroti district namely pest and disease management, food/grain storage and preservation and soil fertility management. This is only applicable to Soroti district and they are based on the responses from the field. From the literature, many authors talk about AIK but there are no specific forms/types of Agricultural Indigenous Knowledge they give. They differ in names but the applicability is the same from community to community and from clan to clan. This finding supports (Thomas, 2008) who noted that Agricultural Indigenous Knowledge is not uniformly distributed and differs between and within communities. These variations in AIK according to (Somnasang and Moreno-Black, 2000), occur because of cultural and geographical diversity. In Uganda, it is estimated that there are more than sixty-five indigenous communities (MGLSD, 2006), each of which is culturally distinct and has unique IK. Even within the same culture there are variations. For example, for each tribe in Uganda there exists a diversity of clans which greatly add to the diversity in IK (Katende and Kityo, 1996).

Pest and Disease Management

In crop husbandry, Teso people use IK to control pests and protect harvests. This finding supports (Aluma, 2010) who noted that farmers use IK in the identification, production and/or harvesting of plants, animals and insects and their preparation and preservation for food. He further adds that IK is used in the making drugs for human and animal health, food preservation and crop protection (against pests/diseases); spells, luck, love, business as well as management systems and techniques for crops, livestock, ecosystems conservation and communities.

The farmers in Soroti for example use local medicines to treat animals and plants when they are attacked by pests and diseases. To control pests and diseases in livestock for instance, the findings indicate that farmers use a variety of medicinal plants to treat the animals. In support of this finding, Waziri and Aliero (2005) stated that if pest and diseases cannot be prevented or

controlled by cultural and physical means, it may be necessary to use natural pesticides. Many growers have developed ways of making their own spray from plants such as NEEM, garlic, hot peppers, marigolds, etc.

Furthermore, to control pests and diseases in crops, farmers also slash and burn the infected crops, carry out crop rotation and cultivate different varieties of crops to control pest and disease spread. This finding further supports Waziri and Aliero (2005) who noted that growing the same crops in the same site year after year can encourage a buildup of pests and diseases in the soil. These will transfer from one crop to the next. They recommended that crops should be moved to a different area of land each year, and not returned to the original site for several years. For vegetables a 3 to 4 year rotation is usually recommended as a minimum. According to Waziri and Aliero (2005), crop rotation helps a variety of natural predators to survive on the farm. Furthermore, farmers in Soroti also spray crops with human and animal urine, dust the seeds with ash and pepper; one farmer stated that

(...we mix animal urine, animal waste, poisonous plant leaves and ash to treat diseases in their animals such as dieariioa, Constipation and stomach, flu in cows and goats...).

According to the farmer, pest control medicine for plants is locally known as: "Ikeeluikorion".

A thematic analysis of pest and disease control methods was done and results coded into response themes. Most popular methods identified were inter-cropping in sorghum (43%), the selection of planting material in maize (35%), and Bananas (62.4%). A tally sheet of fifteen (15) categories was used. Results are summarized in **Table 1** below.

Table 1: INDIGENOUS METHODS OF CONTROLLING PESTS AND DISEASES IN CROPS

Indigenous methods of controlling pests and diseases in Maize, Bananas, Cassava and								
Sorghum.(n=351)								
Indigenous control	Maize	%	Banana	%	Cassava	%	Sorghu	%
methods							m	
Activity /Response Theme							•	
1. Sanitation (hygiene)	81	23%	87	25%	78	22%	105	30%
2. Burning & smoking	73	21%	87	25%	101	29%	90	26%
3. Use of resistant variety	71	20%	76	22%	106	30%	98	28%
4. Intercropping	116	33.0%	39	11%	47	13%	149	42%
5. Rouging of diseased	100	28%	78	22%	98	28%	75	21%
6. Use plants as repellent	87	25%	77	22%	104	30%	83	24%
7. Dusted planting materials(Ashes)	54	15%	67	19%	116	33.0 %	114	32%
8. Hand picking and squashing of beetles	67	19%	115	33%	80	23%	89	25%
9. Fallowing and Shifting cultivation	54	15%	82	23%	65	19%	150	43%
10. Using physical barriers	118	34%	51	15%	95	27%	87	25%
11. Selection of planting materials	56	16%	165	47%	85	24%	45	13%
12. Manipulation of planting season	106	30%	64	18%	103	29%	78	22%
13. Scaring devices for	54	15%	43	12%	35	10.0%	219	62%
14. Slash and burn	58	17%	53	15%	57	16%	183	52%
15. Plant cover crop	87	25%		0.0%	105	30%	159	45%

Source: Field Data, 2015

Results in Table **1** show that farmers control pests and diseases in Maize gardens through Sanitation 23%, burning and smoking 21%, use of resistant crop varieties 20%, intercropping 33.0%, roughing of diseased plants and leaves 3.4%. Findings also reveal that farmers use some plants as repellants 25%, use ashes 15%, hand picking and squashing of beetles 19%, bushing following and shifting cultivation 15%, use physical barriers 34%, and select planting materials 16%. Additionally, they manipulate planting seasons 30%, use scaring devices for vertebrate pests 15% and plant cover crops takes 3.7%.

Within the banana plantations, farmers ensure sanitation 25%, burn and smoke bushes 25%, use resistant crop varieties 22%, intercropping 11%, while roughing of diseased plants and leaves (1.4%) is also done although sporadically. Farmers also use plant repellants 22%, ashes 19%, hand picking and squashing of beetles 33%, fallowing and shifting cultivation 23%, use of physical barriers 15%, selection of planting materials is most practiced here at 47%, manipulation of planting seasons 18%, scaring devices 12%, slash and burn 15% while only 3.7% plant cover crops.

To control pests and diseases in cassava, findings reveal that farmers plant cover crops 30%, slash and burn 16%, use scaring devices 10.0%, manipulate planting seasons 29%, selection of planting materials 24% and use physical barriers 27%. Findings also indicate that fallowing and shifting cultivation is done 19%, hand picking and squashing of beetles 23%, Ashes being popularly used 33.0%, use of repellent plants 30%, roughing of diseased plants and leaves 12.8%, intercropping 13%, use of resistant varieties 30%, burning and smoking 29% while sanitation stands at 22%.

To control pests and diseases in sorghum, 30% maintain sanitation, burning and smoking 26%, use of resistant varieties 28%, intercropping 42%, roughing of diseased plants 12%, and use of plants as repellants 24% while ashes are used by 32% of the respondents. Furthermore,

25% do hand picking and squashing of the beetles, fallowing and shifting cultivation 43%, use of physical barriers 25%, selection of planting materials 13%, manipulation of planting seasons

22%, scaring devices for vertebrate pests 62%, slash and burn 52% and plant cover crops 45%.

From the findings in the table above, it is believed that the people of Soroti still use indigenous methods of controlling pests and diseases in the four crop categories of Cassava, Maize, Sorghum and bananas.

Although findings show that some methods are more used than others, it was noted that individual farmers who used isolated methods were very comfortable and the methods were effective for them. According to one farmer, "...*these methods are very effective for us in" in Asuret.* ...". These indigenous methods to controlling pests and diseases in the above mentioned crops have several voices to buck them up.

According to the African Agricultural Training Manual (2011), the traditional approach to plant pest, plant disease and weed management is still very common in many parts of Africa. According to this manual, generally, rural farmers aim at sustaining and enhancing the health of their soils, plants, animals, humankind and in the widest sense the planet.

