ASSESSMENT OF SHEEP PRODUCTION STATUS IN NKASI DISTRICT, RUKWA REGION

BY

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ABSTRACT

This study was conducted in two divisions namely Namanyere and Mkwamba of Nkasi district in Rukwa region in order to assess sheep production status for smallholder farmers. Eight wards namely Namanyere, Mtenga, Chala, Swaila, Kipande, Sintali, Kate and Isale were surveyed from November 2010 to April 2011. The random sampling technique was adopted to get 20 respondents from each of the selected wards. This means two villages from each ward were chosen randomly whereby in each village 10 respondents were interviewed. A structured questionnaire was used to collect data from smallholder farmers keeping sheep and was complimented by secondary data from the district council offices. The results showed that sheep strains mostly kept by smallholder farmers were variant crosses of local strains and Red Maasai. The strains were deemed to be tolerant to diseases/parasites, heat, drought and had better carcass. Extensive grazing system was adopted by most of smallholder farmers both during dry and wet seasons. Breeding was uncontrolled however, rams were selected basing on their body sizes, conformation and performance (e.g. number of lambs per ewe's life time, age at first lambing and lambing intervals). Traits such as disease tolerance, drought and heat tolerance scored higher for most strains. Average age at first lambing was 6.5 months, the lambing interval was 3 months and the average number of lambs per ewe's lifetime was 14 lambs. The constraints to sheep production mostly were poor market availability, endemic diseases and mortality of lambs. On marketing, fewer sheep were sold in the market compared to goats and the price was 22% lower than that of goats.

DECLARATION

I, REUBEN YOHANA KAPONGO, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is of my own original work and that it has neither been submitted nor concurrently being submitted in any other institution.

_____ _____

Reuben Yohana Kapongo Date

(MSc. Candidate)

The above declaration is confirmed

_____ _____

Dr. Mbaga, S.H Date

(Supervisor)

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DEDICATION

This work is firstly dedicated to my Almighty God for his salvation and abundance blessings provided to me, secondly my parents Yohana Kapongo and Taabu Selestine Masalla and lastly my loving child Grace Reuben Kapongo for their love and patient during the whole period of my study.

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LIST OF ABBREVIATIONS

%	Percent
BHP	Blackhead Persian
DALDO	District Agriculture and Livestock Development Officer
DASP	Department of Animal Science and Production
DC	District Council
DED	District Executive Director
FAO	Food and Agriculture Organization

FGDs	Focused Group Discussions
FMD	Foot and Mouth Disease
GIT	Gastro Intestine Tract
Kg	Kilogram
Km	Kilometre
Km^2	Kilometre Square
MLDF	Ministry of Livestock Development and Fisheries
MSc	Master of Science
RALDO	Regional Agriculture and Livestock Development Officer
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
SUA	Sokoine University of Agriculture
TZS	Tanzanian Shillings
URT	United Republic of Tanzania

CHAPTER ONE

INTRODUCTION

1.1 Background information

Livestock populations in Tanzania were estimated at 19.2 million cattle, 13.7 million goats, 3.6 million sheep, 1.9 million pigs and 58 million chickens (MLDF, 2010). Sheep and goats composed of mainly indigenous strains are widely distributed and adapted to a wide range of agro-ecological zones and are kept by smallholder farmers and pastoralists under traditional management systems.

Sheep are more attractive to smallholder farmers due to their ability to multiply and grow faster than cattle at a relative low cost. They provide source of income, have two parities per year, easy to handle, require small grazing area and little feeds, provide manure, require little initial capital investment, used in social functions, attain maturity age in short time, provide meat and have no traditional or religious restrictions compared to pigs (Moshi, 1994; Boutonnet, 1999; Mtenga *et al.*, 2003; de Rancourt *et al.*, 2006; Morris, 2009). Despite their advantages, sheep production is constrained by prevalence of diseases, poor nutrition, poor marketing infrastructures and low genetic potentials. In Rukwa region, sheep production account 1.6% of total livestock population kept. However, in Nkasi district sheep production is about 1.9% of the total 296,670 livestock population found in the district. The study focused on assessment of sheep production status to smallholder farmers in view of socio-economic significance of sheep production in Nkasi district and Tanzania as a whole.

1.2 Problem statement and justification

Sheep are traditionally raised in Nkasi district but there are little efforts for their improvement despite their socio-economic roles to smallholder farmers. As a consequence of poor sheep husbandry slow growth, regular mortality of lambs and adult sheep and low conception rates has been reported (Mtenga *et al.,* 2003). Similarly, delays of ewe on first mating, long lambing intervals, low slaughter weight and poor mutton marketing are common (Mtenga *et al.,* 2003). Such situation is contributed by many factors such as poor nutrition, diseases, poor management, low quality breeds, inbreeding and inadequate knowledge on sheep production (Mtenga *et al.*, 2003).

In the past, a number of livestock production improvement programs in Nkasi district have been implemented by government and development agencies with varying degrees of success. Little success of these endeavours was caused by inadequate understanding of the need and aspiration of the farmers. On the other hand, there have been no specific studies on sheep production and general information on management practices, market availability, production performances, constraints and their contribution to livehoods of smallholder farmers in the district is lacking. Therefore, information is needed to facilitate in the design of strategies to improve sheep production in the district. The present study aimed at assessing the production status of sheep in smallholder production systems of Nkasi district.

1.3 Objectives of the study

1.3.1 Overall objective

To investigate the productivity of sheep in smallholder production systems of Rukwa region.

1.3.2 Specific objectives

i. To describe the desired qualities of sheep kept by smallholders farmers in Nkasi district.
ii. To determine traditional management practices of sheep kept by smallholder farmers in Nkasi district.
iii. To asses prices and market availability of sheep inside and outside the district.
iv. To assess production performance and constraints of sheep kept by smallholder farmers.

1.4 Research questions

i. What are desired qualities of sheep kept by the smallholder farmers in the district?
ii. What are the traditional management practices of sheep conducted by smallholder farmers in the district?
iii. Is sheep market available inside and outside the district and what are the price determinants?
iv. What are the sheep production performances and constraints faced by smallholder farmers in the district?

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the general aspects of sheep husbandry including the desirable sheep qualities, sheep management practices, production performances and constraints and sheep marketing and pricing.

2.2.1 Source, qualities and purpose of keeping sheep

Common sheep breeds kept in Tanzania are mainly the local types that include the Red Maasai sheep, Gogo sheep and the exotic Black Head Persian sheep (BHP) as well as crosses of BHP and the local subtypes. The Red Maasai sheep (Fig. 1) are widely distributed in various areas of Kenya and Tanzania and mostly kept by pastoral Maasai tribe (Mtenga *et al.*, 2003; Yamashiro *et al.*, 2011). BHP sheep breeds sometimes known as Somalia sheep originated from northern part of Africa in Somaliland have black head and neck but white in other parts of the body. They are kept for meat purposes and have short-fat tail weighing up to 10kg, long-thin legs, small horn and ears. Adult BHP sheep are heavier than Red Maasai sheep and are tolerant to drought (Mtenga *et al.*, 2003).

Figure 1: Red Maasai sheep

2.2.2 Quality of sheep traits and purpose of keeping sheep

The desirable traits in a crossbreeding system in addition to improving breeding efficiency are higher milk yield, improved growth rate, feed efficiency, market desirability of lambs, better adaptability of ewes and lambs to the environmental conditions (FAO, 1983). However, in Ethiopia the sheep adaptive trait like tolerance to diseases was rated low (Tibbo, 2006).

Sheep kept by the communities have an important role for household consumption and source of cash income (Andrew, 2003; Carlos, Henning and Jan, 1995). In Mexico sheep are kept primarily for wool production, but plays a secondary role in other agricultural (manure) and cultural aspects of the household (Geoff and Trevor,

2009). They can be kept for medicinal purposes, for example sheep fats are used in concoctions for treatment of mothers' during medical complications after delivery (Pius and Christopher, 2010). Sheep serve as living bank for their owners and serve as source of immediate cash and insurance against crop failures especially, where land productivity is low and availability of fodder is unreliable due to erratic rainfall, severe erosion, frost and water logging.

2.2 Traditional management practices of sheep

In Tanzania, both extensive and intensive sheep feeding systems are practiced. Under extensive system sheep graze in the field or bushes and sometimes they are tethered in case of small sheep flock. Extensive system is more practiced in Tanzania because it is difficult to exercise intensive system for a herd of more than 50 sheep. Also sheep can be grazed in rotation to avoid worm infestation, to allow germination of new pastures and to avoid soil erosions. Advantages of extensive system include low feeding costs (Mtenga *et al.*, 2003).

Tethered sheep are shifted regularly to different green pastures to obtain enough nutrients, enabling farmers to control animals in order to minimize crop damage and avoiding the necessity of additional labour for herding (Sendalo *et al.*, 1993). The advantages of the system is that sheep can be fed on crop residues, serve time for grazing, easy to control breeding, avoid destruction of neighbours' crops and protection against spread of diseases. When sheep are reared in stall they have to be provided with bundles of grasses all the time and fed with crop residues such as

straws from maize, sorghum, beans and wheat, and the feed can be improved by mixing with molasses and urea depending on their availability. Sheep can be provided with supplementary feeds such as maize bran, rice bran and mineral mix (Mtenga *et al.*, 2003). The major sheep supplementary feeds in Ethiopia are grains such as boiled bean, pea, maize and non-conventional feeds like Atella, Areke and Borde, which are the by-products of locally made beverages (Tibbo, 2006). FAO (1983) reported that the supplementation of a basic concentrate diet containing 16 percent crude protein with a trace element and/or a vitamin mixture (A, D, E) significantly improves the daily gain and feed efficiency of male lambs. During dry seasons supplementation of animals with concentrates and industrial by-products can not be afforded by most small holder farmers due to high costs and lack of accessibility (Talle, 1995). Sheep flocks kept in Iran do not receive any supplementary feeds before or during the mating season, instead they depend on grazing pastures alone (Acharya, 1981).

2.2.1 Sheep housing and housing materials

Sheep can be kept in houses, shed/hut or bomas at night constructed with thorn bush trees or timbers to prevent them from sunlight, predators and thieves. Sheep huts/sheds are constructed with a roof, wall and floor depend on the production system, cost and availability of building materials (Mtenga *et al.*, 2003). In India about 60% of sheep flocks are penned in open fields away from the house while the rest penned in temporary courtyards made out of thorny bushes or earth near the house (Acharya, 1981). Most smallholder farmers in Rome keep their livestock in

the buildings made from local materials such as wood or sun dried bricks, local grasses and bush poles (Geoff and Trevor, 2009). The cost of sheep housing which has a shed must be kept low and provided with only the most essential facilities such as feed storage, feeders, waterers, lambing pens and creeps (FAO, 1983).

