Indigenous knowledge systems (IKS) and sustainable agriculture: the case of sorghum production in Lesotho.

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Abstract

The research whose results are presented in this paper sought to investigate the use of Indigenous Knowledge Systems (IKS) in the production of sorghum by Basotho farmers. Participatory research methods were employed to facilitate the sampled communities to document and discuss their use of indigenous knowledge in sorghum production. The researchers were facilitators only in this process while some of the community members were research assistants in order make this research process to be community driven. Assessment of temporal variations in the study indicated that the indigenous knowledge systems had undergone continual changes as new innovations and resources became available and others dwindled in the communities. This flexibility facilitated the establishment of local knowledge systems (LKS) that reflected both temporal and spatial variations and regional specificities. Moreover, the indigenous knowledge was reported to be under threat of extinction, not only partly due to western cultural and scientific imperialism, but also because of the oral tradition through which it is passed from one generation to the other and recorded in the people's heads and practices without written documentation. The research also found that indigenous knowledge systems used in sorghum production and management were environmentally driven. The various plants, trees, animals and implements used to drive various techniques and technologies were sourced within the local environment of the communities. Moreover, the indigenous knowledge systems were culturally driven. They were ocastrated and executed within the rubric of Sesotho culture – Bosotho. Furthermore, the indigenous knowledge systems emphasized the concept and practice of African Communalism where the sharing of resources within the community was central to the welfare of all members. Lastly, indigenous knowledge systems were also gender sensitive. The multiple differential roles and tasks performed in sorghum production and management were based on a socially-derived division of labour between women and men.

Key Words:

1. Introduction

Management of environment in the African context has largely been derived from western knowledge and technological systems. This might be so largely because of the

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past colonial legacy, which however, has been passed on into the independence era in Africa as a neo colonial legacy that dominates production, management and distribution system throughout the continent. It is our opinion that this western dominated technological knowledge and its applications has been, at best, more destructive to, rather than constructive of, the African environment.

The unfolding scenario today, is that Africans had, and still have, their own indigenous knowledge systems ideal for the increased efficient production and management of their environmental systems. However, what is also clear is that the indigenous knowledge is not incorporated in policy formulation, planning and decision-making (Singh, 2000).

In order to rectify this situation two things are necessary. First, given the western technological imperialism, which took centuries in Africa, much of the existing indigenous knowledge has been demeaned in statue and value. This means, therefore, that intensive and extensive basic and applied research has to be carried out to reveal and re-assert these systems in Africa. The findings of this research would then provide basic information needed by policy makers and planners in the design of technological policy for environmental management in Africa. Secondly, the policy makers and planners themselves need to adopt an Afro centric attitude and preference in their design of technology policies for sustainable environmental management in Africa (Singh, 2000).

It has been observed in Sierra Leone (Ashley, 2000) that indigenous knowledge is a science of adjustment and adaptation, which is produced by local farmers and reflects the interests of local farmers as a group within the society. Sinclair and Walker (1999) observed that local knowledge is seen as the central aspect of culture, derived from education and experience. Therefore IKS is endogenous to the farmers. Another important aspect of IKS is that it is rooted and sourced within the local environments of the farmers, therefore it is easily accessible, less expensive and manageable with the low levels of education and low western skills that most farmers have. Moreover, a further observation is that IKS tends to reflect gender biased use by both men and women in line with their roles accorded by society in the African context. Furthermore, IKS tends to differ from one community to the other within the same country due to some differences across the communities and their local spaces.

Within the context of Southern Africa, historical evidence abounds which illustrates the efficiency of indigenous knowledge in the promotion of sustainable agriculture, which was subsequently suppressed by colonial capitalist interests in the region in pursuit of commercial agriculture. The net result of the introduction of western market-oriented technology and science laid the genesis for the current chronic land degradation (Palmer and Parsons, 1977). In Lesotho, in particular, Singh (2000: 32) unreservedly argues that:

" Indigenous Basuto agriculture was well adapted to climatic and weather fluctuations and maintained a good vegetative cover which protected the soil from accelerated erosion."

Singh (2000:33) concludes that in the search for environmental security in the SADC region, "the local indigenous knowledge should be incorporated to build environmental security for the present and future generations."