Especially about the use of resistant varieties, Altieri, (1995) states that the use of crops and varieties tolerant or even resistant against common pests and diseases is an effective measure to lower risks of pest and disease damage. The author states that in traditional farming, selection of varieties with partial resistance or field tolerance to pests is practical and even preferable to high-level resistance. There are more crop varieties with disease resistance than are known for pest resistance. Therefore, for pest resistance, the local knowledge of farmers and advisers about the characteristics of traditional and local crop varieties is of high value (Altieri, 1995).

About manipulation of planting seasons, Altieri, (1995) still notes that planting should be

scheduled so that the most susceptible time of plant growth does not coincide with the life stage of pest or disease inoculum that damage the plant. To him, timing of seeding and planting is used to avoid invasion by migrants, or the oviposition period of particular pests, and the introduction of disease in the crop by insect vectors (like aphids and psyllids). In addition, it is used to synchronize the pest or disease attack with its natural enemies.

The use of cover crops is also supported by many voices in the literature. Betegeka (2013), Aluma, (2010) & Agea, (2008) echoed that cover crops and green manures, besides feeding the soil and improving its organic matter content, can reduce pests by confusion and diseases by bio fumigation. Pest species like aphids, root flies or weevils will not find the crop plants due to the intercrop causing olfactory confusion.

In the application of compost manure to help control plant pests and diseases through, Altieri, (1995) noted that compost manure helps to control plant pests and diseases through (i) successful amendment of the soil with insect pathogenic microorganisms (ii) antibiotic production by beneficial microorganisms and (iii) activation of pest-tolerance or disease resistant genes in plants by essential nutrients of composts. Application of organic mulches can, in special cases, reduce pests like root flies, cutworms or aphids by olfactory confusion or by hiding the preferred places for egg laying. In special cases, they reduce diseases by altering the immediate environment or by reducing raindrop splash-dispersal of some soil- borne diseases. However, organic mulches might also enhance some fungal diseases by enhancing soil moisture (Elwell, 1995).

About field hygiene and sanitation, findings show that farmers endlessly employ this method especially in crops such as sorghum. In support of this, Butterfield, (2007) & Cook, (2006) share similar views. They agree that sanitation of existing crops, especially perennial crops should be done regularly. They report that poorly managed or abandoned perennial crops can

result in build-up of pest and disease problems. In recommendation, they indicate that all damaged plant materials and rotten fruits from the ground must be either burned or deeply buried at least 50 cm deep.

Literature furthermore suggests another form of field sanitation called pruning. According to Elwell, (1995), pruning eliminates inoculum in perennial crops. All infected branches or shoots should be cut at least 20 cm below the visible damage. Pruning also improves aeration and light exposure to the crown, which contribute to prevention of diseases. Regular cleaning of all the tools used for pruning infected plants or gardens is important, especially in the case of bacterial and viral diseases (Elwell, 1995).

Regarding intercropping, another approach for managing pests and diseases involves intercropping with other crops. According to Biovision-Infonet, the idea behind it is to have less concentrated areas of host plants which are less easy to be detected and colonized. Distantly related crop plants can visually or chemically interfere with specialist pests, making the habitat less favorable for them. Intercropping systems where two or often more species are grown intermingled without distinct rows are very commonly used in the Soroti. This method had been effective (growing two or more crops together in rows) and strip cropping (cropping by growing two or more species in strips) must be sufficiently wide to allow separate management regimes, but sufficiently close to influence each other. In support of this, Eyhorn (2002) states that these types of mixed cropping systems have been widely investigated as they have great potential for reducing pest attacks.

The mixture of plants needs to be carefully chosen. Anise, chives, garlic, on- ions, radish, parsley and many other species are reported as good partners for intercropping. About the use of plant repellants, Butterfield et al. 2006 noted an example of the Mexican marigold that shows the advantage of repelling pest insects like aphids and root nematodes. However, they note that, such plants attract slugs and can have an herbicidal effect on some plants like cabbages.

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A tally sheet of ten (10) categories on indigenous methods of maintaining soil fertility is summarized in **Table 2.**

Frequency distribution according to indigenous methods of maintaining soil fertility in Maize, Bananas, Cassava and Sarghum (n=351)								
Indigenous method	Indigenous method Frequency of use							
of Maintaining soil fertility(Response	Maize	%	Bananas	%	Cassava	%	Sorghum	%
Themes)								
1.Fallow	98	18.2%	78	18.5%	88	13.11%	87	25%
2. Planting local legumes	89	25%	111	32%	76	22%	75	21%
3. Mulching	104	30%	87	25%	87	25%	73	21%
4. Intercropping	143	41%	43	12%	98	28%	67	19%
5. Adding compost (dead leaves)	101	29%		26%	91	25%	76	21%
6. Mixed cropping	78	22%	91	26%	76	22%	106	30%
7. Shifting cultivation	73	21%	97	28%	112	32%	69	20%
8. Charcoal and ashes	95	27%	99	28%	54	15%	103	29%
9. Animal manure	78	22%	57	16%	112	32%	104	30%

Table 2: Indigenous methods of maintaining soil fertility

Source: Field Data, 2015

Results in **Table 2** show that Mulching 30% and intercropping 41% are the most common methods of maintaining soil fertility in Maize. Use of charcoal ashes 27%, adding of composite manure 29%, intercropping was done by 25% of the farmers, and planting of legumes was 25%, mixed cropping 22%, shifting cultivation 21%, animal manure 22% while bush fallow was at 18.2%.

To maintain the fertility in banana plantations, the dominant methods were planting of local legumes 32%, shifting cultivation 28%, use of charcoal and ashes 28%, adding dead leaves 26% and mixed

cropping 28%. The other methods were also practiced with bush fallowing 18.5%, inter cropping 14% and use of animal manure 16%. In cassava plantations, farmers use animal manure 32%, intercropping 28%, Charcoal and ashes 15%, shifting cultivation 32%, while mixed cropping is at 22%. They also use dead leaves added in the gardens 25%, practice intercropping 28%, mulching 25%, plant local legumes 22% as well as fallowing of the bushes 13.11%.

To maintain soil fertility in Sorghum, farmers carry out bush fallowing 25%, plant local legumes 21%, Mulch 21%, Intercropping 19% and they also add compost manure in the gardens 21%. Furthermore, mixed cropping is practiced 30%, do shifting cultivation 20%, use of ashes 29%, intercropping 32% and 30% add animal manure.

Rejuvenating and maintaining of soil a very vital issue for the farming communities of Soroti. Using traditional indigenous methods, the farmers commonly use bush fallowing, planting of local legumes, mulching as well as intercropping. They also employ compost manure, mixed cropping, shifting cultivation, ashes, intercropping and animal manure to rejuvenate and maintain farm fertility. These practices are not only applicable

There is a growing recognition that soil influences agriculture and traditional methods of ensuring soil fertility are still of great need. For example, in his study of "Indigenous soil management to revive below ground biodiversity - case of Garhwal", Shalini, Maikhuri and Dhyani, (2007) noted that local inhabitants of higher Garhwal are understanding the importance of forests and the value of indigenous products and methods to maintain soil fertility within the forests. According to the authors, the practice of mixed cropping for example exists in the traditional farming system of Garhwal Himalaya. Paddy, millet and pulses are the crops of Kharif (April - October) season and wheat, barley, mustard, lentils and peas of winter season. Farmers generally cultivate 10 - 12 staple food crops together in a year to meet their food requirements. This system, locally known as 'Barahnaja' (meaning food sufficiency and security can be achieved only through a highly diversifying cropping system, which means growing at least 12 staple food crops in a year. Furthermore, the spraying of ash is a common and indigenous practice used almost in each and

every household for the sake of increasing fertility of the various crops in Soroti. In support of this finding, Aluma, (2010) notes that the amount of ash applied has not been quantified but mainly practiced for crops like bananas, ground nuts, maize and onions.