2.2.2 Herd structure and breeding management

In Ethiopia the average flock size in both Adiyo Kaka and Horro districts were 11.3 and 8.2 respectively (Tibbo, 2006). The author contends that small flock size is one of the limiting factors in applying within-breed selection at the household level and in this situation a selection scheme at village level or even across villages would be inappropriate.

Given the small flock size, designing and implementation of community-based breeding programmes require a good understanding of production system used, different constraints in the system, clear understanding of breeding objectives and accurate methods of identifying the superior genotypes (Baker *et al.*, 2003). Under a controlled breeding system mating dates are recorded in order to trace back if the mated ewe conceived or not (Mtenga *et al.*, 2003) while in Asia, sheep breed throughout the year and usually no control on the breeding season except occasionally when one is eager to ensure the offspring are born on favourable season with plenty of grazing pastures (Acharya, 1981). To the contrary, in Ethiopia breeding males are not reared together with female sheep instead smallholder farmers get the service from neighbours' or use communal rams. Some farmers have breeding rams originated from the same flock and few purchase from market. The

ratio of rams older than one year to ewe flocks is 1:6. Majority of smallholder farmers practice selection for breeding rams and breeding females (Tibbo, 2006) and the selected rams for breeding start mating few ewes at the age of 12-18 months. After two years, one ram can serve fully 20-30 ewes (Mtenga *et al.*, 2003). In Ethiopia traits like size, colour and tail type are considered as important in selecting breeding animals. In case of females the size, colour and tail formation are the most highly preferred traits in selecting breeding females. Other traits like lambing interval, mothering ability and age at first lambing are considered in selecting breeding females (Tibbo, 2006).

2.3 Sheep production performances and constraints

2.3.1 Production performance of sheep

Sheep can live and produce on unfavourable lands for other forms of agriculture, have ability to forage and survive in areas where cattle would perform poorly (Morris, 2009). Hybrids of BHP take short time to attain weight for marketing and matured ewes enter oestrus cycle at the age of 6-8 months, mated at the age of 8-12 months and their bodies become large to enable sustain well gestation period and proper lambing. Gestation period of pregnant ewes are about 150 days and resume oestrus cycle 2-3 weeks after lambing however, some may take 1-2 months due to lactation. Once the ewe is mated at 3-4 months after lambing can have 3 parities in two years (Mtenga *et al.*, 2003).

2.3.2 Production constraints of sheep

Sheep production in developing countries like Tanzania largely depends on natural pastures and crop residues as source of feed. The quality and quantity of tropical pastures vary seasonally depending on length and intensity of wet and dry seasons. As dry season advances the grasses become scarce, unpalatable and of low nutritive values. Thus, during dry season the grazing lands of tropical countries are covered by fibrous standing hay which is deficient in energy, protein, minerals and vitamins (Talle, 1995).

Major reasons for low productivity of sheep are inadequate grazing resources, tropical heat, disease problems and serious lack of organized effort for genetic improvement (Acharya, 1981). Other production constraints are early disposal of breeding stocks, small flock sizes with only a few breeding males and uncontrolled mating (Tibbo, 2006).

CHAPTER THREE

METHODOLOGY

3.1 Description of the study area

This study was conducted in Nkasi District, Rukwa Region of Tanzania (Fig. 1). The district is located to the South-West of Tanzania between latitude 6°58' and 8° 17' South of the equator and between longitude 30°20' and 31°30' East of Greenwich. It is bordering Mpanda district to the North, Zambia to the South-West, the East and South-East is boarded by Sumbawanga municipality and to the West by Democratic Republic of Congo. The district has a land area of 13 124 km^2 of which 54.4% is arable land, 17% is Katavi game reserve, 28.56% is water bodies and 4% others**.** It is a large and sparsely populated district divided into five administrative divisions with 17 wards and 87 registered villages. The study area entails a diversity of farming systems and land use changes. Two divisions namely Namanyere and Mkwamba comprising eight wards were involved in the study from November 2010 to April 2011. These wards include Mtenga, Chala, Swaila, Kipande, Kate, Sintali and Isale dominated by agro-pastoralists and Namanyere in which agriculture is the dominant economic activity.

According to the 2002 population census, the district has a human population of 207,311 out of which 102,117 were males and 105,194 were females (Nkasi District, 2004). The population of Nkasi was estimated to be growing at the growth rate of 4.7% in the year 2004. 81 % of the population is residing in rural and only 19% are

living in urban areas (URT, 2004). About two percent of the population in the district undertaking livestock keeping as the main activity while the majority engaged in crop production. The main types of livestock kept in the district are cattle, goats, sheep, pigs, donkey and chickens. Approximately 7.24% of the households have immigrated into the district during the last five years (DALDO, 2008). Most of this spectacular growth was due to immigration of Sukuma tribe who are agro-pastoralists with their cattle, thus reflecting availability of grazing and agriculture lands. Nkasi district is largely semi-arid with bimodal rainfall ranging from 750-1200 mm with average altitude of about 1,300 meters above the sea level. The short rains are between October and December whereas; the long rains are from February to April. The dominant natural vegetation comprises the plateau woodland occupied by Sukuma agro-pastoralists with large herd of cattle, goats and sheep. Soils have natural fertility and cultivated extensively (DALDO, 2008).

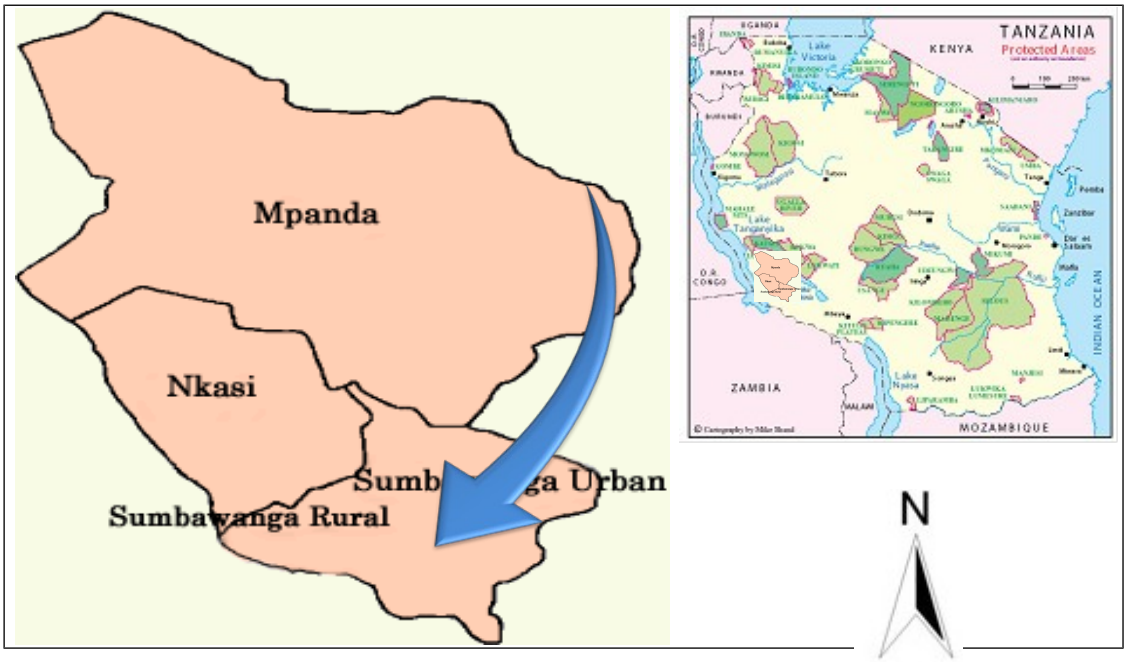

Figure 2: Location of the study area
Source: Nkasi district council, (2010)

3.2 Sampling procedure

Purposeful sampling was employed in the selection of the study wards based on their accessibility, availability of sheep, prevailing land uses and socio-economic characteristics. Based on the selected divisions sample (n) from each division was obtained through stratification of the population into wards. Five-digit random numbers generated in a LIMDEP version 5.1 software was matched with the name in the ward register that bore the number. The total sample (n=20) was a gross proportionate number of individuals in each stratum from each ward. In each division, four wards were picked and from every ward two villages were selected.

Smallholder farmers keeping sheep was identified with assistance from extension workers in each ward in the two divisions. For each selected village, 10 smallholder farmers keeping sheep were chosen for interview and at the end of the study the total number of respondents interviewed in the two divisions was 160 (Table 1).

Table 1: Sampling frame for smallholder farmers keeping sheep

Division	Ward	Village	Number of Respondents
Namanyere	Namanyere	Ipanda, Kakoma	20
	Mtenga	Mashete, Mtenga	20
	Chala	Chala, Kacheche	20
	Isale	Isale, Ntuchi	20
Mkwamba	Swaila	Kasu, Swaila	20
	Kipande	Kantawa, Kipande	20
	Sintali	Nkundi, Sintali	20
	Kate	Ntalamila, Kate	20

Data on sheep prices and market availability were collected randomly from sellers and buyers of sheep in the four livestock primary markets using structured questionnaires. Livestock primary markets in the districts are conducted in four

wards namely Namanyere, Chala, Kipande and Kate. In each livestock primary market five buyers and five sellers of sheep were interviewed to make a total 40 respondents in all livestock primary markets (Table 2).

Table 2: Sampling frame for primary livestock market

Division	Primary livestock market (ward)	Number of respondents
Namanyere	Namanyere	10
	Chala	10
Mkwamba	Kipande	10
	Kate	10

3.3 Types and sources of data

Primary data were obtained from rural households in the study area. A structured questionnaire was administered to a random sample of smallholder farmers in the sample villages. The questionnaire was designed to capture desired qualities of sheep and information on sheep traditional management practices, production performances and constraints faced by smallholder farmers (Appendix 1). Furthermore, the study sought information on sheep prices and market availability inside and outside the district (Appendix 2). In order to gather a wide range of responses, two focus group discussions for each division (8-12 individuals) were used. Conversation taking place during focus group discussions were noted. FGDs were used to identify sheep price and market availability, decision making on sheep, preferred sheep breeds and different national polices and if programmes directed towards livestock industry in trying to modernize. The interview guide is attached in Appendix 3. FGD was used to quickly generate more information through interactive learning, knowledge sharing and assurance of high-level local people's participation in research. This

involved relaxed rapport, open dialogue, brainstorming and mutual sharing of knowledge, skills and experiences (McCkracken, Pretty and Gonnay, 1988; Chambers, 1992). Other techniques used include direct observations. Secondary data were sourced from district livestock office, unpublished, gray and published literature from libraries.