In the case of farming methods, Basotho farmers have, since the arrival of the Missionaries in the 19th century adopted external innovations and practices and used them to improve their performance. Adoption of maize and wheat and the use of ox-drawn ploughs are classic examples, and were so successfully adopted that they made Lesotho the granary of Southern African in the 19the century (Palmer and Parsons, 1977). The adoption of modern technologies and crops have been key policies pursued by the Ministry of Agriculture in its extension system with the hope that these were ideal for the attainment of both household and national food security. However, lack of access to modern technologies and farming methods including High Value Crops (HVCs)) have continued to make food security a distant reality, because of the poor resource position of most Basotho peasant farmers.

It is in this context, that the necessity for 1KS becomes relevant. Historically, the disadvantaged farmers never abandoned 1KS, but continued to use it in their farming operations in conjunction with limited amounts of modern technologies that they could lay their hands on; and combined these two to create a local knowledge-based farming which Turner, (1979) aptly refers to as Sesotho farming.

More recently an opportunity offered itself due to the success of a local Non-Governmental Organization – The Machobane Agricultural Development Foundation and its development and promotion of the indigenous farming system called the Machobane Farming System (MFS). MFS is basically an integrated organic farming system which derives inputs from crop-livestock combination. It is a rotational, labour intensive intercropping system which relies on the use of kraal manure/ash to improve soil fertility. With increased knowledge of health risks associated with chemical fertilizers, MFS is responding to consumer needs of food variety and food security (Nkoala, 1999).

It is therefore essential for the Ministry of Agriculture to come to recognize and advocate the Machobane Farming system as part of its agricultural extension package to the farmers. However, the sixth National Development Plan does not show this commitment by the Ministry under its extension (Government of Lesotho, 1997). The

need for a detailed evaluation of the Machobane Farming System is long overdue as a research contribution to debates on IKS and agriculture in Lesotho.

This paper presents the results of a study carried out in three agro ecological areas namely, the lowlands, the foothills and the mountains. The objectives of the study were to, firstly, identify the use of IKS and, secondly, to identify its spatial and temporal variation in Lesotho. The study covered the Northern districts of Butha-Buthe and Leribe, the Central Mountainous area at Setibing and the Southern districts of Mohale's Hoek and Mafeteng.

2. Materials and Methods

The study employed two methods of data collection. Firstly, secondary data on existing indigenous knowledge systems for environmental management in Africa was reviewed. This data was sought from libraries, offices and the Internet. Secondly primary data was solicited from farmers in the rural areas of the country. Since the study used participatory research methodology, the primary data was qualitative rather than quantitative. The study only employed simple random sampling in stratified agro-ecological zones for selecting study areas. The study was interpretative in nature and sought to express the knowledge base of farmers and their communities on indigenous knowledge systems in the management of sorghum production. To this end the researchers had to play the role of facilitators while research assistants (who were members of the communities sampled) administered a checklist to compile the documentaries. A multi-stage sampling procedure was used to select study areas as follows:

Chieftainship area	**Community**	**Agro-ecological zone**
Leribe	Qoqolosing	Northern foothills
Thaba-Bosiu	Setibing	Central Mountains
Tebang	Ha Molise	Southern Lowlands
Likueneng	Likueneng	Southern foothills
Butha-Buthe	Pholonamane	Northern lowlands
Tajane	Ha Phala	Southern Mountains

The researchers addressed the communities in the sampled chieftainship areas in a community gathering (pitso) in order to introduce the research, its objectives and methodology and seek people's perception of IKS. Secondly, focus group discussions were conducted with identified key informants selected from men and women considered well vested with indigenous knowledge. Then key informants were identified through the assistance of the Interim Community Councils.

The community research assistants interviewed the communities in each public gathering (pitso), and followed this up with the special interviews with the key

informants with specialized knowledge in IKS and sustainable agriculture, using the snowball technique. This technique enabled local people to share, enhance and analyze the knowledge regarding indigenous knowledge (Dube and Musi, 1998).
The researchers then collated the data collected by the community research assistants from each chieftainship area and compiled an area report for that community. They then took all community area reports from the sampled chieftainship areas and compiled them into a general national report which is summarized in this paper.

Two major problems were encountered during the fieldwork. Firstly, community gatherings were not always a success and several visits were necessary for community discussions. Secondly, the younger generations were not very conversant with the classical perspectives on sorghum and special trips had to be made to seek the elderly as key informants in the communities. In some communities there were no such elderly people and data gaps remained visible on classic IKS in some of the areas.

