

INFLUENCE OF STUDY CIRCLE EXTENSION STRATEGY ON DISSEMINATION
OF DAIRY GOAT TECHNOLOGIES AMONG SMALLHOLDER FARMERS IN
NYANDO DISTRICT, KENYA

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the Award of the Master of Science Degree in Agricultural Extension of Egerton
University.

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DEDICATION

This thesis is dedicated to my LORD – and - Saviour, Jesus Christ, the LORD of Lords and KING of Kings who, not only knew me before my conception and predestined me for this course, but has also preserved my life; giving me strength to do all things through Him (Philippians 4: 13). It is also dedicated to my parents, Raphael and Yudis, for educating me and teaching me the way of the Lord; my beloved wife, Sylvia and my children, Calvin, Pauline, Shalom-Dolly and Miriam Mbirwa for being there for me during my stay away from home. Their prayers were a source of inspiration to me; and to all my children, brothers and sisters who will aspire to learn.

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ABSTRACT

Participatory approaches to extension have emerged in developing countries to facilitate development efforts towards addressing rural people's livelihood concerns. The government of Kenya has embraced consultative demand-driven approaches to tap farmers' participation and private sector contribution in running extension services. The emergence of Study Circle (SC) in Kenya as a participatory extension strategy aims at expanding membership to building a critical mass of farmers, managerial capacity of local organizations and facilitating a linkage between groups to relevant stakeholders. The Study Circle (SC) Extension Strategy, which is a relatively new extension strategy, was introduced in Nyando District by Livelihood Improvement and Family Empowerment (LIFE) Project in 2002. It was a Pilot Project to create critical mass of farmers to up-scale technologies and improve farmers' livelihood through sharing extension related knowledge and skills. However, little is known about its influence on the dissemination of livestock production practices. The main purpose of this study was to investigate the influence of Study Circle as an Extension Strategy on the Dissemination of Dairy Goat Technologies (DGT) among Smallholder Farmers in the District. Specific characteristics of Study Circle such as size, gender composition, age, networking capacity and cohesiveness were studied. The study used survey research design with an *ex-post-facto* approach. The target population for the study was 261 Dairy Goat Farmers. Questionnaire was used to collect primary data from 110 Respondents, comprising of 50 SC and 60 NSC Farmers obtained by Proportionate Stratified Random Sampling. Data was analysed using Statistical Package for Social Sciences (SPSS Version 11.5 program). Both descriptive and inferential statistics were used to analyse the data. Hypotheses of the study were tested at 5% level of significance. The results show that the performance of SC participants in the Dissemination of Dairy Goat Technologies (DGT) was higher than Non Study Circle (NSC) participants. The study further established that, the SC Extension Strategy had significant influence on dissemination of DGT. It was, therefore, concluded that SC Extension Strategy is quite effective in Influencing Dissemination of Technologies. On the basis of this, it is recommended that Participatory Extension Strategies such as Study Circle should be used more in Dissemination of Agricultural Technologies among farming communities.

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ABBREVIATION AND ACRONYMS

CSP	Commodity Specialized Approach
DGT	Dairy Goat Technology
FAA	Focal Area Approach
FFS	Farmers Field Schools
FGDI	Farmers Group Dissemination Index
FPR	Farmers Participatory Research
FSA	Farming System Approach
GOK	Government of Kenya
HPI	Heifer Project International
IAD	Integrated Agricultural Development
ITK	Indigenous Technical Knowledge
LIFE	Livelihood Improvement and Family Empowerment Project
LVEMP	Lake Victoria Environment and Management Program
M&E	Monitoring and Evaluation
MoA	Ministry of Agriculture
MoARD	Ministry of Agriculture and Rural Development
MoLFD	Ministry of Livestock and Fisheries Development
NAEP	National Agricultural Extension Policy
NALEP	National Agriculture and Livestock Extension Programme
NASEP	National Agricultural Sector Extension Policy
NEP	National Extension Programme
SC	Study Circle
SCC	Swedish Cooperative Centre
Sida	Swedish International Development Agency
SFAA	Shifting Focal Area Approach
SRA	Strategy for Revitalizing Agriculture
T & V	Training and Visit
TOT	Transfer-of-Technology