3.4 Data analysis

Data from questionnaires were coded and analysed using the Statistical Package for Social Sciences (SPSS 16.0, 2006) computer programme. Quantitative data was analysed whereby frequencies, percentages and means were used to determine the desired qualities of sheep, traditional management practices, prices and market availability of sheep and sheep production performances and constraints. The recorded information from FGDs was summarised and synthesised according to the checklist used during the discussion.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Overview

The results and discussion of the findings is based on seven sections. The first part of the section provides demographic profiles of the respondents, the second part focused on sheep strains and preferences kept by smallholder farmers. The third part focused on the traditional management practices of sheep, the fourth part concentrate on production performances and constraints of sheep, the fifth part based on the sheep pricing and market availability. The sixth part explains the preferred animals, prices and sources in the primary livestock markets. The last part of the section gives way forward for improving sheep production.

4.2 Demographic profiles of the respondents

The demographic profiles of the respondents examined and presented in this chapter are household profile, source of income, livestock species kept and members of household responsible for sheep activities.

4.2.1 Demographic characteristics of sheep owning households

Demographic characteristics of sheep owning households are shown in Table 3. The findings revealed that the leading tribe in keeping sheep in the district was the Sukuma (60.6%) while the native comprised of Fipa (39.4%). The Sukuma tribe are

agro-pastoralists who emigrated with their herds from different regions of Tanzania to Nkasi district in search of extensive arable and grazing lands. Also the study revealed that most of the smallholder families keeping sheep in surveyed wards were male-headed 81.2%. Under normal situation for Tanzanian culture, men are the ones who head the family and are the main speakers bearing in mind that during the study respondents were visited at their residential areas.

Furthermore, the results show that 80.6% of the respondents were married, 10.6% single, 6.2% divorced and 2.5% widow/widowers. The result further showed that 51.9% of the respondents had primary school education, 40% without school education and the remaining 8.1% attained secondary education. Lack of education was attributed by long distance to school and also in the past parents was reluctant to send their children to school and children were considered as source of labour for farm operations. The finding conform with that reported by Faustine *et al.,* (2002) who observed low rate of children enrolment to school for Maasai tribe which was partly explained by the fact that pastoralists were less inclined to send their children to school, as they provide an important source of labour in livestock keeping. Education is perceive to be among the factors that influence individuals' perception on innovations before making adoption decision and it motivates the desire for individuals to learn more, attend training, seek resources or any other informations regarding the improvement of livestock production (Fortunate, 2009).

Table 3: Demographic characteristics of sheep owning households

Respondents characteristics	Number of respondents (N=160)	Percentage
Tribe name		
Sukuma	97	60.6
Fipa	63	39.4
Total	**160**	**100**
Head of household		
Male	130	81.2
Female	30	18.8
Total	**160**	**100**
Marital status of the household		
Married	129	80.6
Single	17	10.6
Divorced	10	6.3
Widow/widower	4	2.5
Total	**160**	**100**
Highest education level		
No school education	64	40.0
Primary education	83	51.9
Secondary education	13	8.1
Total	**160**	**100**
*Members of household who own sheep**		
Head	145	90.6
Spouse	143	89.4
Sons	117	73.1
Daughter	107	66.9

Note: *Data on percentages were based on multiple responses and N = Total number of respondents interviewed.

It was revealed that majority (90.6%) of sheep were owned by household head, followed by spouse (89.4%), sons (73.1%) and daughters (66.9%) (Table 3). The access to resources such as livestock and lands is determined by the patriarchal system in which males have dominance over women because the inheritance of resources favours men over women. Solomon *et al.* (2010) reported that in Ethiopia the access to resources in terms of ownership and decision-making roles vary

between husbands, spouses and children; for example women and children have the property right over the flocks but are not decision-makers and husbands decide on the income from livestock. In Tanzania, earlier studies done by Geoff and Trevor, (2009) showed that women and children were usually the managers and not actually the owners of small ruminants in agro-pastoral communities. The head (father) of the household appropriated all wealth generated activities and little to nothing was allocated to women (mother) and this type of household power asymmetry constrains the contribution of women in poverty alleviation at household level. However, a different finding was reported by Pius and Christopher, (2010) who reported that women for Maasai community in Simanjiro district in Tanzania owned small ruminants and donkeys while men owned cattle.

4.2.2 Source of income and livestock kept

In terms of respondents' source of income the results revealed that crops (99.4%) and livestock/livestock products (98.1%) were the main sources of income for majority of the households (Table 4). Other sources of income were off-farm business (16.9%), home industries (13.1%), salary/wages (5%) and pension (0.6%). This indicates that smallholder farmers in the district depend more on crops and livestock for source of income than other sources of income. Similar finding was reported by Solomon *et al.,* (2010) in the agro pastoralist communities in Ethiopia.

Table 4: Source of income and livestock kept

Parameter	**Number of respondents (N=160)**	**Percentages**
Source of income		

Salary/wages	8	5
Pension	1	0.6
Off-farm business	27	16.9
Livestock and livestock products	157	98.1
Home industries	21	13.1
Crops	159	99.4
Livestock kept		
Cattle	138	86.2
Goats	159	99.4
Sheep	158	98.8
Pigs	20	12.5
Donkey	42	26.2
Poultry	145	90.6

Note: Data on percentages were based on multiple responses and N = Total number of respondents interviewed.

The study revealed that most farmers (99.4%) kept goats, sheep (98.8%) and cattle (86.2%) (Table 4). Other livestock species kept were poultry (90.6%), donkey (26.2%) and pigs (12.5%). Cattle were valued for wealth, prestige, dowry and business while both goats and sheep were kept for households' consumption and for cash. In addition sheep were kept for medical purposes whereby sheep fat was used in concoctions used for treating mothers' medical complications after delivery.

4.2.3 Sheep activities

The study revealed that the activity of purchasing sheep (Table 5) was mainly done by adult males (93.1%) and females (67.5%). Other members of the household who are involved in purchasing sheep were boys (51.2%), girls (26.2%) and hired labour (3.1%). The activity of selling or slaughtering sheep was mainly conducted by adult males (92.5%) and adult females (69.1%). This activity was supported by boys (55.6%), girls (30.6%) and hired labour (5.9%). Herding and feeding sheep was the main activity done by boys (95%) (Fig 3), adult males (68.8%) and girls (68.1%).

This shows that the family labour is the main source of livestock farm labour and the use of hired labour for flock management is minimal and uncommon. In contrast Solomon *et al.,* (2010) reported that children and women provide the bulk of labour in sheep and goat management in Ethiopia. This difference in sheep management activities is due to differences in cultural considerations with respect to division labour. Among the Maasai the young boys *Layoni/Engayoni* not yet to be circumcised assist their mothers in all female related works including grazing sheep, goats and calves near their *bomas* and this work was shared with girls (Faustine *et al.,* 2002). In terms of breeding decisions adult males were responsible (93.1%). Similarly, adult males were responsible for sheep health while other household members also provided assistance.

Table 5: Members of household responsible for sheep activities

Activity	**Percentage of respondents, N=160**				
	Adult		**Boys**	**Girls**	**Hired**
	Males	**Females**	**(<15 yrs)**	**(<15 yrs)**	**labour**
Purchasing sheep	149(93.1)	108(67.5)	82(51.2)	42(26.2)	5(3.1)
Selling/slaughtering sheep	148(92.5)	109(68.1)	89(55.6)	49(30.6)	9(5.9)
Herding and feeding	110(68.8)	30(18.8)	152(95.0)	109(68.1)	16(10.0)
Breeding decisions	149(93.1)	98(61.2)	110(68.8)	59(36.9)	5(3.1)
Animal health	148(92.5)	111(69.4)	125(78.1)	66(41.2)	11(6.9)

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents, data on percentages were based on multiple responses and N = Total number of respondents interviewed.

Figure 3: Children <15 years of Sukuma tribe responsible in sheep herding

4.3 Sheep strains and preferences

4.3.1 Common name, strain type and trend within sheep herd

Most of sheep strains kept by smallholder farmers (Table 6) were variant crosses of local breeds, Red Maasai, Sukuma and possibly BHP. Fig. 4 show the mixed strains kept by smallholder farmers in the district. There were no pure breeds kept by the smallholder farmers because no breeding programme was in place instead uncontrolled breeding was commonly used. The trend of sheep number shows that majority (69.4%) of the respondents said it is increasing while the minority (11.9%) of them declared that sheep numbers were decreasing.

Table 6: Common name, type of strain and trend within sheep herd

Parameter	Number of	Percentages

	respondents (N=160)	
*Common name for the breed/strain**		
Variant of cross of BHP and local strains	152	95.0
Variant cross of Red Maasai sheep and local strains	81	50.6
Unknown	23	14.4
Strain type kept		
Pure strain	0	0
Cross breed/strain	154	96.2
Unknown	6	3.8
Total	**160**	**100**
Trend within sheep herd		
Increasing	111	69.4
Decreasing	19	11.9
Stable	29	18.1
Unknown	1	0.6
Total	**160**	**100**

Note: *Data on percentages were based on multiple responses and N = Total number of respondents interviewed.

Figure 4: Variant cross group of local sheep strains kept by smallholder farmers in Nkasi district

4.3.2 Herd structure

The herd structure was composed of an average of two intact adult males (rams) and 9 adult females (Table 7). The intact male lambs were about three and intact female lambs were approximately six. The lower proportion of male (intact and castrates) could be attributed to the preference of farmers selling males for slaughter. Smallholder farmers did not prefer to castrate either adult sheep or lambs.

Table 7: Herd structure

Herd structure	Mean
Adult sheep	
Intact male (rams)	2.07±1.7
Castrate	0.01±0.1
Female (ewes)	8.62±7.1
Total	10.41±7.6
Lambs	
Intact male	2.61±1.9
Castrate	0.16±0.9
Female	4.71±4.4
Total	7.02±6.1

4.3.3 Source and preferred traits of strain of sheep

The source of the sheep strains were studied in order to get information about where smallholder farmers obtained different types (Table 8). Smallholder farmers obtained

their animals through purchasing from their neighbours (92.5%). Others obtained their initial stock through inheritance (26.2%), purchasing from primary livestock markets (25.6%) and also from the bride price and as gift after taking care of other people's animals (5.6% each). Smallholder farmers keeping sheep in the district preferred sheep strains which were both tolerant to diseases/parasite (76.9%) and heat (73.1%) because the strains of this type had adaptive capacities enabling them to live and produce under low level of management. Similar finding was reported by Owen *et al*. (2005); Baker *et al.* (2002) as cited by Muigai *et al.* (2009) that among the traits preferred by farmers keeping indigenous sheep in Kenya include adaptability to the harsh environmental conditions and resistance to gastrointestinal nematodes. Other preferences were better carcass (67.5%) and drought tolerance (63.5%). On other hand, according to FGDs, the most preferred sheep traits were disease tolerance (84.4%) and easy to market (71.9%). Both farmers and FGD members had high preferences on trait of disease tolerance; however farmers had other high preference like heat tolerances contrary to FGDs who highly preferred trait of easy to market.

