FACTORS AFFECTING ADOPTION OF IMPROVED MEAT GOAT (BOER) PRODUCTION IN RANGELANDS OF SEMBABULE DISTRICT.

BWIRE JOSEPH

2002/HD02/1015/U

B.SC. AGRICULTURE (HONS) MUK

A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AS A PARTIAL FULFILLMENT FOR THE AWARD OF THE DEGREE MASTERS OF SCIENCE IN AGRICULTURE ECONOMICS OF MAKERERE UNIVERSITY KAMPALA.

DECEMBER

2008

DECLARATION

I **Bwire Joseph**, hereby declare to the best of my knowledge and understanding that the originality of the findings in this thesis is my work and has never been presented to Makerere University or any other University for the award of a degree.

Signature…… Date……

BWIRE JOSEPH

This thesis has been submitted with permission and satisfaction from the University Supervisors.

FIRST SUPERVISOR

Signature…… Date……..…….....

DR. BARNABAS AMOOTI KIIZA

SECOND SUPERVISOR

Signature…….. Date…….……

DR. DAVID MUTETIKKA

DEDICATION

To my dear parents Wabwire Clement, Natocho Margaret and my family

ACKNOWLEGEMENT

Iam very grateful to my surperisors Dr. Barnabas Amooti Kiiza and Dr. David Mutetikka for their invaluable academic guidence towards the successful completion of this thesis. I also acknowledge all my enumerators and households that provided the data that formed the basis of this study.

Special thanks go to my wife Nakazibwe Prossy and Sembabule district admibistration for the encouragement and support they gave me while pursing this study.

List of acronyms

GDP	Gross Domestic Product
GOU	Government of Uganda
FAO	Food and Agriculture Organization
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MFEPD	Ministry of Finance, Planning and Economic Development
MU	Makerere University
Eq	Equation
GLM	Generalised least squares
In	Linear logarithm
Sq	Square Root
LDCs	Low Developing Countries
GOK	Government of Kenya
LGDP	Local Government Development Programme
NAADS	National Agricultural Advisory Services
COMESA	Common Market for East and Southern Africa
EAC	East Africa Community
NLPIP	National Livestock Productivity Improvement Project
AAMP	Area Based Agriculrture Modernisation Programme
NGOs	Non Governmental Organizations

ABSTRACT

Livestock production in Uganda contributes 5.25% and 17% to total GDP and agricultural GDP respectively. Despite efforts to improve and increase goat production, most farmers are still keeping local breeds and even some farmers who have adopted the technology keep crosses. No study has addressed Boer goat adoption so far to see how the farmers in Uganda and Sembabule in particular are taking up the technology. It is thus important to study why adoption of improved meat goat is still low in Sembabule district and to identify the constraints in the adoption of this technology. The broad objective of this study is to assess factors that affect the adoption of improved meat goat production in the rangelands of Sembabule District.

Literature reviewed indicated that profitability of the technology under consideration, the risk associated with adoption, household size, investment requirements, land size, credit facility, education, experience in goat farming, distance to market, membership to farmer groups, source of labor, sex, extension services were considered to be the major factors that influence the adoption of a new technology. A cross sectional study design was adopted where 150 randomly selected farmers were interviewed. Descriptive analysis and Tobit model were employed to answer the objectives of the study. One aspect in which the results is interesting is the apparent differences in explanatory variable effects between the probability and intensity of adoption. Education, distance to market, access to credit, goat farming experience, membership to farmer organization and land size owned had a significant relationship on the intensity of adoption. Whereas land size, level of education, extension services, labor availability, had a significant relationship on the probability of adoption. Policies geared at improving education system,

empowering women, strengthening extension services, appropriate land policy reforms and providing financial support to farmers as well as organized markets will help a lot in promoting adoption of improved meat goats' production in the district.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Economic Importance of Goats in Uganda

Livestock production in Uganda contributes 5.25% and 17% to total GDP and agricultural GDP respectively (MAAIF and MFPED, 2001). It is an integral part of the agricultural system of many parts of the country. Mixed farming small holders and pastoralists own over 90% of the cattle herd and 100% of the small ruminants and non-ruminants stock. Livestock production has continued to grow at a rate of over 4% per annum, in response to increasing demand for milk and meat in the local market. Higher rates of growth are envisaged as Government pursues its policies of modernizing and commercializing agriculture. Meanwhile the export market for live goats and sheep in the oil rich Middle East Arab countries is estimated at one million small ruminants per annum (Allan, 2002), which provides potential market for goats.

Of the 400 million goats in the world, 67% is found in Africa. The total goat population in Uganda is 3.9 million as opposed to 6.4 million in Kenya and 4.3 million in Tanzania and they are mainly the Small East African goat, whose mature weight is about 25 to 30 kg. Goats make an important contribution to the subsistence sub sector of the economy of Uganda and, indeed, of livestock farmers. The skins contribute substantially to foreign exchange earnings as well as permitting import substitution for use in the local tannery and leather craft industry of Uganda. It also provides raw materials to traditional technology like in the making of mats, covering handles of tools (knives, dancing costumes, ropes, drums and shields) and covering ornamental articles, footwear, strings and musical instruments.

Meat production from small ruminants is very important in Africa. This is so because these animals are more suitable for family consumption (5-10) people, than cattle owing to their comparatively small carcasses 25 to 30 kg. The importance of goats in Uganda is based on meat and skins. Some of the major reasons for promoting goat production in Uganda include a growing human population which has created a significant demand for goat meat in Uganda and in the Arab world. Goat rearing requires a low capital investment; local breeds are of poor quality and can be improved by selection and cross-breeding. In addition, where ranching is widespread, goats are useful in bush clearing and as well as pasture improvers (Nsubuga, 1996).

1.2 Current Policy on Meat Goat

The overall development strategy aims at maximizing the potential of Uganda's livestock sub sector by providing investment incentives to increase animal inventories and related agribusiness, supporting the development of efficient livestock production systems for increased productivity to meet the domestic demand, integrating production into the main stream monetary economy, and generating a surplus for export. This is outlined in the livestock production, marketing strategy and the sectoral development framework the plan for Modernization of Agriculture (MAAIF, 2001). The livestock development strategy focuses on: establishing an efficient livestock disease control system based on cost recovery; achieving self-sufficiency in meat, milk, poultry and other livestock products; promoting and developing industrial linkages for livestock products including dairy, leather and meat processing; encouraging the export of livestock and livestock products; Strengthening research in livestock breeding in order to upgrade the quality and productivity of the present livestock breeds (MAAIF, 2001**)**

1.3 Problem Statement

The annual rate of increase in consumption of goat meat in Uganda is 7.45% (MAAIF and MFPED, 1997). Domestic consumption of goat meat has continued to rise and will continue as incomes go up due to focused government interventions geared towards poverty eradication. The tourist industry has expanded tremendously bringing in a new clientele of consumers often demanding prime quality and sometimes unique products. This continued expansion of the internal market provides good prospects for medium term growth in the industry (MAAIF, 2001)

The neighboring countries and others in the COMESA have limited arable land, unpredictable weather patterns and high population growth rates. This offers opportunities for Uganda to penetrate EAC and COMESA market. The establishment of the East African community has opened a wider market for Uganda. The Middle East and the Arab countries of North Africa are also a potential market (Allan, 2002). Most of the common goats we have are mainly of one type the east African goats, which are small, compact and hardy. Mature weight is about 25-30kg compared to Boer ones. A mature female Boer weighs between 60-75kg and males 90-100kg live weight. The local goats have low twinning rate 36% compared to Boer 62%. In addition, they also have low growth rates (Nsubuga, 1996) and low economic returns compared to Boer. A mature Boer is sold at 200,000 Ug.shs whereas a local goat costs 30,000 Ug.shs with the same management costs on pastoral system (MAAIF, 2001). Therefore increased goat meat production with high economic returns can be realized by keeping Boer goats.

Boer goats were first introduced in Sembabule district in 1995 by Minnesota International Health Volunteers, (MIHV), a Non Governmental Organization. The goats were given to women groups in the district. Also the Government of Uganda through restocking programme, Local Government Development Programme (LGDP), NAADS, NLPIP and AAMP have been distributing Boer goats to farmers to improve their stock since 2000.

Despite all these efforts to improve and increase goat production, most farmers are still keeping local breeds. .Some of the farmers who have adopted the technology keep crosses. Though many studies have been carried out on Boer goats in Uganda and else where, much effort has concentrated on: breeding, feeding, goat production and management. Little has been done on adoption so far to determine how the farmers in Uganda and Sembabule in particular are taking up the technology. It is thus important to study why adoption of improved meat goat is still low in Sembabule district and to identify the constraints in the adoption of this technology.

1.4 Objective of the Study

The broad objective of this study is to assess factors that affect the adoption of improved meat goat production in Uganda with specific reference to Sembabule district.

The specific objectives are:

1. To establish the socio-economic characteristics of meat goat farmers.
2. To determine the determinants of adoption of improved meat goat production in Sembabule District
3. To identify major production constraints limiting improved meat goat production

1.5 Hypotheses:

Farmers' adoption of improved meat goat production is dependent upon factors such as; farmers experience, land size, availability of credit, extension links, marketing distance, household size, educational level, and household income/expenditure, availability of labor, sex, and membership to farmer organizations.