3. Data Presentation and Analysis

The Process of Sorghum Production
The research revealed that indigenous knowledge is used by Basotho to guide and manage the process of sorghum production and related activities throughout the four seasons of the cropping calendar.

Spring
Traditionally, a year in Sesotho was based on the natural cropping cycle, which starts in spring. The community identified a number of items as indicators of the arrival of spring to mark the start of the new cropping calendar for sorghum.

Firstly, in the case of the month, there was no uniform response from the communities. Some said July others mentioned August. Secondly, the communities said that plants were good indicators of spring through their sprouts. Nowadays it is mostly trees that are used. Willow trees became green, wattle trees yellow. However, in the old times, it was the sorghum grains left at the fields where threshing was done that was used. When this grain started to sprout it was a reliable indicator that spring had come and communities could get ready to start cultivation of sorghum.

Thirdly, changing weather conditions, which became mostly windy, dusty and rainy, also signified spring. This response was given in the same way by all the communities and had no spatial or temporal variation.

Fourthly, the behaviour of domestic animals was observed and used, such as when they started to shed some of their wool and become smooth. The mating behaviour of animals, especially donkeys and cows were also observed and once they started mating, it was regarded it was time to get ready for Sorghum cultivation.

The communities argued that these multiple indicators were used in the past and today by Basotho farmers to guide them about the beginning of the cropping calendar and the subsequent necessity to get ready for the process of sorghum cultivation. It might be noted that, all these indicators are components of the environment around and within which the communities lived. So there was a link between the Basotho and their environment in the search for livelihoods facilitated by their indigenous knowledge system. Indigenous knowledge was and is also used in preparing for and getting ready to start sorghum cultivation.

In the case of tilling the soil, the communities said that nowadays most farmers use the animal-drawn plough, while in the distant past they used hand powered hoes made of Granite ("morema phofu") stone chips mounted to light tree branches to till the land and, in the past, iron stone was melted and molded into a triangular — shaped light instrument and mounted to wooden handle to make hand powered hoe for tilling the land. In the distant past seed was broadcast before tilling the land. Nowadays some farmers use animal drawn planters.

The stones used to make the hand powered hoes were available and accessible to Basotho within their immediate environments, and did not constitute a big significant cost in the farming process. However, the introduction of the animal-drawn plough is mainly accessible to households with livestock and capital to purchase the plough. Those without these assets either have to hire their services, enter into some arrangement such as share cropping, with households that have them, or completely fail to cultivate their fields and become vulnerable to lack of food security.

With regard to the soil, the communities reported that both loam and sandy soils were good for Sorghum production because it could grow well even under unfertile soils and resist drought. Traditionally nothing was done to improve soil fertility other than rotational tilling. Over time, up to the present manure composed of animal dung and green matter are added to the soil to improve fertility either before or at the planting time. Some combine animal manure with chemical fertilizers.

In the case of seeds, the communities said that seed was selected during harvest time in winter. The best Sorghum heads were identified, cut, threshed and the grain stored separately. Before storage, the seed was traditionally dipped in water with leaves from bitter and strong smelling bushes and plants such as mofifi (dogwood), sehalahala sa matlaka (erescephalus panctulatus) and Mohalakane (Aloe stirtantula) in order to protect it against pests such as Tsupa (snout beatle) and Seseli (cut worm).

Today farmers who can afford to purchase them dip the seed in Theodine and BlueDeath for the same purpose. Those who cannot afford them were reported to be still using the traditional methods.

The communities disclosed that knowledge on the use of these traditional technologies differed from farmer to farmer within the same community and from one community to the other, depending on exposure to their use at early ages and their differential availability among different communities in line with their ecosystems.

Summer

Indigenous knowledge systems were used during the summer season as well to manage sorghum production.

Firstly, seed planted needs rain in order to germinate and grow. In the absence of rain, indigenous knowledge was used by Basotho to induce rain. During the past, traditional rainmakers were called upon by the chief to use their medicinal skills to induce rain. This specialized knowledge could not be disclosed to the researchers by those with specialist knowledge in all communities researched because of its sensitivity and importance to them.