Table 8: Source of the breeds/strains, preferred traits of the sheep breeds and the way how preferred criteria of sheep breeds can be achieved

Parameter	Number of respondents (N=160)	Percentages
Origin/source of the breeds/strains		
Inherited	42	26.2
Market (purchased)	41	25.6
Through paid bride price	9	5.6
Commercial farms	0	0
After taking care of other people's animals	9	5.6
Purchasing from their neighbours	148	92.5
Preferred traits of the sheep breeds (farmers)		

Heat tolerance	117	73.1
Highly fertile	89	55.6
Drought tolerant	102	63.8
Ability to forage	47	29.4
Disease/parasite tolerance	123	76.9
Ability to travel long distance	95	59.4
Low water requirements	93	58.1
Easy to market	63	39.4
Better carcass	108	67.5
High lamb survival	88	55.0
How the preferred criteria of sheep breed achieved?		
Through government by provision of hybrid sheep to sheep keepers	13	8.1
Through purchasing good sheep breeds from neighbors' sheep flocks	68	42.5
Through selecting best animal from the existing sheep flock	42	26.2
No opinion on how the preferred criteria of sheep breed can be achieved	64	40.0
Preferred traits of the sheep breeds (FGDs)		
Disease tolerance	27	84.4
Easy to market	23	71.9
Drought tolerant	21	65.6
Highly fertile	17	53.1

Note: Data on percentages were based on multiple responses and N = Total number of respondents interviewed

Also the preferred traits of sheep strains were achieved by purchasing good sheep breeds from neighbour's sheep flocks (42.5%) and selecting best animals from the existing stock (26.2%). Some (40%) of the respondents had no opinion on how the preferred criteria of sheep breed could be achieved.

4.3.4 Perception of sheep quality traits by owners

The good quality traits of sheep perceived by smallholder farmers (Table 9) mainly were disease tolerance (64.4%) and drought tolerance (60%). Farmers considered these traits as good because the sheep graze in communal land where there is high risk of disease infection and low water availability. Sheep kept by smallholder farmers depended on their natural body immunity to tolerate against diseases such as

FMD and worms since the majority of farmers did not treat or provide vaccination to sheep.

Table 9: Perception of sheep quality traits by owners

Quality traits	Description of trait (N=160)			
	Poor	**Average**	**Good**	**No opinion**
Size	4(2.5)	115(71.9)	38(23.8)	3(1.9)
Conformation/shape	6(3.8)	100(62.5)	49(30.6)	5(3.1)
Colour	4(2.5)	88(55.0)	57(35.6)	11(6.9)
Disease tolerance	6(3.8)	51(31.9)	103(64.4)	0(0)
Drought tolerance	6(3.8)	55(34.4)	96(60.0)	2(1.2)
Heat tolerance	4(2.5)	63(39.4)	90(56.2)	3(1.9)
Meat quality	6(3.8)	62(38.8)	82(51.2)	10(6.2)
Growth rate	2(1.2)	78(48.8)	77(48.1)	3(1.9)
Fertility	4(2.5)	82(51.2)	65(40.6)	9(5.6)

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents, data on percentages were based on multiple responses and N = Total number of respondents interviewed

Other traits that scored average quality traits were size (71.9%), conformation/shape (62.5%) and colour (Black and white or red) (55%). FAO (1983) reported that the desirable traits in a crossbreeding system include improving breeding efficiency,

improved growth rate, feed efficiency, market desirability, better adaptability of ewes and lambs to the environmental conditions.

4.3.5 Purpose of keeping sheep

Sheep were kept mainly for meat (99.4%), income (84.4%) and manure (68.1%) as shown in Table 10. Sheep were also sold by farmers for the purpose of obtaining cash for school fees, buying clothes or other household expenditures.

Table 10: Purpose of keeping sheep

Purposes of keeping sheep	Number of respondents (N=160)	Percentages
Nutrition	159	99.4
Manure	109	68.1
Cultural	52	32.5
Skin	2	1.2
Dowry	8	5.0
Ceremony	7	4.4
Investment	135	84.4

Note: Data on percentages were based on multiple responses and N = Total number of respondents interviewed

Other purposes were cultural (32.5%), dowry (5%), ceremony (4.4%) and skin (1.2%). The observations in the present study are consistent with the findings of (Andrew, 2003; Moradi *et al.*, 2010) who reported that agro pastoralist communities kept sheep for household consumption and source of cash income generation. In most cases some women from Sukuma tribe use ewes for sacrifices. Also Geoff and Trevor, (2009) reported that in Mexico sheep were kept primarily for wool production, manure and cultural aspects. Generally, small ruminants contribute to landless, rural farming, peri-urban and increasingly to urban household livelihoods.

4.4 Traditional management practices of sheep

4.4.1 Production, grazing system, feeding, supplementation and watering

Majority (94.4%) of smallholder farmers kept sheep under extensive system through herding continuously during both dry and wet seasons (Table 11). This is because large area in the district is rangeland where the animals have access to plenty of pasture although in some areas they grow crops. Few practiced semi-intensive system (8.1%) and intensive system (1.2%) by grazing sheep around their homes. Both semi-intensive and intensive systems are mainly practiced in Namanyere town by few farmers where the grazing land is scarce. The result is line with findings of Mtenga *et al.,* (2003) who reported that sheep feeding systems practiced in Tanzania are both extensive and intensive systems although it is difficult to exercise intensive system for large herd. Most of the farmers (96.6%) practiced continuous grazing and only 3.1% rotational grazing. Continuous grazing is more preferred by farmers due to availability of large grazing land since many farmers live in rural areas.

Table 11: Production and grazing systems

Parameter	**Number of respondents (N=160)**	**Percentages**
Production systems		
Extension system	151	94.4
Semi-intensive system	13	8.1
Intensive system	2	1.2
Grazing management		
Continuous grazing	155	96.6
Rotational grazing	5	3.1
*Grazing land ownership**		
Own	33	20.6
Communal	156	97.5
Lease	17	10.6

Note: Data on percentages were based on multiple responses and N = Total number of respondents interviewed

The most grazing system (Table 12) used during dry season was free grazing (89%) and herded grazing (21.9%). During wet season smallholder farmers practiced free grazing (71.2%), herded grazing (23.8%) and tethering (21.9%). Free grazing is more preferred because it reduces the costs for feeds. Similarly, Solomon *et al.*, (2010) in Ethiopia reported that extensive grazing in communal grazing lands is practiced but there were differences depending on agro-ecologies and geographic regions. Farmers in Nkasi district prefer grazing sheep together with cattle or practice tethering during wet season due to availability of pastures. Sendalo *et al.*, (1993) reported that the farmers in Morogoro tethered their sheep in order to minimize crop damage and avoiding the use of additional labour for herding.

During dry season majority of smallholder farmers reported to rely on crop residues or roughages (49.4%) and most of them did not supplement their sheep (47.5%). During dry season maize straw, sunflower seedcake, maize bran, household food leftovers, sweat and irish potatoes were the common available supplements. Talle, (1995) reported that during dry season supplementation of animals with concentrates and industrial by-products can not be afforded by most small holder farmers due to high costs and lack of accessibility. There were minimal supplementations during wet season (7.5%). In contrast Tibbo (2006) reported that the major supplementary feeds to sheep in Ethiopia were boiled bean, pea, maize and non-conventional feeds like Atella, Areke and Borde made with by-products of local beverages. However, FAO (1983) recommended that in order to improve daily gain and feed efficiency on

sheep the basic concentrate diet containing 16 percent crude protein with a trace element and/or a vitamin mixture (A, D, E) as supplement feed should be used.

Most (97.5%) of the households used communal land for grazing, some had their own lands (20.6%) and while others had leased lands for grazing (10.6%). Sukuma tribe who are immigrant to the district often purchase lands from the native Fipa tribe for the purpose of growing crops or grazing their animals after crop harvesting. Similar observation was reported by Solomon *et al.*, (2010) in Ethiopia that the major feed resources for sheep include grazing on communal natural pasture, crop stubble, fallow grazing, road side grazing, crop residues and browses.

Table 12: Grazing system and supplementation

	N=160	
Grazing systems	**Dry season**	**Wet season**
Grazing system		
Free grazing	128(80.0)	114(71.2)
Tethering	17(10.6)	35(21.9)
Paddock	2(1.2)	3(1.9)
Stall fed	1(0.6)	0(0)
Backyard	0(0)	0(0)
Herded grazing	35(21.9)	38(23.8)
Supplementation regime		
Concentrates or bought-in feed	5(3.1)	8(5.0)
Crop residue or roughage	79(49.4)	9(5.6)
Vitamins and minerals (salts)	5(3.1)	12(7.5)
None	76(47.5)	130(81.2)

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents, data on percentages were based on multiple responses and N = Total number of respondents interviewed

In general smallholder farmers used two methods (Table 13) to provide water to their sheep, *i.e.,* providing water at the household or taking sheep to water sources at a certain distance from their homes. Majority (68.1%) of the smallholder farmers

provided water to their sheep during dry season while during wet season sheep were brought to water sources (75%). A small percentage of the smallholder farmers used both watering methods during both dry and wet seasons. About 73.1% used ponds water as a major source of water during dry and wet seasons. The distance to the furthest watering point during the dry season was 1-5km (72.5%). Few had to travel less than 1km to reach furthest watering point (22.5%). During wet season water was readily available within a radius of 1km. Similarly, Solomon, (2010) reported that in Ethiopia sheep were taken to watering points at distance ranging from 2-5km during the dry season.

The frequency of watering in dry season for most households was twice a day (60%) while in wet season water was available at all time. Contrary to the Solomon *et al.*, (2010) reported that during dry season in Ethiopia sheep were provided with drinking water every three days however the frequency of watering varied with season and agro ecological zones. Similarly, Acharya, (1981) reported that availability of drenching water and quality was poor and animals had to travel long distance in search of water.