Furthermore, fallowing is also practiced in Soroti district. This method is not only applicable in Soroti but elsewhere in the country and the world over. For example Shalini et al, (2007) note that the keeping agricultural land fallow for a brief period of 4-6 months is a general practice in the rain-fed regions. To them, no crop is cultivated during Rabi season on the land from where the mixed crop of finger millet and pulses are taken during Kharif season. They also noted that applying compost manure locally called as (Mole) is one of the most useful and significant indigenous methods practiced.

4.3 How AIK Practices are used to improve food security amongst farming communities in Soroti

Storage and Preservation

During storage and preservation of agricultural harvest, the farmers noted that they majorly use granaries to store and preserve their farm produce. The farmers further noted that they after harvesting their produce such as sweet-potatoes, they peel and slice them, put them under the sun to dry and store the dry sweet potatoes (*Amukeke*) in the granary. According to one farmer;

"...this amukeke can be stored and remains fresh for 2-3 years. However, when pests attack this amukeke in the granary, its periodically removed and exposed under direct sunshine and the pests and flea will die".

Another farmer noted that;

"After harvesting maize, they dry it and remove it from the corns. After that, they put it in sacks, fix charismas tree leaves and store the maize in a cool dry place. The charismas tree will then dry in the stored maize and the scent will remain in the maize. This scent is very crucial in repelling any potential pest that intends to attach the stored maize".

Additionally, farmers noted that the use of red paper (pili-pili) to keep and protect their beans from pests is very common. One particular farmer noted that:

"... and after harvesting, I dry the beans, remove them from pods by hitting the dry heaps of the beans. I then winnow then, picking out the good seeds mix them with red paper, put in the sack and store in the kitchen. The beans will never be attacked by the beans weevils at all).

Storage of grains for food

It was noted that the indigenous storage systems used to store grains such as maize and sorghum are different from perishable crops. In Teso region maize is primarily stored in granaries, locally known as "*Edula*" (*See Appendices b2*) by the majority of the famers. While some farmers agreed to have stored maize and sorghum in cool shades, they still confessed that keeping such produce in granaries was better. One farmer particularly noted that; *last longer. This way, such stored food helps us during the hard times of famine and long try spells*".

Notably however, even in few homesteads where farming is commercialized with a sizable acreage, material resource bases are strictly limited therefore their storage and processing systems are generally simple. As a result of their simplicity and the fact that these techniques are usually individually small-scale, they have in been disregarded "naive" many cases as by agricultural extension workers and other commercial farmers. But these local ways of preserving agricultural produce has been pivotal in promoting food security in Soroti.

Seeds Preservations

Most food crops found in Soroti include maize, simsim, groundnuts (em*aido*), millets and sorghum. *Itesots* do have a clear concept of selecting seeds. In the case or sorghum, those that are kept specifically for use as seed are differentiated as and are selected at the time of threshing and kept specifically for seed for the next year. To store maize and sorghum, one farmer noted that they select the best quality seeds and cobs and keep them around the fire-place. According to one farmer;

"...this local method of preserving produce for food and seeds has been very effective for me. It keeps the produce free from any insects that can attack it. The hot environment and the

unbearable smoke kills the insects that try to invade the maize and sorghum"

For crops like groundnuts and soya beans, the seeds are stored in pods or sacks so at the time of planting they have to be further sorted. Similarly after harvesting, the grains are also hung in the kitchen or shades in special containers/baskets. For types of produce such as simsim, smaller quantities of grains are selected and kept in gourds (*Etuwo*) (*See Apices b5*). There are different varieties planted by farmers in the area. For instance, some varieties of Simsin are for short periods –taking 3 month to harvest while others varieties take up to 7 months to harvest. To treat the simsim plants, respondents agreed to growing modern varieties which need modern medicine for weeding and harvesting. But for traditional varieties which are also commonly ground, farmers still use ash to control pests such as weevils which attack the harvested seeds.

Some commonly used AIK practices in harvesting and storage include the use of traditional basket granaries, dusting with ash for storage preservation against weevils, winnowing of millet to remove thrash, packing cereals in sacks after threshing, sun drying of legumes to dry them fully before storage and mixing with ash for storage.

Other methods previously much used but now fading out include leaving harvests in the field (ground) and storing under shades (Banana leaves or trees) helps avoid pests and rodents (locally known as "*Ikuru*" and "*imukunyo*"). They are no longer suitable because of land fragmentation and as a measure taken as a precaution against theft.

Therefore, in an effort to overcome constraints to food security, the people of Teso region especially Soroti district, harvest their produce and store them in granaries and around fire places or on top of the roof. Elsewhere in Uganda, granaries are widely used to store agricultural produce. For crops such as cassava, local farmers practice what they call *"storage avoidance"*. This has been seen in many local in communities in other parts of the country, like in Hoima and Butaleja, where local farmers keep their produce in granaries and leave cassava in the gardens. They up-root the cassava only when they are going to prepare it a meal that day or the following day (Tororo District Local Government, 2013).

Additionally, food security in Soroti has significantly improved following the return of internally displaced persons (IDPs) to their original homes. Findings of a recent WFP-led Emergency Food Security Assessment, (2009) confirmed that food security conditions have greatly improved in Teso sub region and that food distributions to household's affected by poor seasons will not needed beyond 2014. No wonder, by the time of the data collection of this study, farmers noted that the government and non-governmental organizations who had been operating in the entire Teso sub-region and Karamoja had stopped issuing food hand-outs and concentrated on promoting food security.

Indigenous soil identification and preparation methods

The farmers employ the use of indigenous ways of classifying characterizing local soil types in fields based on the soils characteristics, problems, and their suitability for various crops. They also make use of ditches, traditional waterways, stone terraces, vegetative barriers and contour ploughing to control soil erosion.

Traditionally some households in Soroti practice non-tillage farming (soil is not tilled) as a method of soil fertility control whereby the land is cleared by hand or burning and crops raised *(See Appendices 4)* with minimum disturbance to the soil. Holes for planting are made with hoes. In the case of Cassava, the cuttings are placed in the hole and base is covered with soil. Farmers testified that there are no significant differences on yield between tillage and non- tillage and they also mentioned that there are other benefits such as soil conservation and lower labor inputs compared to mechechanized ploughing. Some felt that it would be wise to avoid ploughing fields because weed infestation is greater with tillage and inputs are also high. A tally sheet of nine (9) categories showing the effectiveness of indigenous soil fertility and we control methods in Maize, Bananas, Cassava and Sorghum is summarized in **figure 5**.



Figure 5: Indigenous methods of maintaining soil fertility and weed control

Source: Field Data, 2015

Findings in **figure 5** indicate that the majority of small holder farms in Soroti practice cultural methods of soil fertility control such as pull and burn (44.20%), mulching (57%), and intercropping (43.10%) in bananas. Dead leaves *locally called "Ebolia" (33.10%)*, and ashes (25.70%) are also commonly used in bananas. A farmer clearly noted that:

"...it does not require chemical fertilizers or modern machinery to grow bananas in Soroti..."