1.6 Justification:

Goat production is considered to be an important tool for socio-economic transformation of the rural poor. It is estimated that with the adoption of scientific goat rearing practices goat keepers will be able to achieve better levels of production leading to higher income (Veeranna, 2000). The export market for live goats in the Middle East Arab countries is estimated to be of the order of one million small ruminants per annum (Allan 2002; Nsubuga, 1996). This situation poses a challenge to policy makers both at national and local levels, policy implementers (extensions workers), scientists and farmers to boost production hence economic growth through increased household incomes. It's hoped that this study will address future directions in the adoption of improved meat goat production by the farmers. Policy implementers like extension agents will be in position to enhance the adoption of these technologies after being enlightened with the factors that have affected the adoption of these technologies and therefore are able to address those that concern them. It will therefore contribute towards design of appropriate policies enabling developing the goat sub sector.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Technology Transfer and Adoption of Agricultural Innovations

The development of appropriate agricultural technology assumes critical importance, the magnitude of which is reflected in the desire to adopt such innovations by the developing countries. According to Feder *et al.,* (1985), adoption of technological innovations in agriculture has attracted considerable attention among development economists. This is because the majority of the people in less developed countries (LDCs) derive their livelihood from agricultural production and new technologies seem to offer an opportunity to increase production and income substantially. It is therefore imperative that delivery of such technologies be accorded priority attention. The available literature on the adoption process gives different perspectives. According to Misra (1990), farmers' adoption is about their acceptance of an innovation. Adoption is a slow process depending on the nature of the innovation, farmers' level of understanding and competence of the delivery systems. There is a time lag between technology development and its adoption. English *et al.,* (1984), suggested that two decades is about the time frame that technologies take to develop from the research stage to widespread implementation.

Feder *et al.,* (1985) considers individual farmer adoption as being the degree of use of a new technology in the long-run equilibrium when the farmer has full information about the new technology and it's potential. On dissemination of agricultural messages, Monu (1981) suggested that it is the sociological starting point in the direction of productivity and improvement of agriculture through adoption of innovations or improved methods of production. He pointed out

that adoption is positively related to certain factors such as farm size, education and living standards, farm information such as radio and extension. Monu (1981) further asserted that innovation attributes of the technology such as relative advantage, adoptability, and compatibility and trial ability are also believed to bear relationship with its adoption, but that what is most needed for farmers to adopt is appropriateness of the technology.

2.2 Empirical Aspects in Adoption and Diffusion of Innovations

The rate of adoption, defined as the proportion of farmers who have adopted a new technology varies from technology to technology and from one location to another. Mafuru *et al*., (1999) observed adoption rates ranging from 0.08 to 0.52 and 0.1 to 0.33 for improved maize varieties and fertilizer in Tanzania respectively. Nkonya *et al*., (1997) established a higher rate of adoption (0.52) for improved maize varieties in Northern Tanzania while Bisanda *et* a*l*., (1998) established adoption rates of 0.17 to 0.35 for improved maize varieties in the highland and intermediate zones of Southern Tanzania using the Tobit model.

According to Sall *et al*.,(2000), when doing a quantitative assessment of improved rice variety adoption in Senegal using the Tobit regression analysis, variables representing both farmers perceptions as well as farm and farmer characteristics were found to be significant in determining the decision to adopt and the intensity of adoption. In terms of the farmer/farm specific variables, the statistically significant variables were heavily tilted towards those reflecting experience and availability of information (age, farmer experience, environment factors, extension services, variety/breeds). None of the variables reflecting physical resources (labor, size, wealth) and accessibility to credit was statistically significant. The total elasticity of production would appear that greater impact could be achieved from extension concentration on

farmers who have not yet decided to adopt an improved rice variety rather than on trying to increase the intensity of adoption of those who have already adopted.

Brereket *et al*.,(1986) revealed that profitability of the technology under consideration, the risk associated with its adoption, farm size, investment requirements, land tenure, credit facility were considered to be the major factors that influence the adoption of new practices. Their study further indicated that family size and profitability were positively and significantly associated with rate of adoption whereas off farm employment was negatively correlated to rate of adoption. Baidu, (1999) in the study of factors influencing adoption of land enhancing technology in Sahel, Niger, the Tobit analysis was preferred because it uses both data at the limit as well as those above the limit to estimate regressions (Mc Donald and Moffit, 1980). It provides the needed information on adoption probability and intensity of using a technology.

In the afore mentioned Baidu, (1999) study the high squared correlation of 0.478 between observed and expected values indicated the existence of useful information in the estimated Tobit Model. All the variables except literacy rate had the expected signs. The results shown that age had no significant effect on the adoption. This result was contrary to the observed negative influence of age because of the conservative outlook of the old farmers (Cotlear,1986). However, this contrary observation confirms the inconsistency of evidence about the relationship between age and innovations (Rodgers, 1983). The size of farm and adoption were found to have a positive relationship because of their income, economic power, social prestige and links with local political leadership, have more assured supply of modern inputs including credit facility

necessary for fruitfully utilizing the potential of the technology. Lack of cash for investment was a constraint.

To verify the intensity of adoption, a multiple linear regression (Tobit) model was used and Ordinary Least Squares (OLS) computed. The coefficient of farm size had a negative sign but it was not significant. Rodger (1983) contended that the intensity of adoption tends to decline with farm size. When testing for the overall significance (non- intercept coefficients are zero) of these models employed a livelihood ratio test and twice the difference between unconstrained and constrained log-livelihoods follows an X^2 Distribution with degrees of freedom equal to the number of restrictions. All the coefficients had the expected signs. The value of R^2 was low which is unusual with the case of the cross-sectional data and when heteroscedasticity was tested using Gleser's test, it was not established. This was attributed to the construction of variables (intensity and tenancy) in form of ratios.

Similarly Makokha (1999), in his study conducted to test two hypotheses: that farming conditions significantly influence farmer's perception of new agricultural technologies and the probability of adoption and those farmers' perceptions of technology specific attributes associated with use of new technology significantly influence adoption decisions employed the same model. Farmer's participation in field days and on farm trials were found to be significant, even though it differed from the findings reported from Sierra Leone where none of the farm characteristics had any influence on the farmers' perception and adoption of new rice varieties (Adesina and Zinnah, 1993).

Farmer attendance in workshops and Seminars were positive and statistically significant. Contact with extension workers even though significant, Hussain *et al*., (1994) disagreed with this. Leadership position was found not significant. These results deviate from expectations of innovation diffusion theory (Voh, 1982; 1982; Kabede *et al*., 1990; Polson and Spencer, 1991). However these findings agree with those of Adesina and Baidu-Forson, (1999) in West Africa. To measure the intensity of adoption of chickpea varieties in tribal Region of Gujarat by Shiyani, (2000), a Tobit model was used. The Tobit was estimated and Maximum likelihood computed and showed that all explanatory variables, except market distance and level of education were significant and had the expected signs.

Jorge (1994), in the study to estimate fluid milk expenditure functions to improve the ability to understand future consumption patterns, a censored Tobit model was used as noted by Greene that a regression model where a large proportion of the dependent variable is zero, OLS parameter estimates tended to be biased towards zero, the degree of bias depending on the amount of censoring. The maximum likelihood parameter estimates were computed. The statistical significance of the model was examined by using a likelihood ratio test of the null hypothesis that all slope coefficients are zero. The resulting X^2 was statistically significant leading to rejection of the null hypothesis that ‘’households with highly educated adults lead to more nutritional awareness and diet- conscious behavior’’ These results were not contrary to Liqun (1997). Honore *et a*l., (1995), estimated the Type 3 Tobit models using symmetric trimming and pair wise comparisons. The type 3 Tobit model may be estimated as a type 2 Tobit model by any of the existing methods, using only the information on the sign of the selection variable. Intuitively, though one would expect that this loss of information may lead to less

efficient estimators. It is thus desirable to exploit the additional information in the Type 3 Tobit model.

2.3 Analytical Methods used in Earlier Adoption Studies

Several methods have been used in adoption studies. Some of the most appropriate models are the Probit ,Logit and Tobit (Pindyck and Rubinfeld ,1991).These models have the advantage of generating the marginal effects of the explanatory variables on the probability of adoption .The Probit model has been used to estimate factors affecting adoption (Lagar and Pandey ,1999). The model assumes an underlying normal distribution and it has an advantage of giving efficient, unbiased and normally distributed estimates. It however, does not give the intensity of adoption.
In studies by Dimara and Skuras (1998), Knesur *et al*., (1999) and Kato (2000), the logit model was used to determine the factors affecting adoption. This model corresponds to the logistic distribution. Though the model gives efficient and unbiased estimates of the role of adoption, it does not give the intensity of adoption (Kaliba *et al*., 1998).

The Probit and Logit model specify the functional relationship between the probability of adoption and the explanatory variables (Feder *et al*., 1985). According to Amemiya (1981) Probit and Logit models give similar results. In the choice of the Probit or Logit model convenience and availability of the computer package are considered. The Tobit model has also been used to study adoption (Kaliba *et al*., 1998). This model accommodates the lower and upper limit of a variable, gives efficient, unbiased and normally distributed coefficients and can give the intensity of adoption (Ramasamy *et al*., 1999).

2.4 The Adoption Process and Factors Affecting Adoption

Rogers (1962) defined adoption as the mental process an individual passes from first learning about an innovation to final adoption. Adoption is a decision to make full use of an innovation as the best course of action available (Rogers, 1983); Feder *et al*., (1985) argued that for vigorous theoretical and empirical analysis, a precise quantitative definition is necessary. Empirical studies have shown that adoption is affected by several factors (Ruttan, 1977; CIMMYT,1993). Lionberger (1968) and Monu (1981) classified them as socio-economic, cultural personal and situational factors. Demographic characteristics of farmers affect adoption of researcher-developed technologies (Basu, 1969; Aao, 1971; Nijindad and Njoki, 1985).