The difference in frequency of watering animals in Nkasi district and that reported in Ethiopia could be explained by fact that in Nkasi district water table is high and ponds or bore holes provide enough water to livestock during dry seasons. The quality of sheep drinking water was generally good and clear both during the dry season (79.4%) and wet season (97.5%).

Table 13: Watering

	N=160	
Watering	**Dry season**	**Wet season**
Provision of drinking water		
1 Water is fetched or provided	109(68.1)	17(10.6)
2.Sheep go to water	50(31.2)	120(75.0)
3.Both	6(3.8)	29(18.1)
Source of water		
1. River	18(11.2)	45(28.1)
2.Spring	23(14.4)	113(70.6)
3.Dam or pond	117(73.1)	124(75.5)
4.Borehole	56(35.0)	64(40.0)
Distance to watering point		
1 At household	0(0)	11(6.9)
2. < 1km	36(22.5)	123(76.9)
3. 1 – 5km	116(72.5)	51(31.9)
4. 6 – 10km	8(5.0)	0(0)
5. > 10km	0(0)	0(0)
Frequency of watering		
1 Freely available	12(7.5)	151(94.4)
2.Once a day	47(29.4)	2(1.2)
3.Twice a day	96(60.0)	8(5.0)
4.Once in two days	3(1.9)	0(0)
5.Once in three days	0(0)	0(0)
Quality of water		
1 Good and clear	127(79.4)	156(97.5)
2. Salty (brackish)	22(13.8)	2(1.2)
3. Muddy	11(6.9)	2(1.2)
4. Smelly	4(2.5)	2(1.2)

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents, data on percentages were based on multiple responses and N = Total number of respondents interviewed

4.4.2 Housing and housing materials

The findings revealed that majority of the smallholder farmers (Table 14) used simple shed or stall housing during dry season (54.4%), while others used yard and houses (20% each). During wet season, most (60.6%) of them used shed or stall while some had a house (24.4%). 7.5% and 8.1% used kraal during dry and wet seasons respectively. Some farmers in the district reported predation by wild animals

such as hyena and the problem was more pronounced in houses constructed using weak local materials as shown in both Fig. 5 and 6. Farmers did not clean their sheep house thereby increases the chance for diseases infection.

Table 14: Housing

	N=160	
Housing	**Dry season**	**Wet season**
Sheep housing		
Yard	(32)20.0	(10)6.2
Kraal	(12)7.5	(13)8.1
Shed or stall	(87)54.4	(97)60.6
House	(32)20.0	(39)24.4

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents, data on percentages were based on multiple responses and N = Total number of respondents interviewed

Figure 5: Stall/shed for sheep housing

Figure 6: An open kraal for sheep

Lambs were normally housed together with adults as it was reported by majority (55.6%) of farmers (Table 15). Most of sheep housing materials used were untreated woods (85%) but few used bricks (16.9%), mud houses (12.5%) and iron sheets (1.2%). The results conform to the ones reported by Geoff and Trevor, (2009) that most smallholder farmers kept their livestock in buildings and pens made from local materials such as wood or sun dried bricks, thatch from local grasses and bush poles. FAO (1983) reported that the cost of sheep housing must be kept low with buildings providing only the most essential facilities such as feed storage, feeders, waterers, lambing pens and creeps while the roof shape should be of the shed type.

Table 15: Housing materials

Parameter	**N=160**	
	Frequency	**% of respondents**

Are lambs housed together with adults?		
Yes	89	55.6
No	71	44.4
Total	**160**	**100.0**
*Housing materials used**		
Bricks	27	16.9
Iron sheet	2	1.2
Wire	0	0
Mud	20	12.5
Untreated woods or bush materials	136	85.0

Note: *Data on percentages were based on multiple responses and N = Total number of respondents interviewed

4.4.3 Disease prevalence and health management

The prevalent diseases which occured on sheep flock kept by most smallholder farmers was (85%) (Table 16). Diseases occurring to sheep flock include worms (45%), flue (20%), FMD (15.6%) and mange mites (4.4%).

Table 16: Prevalent sheep diseases

Parameter	**N=160**	
	Frequency	**% of respondents**
Are prevalent diseases occurring on farm?		
Yes	136	85.0
No	24	15.0
Total	**160**	**100.0**
Are treatment given?		
Yes	77	48.1
No	83	51.9
Total	**160**	**100.0**
*Prevalent diseases occur on farm**		
FMD	25	15.6
Mange mites	7	4.4
Flue	32	20.0
Worms	72	45.0
Is vaccination/preventive treatments given		
Yes	62	38.8
No	98	61.2
Total	**160**	**100.0**
Methods		
Done routinely	23	14.4
Done when need arises	137	85.6

Total	**160**	**100.0**

Note: *Data on percentages were based on multiple responses and N = Total number of respondents interviewed

These results are similar to those reported by Solomon *et al.*, (2010) where mange mites, ticks, lice and fasciolosis were common. Majority (61.2%) of farmers in the district did not vaccinate their sheep while only few (38.8%) vaccinated them against diseases. The vaccination or preventive treatments was done when need arises (85.6%) and only 14.4% vaccinated routinely. According to the farmers the reason that caused them not to vaccinate their sheep includes inadequate funds to purchase vaccines and poor knowledge on the importance of vaccination.

Most (71.9%) of smallholder farmers (Table 17) do treat their sheep themselves and some had no access to veterinary services (23.8%). Some villages had no livestock officers or drug shops where the smallholder farmers can have access to drugs. In this case they are forced to travel long distance to other areas in search of the services.

Table 17: Health management

Access to veterinary services	**N=160**	
	Number of respondents	**Percentage**
Government vet	1	0.6
Private vet	115	71.9
Extension service	31	19.4
Veterinary drug supplier	1	0.6
None	38	23.8

Note: Data on percentages were based on multiple responses and N = Total number of respondents interviewed

4.4.4 Control of ectoparasites

Majority (80%) of smallholder farmers did not routinely controlled ectoparasites and only a few (42%) adhered to routines (Table 18). Spraying (56.2%) was the common method while about 16.9% used dip.

Table 18: Control of ectoparasites

Control methods	**N=160**	
	Done routinely	**Done when need arises**
None	42(26.2)	128(80.0)
Dip	27 (16.9)	5 (3.1)
Spray	90 (56.2)	27 (16.9)
Hand dressing	1 (0.6)	0 (0)

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents, data on percentages were based on multiple responses and N = Total number of respondents interviewed

4.4.5 Control of internal parasites

Control of internal parasites (Table 19) mostly was done when need arises during dry season (28.1%) and during wet season (27.5%). Most of the respondents did not controlled internal parasites either during dry or wet seasons each (36.9% each). However no traditional method was used to control internal parasites on sheep. The low level of internal parasite control could be explained by either the sheep were resistant or farmers lacked the knowledge on economic implication of the internal parasite.

Table 19: Control of internal parasites

	Method	Done when Need arises		Done routinely		*If routinely, specify how often*	
		Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season
a.	Drench	45(28.1)	44(27.5)	8 (5.0)	8 (5.0)	Every 3 months	Every 4 months
b.	Traditional	0 (0)	0 (0)	0 (0)	0 (0)	Every 0 month	Every 0 months

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents and data on percentages were based on multiple responses

4.4.6 Overall sheep flock morbidity rate

Morbidity rate were generally high (>70%) both in adult and lambs (Table 20). High morbidity of lambs was caused by ignorance on disease management including control of internal parasites and poor housing of lambs. Given the communal system of grazing re-infection was common even for those practicing routine external and internal parasite controls.

Table 20: Overall sheep flock morbidity rate

Sheep classes	Number of respondents (N=160)	% of respondents
Suckling lambs	117	73.1
Weaned lambs	115	71.9
Adults	118	73.8

Note: Data on percentages were based on multiple responses

4.4.7 Castration

Majority (91.9%) of smallholder farmers did not castrate their sheep (Table 21). Only (8.1%) practiced castration in order to control breeding (6.2%) and improving meat quality (5%). Lambs were castrated when they were about three-six months. According to FAO (1983) castration should be carried out before lambs attained six weeks of age although it reduces the rate of gain, feed efficiency and the carcass may contains more fat compared to intact male lambs.

Table 21: Castration

Castration process	N=160	
	Number of respondents	% of respondents

Do you castrate?		
Yes	13	8.1
No	147	91.9
Total	160	100
*Reasons for castration**		
Better price	4	2.5
Control breeding	10	6.2
Improving meat quality	8	5.0
*Age of castration**		
< 3 months	1	0.6
3-6 months	4	2.5
6-12 months	3	1.2
> 12 months	2	1.2

Note: *Data on percentages were based on multiple responses and N = Total number of respondents interviewed

4.4.8 Entries, disposal and culling

The major sheep entry within the flock was through lambs born (Table 22). On average about six lambs were born within the last 12 months. Farmers depend on lambs born to increase the flock size rather than purchasing from their neighbours. Entries in the form of donations, purchasing, gift and exchange within the last 12 months were generally low.

Table 22: Entries within last 12 months

Entry	**Mean**
Lambs born	5.78±5.4
Lambs bought	0.06±0.7
Adult male sheep bought	0.01±0.1
Adult female sheep bought	0.05±0.3
Total lambs and adult sheep	0.08±0.3
Lambs donated or given gift	0.01±0.1
Adult male donated/given gift	0.01±0.1
Adult female donated/given gift	0.04±0.2
Total lambs and adults donated	0.05±0.2
Lambs exchanged or lent	0.01±0.1

Adult male exchanged/lent	0.07±0.4
Adult female exchanged/lent	0.09±0.6
Total lambs and adults lent	0.18±0.8

The majority of the sheep exits were in the form of death whereas on average about one lamb died within last 12 months (Table 23). Also, sheep exited through slaughtering, exchange and donations. Death to lambs caused by improper management soon after lambing whereby most of the farmers house the lambs born together with their adults. During land preparation some farmers usually slaughter an animal, as a friendly gesture to individuals who provided assistance in these activities.

Table 23: Exits within last 12 months

Exits	**Mean**
Lambs died	1.07±1.4
Lambs sold	0.02±0.2
Adult male sheep sold	0.09±0.4
Adult female sheep sold	0.11±0.6
Total lambs and adult sold	0.17±0.7
Lambs slaughtered	0.04±0.4
Adult male slaughtered	0.92±1.3
Adult female slaughtered	0.41±0.9
Total lambs and adults slaughtered	1.13±1.5
Lambs donated/given gift	0.01±0.2
Adult male donated/given gift	0.02±0.2
Adult female donated/given gift	0.03±0.2
Total lambs and adults donated/given gift	0.04±0.3
Lambs exchanged/lent	0.02±0.2
Adult male exchanged/lent	0.09±0.5
Adult female exchanged/lent	0.12±0.6
Total lambs & adults exchanged/lent	0.19±1.0
Lambs stolen	0.02±0.2
Adult male stolen	0.02±0.2
Adult female stolen	0.06±0.3
Total lambs and adults stolen	0.09±0.3

Most of the farmers did not cull their sheep but few practiced culling (Table 24). The main reasons for culling sheep were small size, poor health, poor performance and poor conformation (1.9% each). Culling was rarely practiced owing to small flock size.