In some cases, both women and men used games to induce rain. In the case of women, a play called Lesokoana was used, where girls from one community would collect, by deception, a steering stick for porridge from the homestead of a chief in another community. They would run away with the stick throwing it in the air and from one girl to another on their way back to their own village, singing the request song for rain as follows:

Pula e kae banana, pula e kae? Where is the rain girls, where is the rain?
Re kopa pula morena We request for rain oh! Lord.

The girls from the community where the stick had been taken would assemble quickly and chase the other girls in an attempt to retrieve their chief's porridge stick. The chase game would go on for the better part of the day and end at the stream or river, where the girls would swim or stir the river water with the stick and then take it to their chief's place, where they would be awaited by the women and the request song for rain would continue.

All the communities reported on the Lesokoana game. However, they differed on who took part. Some said it was both young women and girls, while others maintained that it was only girls who took part because of the virginity of the girls which was associated with purity, and that a prayer to God for rain through the Lesokoana, needed to be done by pure innocent people.

In the case of men, the molutsoane was performed, where able-bodied men in the community woke up early in the morning and went hunting. They would kill all wild animals that they came across and sing a war chant-Mokorotlo as a prayer.

The hunt would end at the river, where all the internal organs of the animals killed would be thrown into the river and some of the animal parts would be burnt as sacrifice

amidst the Mokorotlo chant. The ash would be dumped into the river and the men would return with some meat to the chief's "Khotla ", where more singing and meat roasting and feasting would continue for the rest of the day.

The informants revealed that nowadays these games were not played well anymore and that, in most cases, when there was no rain, chiefs asked communities to go and pray for rain in western churches, instead.

Indigenous knowledge systems were used in the management of sorghum production through control of the weeds from cultivated plots. Traditionally, women did weeding only and the communities organized themselves into communal labour parties and removed the weeds from the fields using their bare hands. Nowadays removing the weeds is mostly done by individual households using their own labour and sometimes, hired labour paid with either cash or a bag of grain at harvest. Although not common anymore, communal labour parties are still practiced and weed for free but are well fed with food and traditional beer. Often, the working parties sing some songs to make the work lighter and promote the spirit of togetherness. In the not so distant past, hoes were used to ease the task of weeding. At first granite stone chips mounted to a wooden handle were used for weeding. Lately, the metal hoe replaced these. There were no spatial variations reported by the communities on weeding practices.

The Basotho equally used the indigenous knowledge for pest management. In the case of controlling the stock borer/cutworms they used a number of techniques. Herbs with strong smell and bitter taste such as the Seholobe (Aloe striantula) and Sehalahala as matlaka (Eriocephalus punctulatus) and Letjoi (Datura stramonium) were boiled and the concoction sprayed on sorghum crop to kill the pests. In other cases, meat bones would be placed at various points in the field in order to generate "maroana" (army ants) which would in turn feast on the stock borers/cutworms. Today those farmers who can afford them use theodine and Blue death for pest control.

Autumn

During this season indigenous knowledge systems were used to control too much rain and/or hailstorms as well. The communities said that many methods were used in the process of hail control (ho upella sefako) such as the use of the head of a cobra or puff adder that is placed at all the corners of a field. Apparently, hail does not fall where there is a cobra or puff adder. According to the report from the communities, therefore positioning their heads in the field would induce the same effect.

Spatially, the control of hail was not reported by all the communities. For instance, the Ha Molise village at Tebang said it did not know how to control hail. Temporally, the respondents argued that the traditional technologies on hail control were not commonly

used anymore. They reported that hail destroyed a lot of crops nowadays, because there is no substitute western technology available on hail control.

During autumn, during February, March and April, sorghum heads would have begun to form soft grains, which attract birds to eat them. Indigenous Knowledge was used to control the birds through the process of discouraging the birds from damaging the sorghum's soft grains (ho upa linonyana). Multiple techniques were used such as the scarecrow, the thistle (tsoibila), smoking of strong traditional medicines by traditional doctors. Particularly during March, which is named Tihakubele, in Sesotho to denote that Sorghum grains would have been formed, scare crow techniques are used. Traditionally, the upper ends of strong long sticks would have tattered animal skins bundled on to them or old grass hats and then the sticks would be embedded at different points throughout the field to scare the birds away from sitting on the fresh sorghum heads and eating the soft grains. Nowadays farmers use tattered clothing, plastic bags and/or old modern hats for the same purpose.