2.4.1 The Socio-Economic Factors

Formation of the model was influenced by theory, empirical studies, own study and a number of working hypotheses. Several variables were hypothesized to influence the adoption of improved meat goats in the study area. Age may be positively or negatively affect adoption depending on the individual farmer and technology involved. For instance, older farmers may have more experience, resources and authority that allow them more possibilities of trying a new technology. Mugisa-Mutetika *et al.*, (1993) reported an increase in the proportion of adopters with age in case of improved bean varieties in Central Uganda. Sabiiti (1989) found a significant correlation between age and use of summethion pesticide in Uganda among coffee farmers with most adopters being above 50 years. Young farmers in India were found to adopt new innovation related to vegetables growing more readily than their older counter parts (Remmy, 1987).

Pession (1967) found that age was significantly related to adoption while Garvin (1980) and Dudhani *et a*l., (1987) found no significant relationship between age and adoption.

Formal schooling enhances the farmers' ability to perceive, interpret and respond to new events in the context of risk. Hence education is likely to increase the probability of adoption of improved meat goat production in the study area. Gender is also hypothesized to influence adoption. It is often that women are forgotten alot in the case of technology adoption and transfer (CIMMYT, 1993). This is reinforced by the cultural system which requires women to remain at home while husbands attend seminars, and yet do not always teach the women what they have learnt in the extension meetings (Morris, 1991). Women also do not have accessibility to the key productive resources of land, labor and capital, as well as being under priviledged in education and knowledge (Morris, 1991).

Farming experience was identified as a key factor of new hybrid rice technologies in Thailand (Ruttan and Thirtle 1987). Nabbumba (1994) found farmers experience as a key factors affecting adoption of clonal coffee in Mukono district. Experience was also reported as a significant factor among graduates that influenced their contribution to development in Masaka district (Mayanja 1992). Ntege- Nanyeenya *et al* (1997) found that adopters of Longe 1 technology were older, owned larger farms, were more educated, used more hired labor, had more non farm income opportunities, and greater access to extension services and were predominantly men. It is therefore likely that farmers, who are exposed to improved meat goats, are more likely to increase the farmers' adoption of this technology.

Lack of access to capital could significantly constrain adoption (Havens and Flinn 1976). Ruttan and Thirtle (1987) identified credit as a major factor affecting adoption for new hybrid rice technologies in Thailand. Land degradation in Bushenyi was found to be significantly affected by accessibility to credit (Nuwamanya 1994). Lack of credit was a major constraint that limited 48% of the small scale farmers in India from applying fertilizers (Bhalla 1979). Credit timing, distribution and efficiency all affect adoption (Feder *et al.*, 1985).

Large scale farmers are more likely to adopt a technology than small holders (CIMMYT, 1993). Binswanger (1978) observed that adopters of tractors in South Africa operated larger farms. Farm size may also influence access to information and extension services in general (Leonard 1977). Pession (1967) and Garvin (1989) found that size was highly correlated to the adoption of agricultural innovations whereas, Buyucolak (1978) who studied adoption of improved wheat varieties in Turkey, found no significant relationship between farm size and adoption due to the small land sizes. Therefore lack of access to land could significantly constrain adoption (Yapa and May Field 1978). Population pressure in the study area is causing a land shortage and the scope of using land productivity will rely on increased farming intensity. This in turn will require farmers to allocate their limited land to newer and better yielding enterprises, hence land availability increase farmers adoption.

Labor is a key factor known to constrain adoption of new technologies more especially those which are labor intensive. Hicks and Johnson (1974) reported that a higher rural labor requirement explained non-adoption of intensive rice varieties in Taiwan and that shortages of family labor explains non-adoption of high yielding rice varieties in India (Harris, 1972).

Adoption of improved maize varieties in Iganga District was significantly found to be positively affected by use of hired labor (Ntege-Nanyeeya *et al*.,1997). Akinola and Young (1985), who studied the Nigerian farming system found that labor scarcity increased the importance of family labor. Theison (1970) found that in Zimbabwe, the majority of the local farmers preferred shallow ploughing and low yields to higher yields associated with three or four farm operations because the former was labor saving. Buyukoak (1978) found non-significant correlation between family size and adoption of wheat varieties in Turkey which is a developed society. Adhikani and Patel (1985) who carried out studies in Nepal reported that adopters preferred less labor demand innovations.

The channels used by farmers affect their adoption behavior as well as the adoption rate (Rogers 1993); Lionbeger 1982). Bangura (1983) found that lack of demonstration hindered the adoption of agricultural practices. Garvin (1980) showed a high positive correlation between knowledge of innovation and adoption. Brown (1981) reported that the impact of information on adoption decision varied according to the channel used, information source, its content, motivation and frequency of use. Dhudani *et al*., (1970) found a significant correlation between adoption and personal extension contact. Market infrastructure status, co-operative membership, access to credit and intensity of extension services significantly influence adoption and dissemination of a new technology (Hearath, 1983; Nalmud and Naqtada 1983). Large households would be able to provide the labor required to rear goats. Thus a large family size would be expected to increase probability of adopting improved meat goats. It is hypothesized that those farmers who are nearer to market receive information on new breed, whereas those far away will not. Nearness to the market should increase the probability that farmers adopt improved meat goats.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Field Methods

3.1.1 Study Area

The study was conducted in Sembabule district. It is located in South Western part of Uganda. About half of the population are typical pastoralists and the other half engaged in either crop production or mixed farming. The area was chosen because of efforts by both government of Uganda through its programmes like LGDP, NLPIP, AAMP, NAADS, Restocking programme and NGOs to promote Boer goat production in the district.

3.1.2 Sample Selection and Sample Size

With the help of local authorities, thirty respondents were randomly selected from each of the five sub counties of Lyemiyaga, Ntusi, and Lwebitakuli, Mijwala and Lugusulu out of the six sub counties and one town council which make up a district. These included adopters and non adopters where an adopter was defined as a farmer who kept at least one Boer goat and a non adopter with zero Boer goats. A total of hundred and fifty respondents were interviewed in the study out of a total of 165 who were targeted for the study as calculated from the formula below. The method of sample proportions was applied in calculating the sample size, n (Cooper and Emory, 1996).

$$n = \left(\frac{pq}{\sigma_p^2} \right) + 1 \qquad \text{..... (1)}$$

Where:

n= sample size

p = Proportion of interest within the district (Proportion of adopters in the district)

q= 1-p (Proportion of non-adopters in the district)

σ_p = sampling error =0.10 /2.58 (precision divided by 90 % confidence that the proportion lies within 2.58σ from the mean.

0.10 = precision (chosen arbitrarily; not to be confused with the level of significance)

Therefore $n = (0.50 \times 0.50) / [0.10 / 2.58]^2 + 1$

$= 165$

A sample size of 170 farmers was targeted for the study, an addition of 5 more to compensate for non-responses and refusals.

3.1.3 Data Types and Collection

The primary data for this study were obtained using a pre-tested questionnaire and in depth interviews among household heads. In the absence of a household head, a knowledgeable household head was identified and interviewed. Data were collected on the relationship to the household head, sex of household members, age, farming experience, expenditure, education level, land area, household size, labor types, management practices, constraints to goat keeping, types of breeds kept, market distance, extension services, access to financial services, membership to farmer groups and working status or occupation of household head. Data were collected with assistance of two research assistants since it is a vast area, the exercise lasted for one month. Secondary data were obtained to supplement primary data from: MAAIF, MU Library, Department of Veterinary services of Sembabule district and other relevant sources. Questionnaires were both open and close ended. Each research assistant was assigned two sub counties and researcher handled one sub county.

3.1.4 Data Processing and Analysis

Data on farmer characteristics and goat production was coded, summarized, field edited and descriptive statistics (bi –variate statistical methods viz Kolmogorov –Smirnov non parametric test) were generated in the analysis using SPSS. The Z-statistics were used to test whether there are significant differences in the socio-economic characteristics. To study the adoption behavior, limited dependent variable model provides a good framework, Generalized Tobit model was found appropriate and was used. Inverse of Mills Ratio was incorporated to control foe selection bias. The Kolmogorov-Smirnov Test of significance was used to determine whether differences in socio-economic differences existed between adopters and non-adopters. This is a variant of the ANOVA procedure but more robust in that it does not impose stringent assumptions on the data such as normality of the errors and homogeneity of variance. It is thus suitable in cases where the distribution of the data is not guaranteed to be normal. Generalized Tobit (the endogenous variable per capita expenditure squared was instrumented) was used to determine the determinants of adoption.

3.2 Analytical Methods

3.2.1 The Tobit Model

The Tobit estimation procedure involved the calculation of intensity of adoption of Boer goats. The intensity was calculated as the percentage of Boer goats in relation to the total herd size. This was the dependent variable. The calculation of intensity of adoption is necessary since it would not be appropriate to lump a farmer who has adopted 5 Boer goats together a farmer who has adopted 1000 of them. Farmers who are non adopters were those whose was intensity was zero.

Following this unbalanced level of adoption for different farmers, a more sophisticated estimation procedure is required as Ordinary Least Squares normally introduces biases in the results. Recommended procedures include Heckman's Probit two-step procedure and the Tobit model (Winship and Mare, 1992; Long, 1997; Vella, 1998). The probit was used to generate the Inverse of the Mills ratio, which was then incorporated in the generalized Tobit Model. A concern with the Tobit specification is whether or not it adequately fits the data. The Tobit model is based on the assumption that there is no sample selection problem. In the presence of this weakness, however, results of the Tobit model are biased and inconsistent (Winship and Mare, 1992; Vella, 1998). A modified version of the Tobit took the form shown below.

$$y_i^* = \beta' X_i + \beta\lambda + \varepsilon_i \quad \text{…………………………………………………………} (2)$$

Where:

y_i^* is the intensity of adoption taking values ranging from 0% - 100%

β' = A vector of parameter estimates

X_i Is a vector of explanatory variables which include:

X_1 = Education level of the farmer in terms of years spent at school.