Table 24: Reasons for culling

Reasons for culling	N=160	
	Males	**Females**
Small size	(3)1.9	(1)0.6
Health	(3)1.9	(2)1.2
Performance	(3) 1.9	(1)0.6
Temperament	(1)0.6	(0)0
Body condition	(2) 1.2	(0)0
Old age	(1)0.6	(0) 0
Scarcity	(0) 0	(0)0
Overpopulation	(0) 0	(0)0
Drought	(0) 0	(1)0.6
Prevention of inbreeding	(2)1.2	(1)0.6
Conformation	(3)1.9	(2)1.2

Note: The values in parenthesis are percentages while the ones without parentheses are number of respondents and data on percentages were based on multiple responses

4.4.9 Breeding

The primary reason for keeping rams was for breeding 100% though some kept for socio-cultural purposes (21.2%) (Table 25). Rams for breeding were selected by farmers basing on size (88.8%) and conformation (71.9%). For example, Sukumas select animals with large body size and long fat tail. Fats from sheep tail are used for medical purposes like treating a person bitten by snake.

The breeding method used by most smallholder farmers in the district was uncontrolled natural mating (98.8%). In this regard smallholder farmers allowed their

ewes to mate randomly with rams from other herds in the same village or nearby villages during grazing time. The consequence of rams and ewes to run together throughout the year in uncontrolled breeding include the lambing to occur even in unfavourable seasons of low pasture quality. Uncontrolled breeding was also reported by Tibbo, (2006); Solomon *et al.*, (2010).

Table 25: Breeding, choice criteria and mating system

Parameters	**N=160**	
	Frequency	**% of respondents**
Primary reason for keeping ram(s)		
Breeding	160	100.0
Socio-cultural	34	21.2
Criteria for choice of ram(s) for breeding		
Conformation	115	71.9
Performance	74	46.2
Size	142	88.8
Mating system		
Controlled natural mating	3	1.9
Uncontrolled natural mating	158	98.8
Group natural mating	6	3.8

Note: Data on percentages were based on multiple responses and N = Total number of respondents interviewed

4.5 Production performances and constraints of sheep

The results (Table 26) indicate production performances of sheep kept by smallholder farmers. Number of rams kept per herd was approximately two and the average productive life for rams within the herd was about seven years while that of ewes was approximately eight years. The average number of lambs per ewes' lifetime is about 13 while the average age at first lambing and lambing intervals were six and two months respectively.

Table 26: Production performances

Production performance	N	Mean
Number of rams per herd	160	1.91±1.2
Average productive life for rams (years)	160	7.06±2.3
Average productive life for ewes (years)	160	7.79±2.2
Average number of lambs per ewe's lifetime	160	13.97±4.8
Average age at first lambing (months)	160	6.46±1.8
Lambing interval (months)	160	2.82±1.3

N = Total number of respondents interviewed

The most production constraints faced smallholder farmers keeping sheep were poor market availability (88.1%), endemic diseases (82.5%) and mortality of lambs (50.0%) (Table 27). Sheep in the primary livestock market are less purchased by buyers because most of people in the community do not prefer mutton since it contains more fats and little taste compared to goat's meat. Endemic diseases such as worms, FMD and flue are major diseases that face farmers in sheep production and usually cause high lamb mortality.

Other constraints were conflict with crops growers (34.4%), water shortages (16.9%), feed shortages (9.4%), shortage of grazing land (6.2%), theft and poor mothering ability (3.8% each). Problems related to service giving include absence of preventive veterinary services such as vaccination and accessible and adequate veterinary clinics resulting in unethical and inappropriate use of drugs from illegal sources.

Sheep market mostly was available through buying/selling from neighbours and there were few customers from outside the district. The constraints reported by Solomon *et al.,* (2010) in Ethiopia include lack of adequate supply of appropriate and good quality animals, poor marketing infrastructure, livestock diseases, lack of

adequate sanitary and phytosanitary services to support exports and long market channels (usually three-five stages between producer and the abattoirs).

Table 27: Production constraints of sheep

Constraints	Number of respondents (N=160)	Percentages
Theft	6	3.8
Feed shortages	15	9.4
Endemic diseases	132	82.5
Water shortages	27	16.9
Shortage of grazing land	10	6.2
Conflict with crops growers	55	34.4
Low fertility	0	0
Poor mothering ability	6	3.8
Mortality of lambs	80	50.0
Poor market availability	141	88.1
Cause overgrazing	3	1.9

N = Total number of respondents interviewed

In Kenya, Kosgey *et al*., (2008) as cited by Muigai *et al.*, (2009) reported that indigenous sheep are faced with many challenges including persistent droughts, diseases, conflicts and poor nutrition. In addition, low productivity of sheep was caused by inadequate grazing resources, tropical heat, disease problems and serious lack of organized effort for genetic improvement (Solomon *et al.*, 2010).

4.6 Sheep pricing and market availability

Most (sheep 65% and goats 37%) of customers who were involved in purchasing/selling sheep came from within the district (Table 28). Large number of sheep were sold and purchased among the farmers themselves without taking them to primary livestock markets. There were many goat sellers (52.5%) than sheep sellers (30%) in the primary livestock markets. There were opinions that over the years the

number of sheep sold was decreasing (22.5%) while that of goats was constant (22.5%). Moreover, nearly (70%) had no opinion on the trend for the two species.

Table 28: Market availability of sheep and goats

Parameters	Percentages	
	Sheep	**Goats**
*Where do you come from?**		
Within the district	65.0	37.0
Outside the district	17.5	25.0
Are you sellers?		
Yes	30.0	52.5
No	70.0	47.5
Total	**100**	**100**
Trend of animals sold as compared to last year		
Increasing	0	7.5
Decreasing	22.5	0
Constant	10.0	22.5
No opinion	67.5	70.0
Total	**100**	**100**
Demand to the market		
High	0	47.5
Medium	25.0	15.0
Low	42.5	0
No demand at all	10.0	5.0
No opinion	22.5	32.5
Total	**100**	**100**

Note: *Data on percentages were based on multiple responses

On average the number of sheep sold or bought per each primary livestock market was approximately two while the number of goats sold or bought was about five per day (Table 29) indicating high demand of goats than sheep. The mean selling prices of rams (mean) was Tshs 39200 while that of buck was Tshs 50800 and ewes were sold at mean price of Tshs 36500 while that of does Tshs 47400.

Table 29: Number and prices of sheep and goats sold/bought in the primary livestock market

Parameter	N	Mean
Number of sheep/goats sold/bought		
Number of sheep sold	12	1.92±0.5
Number of sheep bought	15	1.67±0.7
Number of goats sold	11	4.91±1.6
Number of goats bought	14	4.86±1.7
Price of sheep/goats sold/bought in Tshs		
Price of ram sold	13	39200±2794.2
Price of ram bought	18	41400±3110.2
Price of ewe sold	13	36500±3526.5
Price of ewe bought	18	38500±4003.7
Price of lamb sold	13	13400±1850.2
Price of lamb bought	18	13100±1567.7
Price of buck sold	12	50800±3713.2
Price of buck bought	13	48500±3281.7
Price of doe sold	12	47400±3604.5
Price of doe bought	13	45100±3451.1
Price of kid sold	12	17100±3800.8
Price of kid bought	13	15800±1589.2

N = Total number of respondents interviewed

4.7 Preferred animals, prices and sources in the primary livestock markets

The most sold specie in the primary livestock market (Table 30) was cattle (95%) followed by goats (85%) and sheep (65%).

Table 30: Preference, price, sources and constraints in the primary livestock market

Parameters	Number of	Percentage

	respondents (N=40)	
Preferred animals in primary livestock market		
Goats	34	85.0
Cattle	38	95.0
Sheep	26	65.0
Preferred sheep breed/strain in primary livestock market		
Variant crosses of BHP and local strains	31	77.5
Variant crosses of Red Maasai sheep and local strains	27	67.5
Long- fat tailed sheep (non descript)	11	27.5
Determinant of sheep price in the primary livestock market		
Season	32	80.0
Age	37	92.5
Sex	34	85.0
Levy	8	20.0
Sources of sheep to the primary livestock market		
Within the district	40	100.0
Outside the district	0	0
Constraints in sheep marketing		
Few customers	23	57.5
Little interest on sheep's meat(mutton)	21	52,5
Low sheep price on livestock primary market	25	62.5

Note: *Data on percentages were based on multiple responses and N = Total number of respondents interviewed

The breed/strain of sheep mostly preferred by customers in the market was variant crosses of BHP and local strains (77.5%); and variant crosses of Red Maasai sheep and local strains (67.5%). The determinant of sheep price in the primary livestock market mostly depended on age (92.5%), sex (85%) and season (80%). The source of sheep to the primary livestock market was within the district (100%). The constraints in sheep marketing in the district were low sheep price on the primary livestock market (62.5%), few customers (57.5%) and little interest on mutton (52.5%).

4.8 Way forward for improving sheep production

The plans that smallholder farmers had on improving sheep production in the district was to improve management of existing sheep flock kept (63.8%) while 36.2% had no opinion (Table 31). Farmers argued that the government (DC, MLDF) has to provide vaccines for treating diseases (33.8%) and improving sheep market availability (15%). Most (60%) of them advised the government (DC or MLDF) to outsource sheep customers from outside the district while few (17.5%) requested to be provided with hybrid sheep breeds for crossbreeding with their local breeds to obtain desired quality traits which they preferred. Some had no opinion on what the government should do to improve sheep production in the district (16.9%) while majority (33.8%) of them recommended that the government should improve sheep market and provision of better breeding stocks (23.1%). Some proposed training on proper sheep husbandry (11.9%). About (18.1%) of the smallholder farmers had no idea on the current situation.