Animal manure (46.40%), pull and burn (41%) and shifting cultivation (36.70%) were the commonest methods for fertility control in maize farmers. This finding supports Tofinga (2001) who noted that mixed cropping as the growing two or more crops simultaneously on the same piece of land with or without distinct row management. Mixed cropping systems create

favorable condition for the soil, water, nutrients and provide excellent environmental conservation and sustainability. Shifting cultivation has been in use in the Teso community for long however, its usage depends mostly on the inherent soil fertility and existing pressure on land due to population growth and the resulting fragmentation of agricultural land. For this reason, the parentage of cleared land useful for shifting cultivation varies considerably between villages in the same district. Other soil fertility maintenance techniques include use of trenches or gullies and the stone bunds (locally known as *"amatutai"*) to control surface run off in heavy rains.

Other than that, many farming communities in Teso have been dependent on the perishable staples for long and have therefore devised a large number of ingenious storage techniques for these staples. There is traditional storage systems used to store roots crops such as Cassava or Sweet Potatoes. Their storage systems are different from food grains such as maize or sorghum since tubers/roots are all perishable stable foods. For this reason, the small scale farmers traditionally also practice what is called *"storage avoidance"*, whereby root crops such as cassava, yams and sweet potatoes are harvested only for immediate or short term requirements. A farmer had this to say about storage avoidance (...we only dig out the cassava we want to eat on that particular day. Since it cannot get spoilt while it's in the soil, we leave it there until we really need to pick it...). Thus, storage systems are usually relatively short term for seasonal and perishable crops.

4.4 Importance of AIK to Sustainable Agriculture - Crop Production (n=323)

323 crop farmers were asked to state their main reason for using indigenous methods in crop production. The majority of the crop farmers (28%) agreed that AIK increases crop yield. 24% felt it was cost effective and 21% said it improved storage quality. The responses are presented in the Frequency **Pie Chart** (Figure 6).





Other concerns raised were that wild medicinal plants and traditional crops are now reduced, of which modern farming system practices is a major contributor. Asked about future trends, some farmers indicated that (...traditional cropping practices are declining due to increased use in external inputs such as inorganic fertilizer, pesticides and mechanization that diminishes the significance of nature. Introduced agricultural crop diversification likewise contributes to the loss of agro biodiversity and causes other environmental challenges which are unique to IK users...)

Using folk taxonomies (practice of classifying plants and animals according to their presumed natural relationships); the study found that the people of Soroti District possess large and diverse plant use knowledge. Their knowledge covered the management of human illnesses as well as magical, spiritual or ritual conditions. Other plants were specifically for diseases and conditions of cattle, covering many aspects of animal diseases, their treatment and control. Figure 7 (**Bar Chart**) summarizes the responses of the perceived advantages of using IK in animal production from 338 respondents who kept livestock.



Figure 7: Bar Chart: Perceived advantages of using IK in animal production

4.5 Importance of IK to sustainable agriculture – Animal production (n=338)

Survey respondents mentioned over 45 plant species used variously and in overlapping ways as medicine and food for both man and animals (*see appendix number 5*).

Advantage	Number	Percent
1. Less time consuming	78	23%
2. Cost effective	92	27%
3. Easily Available	112	33%
4. Compatible system of production	56	17%
	N= 338	100%

Table 3: Importance of IK in Animal J	production
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Findings show that IK is important in animal husbandry regards. Regarding the responses,

23% of the respondents said it was less time consuming, 27% said it was cost effective, 33% did say that it was easily available, and 17% confessed that IK was compatible with their systems of animal production . According to a farmers, "local herbs are crushed and mixed with water to activate hormones that increase milk production (locally called "Nabekiroke".

This herb is made from groundnuts ("*okileomaido*" leaves). This drug also is general purpose and serves a variety of animal ailments. According to one respondent,

".....ekweru" is an herb used to cure blind cows and goats. When livestock has eye infections or the skin is dry, the leaves are harvested, mashed then mixed with water...." It is also believed to cure several ailments in animals (Broad- spectrum treatment). Other animals diseases frequently mentioned in Teso sub-region include CBPB (Cough for cows) which affects cow's lungs. In one account, it was revealed that some years back, when there was an outbreak of this disease in Soroti (CDPP) many animals died despite receiving treatment from area veterinary officers.

The elders in the area recommended an expert traditionalist to the DAO officers who intervened with IK and helped cure the disease. The experts claim they acquired knowledge along the family line through community elders and the father. He in turn determinates the same knowledge by teaching his children. Several respondents were of the opinion that AIK for animal diseases was in fact more effective than western medicine. It was noted that different Teso communities have medicinal experts whom they consult whenever there is an outbreak of animal's diseases in their areas. Also noted was the fact that the very *Iteso* culture has restrictions on who acquires the knowledge. For instance, only the children of the medicine man are entitled to inherit that specific knowledge. It is very much protected that nobody from outside the family or direct lineage should get to benefit from the skills. This is in a way a barrier to effective documentation and dissemination of the useful AIKs. In cases where an individual who is not a family members wants to acquire the skill from experts on AIK, there is some "fee" to be paid for one to learn. It is not free.

One farmer had this to say:

"...local knowledge in animal production was advantageous because we utilizes local resources which are also cost effective".

This may be true because chemicals and manufactured animal feeds are expensive, require ongoing cash and majority of farmers in Soroti are small holders and cannot afford to rely on it
because it might be far more than their average household income. These small scale farmers are less dependent on outside supplies which can be more expensive and can be available only on an irregular basis. Therefore IK seems to give them a sense of "ownership of the means of production" at all levels.

They are deemed to be less time consuming because of smallness of the farms and the system of production compatible is basically manual. They felt that IK in animal production is more compatible system of production because they are familiar with indigenous practices and technologies. They understand how to handle and maintain them better than introduced western practices and technologies that are encouraged by agricultural extension farmers.

4.6 Objective 2: Existing Methods of documenting and disseminating AIK

The second objective sought to establish the existing methods of documenting and disseminating AIK in Soroti district. These findings are summarized in the **figure 8**.



Figure 8: Existing methods of documenting and disseminating AIK

Findings in the **figure 4** show that there are majorly three existing methods of documenting and disseminating AIK in Soroti district. These methods are in categorized in distinctive units namely: Family Units, Agricultural researchers and agricultural extension workers also sometimes called development practitioners. This finding is supports Abiola et al. (2011) who conducted a study on "*Documenting and Disseminating Agricultural Indigenous Knowledge for Sustainable Food Security: The Efforts of Agricultural Research Libraries in Nigeria*". They stated that all the respondents identified oral history, case study, group interview, dialogue, field observation and joint interpretation, farmers' participation and key informant means as the major methods employed in documenting AIK.

Family Units. Within family units, AIK is documented by some families and disseminated through family members and the communities. The family members are both female and male. Under the communities, AIK is documented and disseminated through Folklore.

Agricultural Researchers. According to findings, Agricultural researchers mainly document AIK through academic research reports and dissertations and thesis.

Agricultural extension workers. Agricultural extension workers also play a role in the documentation and dissemination of AIK in Soroti district. The findings show that agricultural extension workers make field visits. It's during these field visits that they document and disseminate AIK to the locals. This finding supports Abiola et al. (2011) who found out that the major channel of documenting and disseminating AIK as reported by is leaflets and bulletin. In their study conducted in Southwest Nigeria, majority of respondents claimed to use agricultural extension workers while a small fraction of respondents (6.2%) claimed to use the radio and television as channels of AIK dissemination. Other channels identified by the authors in the course of the study are mobile library services and research reports.