X_2 = Sex of the farmer (1=male, 2=female)

X_3= Access to credit for production (1=yes, 2=no)

X_4 = Membership in group /association (1=member, 2=not member)

X_5 = Goat farming experience years

X_6 = Land size holding (hectares)

X_7 =Land size squared (hatares^2)

X_8 = Household size (number of people in household)

X_9= Market distance (km)

X_{10}= Predicted expenditure (Ug.shs).

λ = Inverse of the mills ratio used to check and control for selectivity bias

ε_i = Random errors associated with intensity of adoption

3.2.2 Testing for Regression Diagnostics

Robust standard errors of the Huber/White/sandwich estimators of variance were used to correct for possible heteroscedasticity of unknown form (White, 1980; Vella, 1998). This was done in order to conform to the regression requirement that the errors must be homogenous. To eliminate skew ness and kurtosis, all numerical variables were subjected to a log transformation (Gujarati, 1995). Regression diagnostics preceded the analysis, that is checking the data for distribution of variables and appropriate transformations of variables were done where necessary to fit a normal distribution. Multicollinearity was checked using a correlation matrix and the variance inflation factor (VIF). The use of VIF to test for multicollinearity is popularly used in primary data and this is the reason for its use in this study. According to Green (1997), the threshold value of the VIF is 10 and that a highly positive value of the VIF indicates that there is significant Multicollinearity in the model. All variables included in the analysis gave values of the VIF less than 10 and tolerance values (1/VIF) greater than 0.1, therefore warranting further investigation.

Influential observations were detected and removed using diagnostic statistics such as Pearson residuals, deviance residuals and leverages for Maximum likelihood estimation.
Heteroscedasticity was detected using the Cock-Weisberg test and was corrected by using robust standard errors. The Probit coefficients do not directly give the marginal effects of the associated independent variables on the dependent variable. However, their signs show the direction of

change in the probability of change and the marginal intensity of adoption as the respective explanatory variable changes (Amemiya 1984; Goodwin 1992; Maddala 1983)

3.2.3 Rationale for the Variables

A combination of household characteristics, socio- economic factors, and institutional factors were used as explanatory variables in the model and their inclusion was based on a number of hypotheses. The most common household characteristics that are frequently associated with adoption of technology are age of the household head and education level. In this study, gender (sex) was also considered as explanatory household characteristic. There is a strong linkage between the level of education **(education**), which was given by years spent in school and the adoption of new breeds. It is hypothesized that the educated farmers are in a better position to process and use information relevant for adoption. Positive association between adoption of technology and education was reported by Nabbumba (1994), Ntege-Nanyeenya *et al* (1998), Nkonya, *et al* (1997) among others.

The effect of goat farming experience of the household head **(goatexperi**) on technology adoption is an empirical question: it may be that older farmers have more experience in cultivation and are better able to assess the characteristics of new high yielding varieties/breeds. However, it could be that older farmers are more risk averse than younger farmers and have lesser likelihood of adopting new technology, Adesina, and Baidu-Forson, (1995). According to Semgalawe (1998), younger households are expected to have a longer planning horizon (longer pay off period) than older farmers do and hence would be expected to put more effort into

searching for technical information on technologies. In addition, the older heads of households tend to have stronger belief in traditional methods. Statistically significant results for this variable are reported in Nabbumba (1994) where she found a positive relationship between total farming experience and adoption.

Also included in the model is the gender of household head **(sex**). Gender of the household head determines access to technical information provided by extension agents (most of whom in the study area are male). Due to social barriers, male extension agents tend to address male-headed households. Also, female-headed households, who are mainly widows, divorcees and unmarried women, have limited access to production resources such as land (Semgalawe 1998). Kumar (1994) reports that policies that support the participation of women in decision-making and production of improved technologies not only improve efficiency but also household food consumption and children's nutritional status. Socio-economic factors in this study are expected to play a role in determining the willingness and the ability to invest in meat goat production. They include, off farm employment, crop acreage, the use of hired labor, family labor, ownership of livestock.

Off farm employment **(employment)** can affect adoption of technology either positively or negatively. Off- farm employment reduces household labor for farming activities and hence reduces the adoption and effort devoted to technologies (Semgalawe, 1998) while on the other hand, the additional income increases the households ability to invest in capital intensive technology. Family labor (**labsourc)** available for farm work will determine whether or not a household chooses to adopt a technology. Households with more labor may decide to use labor

intensive technology while on the other hand, if households perceive technology to be labor intensive, smaller households may opt out. Harris (1972) reported that shortages of family labor accounted for non-adoption of high yielding rice varieties in India. Farmers that use hired labor may be in a better position to cope with the labor requirements of the new technologies (especially if they are labor intensive). As such the use of hired labor is hypothesized to be positively related to the adoption of new technology. Land size has for a long time been used as a proxy for wealth in rural sub Sahara Africa. Farmers with land are perceived to be wealthy and in addition, livestock can easily be converted into cash that may be needed for the purchase of inputs.

Therefore, ownership of land **(landsize)** is hypothesized to be positively related to the adoption of meat goats. However, one can also argue that ownership may reduce the labor available for looking after goats and negatively affecting adoption. According to Brush (1997) farms that adopt tend to be larger in size, while the non-adopters have smaller, sub family plots. It is hypothesized that households with larger plots **(landsize)** are more likely to adopt new technology as they have additional land on which to experiment and there less risk averse.

Institutional factors like extension service are likely to condition the technology adoption pattern (both probability and intensity). Household access to information sources is likely to determine its awareness of the technology. In most cases, rural households get information from extension agents and as such, agricultural extension plays a key role when it comes to technology adoption. Visits from extension staff **(vistne)** are positively related to adoption by exposing farmers to new information (Adesina and Baidu-Forson (1995). Long distances to and from the market sources

are likely to negatively influence farmer demand for these two inputs because as Griffins (1991) notes, transaction costs increase within the distance between initial endowments and final allocations.

House hold size (**hhsize)** available for farm work will determine whether or not a household chooses to adopt a technology. Households with more labor may decide to use labor –intensive technology while on the other hand, if households perceive technology to be labor intensive, smaller households may opt out. Harris (1972) reported that shortages of family labour accounted for non-adoption of high yielding varieties in India. Farmers that use hired labour may be a better position to cope with the labour requirements of new technologies (especially if they are labour intensive). As such the house hold size is hypothesized to be positively related to the adoption of new technology.

Access to credit (**access**) and predicted expenditure (**expenditure**) as a proxy for income are expected to play a role in determining the willing and ability to invest in improved meat goat production. They can affect adoption of technology either positively or negatively. Access to production credit and increased income of the household members does not necessary mean that; they invest in improved goat farming. The farmer may be rationale in that as his income increases identifies better paying investment opportunities rather than goat farming. Farmers that use hired labour may be in a better position to cope with the labour requirements of new technologies (especially if they are labour intensive). As such the use of hired labour **(Hilab**) is hypothesized to be positively related to the adoption of new technology.

3.2.4 Definition of Variables

Experi = total farming experience (number of years the house hold head has spent in farming)

Hhsize = Household size (number of people in household)

Educatio= Education level of the farmer in terms of years spent at school.

Access= Access to credit for production (1=yes, 0=no)

Expenditure (income proxy)= Annual household expenditure (Ug.shs) calculated as predicted expenditure. Was taken as a function of per capita expenditure squared, house hold size, land size, education and total farming experience

Vistne = Extension visit (1 =getting extension visit, 0=not getting extension visit)

Sex = Sex of the farmer (1=male, 0=female)

Members = Membership in group /association (1=member, 2=not member)

Landsize and Landsize squared = Land size holding of the farmer (hectares)

Dist-makt = Distance from the farmers home to the nearest Market (km)

Period = period "Farmers experience in goat keeping" (years farmer)

Hilab = source of labor (hired labour)

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter gives a detailed account of the results from the study. A background of the respondents is given first followed by a presentation and discussion of the three objectives stated in chapter one. Out of the 170 farmers targeted 150 responded giving a high response rate of 88 percent which was largely attributed to systematic planning of the study and cooperative nature of the respondents.

4.1: Socio-economic Characteristics of Improved Meat Goat Farmers

4.1.1: Descriptive Analysis

The average household size for non adopters was 7.7 while that of adopters was 8.2, table 4.1. There was no significant difference between the two groups, $p > 0.10$. The above being higher than national average household size may be a result of low education level within the study area. High household sizes are also a common feature of poor communities such as one in the study area. This would seem to reflect the important role that availability of family labor (as proxies by number of adults in the household) plays in the adoption of these practices. Family labor assumes great importance given that low incomes constrain financial liquidity for hiring wage laborers, and given possible moral hazard problems associated with non-family labor calling for considerable supervision. These problems raise the real cost of hired workers beyond the observed wage rate. Given that the bulk of labor for most farm operations in rural areas is provided by the family rather than hired, lack of adequate family labor accompanied by inability to hire labor can seriously constrain adoption of agricultural technologies. This finding is in contrast with Marenya *et al.*, (2003) who found that the number of persons per household was

statistically significant and positively associated with the adoption of agricultural technology in Western Kenya.