Table 31: Views for improving sheep productivity

Parameters	**Number of respondents (N=160)**	**Percentages**
Plans to improve sheep production in the district		
To improve management in the existing sheep flock kept	102	63.8
No opinion	58	36.2
Total	**160**	**100.0**
Government (DC,MLDF) contribution to improve sheep production in the district		
Improve sheep market availability	24	15.0
Construction of watering points for drinking animals	13	8.1
Provision of vaccines for treating diseases	54	33.8
Training on proper sheep husbandry	20	12.5
Provision of hybrid sheep	22	13.8
No opinion	27	16.9
Total	**160**	**100.0**

General recommendations on what is required to improve sheep production		
Improving sheep market availability	54	33.8
Construction of watering points for drinking animals	4	2.5
Provision of vaccines for treating diseases	17	10.6
Training on proper sheep husbandry	19	11.9
Provision of hybrid sheep	37	23.1
No opinion	29	18.1
Total	**160**	**100.0**
*Plans to improve sheep market availability**		
Introducing hybrid sheep	2	5.0
No opinion	36	90.0
Other reasons	2	5.0
*Advice to the government in improving sheep market availability in the district**		
Outsourcing sheep customers from outside the district	24	60.0
Provision of hybrid sheep to sheep keepers	7	17.5
Other reasons	12	30.0
*General recommendations on improving sheep market availability**		
The government has to outsource sheep customers from outside the district	17	42.5
The government has to provide hybrid sheep to sheep keepers	7	17.5

Note: *Data on percentages were based on multiple responses and N = Total number of respondents interviewed

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From this study it was found that:

i. Smallholder farmers in the district kept variant crosses of sheep strains of BHP, Red Maasai and local strains. Most of them purchased sheep from their neighbours or inherited from their parents. Farmers prefer sheep that are

tolerant to both diseases and heat while the main reason of keeping sheep was for meat and income.

ii. Sheep were kept under extensive system of management by most farmers. Majority of farmers kept their sheep in stall or shed made of untreated bush materials during both dry and wet seasons.

iii. The average the herd structure of sheep contained two rams and nine ewes. On average ewes had more productive life span in the herd than rams and the average first lambing was about 6.5 months.

iv. The most production constraints faced farmers were poor market availability, diseases and mortality of lambs. Sheep market mainly was available within the district than outside the district and also goats were sold or bought at a higher price as compared to sheep in primary livestock markets while the price of the animal depended on age, sex and season.

Therefore, there is a need to provide training to smallholder farmers keeping sheep on the proper sheep husbandry to attain high production and improving their socio-economic wellbeing and national as a whole.

5.2 Recommendations

Based on the findings of this study, the following recommendations aimed at improving sheep production status so as to increase profitability to smallholder farmers keeping sheep.

i. Low preferences of customers on sheep's meat as compared to meat from both goats and cattle result into low production, low demand and low prices

of sheep. Also more efforts should be put in creating awareness on importance of sheep meat, stimulating sheep production and improving production efficiency through better sheep management and introduction of new sheep germplasm.

ii. There is a need to provide training to smallholder farmers on proper sheep husbandry, diseases control and provision of vaccines for treatment of sheep diseases.

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APPENDICES

Appendix 1: Questionnaire on sheep breeds, preferences, traditional management practices, production performances and constraints in Nkasi district.

Questionnaire No……. Date…….

LOCATION:
District: NKASI: Division:……..... Ward:…….. Village:……

A: DEMOGRAPHIC VARIABLES

1. **Name of respondent**……
2. **Tribe name** ……..…….

3. **Head of the household** *(Tick as appropriate)*
   Sex: 1. Male ( ) 2. Female ( )

4. **Marital status of the household** *(Tick as appropriate)*
   1. Married ( ) 2. Single ( ) 3. Divorced ( ) 4. Widow/widower ( )

5. **Highest education level of respondent** *(Tick as appropriate)*
   1.No school education ( ) 2. Primary education ( ) 3. Secondary education ( )
   4 Other *(specify):* ……... ( )

6. Source of income *(Tick one or more brackets)*
   1. Salary/wages ( ) 2. Pension ( ) 3. Off-farm business ( )
   4. Livestock and Livestock products ( ) 5. Home industries ( )
   6. Crops ( ) 7. Other *(specify):* …… ( )

7. Livestock kept *(Tick as appropriate)*
   1. Cattle ( ) 2. Goats ( ) 3. Sheep ( ) 4. Pigs ( ) 5. Donkey ( )
   6. Poultry ( )**Adult birds only*

8. Grazing land ownership *(Tick one or more brackets)*
   1. Own ( ) 2. Communal ( ) 3. Lease ( ) 4. Other *(specify):* ……. ( )

9. Members of household who own sheep *(Tick one or more brackets)*
   1. Head ( ) 2. Spouse ( ) 3. Sons ( ) 4. Daughters ( ) 5. Other…….

10. Members of household responsible for sheep activities
(Tick as appropriate: more than one column in a row may be ticked)

	Activity	Adult		Boys	Girls	Hired
		Males	Females	(<15 yrs)	(<15 yrs)	labour
1.	Purchasing sheep	( )	( )	( )	( )	( )
2.	Selling/slaughtering sheep	( )	( )	( )	( )	( )
3.	Herding and feeding	( )	( )	( )	( )	( )
4.	Breeding decisions	( )	( )	( )	( )	( )
5.	Animal health	( )	( )	( )	( )	( )
6.	Other *(specify)*:…….	( )	( )	( )	( )	( )

B. SHEEP BREEDS AND PREFERENCES

1. Description of sheep breed or strain kept

a. Common name for the breed/strain ……..…….
b. Breed/strain type kept: 1. Pure breed ( ) 2. Cross breed ( ) 3. Unknown ( )

2. Trend within sheep herd *(Only tick one bracket)*
   1. Increasing ( ) 2. Decreasing ( ) 3. Stable ( ) 4. Unknown ( )

3. Sheep herd structure *(Enter number in each bracket, X for unknown numbers)*

	Herd structure	Adult	Lamb
1.	Intact male	[ ]	[ ]
2.	Castrate	[ ]	[ ]
3.	Female	[ ]	[ ]
4.	Total number of sheep in herd	[ ]	[ ]

4. Origin or source of the breed/strain *(Tick one or more brackets)*

1. Inherited ( ) 2. Market (purchased) ( ) 3. Paid bride price ( )
4. Commercial farms ( ) 5. After taking care of other people's animals ( )
6.Purchasing from their neighbours ( ) 7. Other *(specify)*:…….... ( )

5. Quality of traits on sheep as perceived by owner *(Tick one bracket in each row)*

	Traits	Poor	Average	Good	No opinion
1.	Size	( )	( )	( )	( )
2.	Conformation/shape	( )	( )	( )	( )
3.	Colour	( )	( )	( )	( )
4.	Disease tolerance	( )	( )	( )	( )
5.	Drought tolerance	( )	( )	( )	( )
6.	Heat tolerance	( )	( )	( )	( )
7.	Meat	( )	( )	( )	( )
8.	Growth rate	( )	( )	( )	( )
9.	Fertility	( )	( )	( )	( )
10.	Others *(specify)*:…….…..	( )	( )	( )	( )

6. Preferred traits of the sheep breed *(tick one or more brackets)*

1. Heat tolerance ( ) 5. Disease/parasite tolerance ( ) 9. Easy to market ( )
2. Highly fertile ( ) 6. Ability to travel long distance ( ) 10. Better carcass ( )
3. Drought tolerant ( ) 7. Ability to walk long hours ( ) 11. High lamb survival ( )
4 Ability to forage ( ) 8. Low water requirements ( ) 12. Other *(specify):* ……

7. How the preferred criteria of sheep breed achieved?

a. ……
b. ……
c. ……
d. ……
e. ……
f. ……

8. Purpose of keeping sheep *(Tick one or more brackets)*

1. Nutrition ( ) 2. Manure ( ) 3. Cultural ( ) 4. Skin ( )
5. Dowry ( ) 6. Ceremony ( ) 7. Investment ( ) 8. Breeding ( )
9. Household income ( ) ( ) 10. Other *(specify):* ……..…..( )

C. TRADITIONAL MANAGEMENT PRACTICES OF SHEEP

⌖ Production System and Feeding

1. System of production used *(Tick one or more bracket)*

1. Extension system ( ) 2. Semi-intensive system ( ) 3. Intensive system ( )
4. Others *(specify)*:…….……..….. ( )

2. Grazing management practiced *(Tick as appropriate)*

1. Continuous grazing ( ) 2. Rotational grazing ( ) 3. Deferred grazing ( )

3. Grazing system *(Tick as appropriate)*

Grazing systems	Dry season	Wet season
1 Free grazing	( )	( )
2.Tethering	( )	( )
3.Paddock	( )	( )
4.Stall fed	( )	( )
5.Backyard	( )	( )
6.Herded grazing	( )	( )
7. Other *(specify)*:……	( )	( )

4. Supplementation regime for sheep *(Tick as appropriate)*

Supplementation regime	Dry season	Wet season
1 Concentrates or bought-in feed	( )	( )
2.Crop residue or roughage	( )	( )
3.Vitamins and minerals (salts)	( )	( )
4.None	( )	( )
7. Other *(specify)*:……	( )	( )

- **Housing**

1. Sheep housing *(Tick as appropriate)*

Housing	Dry season		Wet season
1 Yard	( )		( )
2.Kraal	( )		( )
3.Shed or stall	( )		( )
4.House	( )		( )
7. Other *(specify)*:……	( )		( )
Are lambs housed together with adults? Yes	( )	No	( )

2. Housing materials *(Tick one or more brackets)*

1. Bricks ( ) 2. Iron sheet ( ) 3. Wire ( ) 4. Mud ( )
5. Untreated wood or bush ( ) 6. Other *(specify):* ……. ( )

- **Watering**

1. Provision of drinking water for sheep *(Tick one or more brackets)*

Provision of drinking water	Dry season	Wet season

1 Water is fetched or provided	( )	( )
2.Sheep go to water	( )	( )
3.Both	( )	( )

2. Source of water *(Tick one or more brackets)*

Source of water	Dry season	Wet season
1. River	( )	( )
2.Spring	( )	( )
3.Dam or pond	( )	( )
4.Borehole	( )	( )

3. Distance to farthest watering point *(Tick one or more brackets)*

Distance to watering point	Dry season	Wet season
1 At household	( )	( )
2. < 1km	( )	( )
3. 1 – 5km	( )	( )
4. 6 – 10km	( )	( )
5. > 10km	( )	( )

4. Frequency of watering *(Tick one or more brackets)*

Frequency of watering	Dry season	Wet season
1 Freely available	( )	( )
2.Once a day	( )	( )
3.Twice a day	( )	( )
4.Once in two days	( )	( )
5.Once in three days	( )	( )
6. Other *(specify):*……	( )	( )

5. Quality of water *(Tick one or more)*

Quality of water	Dry season	Wet season
1 Good and clear	( )	( )
2. Salty (brackish)	( )	( )
3. Muddy	( )	( )
4. Smelly	( )	( )

- **Health Management**

1. Access to veterinary services *(Tick as appropriate)*

1. Government vet ( ) 2. Private vet ( ) 3. Extension service ( )
4. Veterinary drug supplier ( ) 5. None ( ) 6. Other *(specify)*:……..