The findings further reveal that there are mainly three existing methods of documenting and disseminating AIK is Soroti district. These methods are at three levels namely the family units, agricultural researchers and agricultural extension workers. The local farmers document their AIK through cheap ways such as simple write-ups in books. They then pass on the AIK to their trusted children and other members of the family. This is orally done in their local dialect mainly.

The agricultural researchers and agricultural extension workers are the ones who try to document this AIK in more improved means. They capture the data collected from the field and systematically process it. They then write reports out of the data obtained. This method of AIK dissemination is not done only in Soroti but even other parts of Uganda and the world. It's also practiced in the developed world and in a more technologically advanced way. In support of this, Warren et al. (1993) notes that in the developed world like USA, AIK studies have been archived in national and international centres in the form of databases. The information in these databases is systematically classified. However, Aluma, (2010) has got a totally different view of AIK documentation. He notes that documentation of IK related to medicinal plants, herbal concoctions and the diseases treated (human and livestock), crop protection and food preservation has been ongoing but in and how ways. Looking at the literature reviewed, very few libraries in Uganda and Africa at large are documenting AIK. This is a big challenge and as Africans, we need to be serious about the documentation, protection and promotion of IK that we own (Moahi, 2012).

However, many studies recommend the use of Information Communication Technologies (ICTs) in the documentation and dissemination of AIK. According to (Lwoga and Ngulube, 2008), ICTs are important tools in enabling the management and integration of indigenous and exogenous knowledge in developing countries. This particular statement puts the future of AIK in limelight. It remains to be seen as to how ICTs will be adapted by rural poor communities to document and disseminate AIK.

4.7 Objective 3. Constraints of Documenting and Disseminating AIK

The third objective sought to establish the constraints of documenting and disseminating AIK in Soroti district. The findings of this Objective are also summarized in the **figure 9**.

Figure 9: Constraints of Documenting and Disseminating AIK



According to the findings in the **figure 9**, the constraints of documenting and disseminating AIK are at four levels namely families, communities, agricultural researchers and government and extension workers.

Families: The biggest constraint amongst families is ineffective family linkages. This is coupled with poor gender mainstreaming in extension activities and low land and labour productivity have limited documenting and disseminating AIK in Soroti district

Communities: For the communities, the findings show that the biggest constraints that they face in the dissemination of AIK are communication problems and reservations about innovation, increased population growth and fragmented land holdings and small farms.

Agricultural Researchers: The findings of the study further reveal that the agricultural researchers are faced with the constraints of inadequate trainings, limited input from the framers. More investment in agricultural research would raise production which is critical to Soroti food security now and in the coming decades.

Government & Extension workers: The findings of the study further reveal that the government & extension workers have failed to documenting and disseminating AIK. Since extension workers play a pivotal role in disseminating agricultural information to the farmers. It's important to empower them to documenting and disseminating AIK for food security in Soroti Findings in **Figure 9** indicate that there are several constraints involved in documenting and disseminating AIK is Soroti district. These constraints are positioned in three categories of people namely families, communities and the agricultural researchers. According to findings of the study, the biggest constraint amongst families is ineffective family linkages. This is coupled with poor gender mainstreaming in extension activities and low land and labour productivity.

These findings support Okorafor (2010) who observed that the obstacles faced in the documentation of AIK include lack of suitable equipment for documentation, language barrier (in cases where the documentalist did not understand the local languages), memory failure on the

part of the resource persons as indigenous knowledge is orally passed from generation to generation, particularly in most African societies, cultural practices such as requiring certain rites to be performed as a condition precedent to documentation, and intellectual property right issue which might discourage full disclosure of indigenous knowledge. These findings are in line with those of Anyira (2010) in his study of preservation and accessibility of indigenous knowledge in the Niger Delta area of Nigeria.

For the communities, the findings show that the biggest constraints that they face in the dissemination of AIK are communication problems and reservations about innovation, increased population growth and fragmented land holdings and small farms. Gender dynamics and politics were also noted to have played a role in constraining the documentation of AIK. This finding supports (Mudege, 2005) who noted that AIK distribution is always fragmentary, due to gender dynamics, politics, power, culture, conflicts, resistance, religious beliefs and government policies. Furthermore, (Tabuti et al., 2004) also notes that IK is disappearing because of increasing barriers that affect its transmission between community members.

However, Sighn and Rajoo, (1993) have a different view from the ones above. They observe that one important challenge in documenting AIK mentioned is about the contradiction between the idea of transfer of knowledge from one place to another and the need to maintain and develop cultural diversity of a locality. Moreover, several studies point out that a knowledge system is most often specific to a particular physical, economic, and cultural environment. This view was supported by Karter (1993) who advised that IK is embedded in a given sociocultural environment. From this perspective, this implies that it is difficult to transfer locationspecific knowledge from one place to another. Further, it is stressed that questions of property rights and markets are relevant to the transfer of knowledge (Karter, 1993). He gives an example of a blacksmiths who may be reluctant to forego the property rights of their knowledge and promote its transfer. Besides, acknowledge system is often operational in areas where markets for a particular product exist. Rather, it was argued, that institutions such as community-based associations be promoted to record, preserve, and upgrade a knowledge system within its natural environment (Karter, 1993). Consequently, Karter (1993) highlights the importance of creating awareness among bearers of indigenous knowledge systems.

But Aluma, (2010) has got a totally different view of AIK documentation. He notes that documentation of IK related to medicinal plants, herbal concoctions and the diseases treated (human and livestock), crop protection and food preservation has been ongoing but in ad hoc ways. He further notes that large basic data has been collected, "as is" from the practitioners view point with witness proofs of IK that has worked. However no funds have been secured to publish these for sharing with others (Aluma, 2010). But Moahi (2012) partly gives this role to Librarians, as information professionals.

To sum up the augments of all the above authors, Lwoga et al., (2010) attributes the lack of AIK documentation to libraries. He observed that research libraries have not been particularly active in documenting AIK. Nakata and Langton (2005) emphasizes that libraries must consider indigenous knowledge not simply part of a historical archive, but a contemporary body of relevant knowledge.

4.8 Objective 4: Determine the best strategies for documenting and disseminating of AIK

The best strategies were determined in the light of existing challenges in documenting and disseminating IK in the country. The study makes the following ten recommended strategies for proper management of AIK to ensure sustainable food security in Soroti district.

a) IK should be researched and be thoroughly documented and made freely available to anyone who needs it. This will help solve the challenge of restricted specific lineage or family or clans. It has been noted in the findings that AIK dissemination is not open

for all members even of the same community.

- b) AIK in Soroti district requires attitudinal, behavioral, and methodological changes to give it a scientific touch. It has been noticed that there is little trust between what Agricultural Extension workers think and the perceptions of the small scale farmers.
- c) Small scale farmers should be involved in agricultural extension services rather than leaving the work to formally trained officers who may have little attachment to specific cultural practices in areas they operate. This is supported by Moahi (2005) states that there is need to have individuals with the expertise to research on indigenous knowledge; with the ability to work with communities in non-threatening, respectful ways that would encourage communities to give freely of their knowledge.
- d) IK that has already been documented needs to be evaluated to confirm its efficacy and utility.
- e) More research and documentations about IK. There is need to raise awareness, through dissemination among the community of the most appropriate knowledge and technologies, and the benefits of adopting them.
- f) Where possible, strategies should be developed for mainstreaming IK and technologies in development actions and the national teaching curriculum at all levels of instruction from the primary level through to secondary and university level. No wonder Moahi (2012) recommends that scholars should be teaching IKS and their role in bringing about sustainable development. They should bear in mind the integration of IK and Western knowledge into development process. Universities should take center stage in this campaign since they are the main producers and generators of knowledge and more importantly, their role in producing future leaders
- g) Empower the private sector, the government and Non-Governmental organizations to support and advance the use of IK in the country. Currently, there is such a national strategy for the development and application of IK which was developed and is still being

implemented by different national public and private sector based institutions (NCL, Mbarara University of Science and Technology, Gulu University, Makerere University, National Foundation for Research and Development etc). However, to be effective this initiative still needs to work within a wider policy framework than it presently does.