Table 4.1: Socio –Economic Characteristics of Adopters and Non Adopters

	Non Adopters	Adopters	P value
	Mean (n= 119)	**Mean (n= 31)**	
Household size	7.706 *(.410)*	8.194 *(1. 029)*	0.510
Distance to market	9.110 *(.486)*	8.533 *(1.034)*	0.857
Total land size owned	56.868 *(15. 787)*	159. 820 (*49.599)*	0.003***
Household income per annum	3038718 *(126972)*	7663419 *(4142639)*	0.143
Age of household head	39.328 *(1.437)*	36.645 *(3.402)*	0.695
Level of Education of household head	*6.941* *(.425)*	9.161 *(. 892)*	0.013**
Proportion of Boer goats to total goats kept	0.899 *(.028)*	.968 *(0.032)*	1.000
Sex of the house hold head	0.210 *(. 038)*	0.065 *(. 045)*	0.675
Farmers belonging to farmer groups	0.361 *(0. 044)*	0.516 *(0.091)*	0.598

Table 4.1: Cont'd

	Non Adopters	Adopters	P value
	Mean (n= 119)	**Mean (n= 31)**	
Source of information			
Extension workers	0.714 *(0.042)*	0.968 *(0.032)*	0.085*
Local leaders	0.017 *(0.012)*	0.032 *(0.032)*	1.000
Media	0. 135 *(0.031)*	0.129 *(0.061)*	1.000
Others	0. 345 *(0. 44)*	0.129 *(0.061)*	0.203
Source of Labor			
Family labor	0.597 *(0. 045)*	0. 355 *(0.087)*	0.113
Hired labor	0. 177 *(0. 035)*	0.4522 *(0.091)*	0.048**
Both	0.227 (0.039)	0.194 *(0.072)*	1.000
Occupation: Business man	0.126 *(0.031)*	0.161 (0.067)	0.936
Civil servant	0.118 *(.030)*	0.226 *(0.076)*	0,.936
Farmer	0.672 *(0.043)*	0.0452 *(0.91)*	0.182
Other	0. 050 *(0.020)*	0.065 *(0.91)*	1.000

Source: Survey data. The figures in *parenthesis* are the standard deviation. *** , ** ,* denote levels of significance at 1 %, 5 % and 10 % respectively

The adopters were more likely to have attained a higher level of education at 9.1 years in comparison to non adopters, who had 6.9 years, Table 4.1. The difference in education level between the two groups was statistically significant. Education augments one's ability to receive, decode and understand information relevant to making innovative decisions. This creates an incentive to acquire more information. Farmers with more education should be aware of more sources of information, and be more efficient in evaluating and interpreting information about innovations than those with less education. Therefore producers with more education are more likely to be adopters than farmers with less education. Similar findings were obtained by Wozniak (1984) who got positive and significant relationship between education and likelihood to adopt.

Adopters had a higher likelihood to own greater pieces of land than non adopters and it is statically significant. The acreage of land that a household will allocate to any new technology is dependent upon the perceived degree of trade off between profitability and risk, thus, relative product prices (of crops and livestock) and input prices affect the likelihood to adopt. It may be argued that livestock show higher returns but are riskier than crops, so that different attitudes towards risks (degree of risk aversion) can help explain the probability to adopt. Since direct measures of risk aversion are not available, they can be proxied with relevant household characteristics. Rosenzweig and Binswanger (1993); Shahabuddin *et at*.,(1986) obtained positive and significant relationship between land size and adoption. In particular, the attitude towards risk can be affected by variables such as household wealth which include total land holding.

There was a significant difference between the likelihood to adopt and receipt of information from extension staff. Agricultural extension may also enhance the efficiency of making adoption decisions. In the world of less than perfect information, the introduction of new technologies creates a demand for information useful in making adoption decisions. Of the many sources of information available to farmers, agricultural extension is the most important factor influencing the adoption decision. Based on the innovation-diffusion literature (Adesina and Forson 1995), it was observed that number of extension visits is positively related to adoption by exposing farmers to new information and technical skills about disease control, housing, equipment and feeding. Wozniak (1984) found out that there is a direct and distinct connection between the likelihood to adopt and receipt of information from agricultural extension staff.

Hired labor was statistically significant to the probability of adoption. This is for the reason that with Universal Primary Education and Universal Secondary Education, it is very difficult to get children (family labor) to look after goats. Using hired labor is profitable when some one owns a substantial number of goats which will enable him break even. The association between likelihood to adopt and occupation was not statistically significant. This is on the premise that household heads who engage in off farm employment do not participate in the demonstrations carried out by extension officers. Access to regular information from extension officers enhances successful adoption of technology including improved goats. In addition, livestock adoption requires intensive management in terms constant supervision such that the absence of the household head may undermine the successful adoption of improved goats. Feder *et al.*, (1985) and Nkonya (1994) found negative relationship between participation in off farm employment/income and likelihood to adopt in their studies.

Income per annum earned by adopters was higher at 7.6 million UGshs it was not significantly different from the 3.0 million UGshs earned by non adopters. This is because households with a higher income are absentee landlords and others prefer cattle to goats there fore they do not engage in goat farming. In addition households with higher income tend to be less risk averse than others and this enhances their likelihood to adopt. However, Nkonya *et al*., (1992) did not find any correlation between adoption and level of income in a study of 32 developing countries. They attributed this trend to availability of credit markets and low cost of technologies involved. In contrast Missiaen and Lindert (1993) have shown that a positive and significant relationship exists between likelihood to adopt and income.

The mean age for non adopters was 39.3 years in comparison to 36.6 years for adopters, (Table 4.1). However, there was no obvious variation in age between the two groups. Mixed feelings have been observed in studies around the world. Farmer's age may negatively influence both the decision to adopt and extent of adoption of improved meat goats. It may be that older farmers are more risk averse and less likely to be flexible than younger farmers and thus have a lesser likelihood of adopting new technologies. However, it could also be that older farmers have more experience in farming and are better able to assess the characteristics of modern technology than younger farmers, and hence a higher probability of adopting the practice. There is no agreement in the adoption literature on this as the direction of the effect is generally location or technology specific.

The results show that 90 percent of the non adopters had ever kept goats compared to 97 percent of the adopters, Table 4.1. However there was no noticeable difference between the two proportions. It was attributed to the fact that, improved goat keeping is a new idea in the area. This observation was in contrast to Shiyani *et al* (2000) who found experience to be a significant factor influencing adoption of modern cereal varieties in tribal region of Gujarat, India. More than twenty percent of the non adopters were females compared to 6.5 percent, who were adopters. There was no clear distinction between the two proportions. Often, traditions more than laws prevent women from inheriting and controlling wealth and specifically animals on an equal basis with men. Traditions of paternal property inheritance limit women's access to a secure place to live, their ability to produce subsistence and to generate income through livestock keeping. Female-headed households are constrained in a number of ways, as opposed to male-headed households. An important disadvantage for female-headed household is the fact that female farmers tend to limit their labour time in farm activities due to heavy commitment to domestic chores.

There was no discernable association between membership to a group and likelihood of adoption. This implies that probability of adoption was more or less the same for both adopters and non adopters, Table 4.1. The obvious reason why it is not significant is that because it is a pastoral area farmers are sparsely populated and scattered. Therefore membership in farmers' association may confer many disadvantages like long travel distances and time wastage for going for meeting and doing group worker. Different studies have demonstrated that there exists a positive and significant correlation between social capital and likelihood to adopt For example Fafchamps and Miten (2000) observed that households may belong to a wide variety of groups

that may provide direct or indirect assistance in livestock production. Onyx and Bullen (2000) found that close friends outside with whom inputs are shared and exchanged offer both economic and emotional support on a reciprocity basis.

The non adopters were more likely to travel a slightly longer distance to the market than adopters at 9.1 km and 8.5 km respectively. However, there was no clear cut difference in the distance traveled between the two groups. Households with poor access to roads and markets face higher transaction costs in buying and selling goat products and inputs. Since high transaction costs reduce the returns from market sales, we expect the remote households to have a lower probability of adoption. These remote households expect to have lower agricultural income, both because their market opportunities are limited and because their demand for purchased inputs is dampened by the higher transaction cost of acquiring them. Similar results were obtained by Place *et al.*, (2002) and Sheikh *et al*., (2003).

4.2: The Determinants of Adoption of Improved Meat Goats

Factors affecting the intensity of adoption of Boer goats in Sembabule district are shown in Table 4.2 below. The predicted values of expenditure were used in the model. Findings from the study indicated that the model fitted the data well judging from the pseudo R squared. The inverse of the mills ratio (IMR) was used to control for sample selection bias. This was significant indicating there existed a selection bias without whose control would have reduced the coefficients thus making the results unreliable.

Table 4.2: The determinants of adoption of the Boer Goats

Independent variable	*Marginal effects*	*t- ratio*	*p value*	*dy/dx*
Education level of household head	0.465**	2.47	0.015	0.465
Sex of house hold	-0.081	-0.20	0.842	-0.081
Access to credit	3.454**	2.05	0.043	3.454
Membership to farmer organization	1.871***	2.67	0.009	1.871
Experience in goat farming in years	0.078**	2.36	0.020	0.078
Land size owned	.006***	2.64	0.009	0.006
Land size owned squared	-5.23e6***	-2.47	0.015	0.000
Household size	0.141	0.50	0.619	0.141
Distance to market	-1.729***	-5.96	0.000	-1.729
Expenditure	-5.00e-07	-.22	0.826	5.00e-07
Inverse of Mills Ratio	-5.679***	-3.74	0.000	-5.679
Constant	19.097	3.58	0.000	
N	137			
uncensored observation	95			
Pseudo R2	0.4638			

***, **, * denote significance at 1 %, 5 % and 10% levels respectively

Education was significantly related to intensity of adoption which was not surprising because adoption of a new technology will require some one to have ability to learn and interpret what he/she is taught by either extension worker or fellow farmer before putting it into practice. There require some level of education of about 9 years of schooling. The study revealed that an increase in education level by ten years will increase the probability of adoption by 46 percent. Education is anticipated to play a major role in benefits accrued from the interventions in that better educated individuals are more likely to understand and value more the interventions than their less educated counterparts. In addition, more educated individuals tend to earn higher incomes and thus be able to easily implement the interventions more easily. Appleton and Balihuta (1996) obtained similar findings; Level of education may affect investment decisions

such as probability to adopt in many ways. They observed highly educated households are more likely to have incentives for profitable and innovative activities.