2. Prevalent diseases that occur on farm *(i.e. diseases that are seen by farmer in his animals)*

If none tick this bracket ( )

Local name or symptoms of disease *(Rank the most common first)*	Are animals treated when sick?

		Code*	Yes	No	Treatment given (if known)
a.	……	( )	( )	( )	……
b.	……	( )	( )	( )	……
c.	……	( )	( )	( )	……
d.	……	( )	( )	( )	……
e.	……	( )	( )	( )	……
f.	……	( )	( )	( )	……

3. Vaccination or preventive treatments given

If none tick in this bracket ( )

	Local name or symptoms of disease	Code*	Done routinely	Done when Need arises
a.	……	( )	( )	( )
b.	……	( )	( )	( )
c.	……	( )	( )	( )
d.	……	( )	( )	( )
e.	……	( )	( )	( )
f.	……	( )	( )	( )

**(codes to be entered later from lists of diseases and treatments)*

4. Control of ectoparasites

	Control methods	Code*	Done routinely	Done when Need arises
a.	None	( )	( )	( )
b.	Dip	( )	( )	( )
c.	Spray	( )	( )	( )
d.	Pour-on	( )	( )	( )
e.	Hand dressing	( )	( )	( )
f.	Injectables	( )	( )	( )
g.	Traditional	( )	( )	( )

5. Intestinal parasite control

	Method	(Tick)	Done when Need arises		Done routinely		*If routinely, specify how often*	
			Dry season	Wet	Dry Season	Wet	Dry Season	Wet Season
a.	None	( )						
b.	Drench	( )	( )	( )	( )	( )	Every ( ) weeks	Every ( ) weeks
c.	Traditional	( )	( )	( )	( )	( )	Every ( ) weeks	Every ( ) weeks

If traditional method specify…… ( ) *(to be entered from list of traditional methods)* Code

d.	Other *(specify)*:….	( )	( )	( )	( )	Every ( ) weeks	Every ( ) weeks

6. Overall sheep flock morbidity rate: *(Tick one or more brackets)*

1. Suckling lambs ( ) 2. Weaned lambs ( ) 3. Adults ( )

- **Castration**

Yes ( ) No ( )

1. Do you castrate?

If yes, say why *(Tick one or more brackets)*

1. Better price ( ) 2. Control breeding ( ) 3. Improve meat quality ( )
4. Other *(specify):* …… ( )

2. At what age do you castrate? *(Tick one bracket)*

1. < 3 months ( ) 2. 3-6 months ( ) 3. 6-12 months ( ) 4. > 12 months ( )

- **Entries and exits/Culling in herd**

1. Number of entries within last 12 months

(Write number of animals in each bracket)

	Entry	Lambs and Adults			Total Lambs and Adults
			Adults		
		Lambs	Males	Females	
a.	Born	[ ]			[ ]
b.	Bought	[ ]	[ ]	[ ]	[ ]
c.	Donated/gift*	[ ]	[ ]	[ ]	[ ]* *include bridge and dowry*
d.	Exchanged/lent	[ ]	[ ]	[ ]	[ ]

2. Number of exits within last 12 months

(Write number of animals in each bracket)

	Exit	Lambs and Adults			Total Lambs and Adults
			Adults		
		Lambs	Males	Females	
a.	Died	[ ]			[ ]
b.	Sold	[ ]	[ ]	[ ]	[ ]
c.	Slaughtered	[ ]	[ ]	[ ]	[ ]
c.	Donated/gift*	[ ]	[ ]	[ ]	[ ]* *include bridge and dowry*
d.	Exchanged/lent	[ ]	[ ]	[ ]	[ ]
e.	Stolen	[ ]	[ ]	[ ]	[ ]

3. Do you cull or dispose? Yes ( ) No ( )

If yes, reason for culling or disposal
(Tick one or more bracket)

	Reason for culling	Males	Females
1.	Small size	( )	( )
2.	Health	( )	( )
3.	Performance	( )	( )
4.	Colour**specify*	( )	( )
5.	Temperament	( )	( )
6.	Body condition	( )	( )
7.	Old age	( )	( )
8	Poor fertility	( )	( )
9.	Scarcity	( )	( )
10.	Overpopulation	( )	( )
11.	Drought	( )	( )
12.	Prevention of inbreeding	( )	( )
13.	Conformation	( )	( )
14.	Other*(specify):* ……..	( )	( )

- **Breeding**

1. Primary reason for keeping ram(s) *(Tick one bracket)*
1. Breeding ( ) 2. Social-cultural ( ) 3. Other *(specify):*……( )

2. Criteria for choice of ram(s) for breeding *(Tick one or more brackets)*
1. Conformation ( ) 2. Performance ( ) 3. Size ( ) 4. Colour* (specify)…
5. Other *(specify):* ……..… ( )

3. Number of ram(s) per herd [ ]

4. Mating system *(Tick one or more brackets)*
1. Controlled natural mating ( ) 2. Uncontrolled natural mating ( )
3. Group natural mating ( ) 4. Other *(specify)*: …… ( )

D. PRODUCTION PERFOMANCES AND CONSTRAINTS OF SHEEP

- **Production performance of sheep**

a. Average productive life: 1. Rams [ ] years 2. Ewes [ ] years

b. Average number of lambs per ewe's life time: [ ] years

c. Average age at first lambing: [ ] months

d. Lambing interval: [ ] months

- **Production constraints of sheep**

(Tick one or more bracket)

	Constraints	Tick
1.	Theft	( )
2.	Feed shortages	( )
3.	Endemic diseases	( )
4.	Water shortages	( )
5.	Shortage of grazing land	( )
6.	Conflict with growers	( )
7.	Low fertility	( )
8.	Poor mothering ability	( )
9.	Mortality of lambs	( )
10.	Poor market availability	( )
11.	Cause overgrazing	( )
12.	Other *(specify)*: ……	( )

PART E: WAY FORWAD AND FUTURE

1. What plans do you have in order to improve sheep production in the district?

……
……
……

2. What do you think the Government (DC, MLDF) could assist you in order to improve sheep production in the district?

……
……
……

3. Give general recommendations on what is required to improve sheep production.

……
……
……

Appendix 2: Questionnaire on sheep primary livestock market survey in Nkasi district.

Questionnaire Number:…….. Date: ……..…....

LOCATION

District: NKASI Division:…….Ward:……..…… Village: …….....

Part A: Sheep prices and marketing

1. Market availability of sheep Vs Goats

Sheep	Goats
i. Where do you come from? *(Specify place)* a. Within district ( ) …….. b. Outside the district ( ) …….. ii. Do you sell/buy of sheep? *(Tick one blacket)* 1. Yes ( ) 2.No ( ) iii. How many sheep do you sell/buy per auction market? *(Specify #)*……. iv. Price of sheep sold/bought *(Enter amount)* a. Ram [Tshs……] b. Ewe [Tshs……] c. Lamb [Tshs…….……] v. Trend of sheep sold/bought compared to last year *(Tick one blacket)* 1. Increasing ( ) 2. Decreasing ( ) 3. Constant ( ) vi. Demand of sheep relative to goat *(Tick one)* 1. High ( ) 2. Medium ( ) 3. Low ( ) 4. No demand at all ( )	i. Where do you come from? *(Specify place)* a. Within district ( ) ……. …….. b. Outside the district ( ) …… ii. Do you sell/buy of goats? *(Tick one blacket)* 1. Yes ( ) 2. No ( ) iii. How many goats do you sell/buy per auction market? *(Specify #)*…….. iv. Price of goats sold/bought *(Enter amount)* a. Buck [Tshs……] b. Doe [Tshs……..……] c. Kid [Tshs……..…….] v. Trend of goats sold/bought compared to last year *(Tick one blacket)* 1. Increasing ( ) 2. Decreasing ( ) 3. Constant ( ) vi. Demand of goats relative to sheep *(Tick one)* 1. High ( ) 2. Medium ( ) 3. Low ( ) 4. No demand at all ( )

2. The animals preferred in the livestock auction market (*Tick one or more bracket for the answers given below)*

	Preferred animals	Tick
1.	Goats	( )
2.	Cattle	( )
3.	Sheep	( )
4.	Other (specify) ……..	( )

3. The preferred sheep breed/strain in the livestock auction market (*Tick one or more bracket for the answers given below)*

	Preferred sheep breed/strain	Tick
1.	Black Head Persian sheep	( )
2.	Red Maasai sheep	( )

3.	Long-thin fat tailed sheep	( )
4.	Other (specify) ……..	( )

4. The determinant of sheep price in the livestock auction market (*Tick one or more bracket for the answers given below)*

	Sheep price determinant	Tick
1.	Season	( )
2.	Age	( )
3.	Sex	( )
4.	Levy	( )
4.	Other (specify) ……..	( )

5. The sources of sheep in the livestock auction market *(Tick one or more bracket below)*

a. Within the district ( ) *Specify a place* ……
b. Outside the district ( ) *Specify a place* …….....

6. Constraints in marketing sheep (*list the constraints)*

	Marketing sheep constraints
1.	……..……
2.	……..……
3.	……
4.	……..……
5.	……..……
6.	……
7.	……..……

Part B: Way Forward and Future

1. What plans do you have (and means or resources to implement them) in order to improve sheep marketing?

……
……
……

2. What do you think the Government (DC, MLDF) could assist you in order to improve sheep marketing?

……
……
……

3. Give general recommendations on what is required to improve sheep market in the district.

……
……
……

Appendix 3: Focus-Group Interview Guide

1. Sheep price and market availability: What are the major problems facing sheep marketing? Ask about their perception on the trend of sheep market for the past few years? Ask whether it is increasing or decreasing and why? Ask how price has influence selling of sheep and what situations determine higher sales? What is the use of extra cash? (Probe on investing on IGAs, bank deposit (account) or re-stocking); ask which livestock types are sold/bought mostly, Why; If young and immature animals do not appear in the list, ask them why.

2. Decision making: what is the ownership pattern of sheep production? How the decision to sell sheep is made? Examine who determine when to sell sheep and why?

3. Sheep breeds: ask for the favourite/preferred breed, and discuss why. Probe their awareness on importance of having larger breeds (e.g. Black Head Persian) and crosses.

4. Different national policies and programmes have been directed towards livestock industry in trying to modernize. Ask how they find the impact of such interventions on their part.