- h) There is need for a fund to support IK development in different regions of the country. Already such a fund exists and several institutions have previously benefited from the Fund to improve on agronomy, conservation, and processing and packaging indigenous medicine for treatment of livestock diseases but the uptake for this initiative still low amongst small scale farmers.
- i) There is need to for setting up regional centers for research on IK across the country in order to harness the rich cultural values that have yet to be documented in many cultural practices.
- j) There is need to develop professional courses for Training of Community IK Trainers of (up to two) who would specialize in particular cultural practices including training in local languages.

Table 4: A summary of the findings are presented in the table below according the

four objectives.

	Identified
1. Forms of	1. AIK practices are strong from the point of view of their low financial requirement and
Agricultural	low dependence on external input.
Indigenous Knowledge	2. These include spraying animal urine, dusting the seed with ash and pepper; mixing animal urine,
	animal waste, poisonous plant leaves and ash and spraying it on the crop- land where disease and
	pest occur; repeated ploughing; cutting and getting rid of infected plants; crop rotation; burning and
	smoking; and use of resistant variety
	3. Use of traditional medicine to treat livestock diseases (Aloe Vera plants)
	4. Use of organic fertilizer to enhance soil fertility
2. Existing methods	1. Utilization of linkages and family units
of documenting &	2. Agricultural researchers through academic documentations.
disseminating AIK	3. Agricultural extension workers through demonstrations and field visits.
	4. Communal folktales and gatherings.
3. Constraints of	1. Limited input from farmers in setting priorities and formulating the research agenda;
documenting and	understating and disregarding indigenous knowledge systems, experiments and organizations;
disseminating AIK	2. Technical deficiency of the extension service;
	3. Complexity of the research environment and pressures from stakeholders;
	4. Lack of accountable and responsible institute for the linkage; idle and ineffective linkage
	mechanisms;
	5. Absence of proper monitoring and evaluation systems;
	6. Resource constraints and inefficiency of administration;
	7. Communication problems and deep-rooted reservations about innovation;
	8. Motivation and commitment problems on the part of the research and extension staff;
	9. Lack of adequate and organized trainings for farmers and extension workers;
	10. Lack of gender mainstreaming in extension and research activities; and
	11. Shrinking and fragmented land holdings/ diminishing of farm size
	12. Growing number of human population
	13. Over cultivation of farm lands and overgrazing of pasture lands.
	14. Low productivity of land and labor
	15. Existence of soil erosion problem
	16. Poor development of agriculture
	17. no record to support the effectiveness of some methods
	18. Soil fertility management practices, such as manuring require large number of livestock population
	and green matter while fallowing needs large farm size. That is why these techniques are
	nowadays hardly practiced by most poor farmers.
	19. Although all indigenous practices need less money, they need more labour force and are hence
	labour intensive
	20. There is continuous acculturation of the loss of IK through exposure to external cultures
4. Best strategies for	1. IK should be researched and be thoroughly documented and made freely available to anyone who
disseminating of AIK	2 AIK requires attitudinal behavioral and methodological changes to give it a scientific touch
uisseminating of AIK	 Small scale farmers should be involved in agricultural extension services
	4 IK that has already been documented needs to be evaluated to confirm its efficacy and utility
	5 More research and documentations about IK is needed
	6 Strategies should be developed for mainstreaming IK and technologies in development actions
	and the national teaching curriculum
	7. Empower the private sector, the government and Non-Governmental organizations to support and advance the use of IK in the country.
	8. There is need for a fund to support IK development in different regions of the country.
	9. There is need to for setting up regional centers for research on IK across the country
	10. There is need to develop professional courses for Training of Community IK Trainers.

Source: Field Data, 2015

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section presents the summary, conclusions and the recommendations from the analysis of the data presented in chapter four. The conclusions and the recommendations are organized and presented according to the four study objectives.

5.2 Summary of Findings.

There are various IK forms that exist within the community and are significantly contributing to the people's ways of carrying out agriculture. These forms are majorly pest and disease management, food and grain storage and preservation and soil fertility and management. The Teso farmers are immense users of IK. The IK forms commonly used in Soroti are majorly manifested in pest and disease management in plants and animals, soil fertility management techniques and food storage and preservation. In crop agriculture for example, Teso people use IK to control pests and protect harvests, maintain soil and boost soil fertility, predict weather and identify the good seeds for planting. This shows how important IK is to the people of Soroti. It's clearly evident that IK still forms a large part of the Agricultural Knowledge that farmers in Soroti still employ locally.

The study also observed that AIK is disappearing from Soroti because of increasing barriers that affect its transmission between community members. It is quite unacceptable that despite the present level of information and communication technology (ICT) development in agricultural sector in Uganda like messaging dissemination of information to farmers, no clear documentation and dissemination approaches of AIK exist in Soroti. The study revealed that oral history, case study, group interview, dialogue, field observation and joint interpretation, farmers' participation and key informant means are the very minor methods employed in documenting and disseminating AIK in Soroti district. The study further revealed that in view of the oral nature of

indigenous knowledge forms in Soroti, documentation processes lack proper recording and storage.

Subsequently, there are numerous limitations in documenting and disseminating IK. Some of the limitations are culture specific while others are of universal scope and apply to all communities.

These disparities in IK occur because of traditional and geographical diversity. Even within the trivial coverage such as Soroti with almost the same culture, there are variations in AIK perceptions and beliefs. Specifically, there are majorly three tribal groups in Soroti (Itesots, Kumams and Karamajongs). For each tribe, it is said that there exist a diversity of clans which greatly add to the diversity in AIK. The barriers to AIK transmission identified include poor documentation of AIK and the concealment of IK by its custodians. As a result and over time, IK disappears when its bearers die or migrate before their IK has been adequately transferred or documented. Then when cultures meet, they borrow and share what they consider beneficial aspects from one another, while discarding harmful or non- beneficial practices.

5.3 Objective 1: Forms of Agricultural Indigenous Knowledge

There exist many forms of IK within the community and are significantly contributing to the people's ways of carrying out agriculture. These forms of AIK include pest and disease management, food and grain storage and preservation and soil fertility and management. The study identifies the above forms of AIK. However, literature does not provide a single definition of the concept and no clear type of AIK is mentioned. This relays with (Thomas, 2008) who found out that Agricultural Indigenous knowledge is not uniformly distributed and differs between and within communities. These variations in AIK occur because of cultural (Somnasang and Moreno-Black, 2000), and geographical diversity. It can therefore be concluded that many communities are experiencing rapid changing natural environments and fast pacing economic, political, and cultural changes. This is in part due to the differences in background and perspectives of various authors, ranging from social, anthropology to agricultural engineering.

Nevertheless, the various value chains have some common traits which are that AIK is manifested in: 1. Indigenous soil preparation and planting materials

2. Indigenous methods of controlling pests and diseases 3. Indigenous methods of maintaining soil fertility 4. Indigenous methods of controlling weeds 5. Indigenous methods of harvesting and storage

It has been noted that this Agricultural Indigenous knowledge (AIK) is strongly connected to the natural eco-system and clans in a particular community for the reason that local people know which species and norms are useful and applicable respectively in their communities.