There was a significant relationship between land size and intensity of adoption. Table 4.2 shows that an increase of land area by one hundred percent will increase adoption by 0.6 percent. This is not surprising as the land has become a very scarce resource in the recent past due to population explosion. For example the national average land holding according to UBOS, (2006) shows that the average ownership per house hold is 3.2 ha which is way below the global average. Unlike crops, livestock keeping requires extensive tracts of pastures to feed the animals. Zero grazing may not be possible due to the large head of small ruminants owned by some households in the study area. Therefore, availability of extensive pastures is critical in adoption of Boer goats in such a scenario. These tallies with microeconomic theory in that, smaller enterprises tend to yield better productivity than very larger enterprises due to economies of scale. Large farmers are sometime wrongfully targeted by technology improvement programs with the expectation that they would have a higher yield than smaller ones. Even extensionists tend to favor larger and therefore richer farmers since the rate of success is expected to be higher hence aid in consolidating their positions.

Distance to the market was a significant determinant of intensity of adoption as shown in table 4.2. Distance to the market in this study was time spent traveling to and fro the market, time spent in the market negotiating when buying or selling goat products. All this time could have been allocated to other activities. Households with poor access roads and markets face higher transaction costs in selling their livestock and accessing livestock inputs. However large scale

goat farmers have advantage of selling from their homes because traders can get the livestock they require in one locality hence reducing the transaction costs. Place *et al*.,(2002) noted that nearer to the market is an initiative for intensity of adoption.

There was a significant relationship between access to credit and intensity of adoption. Accessibility here refers to availability of a credit institution or organization within the area at payment terms, which are affordable to local farmers. In most marginal areas where pastoralism is practiced such as the study area, economic activities are at a minimal level. Therefore, most financial institutions skirt around these areas with the effect of denying these communities access to the urgently needed capital to improve their livestock. Often times, livestock production requires a start-up lumpy investment that may constrain the allocation of resources. In addition, there might be large initial costs of input purchases such as expensive drugs or sprayers. In the presence of well-developed credit markets, these fixed costs could be easily covered. When credit constraints are binding, however, the ability to borrow and the availability of collateral can be determinants of decision and intensity of adoption.

Another way of circumventing low education level in pastoral communities is through group membership. This is underlined by the significant association between group membership and intensity of adoption. This means that farmers that had exposure to extension visits had a more likelihood to keep more Boer goats than others. Group membership ensures greater access to much needed funds due to the capital intensive nature of livestock rearing. It also augments access to management information needed for the production of Boer goats. Access to information on sources of new inputs is believed to contribute towards optimal use of scarce

resources. Kebede *et al.*, (1990) and Yirga *et al*., (1996) reported a strong positive relationship between access to information and the adoption patterns of farmers.

There was discernable association between membership to a farmer group and intensity of adoption. Membership in farmer associations/groups may confer many advantages like price information, inputs, livestock production or credit. Each of these elements obtained by virtue of becoming is part of social capital. These groups help shape local social norms and net works despite the functional multiplicity. Close friends out side with whom inputs are shared and exchanged for both economic & emotional support on reciprocity basis such activities play an important role in removing obstacles to livestock. Discussion with friend provides specific information about use of sound livestock production practices. Fafchamps and Miten (2000) observed that house holds may belong to a wide variety of groups that may provide direct or indirect assistance in livestock production. Onyx and bullen (2000) also obtained positive and significant relationship between adoption and membership to farmer groups.

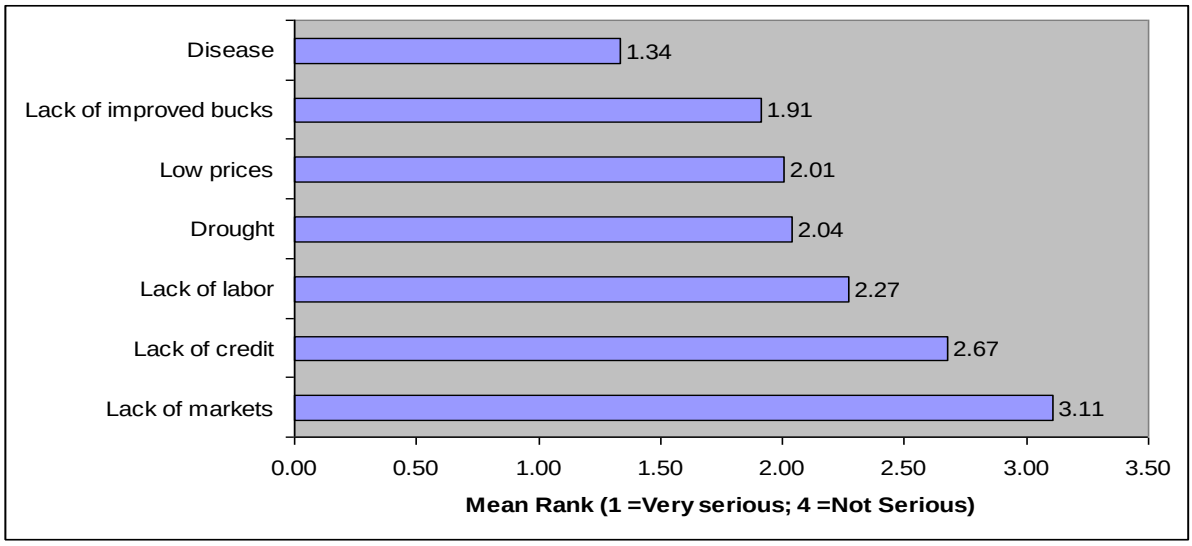
Experience in goat rearing positively influence the intensity of adoption of meat goats. Older farmers may be less risk averse and how more knowledge in goat forming are better socially, politically and economically placed to access modern technology then younger farmers and hence a higher level of adoption of this practice. Adesina and Forson (1995) Obtained negative and significant relationship between adoption and experience in poultry rearing. There was no statically significant relationship between household size, sex, predicted expenditure and intensity of adoption. The insignificant variables are also instructive. However the signs of these

factors are as expected. For all these factors, the null hypothesis is not rejected leading a conclusion that these factors do not significantly affect the intensity of adoption..

4.3: Major Production Constraints Limiting Improved Meat Goat Production

Shown in Figure 4.1 and Table 4.3 are main constraints faced by farmers in adoption of improved goat meat. The chart shows that the most serious constraint faced by farmers in Sembabule District was diseases at rank 1.34. In table 4.4 this is represented by 74.67 percent of farmers reporting that small ruminant disease was a very serious problem. This was followed by lack of improved bucks and low prices with ranks 1.91 and 2.01 respectively. The least common constraints faced by the farmers were lack of credit, lack of market and labour shortage at ranks 3.11, 2.67 and 2.27 respectively. These results are consistent with observations from a small ruminant study in Kenya where mortality due to diseases was found to be a serious constraint in small ruminant production in that area (GOK 1990; Herren 1990).

Figure 4.1 Ranking of Degree of Constraints Faced by Farmers



Source: Survey data

Table 4.3: Ranking of Responses of Problems Hindering Improved Meat Goat Production

Problem	Very serious (%)	Moderate (%)	Not serious (%)	Not a problem at all (%)
Disease	74.7	20.7	1.3	3.3
Lack of improved bucks	43.6	29.5	18.8	8.1
Lack of labor	34.2	59.1	20.8	20.1
Low prices	23.3	58.7	25.3	16.0
Lack of credit	22.3	19.6	27.7	30.4
Drought	22.1	60.7	86.2	16.8
Lack of markets	11.3	16.7	22.0	50.0

Source: Survey data

About 75% of the farmers interviewed indicated that disease is the most serious problem affecting adoption of improved meat goats followed by 44 percent saying lack of improved bucks. About 34% suggested lack of labour and 23percent low prices followed by lack of credit 22 percent. Lack of markets and drought were the least problems hindering adoption with 11 percent and 22 percent respectively. The respondents were giving multiple responses. Pneumonia complex including contagious caprine pleuropneumonia (CCPP) was the main cause of small ruminant mortality, especially among mature stock. Helminths and diarrhoea were other important causes of mortality, with young stock being the most susceptible to them. Kimaru (1993) noted that helminths can be predisposing factors to deaths from pneumonia. It is possible, therefore, that the high death rates resulting from pneumonia may have been partly caused by helminth infection, particularly in the young stock.

Lack of improved breeds undermines the efforts of most agricultural interventions. The major constraints faced by farmers include the lack of improved breeds, disease-resistant/tolerant breeds and the lack of extension services. Profitability of any enterprise is directly related to price of the output and therefore relative product prices (and input prices) affect the choice of enterprise. In sub Saharan Africa price of livestock is mainly determined by other factors other than the invisible hand. One of the main factors influencing prices includes government policy. Livestock pricing policies in SSA are important in four main respects. Firstly, many of the rural people in the sub-continent derive their livelihood from livestock production and their incomes are directly affected by changes in the prices they receive. Secondly, prices serve as signals of market efficiency and performance and policy outcomes. Thirdly, prices represent a cost to consumers who spend an important part of their income on livestock products. Finally, livestock pricing policies are important to governments because of their implications for producer incentives and for government revenue and expenditure.

The findings are also consistent with a study conducted by (Mukhebi *et al.*, 1985) in Eastern Kenya which identified drought (expressed severally as lack of rainfall, insufficient rainfall, lack of water, crop failure, lack of forage during dry season,) as the major constraints facing livestock production in that area. Rosenzweig and Binswanger (1993) observed that the amount of resource that a household will allocate to any enterprise is dependent upon the perceived degree of trade off between profitability and risk.

4.3 .1: Farmers Suggestions for Improvement of Meat Goat Production

The percent distribution of possible ways in which the government can improve goat meat production in Sembabule District is summarized in Table 4.4. Most farmers interviewed suggested that if government wants to improve adoption of improved meat goat production in the district, the following things need attention.