In the case of smoking techniques, half-dry materials, especially weeds are collected and burned in the field in the morning and/or evening to generate a thick smoke cover which would scare the birds away. At times, traditional medicines mixed with parts of a hawk would be burnt as well. The smell of hawk would scare the birds away for fear of being preyed upon by hawks which would appear to frequent the to be protected field.

Another technique used is to build grass make shift stands (maphephe) from which boys continually scare the birds off the sorghum heads by pelting soft clay launched from long sticks (litsoibila).

Spatial variations existed in the indigenous knowledge techniques mentioned as used by the communities. In general communities in the foothills and mountain areas tended to know more techniques because they said they still used them a lot today. Temporally, modifications to the traditional techniques were reported reflecting the use of available materials today in the communities.

During autumn, Indigenous knowledge was used in the preparation of food from fresh Sorghum as well, especially fresh Sorghum bread (senkhoane). This bread is made out of fresh Sorghum, which is pounded on a granite store mill and made into dough. The dough is placed on some Sorghum leaves and stalks in a clay pot and steamed until it is well cooked, whence; it is ready for consumption as steamed fresh sorghum bread. Nowadays iron pots are used instead of pots made of clay. No spatial variation existed on this food and its preparation, in the community reports.

Winter

In the case of winter Basotho used many indigenous signs and changes in their environment as indicators that it was wintertime. Winter starts in May, called

"Motseanong" in Sesotho, which literally means the sorghum grains laugh at the birds for failing to gobble them off the heads because they have ripened and become very hard.

The sorghum attains its full colour depending on the type of seed. In general sorghum is light or light brown if they are a "seghobane" type (sorghum bicolor) while another variety is red, and called "thaha-khube ". The bright colour of the sorghum, be it red or light, attracts the birds to attempt to eat them. Because the grains are hard to gobble from the heads, the birds often fly to the nearest stream to dip their wings in water and then fly back to the sorghum heads to wet them so that they might eventually succeed to get the grains off. Therefore, in order to minimize the risk of pre-harvest loss to the birds, Basotho are disinclined to the use of fields near streams for sorghum production as a risk aversion strategy.

A major farming activity for farmers in winter is harvesting. In the case of sorghum, indigenous knowledge was used in the various technologies applied. In order to assess whether sorghum was, indeed, ripe enough, a sorghum test was performed through sorghum testing "ho loma mabele ". This process of testing sorghum ripeness was done by all farmers who would go to their fields, select and cut off the sorghum heads that looked more ripe, prepare malt and brew sorghum beer out of them. This type of beer is called "molomo ", taste beer, and is offered to the people free of charge to taste the quality of the sorghum and beer. Traditionally, the chief would be the first person in the village to do the "molomo" after which he would declare the harvest process open to the public starting with communal labour (matsema) on his fields. Today, any farmer is free to do their own "molomo" irrespective of the chief due to secularization, modernization, decline in the power of chiefs and universal freedom.

In the case of implements, Basotho used indigenous technologies for harvesting sorghum as well. Traditionally, they used communal labour ("matsema ") to harvest the sorghum by using their bare hands to break the heads off their stalks. As time went on, they used knives and sickles to cut off the heads. Moreover, today, farmers use their household labour to harvest. In cases where "matsema" are used, food is prepared for them, and there is no financial payment. A newly arrived practice is that where some people are engaged in harvesting for payment through direct cash and/or issue of food ration from the harvest. The essence of "matsema" was to promote the philosophy of communalism and sharing of resources, especially labour in this case.

Good sorghum heads were separated from bad ones. The good ones were stacked together to form a big stalk called "setha" just outside the field in space specifically cleared for the stacking and later threshing purpose called "seotlo". The bad sorghum heads, be it "talane" or "phori" (Puccinia .graminis) are put aside. Sorghum heads whose stalks have fallen down are harvested separately, threshed and used to make beer called "~leoa". The "leoa" beer is also offered to people free of charge. Sometimes,

it is offered to those who participated in the harvesting, threshing and winnowing processes.

The next step in the harvesting process is thrashing of sorghum. Sometimes, animals are used to trample over the sorghum stack several times in order to separate the grains from the heads. At other times, men used large sticks or knobkerries ("likoto"), which are raised, head high and brought down heavily in unison on the stack to separate the grains from the heads . The men sing songs to accompany their work such as:

Re polar mabele We thresh the sorghum,

Re siea talane We leave out the unripe heads

Hela koto, o e nka kae? Hey, from where can one get a knob kerrie?