Farmers in Teso are massive users of this AIK. The AIK forms commonly used in Soroti are majorly practiced in pest and disease management in plants and animals, soil fertility management techniques and food storage and preservation. In crop agriculture for example,

Teso people use IK to control pests and protect harvests. Pest control medicine for plants is locally known as: "*Ikeeluikorion*". It was also noted that traditionally, some households in Soroti practice non-tillage farming (soil is not tilled) as method of soil fertility control whereby the land is cleared by hand or burning and crops raised with minimum disturbance to the soil. In this method, holes for planting are made locally with hoes. In the case of crops such as cassava, the cuttings are placed in the hole and base is covered with soil. This shows how important IK is to the people of Soroti. From the field experience, there is a significant size in the yields when IK is employed. Although some farmers testified that there are no significant differences on yield between tillage and non-tillage and many also revealed that there are other benefits such as soil conservation and lower labor inputs compared to mechechanized ploughing. Since some felt that it would be wise to avoid ploughing fields because weed infestation is greater with tillage and inputs are also high, this therefore shows that IK still forms a large part of the Agricultural Knowledge that farmers in Soroti still employ locally. This conclusion was justified by the fact that Indigenous Knowledge uses mostly local resources

and it's applicable in local farming situations.

Recommendation

1. There is much to learn from the existing IK forms if we are to move toward increased food security and agricultural development. This calls a need for networks and synergies between government, international funding bodies and universities to facilitate the learning process. In this way, the AIK should be equally shared and distributed to communities who are interested in it. According to studies, from the conventional transfer of technology approach, it is feasible, efficient and cost effective to learn from the village level experts. As revealed in this study's analysis above, many communities in Teso have confidence in IK systems and they will always integrate them in emerging agricultural technologies. Therefore, there is need for the government to increase support, protect and preserve the existing forms of AIK.

5.4 Objective 2: Methods of documenting and disseminating AIK

From the study findings, it has been observed that AIK is disappearing from Soroti because of increasing barriers that affect its transmission between community members. It is rather disappointing that despite the present level of information and communication technology (ICT) development, no clear documentation and dissemination approaches of AIK exist in Soroti. This study concluded that oral history, case study, group interview, dialogue, field observation and joint interpretation, farmers' participation and key informant means are the very minor methods employed in documenting and disseminating AIK in Soroti district. It is also seen that little AIK is documented in paper format. The study revealed that in view of the oral nature of indigenous knowledge forms in Soroti, documentation processes lack proper recording and storage. This is similar to Tabuti, (2012) who reported that, there are many examples of such loss of AIK in Uganda. Reporting about Kaliro district, he noted that people of the present-day Kaliro District have forgotten how to manage traditional food plants to ensure that such plants are available to future generations, or how to prepare traditional foodstuffs. Previously, people managed species such as Dioscorea bulbifera by cultivating them.

Recommendations

1. Salient need for awareness programmes about the value of IK

There should be awareness programmes by the government about the value of IK for development in order for the communities to conserve their indigenous knowledge and share it with others as well. Furthermore, there is need to capture, preserve and disseminate this knowledge widely and avoid the risk of getting extinct. The majority of the farmers interviewed learnt about AIK through parents and grandparents. Few others may have learnt through formal education.

One of the best modern approaches to preserve traditional knowledge is documentation in some permanent form and public accessibility. In addition to preservation, documentation and dissemination of agricultural indigenous practices provides an effective tool for research and innovation. However, Lwoga et al (2010) observed that research libraries have not been particularly active in documenting AIK. Nakata and Langton (2005) assert that libraries must consider indigenous knowledge not simply part of a historical archive, but a contemporary body of relevant knowledge.

2. Need for National IK Systems Resource Centers

The ministries of Education and Sports together with The Ministry of Labour, Gender and Social Development in Uganda ministry should set up national IK Systems Resource Centers in every region since every region has a distinct culture. The functions of the resource center will include:

- 1) Providing a national data management function where published and unpublished information on IK are systematically documented for use by development practitioners;
- Designing training materials on the methodologies for recording IK systems for use in national training institutes and universities;
- Establishing a link between the local communities, who are the originators of IK and the development community.

These recommendations align with The International Institute of Rural Reconstruction (IIRR) in 1996 who suggested identifying specialists, case studies, field observation, in- depth interview, participant observation, participative technology analysis, surveys, brain storming, games, group discussions role play, SWOT analysis, village reflections, village workshops, flow chart, mapping, taxonomies, participatory video and photo/ slide documentation. The IIRR also reported that AIK could be documented in the form of descriptive texts such as reports, inventories, maps, matrices and decision trees; audiovisuals such as photos, films, videos or audio cassettes as well as dramas, stories, songs, drawings, seasonal pattern charts, daily calendars and so on. Indigenous knowledge could also be stored in local communities, databases, card catalogues, books, journals and other written documents, audiovisuals and museums.

5.5 Objective 3: Constraints of documenting and disseminating AIK

According to the study findings, there are several constraints in documenting and disseminating IK. Some of the challenges are culture specific while others are of universal scope and apply to all communities. This assertion is supported by (Thomas, 2008) who concluded that Indigenous knowledge is not uniformly distributed and differs between and within communities. According to (Somnasang and Moreno-Black, 2000), these variations in IK occur because of cultural and geographical diversity. At national level for example, it is estimated that there are more than sixty-five indigenous communities (MGLSD, 2006), each of which is culturally distinct and has unique IK. Even within the small coverage like Soroti with the same culture there are variations in AIK perceptions and beliefs. For example, there are majorly three tribal groups in Soroti (Itesots, Kumams and Karamajongs). For each tribe, it is said that there exist a diversity of clans which greatly add to the diversity in AIK (Katende and Kityo, 1996). The barriers to AIK transmission identified include inadequate documentation of AIK and the secrecy of custodians of IK. This is well illustrated by (Tabuti, 2012) in study of AIK in Kaliro district, in Uganda. He reported that in Kaliro District, some healers refused to reveal their healing secrets to their daughters fearing that the latter would share the secrets with the families they marry into. As a result and over time, IK disappears when its custodians die or migrate before their IK has been adequately transferred or documented. Then when cultures

meet, they borrow and share what they consider beneficial aspects from one another, while discarding harmful or non-beneficial practices. Of course, the adoption of other cultures may occur through coercion as happened, or is still happening.

It can therefore be concluded that IK is disappearing because of increasing barriers that affect its transmission between community members.

Recommendations

1. More documentation and dissemination of AIK should be undertaken not only in Soroti District but for the whole of Uganda.

More initiatives proliferated by governments and other NGOs have to come up to promote adequate documentation and dissemination of AIK. This AIK can be documented and disseminated in various formats provided the users accept it. To support this, the IIRR also reported that AIK could be documented in the form of descriptive texts such as reports, inventories, maps, matrices and decision trees; audiovisuals such as photos, films, videos or audio cassettes as well as dramas, stories, songs, drawings, seasonal pattern charts, daily calendars and so on. Indigenous knowledge could also be stored in local communities, databases, card catalogues, books, journals and other written documents, audiovisuals and museums. Chande (1993) reported that surveys, competitions and interviews help document AIK. Dubey et al (1993) reported several methods like the case study method, the oral history method; key informant means, making diagrams, case histories, critical incidents, preference ranking and inventory of farmers' indicators could be used for documenting knowledge from local people.