Table 4.4: Farmers Suggestions for Improvement of Meat Goat Production

Suggestion	Frequency	Percent
Provide veterinary and credit facilities	45	30.0
Better prices for improved goat products	31	20.7
Provide breeding Bucks	21	14.0
Provide drugs at affordable prices	20	13.3
Provide credit facilities	17	11.3
Veterinary services should be readily available	10	6.7
Controlled grazing	6	4.0
		100.0

Source: Survey data

The study indicated that 30% of the respondents suggested that extension and credit facilities go hand in hand. The present veterinary staffs are still inadequate compared to areas they are supposed to cover visa vie time and after acquiring the skills they need a financial boast like credit to enable them buy the required inputs. However 20.7% of the respondents urged that the prices for improved meat goats should be encouraging to adopt because they buy breeding stock

as well as inputs expensively but they end up selling their goats locally at almost same price as locals by local traders due to ignorance which discourages adoption. About 14% of the farmers interviewed suggest that government should provide breeding bucks to farmers to improve their stock, 13.33% provide drugs at affordable prices to farmers.11.33 % say only credit facilities alone is enough to improve meat goat production, 6.67% require only veterinary services at their disposal and 4% controlled grazing can do.

CHAPTER FIVE

5.0: SUMMARY, CONCLUSION AND RECOMMENDATIONS

The following chapter gives a summary of the results from the study, draws some conclusions and recommendations in line with the objectives of the study.

5.1: Summary of the Findings

5.1.1: Demographic and Socio Economic Characteristics

The average household size for non adopters was 7.7 while that of adopters was 8.2. There was no significant difference between the two groups. Non adopters were more likely to travel a

slightly longer distance to the market than adopters at 9.1 km and 8.5 km respectively. However, there was no clear cut difference in the distance traveled between the two groups. Findings from the study revealed that adopters had a higher likelihood to own significantly greater pieces of land than non adopters. Income per annum earned by adopters was higher at 7.6 million Ugshs. It was not significantly different from the 3.0 million Ugshs. earned by non adopters. The mean age for non adopters was 39.3 years in comparison to 36.6 years for adopters. However, there was no obvious variation in age between the two groups. Adopters were more likely to have attained a higher level of education at 9.1 years in comparison to non adopters, who had 6.9 years. The difference in education level between the two groups was statistically significant. About 21 percent of the non adopters were female compared to 6.5 percent who were adopters. There was no clear distinction between the two proportions.

There was no discernable association between membership to a group and likelihood of adoption. This implies that the groups were too few to detect any variation between adopters and non adopters. Formation of farmers groups to aid in access of cheaper inputs and information by far is the foremost strategy used the world over by decision makers to encourage adoption of new technology. There was a significant difference between the likelihood to adopt and receipt of information from extension staff. The study revealed that there was no significant association between likelihood to adopt and occupation.

5.1.2: The Determinats of Adoption of Improved Meat Goat Production

Education was significantly related to the intensity of adoption. The number of Boer goats to produce depends on the farmer's level of schooling. A positive sign of the coefficient imply that

farmers who are more educated tend to produce more Boer goats than those of lower education level. There was a significant correction between land size and rate of adoption. Increasing land size by 100% increases the rate of adoption by 0.6%. Larger enterprises tend to yield better productivity than very small enterprises because of economies of scale.

Goat rearing experience of all house hold was significant determinant of adoption of improved meat goats. Older farmers would have invested a lot in local goats and land, so expanding production by adding on goats enterprise may be ease since he has the capital and experience in goat rearing.

It was revealed that there was a positive and significant relationship between access to credit and intensity of adoption. This is for the reason that credit / resources is a stimulus for production, but this credit should be specifically targeting improved meat goat production..

Membership to farmer groups was significantly, related to the intensity of adoption. Group membership ensures greater access to much needed funds due to the capital intensive nature of livestock rearing. It also augments access to information on sources of new inputs is believed to contribute towards optimal use of scarce resources.

Distance to market was positive and statistically significant to the intensity of addition increase in the intensity of adoption by 172%

5.1.3: Major Production Constraints Limiting Improved Meat Goat Production

The most serious constraint faced by farmers in Sembabule District was diseases at rank 1.34. In table 4.4 this is represented by 74.67 percent of farmers reporting that small ruminant disease was a very serious problem. This was followed by lack of improved bucks and low prices with ranks 1.91 and 2.01 respectively.

5.2: Conclusions

Several conclusions can be drawn from this study. The number of Boers goats a farmer keeps depends on the farmer's level of education. This implies that farmers who are more educated tend to produce more Boer goats than their counterparts. Membership to farmer groups significantly affected the intensity of adoption. Group membership enables farmers share farming experiences from their fellow farmers and believe that if others can do it the same locality, then they too can also do it, hence increase the intensity of adoption. Therefore any effort to improve adoption of improved meat goats should be done with such factors in consideration.

Land size owned by the farmer significantly affected the probability and intensity of adoption. Therefore factors aimed at increasing available land for production and its security will go a long way to improve the adoption of improved meat goats. Provision of credit facilities, efficient extension services and remunerative markets for agricultural products will in one or another help increase wealth or acquire more land, hence increasing the adoption of improved meat goats

Most non adopters tended to be women. Women should be empowered through education to gain economic resources which would enable them to compete favorably with men. Encouragement of small scale businesses would enable women to earn income which they would later use to pay domestic workers and support family needs hands. This would go a long way in leaving them with enough time to attend to extension demonstrations. In addition this would also

help them meet their productive and reproductive obligations. Disease was the most serious challenge faced by farmers. Increased access to veterinary services and access to cheap animal drugs would go a long way to relieve this problem.

5.3.0 : Recommendations

Appropriate Education and land policies will be good to stimulate and increase the adoption of improved meat goats since both factors affect the probability and intensity of Adoption of improved meat goats. Women should be empowered through education to gain economic resources which would enable them to compete favorably with men. Extension services should be strengthened to help overcome the problem of disease, marketing opportunities and lack of improved bucks, since it is evident that they provide technical information to farmer's hence increasing the probability and intensity of adoption of improved meat goats . However these should go hand in hand with financial support to enable farmer's get capital for investing in meat goat farming. This would also address the problem of lack of bucks which was a major constraint facing farmers.

A challenge faced by non adopters was distance traveled to the market. Organized farmer groups are known to access better markets as opposed to selling individually. This would also address the problem of poor markets. Although the results indicated that a significant relationship existed between membership to farmer group and adoption, this by far is the foremost strategy used the world over by extensionists to encourage adoption of new technology. The farmer group would

enable them to pool resources with a view of buying inputs in bulk which would otherwise have been expensive. Formation of such groups would also aid in countering the fact that older people are rigid towards technical transformation. It is well known within authoritative marketing circles that word of mouth is more authentic than other sources of information. These farmer groups will therefore aid older farmers to grasp the value of new technology which would otherwise not be the case had they been on their own. Considerable growth of small ruminants' production through greater intensity of adoption can be attained if all the recommendations are implemented

5.3.1: Areas for Further Research

The study does not show what the optimum number of Boer goats a farmer should keep in order to maximize his profits. Other enterprises should also be assessed to advice farmers whether there are other enterprises more profitable than Boer keeping. This way farmers in Sembabule would be able to concentrate on what they have better comparative advantage. This would therefore help them compete favorably at local, regional and international levels. Also during interviewing farmers were saying that it takes a lot of time and extra market dues, transport costs taking goats to the market for selling. Transaction costs analysis of goat marketing was not done, suggesting that it is fertile ground for further research.

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***Appendix 1*: Definition of terms and abbreviations**

Technology adoption: The decision to make full use of an innovation or new technology as the best course of action available (Rogers, 1983). In this study it refers to adoption of Boer goats.

Adopter: A farmer who has at least one Boer goats (cross or Pure)

Non-adopters: Farmers who keep none of Boer goats

Improved meat goats: Any breed developed by the research system for meat

Appendix 2:

Socio –Economic Characteristics of Adopters and Non Adopters Using the Two Sample Kolmogorov –Smirnov (K-S) Test

	Non Adopters		Adopters			
	Mean (n=119)	SE	Mean (n=31)	SE	Z value	p value
NUMBER number of people in household	7.706	0.410	8.194	1.029	0.821	0.510
DISTANCE distance to market in Km	9.110	0.486	8.533	1.034	0.605	0.857
HACTRES total land size in ha	56.868	15.787	159.820	49.599	1.784	0.003
AMOUNT_2 household income per annum in Ugx	3038718.092	126972.564	7663419.839	4142639.473	1.148	0.143
AGE age of household head in yrs	39.328	1.437	36.645	3.402	0.710	0.695
EDUCATIO number of years in education of household head	6.941	0.425	9.161	0.892	1.588	0.013
EXPE proportion 'ever kept goats	0.899	0.028	0.968	0.032	0.340	1.000
SX00 proportion of female respondents	0.227	0.039	0.065	0.045	0.805	0.536
TP00 proportion of female headed households	0.210	0.038	0.065	0.045	0.722	0.675
Marital status						
MARR proportion of married household heads	0.807	0.036	0.871	0.061	0.319	1.000
SINGL proportion of single household heads	0.084	0.026	0.129	0.061	0.223	1.000
WIDO proportion of widowed household heads proportion of married household heads	0.076	0.024	0.000	0.000	0.375	0.999
DIVO proportion of divorced household heads	0.017	0.012	0.000	0.000	0.083	1.000
OTHE proportion of other status household heads	0.034	0.017	0.097	0.054	0.313	1.000
MEM1 prop. Belonging to farmer groups	0.361	0.044	0.516	0.091	0.768	0.598
Sources of information EXTEN proportion of	0.471	0.046	0.710	0.083	1.186	0.120

farmers receiving from extension						
L_LEAD local leaders	0.017	0.012	0.032	0.032	0.077	1.000
MEDIA media	0.135	0.031	0.129	0.061	0.027	1.000
OTH_FARM other farmers	0.345	0.044	0.129	0.061	1.069	0.203
EXT01 proportion visited by extensionists	0.714	0.042	0.968	0.032	1.257	0.085
Source of Labour						
BOTH	0.227	0.039	0.194	0.072	0.165	1.000
FAMIL family labour	0.597	0.045	0.355	0.087	1.199	0.113
HIRE hired labour	0.177	0.035	0.452	0.091	1.364	0.048
Occupation						
BUSIN business man	0.126	0.031	0.161	0.067	0.175	1.000
C_SERV civil servant	0.118	0.030	0.226	0.076	0.536	0.936
FARMER farmer	0.672	0.043	0.452	0.091	1.094	0.182
OTHER other	0.050	0.020	0.065	0.045	0.070	1.000