After threshing the sorghum, the men step aside and the women start the process of winnowing. When winnowing, the women use grass-woven basins ("liroto ") , fill them with threshed sorghum, raise them head high and release the grain down at some part of the "seotlo" cleared for winnowing in order to let the wind blow away the chuff from the grains in mid air position. This process is wind-driven. However, should there be no sufficient wind that day, indigenous knowledge is used to induce wind called "maelana". Fire is kindled nearby by burning the chuff, some bad sorghum heads, "phori" and adding an indigenous plant called "phefo" (Heliachriasum odoratiasimum).The kindled fire heats up the air near it which becomes lighter and rises to be replaced by cooler air and in that way circular localized wind is generated to facilitate the winnowing by women. Thrashing and winnowing are facilitated through the provision of food and drink, but occasionally some women might carry home a basin full ("seroto") of the "talane" to make porridge at their homes.

The sorghum grain is then stored in a grass-woven silo called "sesiu". In order to protect the grain form pests, especially the snout beetle, "tsupa", the Eriocephalus panctulatus ("sehala-hala sa matlaka") is put at the bottom before grain is poured into the silo. When the silo is half-full, another layer of the plant is placed, then more grain is put until the silo is full, whence it is again topped with a third layer of the plant. Sometimes Aloe striantula ("seho lobe") leaves are used instead. At other times it is the dogwood leaves ("mofifi", Rhamniis prinoidles) that are used. Nowadays the use of "lisiu" is very limited because bags as sources of storage of sorghum grain have replaced it. Spatial variations were reported by the communities to the effect that people used a wide variety of plants for anti-pest control in the grass-woven silos, such as the "seholobe" (shrub aloe: Aloe striuiiiula), "sehala-hala sa matlaka" (Eriocephalus panctualsatus), "mofifi" leaves (dogwood: Rhamnus prino idles) "Kuena" (wild mint: Mentha longifolia), "monkhane" (Khaki bush: Targetes minuta) and so on depending on how easily available they were in their immediate environment.

The uses of sorghum

Indigenous knowledge was used by Basotho to produce food such as hard porridge ("bohobe"), soft porridge ("leshele-shele"), sour porridge ("motoho") and sorghum beer ("joala").

In the case of hard porridge (bohobe)**),** sorghum meal is poured into a pot with boiling water; the mixture is stirred with a stick until it is thick. It is covered for some minutes and stirred again intermittently for nearly 30 minutes after which it would be ready for consumption.

The making of soft porridge (leshele-shele) itself is much simpler, in that one pours a semi-diluted bowl of sorhgum meal into a pot with boiling water inside and stirs continuously while the mixture thickens like soup. This process takes about 10 minutes and the porridge is ready for consumption.

Indigenous knowledge was used to facilitate the use of sorghum to contribute to health of the Basotho. The hard porridge is very nutritious and is used as a cure against pellagra ("lefu la poone"). The "leshele-shele" is equally nutritious and mostly recommended for both pellagra sufferers and mothers with young children because it makes them produce a lot of milk for their suckling children. Moreover, it is fed to children as a supplement to their mothers' breast milk, and as the first step food towards the consumption of solid food by children. The sour porridge is nutritious and recommended for pellagra sufferers, children and adults alike. Sorghum beer is itself used to relieve cows of constipation by making them drink it in order to belch liberally. Moreover, sorghum grains are sprayed on the belly of the constipated cow in order to induce belching. Sorghum grains are mixed with some roots of the plant called "mahae" (Ornithogalum) and used as an antidose and cure for some sexually transmitted diseases. In the case of promoting cultural integrity, sorghum is used to brew beer deemed central to cultural feasts and ancestral prayers ("Thapelo tsa balimo le meetlo ea Sesotho"), which lie at the core of the African Philosophy of Basotho — BOSOTHO.

4. Conclusions and Recommendations

A number of conclusions and recommendations arise from the analysis of data presented in section five of this report, and their discussion is presented in the light of literature review highlights provided in section one. Firstly it was pointed out in the literature review highlights that IKS is sustainable because it is easily accessible to the farmers at least cost. This research found out that indigenous knowledge systems used in sorghum production and management was environmentally driven. The various

plants, trees, animals and implements used to drive various techniques and technologies were sourced within the local environment of the communities. This created a positive nexus between man and environment and laid the basis for the practice of sustainable development within the context of primitive accumulation. This positive nexus was later cut as a result of penetration of a modern capitalist mode of production and precipitated the loss of productivity and lack of environmental and food security experienced in Lesotho today. Therefore, it is recommended that the current search for both the environmental and food security in the country must have the revival of the use of indigenous knowledge systems as one of the central components of its agenda.