2. Modern scientific knowledge should be incorporated with the traditional knowledge system

Traditional knowledge is vital to sustainable development of Agriculture. In this case, Institutions of higher learning should ensure that sustainable development and conservation of Uganda's resources could be significantly advanced. This is possible partly if modern scientific knowledge could be incorporated with the traditional knowledge system. This will lead to broad knowledge base that can be used by rural farmers. It's believed that both the traditional knowledge practitioners and modern knowledge possessors can co-exist.

3. Strategies need to be developed for integrating AIK management and technologies

A key strategy for AIK development and promotion through documentation is by integrating AIK management with the available technologies. Most of the farmers who were interviewed confessed to having at one point in time accessed agricultural information using their simple phones. This was done by typing a certain code given to them the extension officers and sends it to specific numbers and the information would be sent to them instantly. With the level of ICT skills that the people of Soroti and Uganda as a whole possess community and community based organizations together with Faith Based Organistions can be a leading force in this initiative.

It's further recommended that community library services are required in many rural areas of Soroti. This will allow and enable farmers and community members to access the local knowledge in this library. Main IK practitioners also have to be encouraged to participate in agricultural and other public shows, contribute articles in local newspapers like Etop bulletin for the Iteso and attend related workshops/conferences to share information.

4. Collaboration and networking among libraries.

Additionally, collaboration and networking among libraries need to be extended to AIK project so that one library can learn and benefit from the experience of others to attain a high level of success in the documentation and dissemination process. In addition, AIK should be disseminated on a wider scale so that it can be integrated into the conventional agricultural production practices. Those libraries that are yet to embark on the project should embrace and regard it as a necessary component of their mandates, particularly at a time like this when all hands must be on deck to save the world from the pangs of hunger and make food security an accomplished millennium development goal.

5.6 Areas of further study

This study suggests that prospective researchers investigate key areas such as strategies for documenting and disseminating IK for sustainable human health and the integration of ICTs in the documentation and dissemination of AIK.

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APPENDICES

APPENDIX A1: INTERVIEW GUIDE

Dear Respondent,

I am Haumba Eric Nelson, Master of Information Science student at Makerere University. My research topic is "Challenges of Documenting and Disseminating Agricultural Indigenous Knowledge for sustainable Food Security in Soroti District. "Participation in this study is absolutely voluntary. The information in this research instrument shall not be used for any other purposes other than for this study. The aim of this interview is to evaluate your opinion, perceptions and feelings about Documenting and Disseminating Agricultural Indigenous Knowledge for sustainable Food Security. The results of the study will be used to help answer unanswered questions far Documenting and **Disseminating Indigenous** as as Knowledge for sustainable Food Security is concerned. It would be highly appreciated if you could answer all questions accurately.

Note: Please give your honest and sincere opinion.

- a) What do you think forms indigenous knowledge when it comes to agriculture and food security?
- b) As an elder in the community, how do you rate the relevance of your experience, community's beliefs and practices on agriculture and food security?
- c) How do you think your indigenous knowledge and experience on agriculture can be basic in ensuring food security in your home and community?
- d) How do you think your community can better benefit from your indigenous knowledge on agriculture and food security?
- e) Do you think Indigenous knowledge is better than the new form of scientific knowledge?
- f) What would you prefer using? IK and Scientific knowledge?

- g) Do you think documenting and disseminating indigenous knowledge can be the best way seeking for alternative measures to challenging agricultural production constraints and food security?
- h) Briefly relate Indigenous knowledge to agricultural development, food security and overall community development.
- i) What do you think would be the best way of disseminating such knowledge?
- j) Do you think disseminating AIK through agricultural extension workers can act more appropriate and effective compared to other channels like radios, TVs and documenting?
- k) How do you rate the roles of different players and platforms for best practices and outcomes in documenting and disseminating AIK?
- Please try and rate the following constraints and their effect on AIK documenting and dissemination?

Death of human resources Lack of professional expertise Lack of capacity Lack of good documentalists Language barrier Memory failure (especially to knowledge sources/ elders/ resource persons) Cultural limitations

- m) In a brief statement, what do you think constrains the documenting and disseminating process of AIK in Soroti district?
- n) How can you recommend for a better practice?

Thank you a lot?

APPENDIX A2: OBSERVATION SCHEDULE

1. Indigenous knowledge practices, tools, methods and Holders.

Pooling of resources, tools, seeds and knowledge

Soil conservation practices (constructed infiltration ditches around homes, grass

covers, tree planting).

Conservation of agricultural practices

Aged community (elders, resource persons) Human beliefs, experiences and

practices

2. Food availability

Food preserved (herbal plants and ashes to store food, sun drying, use of honey and smoking etc.)

smoking etc.)

Embracement of agriculture

Community involvement in food commercial practices

3. Cultural Specifics

Recognition of the elders and their roles

Elders' knowledge, agriculture and food security related

Community culture and how it favours food security practices.**4.** Documenting and Disseminating AIK Available forms of Indigenous knowledge

How this IK is packaged

How this knowledge is passed on to other users. Level of literacy

6. Constraints to dissemination

Culture

Diversity in languages spoken Presence of human resources (elders) Resource limitations like infrastructure.

APPENDIX A3- CONTENT ANALYSIS GUIDE

Overview: Below is a guide that was followed when reviewing available content about the topic under investigation.

- 1. Definitions of and expressions of the concept Indigenous Knowledge
- 2. Definitions of and vocabularies of the idea Agricultural Indigenous Knowledge
- 3. Rural farmer's agricultural information needs and local experiences
- 4. What type of knowledge the farmers require for daily agricultural practices
- 5. Common diseases affecting crops and animals
- 6. How the crops and animals are treated using both local and modern methods
- 7. Which methods/ approaches have worked better and why?
- 8. Existing methods of capturing, processing and disseminating local knowledge
- 9. Problems/challenges faced
- 10. How they have tried to address them

APPENDIX A4: INTRODUCTION LETTER FROM THE COLLEGE



E-mail: info@cis.mak.ac.ug URL: http://www.cis.ac.ug





COLLEGE OF COMPUTING & INFORMATION SCIENCES

May 28, 2014

The Resident District Commissioner Soroti District Uganda

Dear Sir/Madam,

RE: INTRODUCTION LETTER - HAUMBA ERIC NELSON 2012/HD05/912U

This is to introduce to you the above named student of East African School of Library and Information Science under the College of Computing and Information Sciences, Makerere University. He is offering a Master of Science in Information Science.

As part of the degree programme, he is required to carry out a research which he intends to do in your District. The topic of his research is entitled: "Challenges of Documenting and Disseminating Agricultural Indigenous Knowledge For Sustainable Food Security in Soroti District".

The purpose of this communication is to request you to offer him the necessary assistance required.

Please note that all information obtained shall be for academic purposes only.

Sincerely,

Ms. Joyce Bukirwa AG. HEAD OF DEPARTMENT LIBRARY & INFORMATION SCIENCES

APPENDIX BI: TRADITIONAL GRAIN STORAGE



APPENDIX B2: TRADITIONAL GRAIN STORAGE SYSTEM



APPENDIX BJ: PEST AND RODENTS CONTROL METHODS



APPENDIX b4: IK IN WEED AND SOIL FERTILITY CONTROL


APPENDIX b5: GENDER SPECIFIC ROLES IN IK



APPENDIX b 6: GENDER SPECIFIC ROLES IN IK DISSEMINATION



APPENDIX b7: ADDING COMPOST (LEAVES) AND MANURE MAKING





APPENDIX b 8: MEDICINAL HERBS FOR ANIMAL DISEASES