Appendix 3:

Generalized Tobit (catering for heteroscedasticity) was run.
tobit intenset _____isex_2 _____iaccess_2 _____imembersh_2 period education landsize landsqed hhsize dist_mkt yaht5 pexpsqed mymills [aweight = landsize], ll(0)
(sum of wgt is 1.1697e+04)

Tobit regression — Number of obs = 137
LR chi2(12) = 426.39
Prob > chi2 = 0.0000
Log likelihood = -246.51486 — Pseudo R2 = 0.4638

intenset	Coef.	Std. Err.	t	P>|t|
_____isex_2	-0.0813114	.4073585	-0.20	0.842
_____iacce~2	3.454384	1.686936	2.05	0.043
_____imemb~2	1.870589	.7007269	2.67	0.009
period	0.0777092	.0329173	2.36	0.020
education	0.4654398	.1880877	2.47	0.015
landsize	0.0059903	.0022675	2.64	0.009
landsqed	-5.23e-06	2.12e-06	-2.47	0.015
hhsize	0.1410337	.2826676	0.50	0.619
dist_mkt	-1.729352	.2902753	-5.96	0.000
yaht5	-5.00e-07	2.27e-06	-0.22	0.826
pexpsqed	2.32e-13	4.14e-13	0.56	0.576
mymills	-5.678964	1.520409	-3.74	0.000
_cons	19.09741	5.337619	3.58	0.000
/sigma	1.590852	.1166666	1.359954	1.821749

Obs. summary: 42 left-censored observations at intenset<=0
95 uncensored observations
0 right-censored observations

.

Marginal effects after tobit
y = Fitted values (predict)
= 25.948106

variable	dy/dx	Std.	Err.z	P>z	[95% C.I.]		X
____~x_2*	-.0813114	.40736	-0.20	0.842	-.879719	.717097	.290989
____~s_2*	3.454384	1.68694	2.05	0.041	.148051	6.76072	.880317
____~h_2*	1.870589	.70073	2.67	0.008	.49719	3.24399	.924129
period	0.0777092	.03292	2.36	0.018	.013192	.142226	6.76603
educat~n	0.4654398	.18809	2.47	0.013	.096795	.834085	13.0115
landsize	0.0059903	.00227	2.64	0.008	.001546	.010435	595.357
landsqed	-5.23e-06	.00000	-2.47	0.013	-9.4e-06	-1.1e-06	488252
hhsize	.1410337	.28267	0.50	0.618	-.412985	.695052	13.5486
dist_mkt	-1.729352	.29028	-5.96	0.000	-2.29828	-1.16042	4.15475
yaht5	-5.00e-07	.00000	-0.22	0.826	-4.9e-06	3.9e-06	464701
pexpsqed	2.32e-13	.00000	0.56	0.575	-5.8e-13	1.0e-12	6.4e+11
mymills	-5.678964	1.52041	-3.74	0.000	-8.65891	-2.69902	.023045

(*) dy/dx is for discrete change of dummy variablefrom 0 to 1

Appendix 4

QUESTIONNAIRES ON FACTORS AFFECTING ADOPTION OF IMPROVED MEAT GOAT PRODUCTION IN THE RANGE LANDS OF SEMBABULE DISTRICT

1. Sample household identity

(a) House hold identity number……Date…….

(b) County……..

(c) Sub County……..

(d) Parish……..

(e) Village/ Zone……..

(f) Marital status of the household head

1. Married 2. Single 3. Widow 4. Divorced

(g) Type of household

1. Male headed household 2. Female-headed household

(h) How many people do have in your household?

Table1: Household particulars

Name of household Head	Age	Sex	Formal Education (Years in School)	Employment /occupation	Estimated Household Income

3 (a) Do you keep goats? 1. Yes 2. No

(b) If yes, which type?

1. Small East African goats (MEA) 2. Toggenburg 3. Boer 4. Others (specify)

(c) For how long have you been keeping goats (Years)……

Table2: Land use and agricultural production

	Area (ha)	Farmer production goals	Mode of acquisition	Type of land tenure systems
Total land Area(HA)		a) Subsistence b) Commercial c) Both a and b	a) Inherited b) Purchased c) Hired d) Gift e) Others (specify)	Customary Mailo land Freehold
Land under Livestock				Leasehold
Land Under Improved Mea goat				
Land under Crop				

Table 3: List the type livestock kept, giving their purpose of production and decision making in their **household**

Livestock	**Purpose of production**	**Who decides on type of production enterprise to engage in**
Improved Goats	Husbandry	
East African goats		
Sheep		
Chicken		
Cattle		

Key (Purpose of production)

1. Cash 2. Subsistence 3. Cash and food

Table 4: What are the major problems you face in goat production? Rank problems and suggest solutions to each item in the table below.

Item	Rank	Solution
Diseases		
Lack of market		
Land shortage		
Labour shortage		
Drought		
Lack of improved Breeds		
Low goat Meat prices		
Lack of production Credit		
Others specify		

Rank

1. Very serious 2. Moderate 3. Not serious 4. Not a problem at all

Table 5: Meat goat production/ management practices

Meat goat breeds	No. Of Goats	Breed source	No. of goats bought	Reason for buying from this source	Cost of Breeds/ unit	For how long
SEA						
Toggenburg						
Boer						
Others (specify)						

SEA: Small East Africa goats

Key (breed source)

1. Local
2. Bought breeds from neighbours
3. Purchased from breeding centers
4. Others specify

Table 6: Total numbers of goats and their characteristics

Of all the goats in this household, indicate how many are Pure Boer (PB) crosses (Cr) or Locals (Lo)

Number of goats			
PB	Cr	Lo	Grand total

Table 7: what attributes do you like or Dislike about the Boer Goats

Attribute	**Liked attribute**	**Disliked attribute**
Weight (Kg)		
Growth rate period		
Color		
Twining rate		
Meat quality		
Resistance to diseases and pests infection		
Cost of management		
Availability		
Others (specify)		

Table 8: Attraction and constraints to Boer goat keeping

Meat goat management practices	**Attraction to meat goat Keeping**	**Constraints to meat Goat keeping**
Tethering		
Padlocking		

Grazing (Zero-Open)		
Housing		
Disease control		
Vaccination		
De-worming		
Others (specify)		

9 (a) what are your sources of labor?

1. Family 2. Hired labor 3. 1 and 2

Table 9 (a): If hired, fill in the table below.

Workers name	Time spent	Activity done	Monthly wage	Amount paid if contracts

Key (activity)

1. Grazing 2. Vaccination 3. Treatment 4. Housing

5. others (specify)……

(c). How easy is it to get paid workers if one needed them?

1. Very easy 2.Easy Difficulty. 4. Very difficult

Table 9 (b): If family labor, list the members and the activity they participate in

Name of Household Member	**Time spent**	**Activity done**	**Monthly wage**	**Amount paid if contract**
Total				

Table 10: Access to credit Facilities

Source of Financial Capital	**ii) Do you have access to production credit**	**iii) If yes how easy is it to get credit?**	**iv) If you have no access to credit, give reasons why**
(a) Own savings (b) Bank loan (c) Inheritance	a) Yes	Very easy Very Easy Difficult	
(d) Credit from friends and relatives Others (specify)	(d) No	Very difficult Not applicable	

Table 11: Association/ group membership

1) Are you a member of any farmer group or association	(iii) If yes, name the group or association	(iii) For how long have you been a member (Years)	(iv) Do you hold any leadership position	(IV) If the answer for (iv), is yes which Association	(Vi) What benefits have you obtained from the association
Yes	Youth/Women local councils				
No	Farmers association				
	Mawogola Women Development Association (MAWODA)				
	Others (specify)				

Table12: Source of information about Goat Production Activities

Major source of	Do extension agents visit you?	If yes what is the frequency	Type of extension contact	Type of advice given
Media, Radio, T.V, Newsletter				
Other farmers				
Extension workers				
Local Leaders				
Other (Specify)				

Key (Type of extension visit)

1. Personal visit 2. Demonstration

3. Field Visits 4. Others (specify)

13 (a) What is the annual hosehold income ……..

(b) Householdexpenditure

Table13: Estimated annual Household expenditure patterns per annum

	Seasonal One (UG.X)	**Season Two**	**Total expenses UG.X**
School fees and scholastic materials			
Medical bills			
Buying farming inputs			
House hold food items			
Capital investments (buying land, construction, car purchase			
Others			
Total			

Table14: Marketing of livestock

How do you transport your Livestock to the market	How is the goats/ goat products marketed in this area?	How far is this market from your (Km)
Bicycles	locally at home	
Vehicles	take near by livestock market	
lead following	take to urban market	
others specify	others specify	

What are your suggestions for suggestions for improvement of meat goat production?

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Thank you very much for giving me your valuable time.