Secondly, it was observed in literature review highlights that IKS is sustainable because it is endogenous. In this research it was found out that the indigenous knowledge systems were culturally driven. They were ocastrated and executed within the rubric of Sesotho culture — Bosotho, and thus promoted endogenous agricultural development, driven and sustained by the Basotho farmers themselves. It is recommended that the search for sustainable agriculture in Lesotho should seek to entrust the management of development unto Basotho farmers themselves by creating an enabling policy framework for their self-empowerment through regaining confidence in the ability and effectiveness of their indigenous knowledge systems. This might be achieved through the inclusion of indigenous knowledge systems as part of the agricultural extension package nationwide.

Thirdly, the literature review indicated that IKS was also sustainable because of its flexibility. This IKS flexibility was also observed in this study. Assessment of temporal variations in the study indicated that the indigenous knowledge systems had undergone continual changes as new innovations and resources became available and others dwindled in the communities. Therefore, the flexibility facilitated the establishment of local knowledge systems (LKS) that reflected both temporal and spatial variations, differences and regional specificities. It is recommended that local knowledge systems be mutually explored for possible cross regional usefulness and benefits where they might exist.

Fourthly, spatial variations were found in some cases in line with observations made in section one. The foothills communities tendered to know and use IKS in sorghum production than lowland Communities perhaps due to less western influence as one moves towards the mountain region of Lesotho.

Fifthly, the indigenous knowledge systems emphasized the concept and practice of African Communalism where the sharing of resources within the community was central to the welfare of all members. To this end, the indigenous knowledge systems promoted efficiency and equity, as well as social cohesion. Therefore, it is recommended that current efforts to forge a human-centred development strategy must

seek to use the indigenous knowledge systems as part of the instruments engaged in Lesotho.

Sixthly, indigenous knowledge systems were also gender sensitive as observed in section one. The multiple differential roles and tasks performed in sorghum production and management were based on a socially-derived division of labour between women and men. This division of labour facilitated the inclusion and participation of women in production rather than their marginalization and exclusion.

Seventhly, IKS is not only community driven but also community owned so that it is socially inclusive. Although the indigenous knowledge was concentrated more on some individuals such as doctors. herbalists, rain-makers and others, this did not automatically disempower and marginalize the rest of the community members. Instead the indigenous knowledge systems facilitated that they too be aboard the knowledge base as a team, of whom those with more talent - the doctors - were only team leaders. To this extent, not only rain-makers could be sought to induce rain, but every member of the community - girls, women, and men alike had their differential roles to play. This is how inclusiveness in development should function. Therefore, current pursuit for inclusive development in Lesotho, should consider the use of indigenous knowledge systems as part of their strategy.

Eighthly, in all the communities a lot of probing had to be done to those key informants interviewed and in the pitso discussions on some issues on indigenous knowledge systems used in the past. As observed in section one under the issue of cultural imperialism, this gave the researchers a feeling that indigenous knowledge was under threat of extinction, not only partly due to western cultural and scientific imperialism, but also because of the oral tradition in which it is passed from one generation to the other and recorded in the people's heads and practices without written documentation. Moreover, the people with specialist knowledge in this regard, were also reluctant to impart this information so that many might die with it without succession and continuity. It is recommended that intensive documentation research be mounted by the Ministry of Agriculture and Food Security, Ministry of Education, Information Science and Technology, and other stakeholders to rescue the indigenous knowledge from extinction. A viable entry point in this regard would be to guarantee intellectual property rights to the communities and persons who possess this knowledge in order to facilitate their reward and motivation to divulge it for public utilization to promote sustainable development.

Finally, the study concludes that sorghum had and still has multiple functions amongst the Basotho such as nutrition, health and socio-cultural development. However, these multiple functions have seriously deteriorated as a result of the decline in the production of sorghum within the communities. Since the communities themselves

have indicated a desire and request to be capacitated in the production of this crop, this study supports the request.

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