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Study Circle (SC) concept was started in Sweden in the beginning of the 19th century by two organizations that were active in the non-formal adult education. This non-formal adult education began to play a major role in giving members knowledge and the ability to make their voices heard. The concept evolved during the first half of the 20th century in many popular organizations, making the SC one of the most important tools in Sweden for the exchange of knowledge and discussion, and thus firmly establishing it as a unique feature of the Swedish educational structure (Kindstrom, 2000). Group study approaches building on the study circle concept have had enormous impact in other regions of the world, such as Europe and USA, and there are currently emerging initiatives also in Africa that provide valuable lessons and experiences on how farmer-driven study groups can contribute to effective demand-driven extension in Africa (Markham, 1999).

The strategy is used to cover every aspect of livelihood. For example, The Moorhead Justice Circle found the strategy successful in enhancing equal opportunity and promoting rural and ETHNIC JUSTICE in Minnesota, U.S.A (Moorhead Justice Circle, 2005). The justice circle succeeded in placing equal opportunity and inclusion on the public agenda and dramatically increased citizen participation in community development efforts. SC has been used in Cuba to share principles of ecological (organic) farming and to transform the message to population (*Asociacion Cubana de Tecnicos Agricolas Forestale* (ACTAF), 2005). They have developed policies to consolidate agricultural links and contribute to environmental protection. According to ACTAF (2005), SC was used to ensure the participation of different social, cultural and class forces including gender and age balance. Some initiatives that use farmer-driven study groups as an entry point for agricultural development and empowerment are the Study Circle applied by SCC and the Farmer Field Schools (Bunyatta, 2004).

In Kenya, the Swedish Cooperative Centre (SCC) introduced Study Circle for smallholders' farmers around the Lake Victoria basin in Western, Nyanza and parts of the Rift Valley provinces. In Nyando District, it was introduced by Livelihood Improvement and Family Empowerment (LIFE) project in 2002 where 19 SC groups were established. The technologies disseminated included dairy goat management, housing, fodder production, disease control and

value addition. It has established strong viable dairy goat groups in Miwani, Muhoroni and Nyando divisions (Ministry of Livestock and Fisheries Development (MoLFD), 2005). These groups have had enormous success through creation of revolving funds to group members, improved breeding programmes and linkages with other collaborators. Through a facilitator, participants are expected to assist each other rather than competing and develop a belief in group work.

The strategy is voluntary and encourages full participation of the members. After a general meeting with the farmers, those interested in dairy goat keeping group up to form a dairy goat SC. They then contact the study organiser who guides them in choosing a leader and making a study plan. The SC members are then facilitated to acquire dairy goats and run their SC with frontline technical support from the LIFE Project and government. In just two years, the dairy goat population has risen to more than 194, an increase of 44% over the 3-year period. Dairy goat is a source of both milk and meat. It is also used as means of storing cash since it can be sold for cash which is either used in meeting household financial needs or invested in crop farming through purchase of improved seeds and other farm inputs. Nyando District had an estimated 120,000 goats of which 194 were exotic (Ahuya, 2005; MoLFD, 2005; Odhiambo, 2006).

Dairy goat technologies were considered in this study because LIFE project had implemented a pilot dairy goat project in the District using SC strategy. Management practices such as use of recommended housing, feeds and feeding, breeds and breeding, disease and pest control and value addition for market were studied to gauge the influence of study circle and its characteristics on knowledge acquired in DGT in the District. The SC through use of videos is emerging as a powerful strategy for development in the District. For example, it has produced tangible practical innovations such as the addition of salts, shell and cassava binder to make mineral lick blocks for livestock and use of mobile phone technologies to monitor livestock products prices in the market. In doing so, they are improving their own incomes and contributing to the success of the local livestock industry. Studies show that farmers who watch video of other farmers using new agricultural practices/innovations are more likely to be persuaded to try them out themselves. Often, a visual image will stay in the mind for longer than any information conveyed by another media (Leeuwis, 2006; CTA, 2011)

1.2 Statement of the Problem

The dairy goat production has been an important livestock enterprise in Nyando District as it is used for both cash and food at critical periods of need (MoLFD, 2005). The enterprise does well among smallholdings due to its low capital investment. Heifer Project International (HPI) initiated Dairy Goat enterprise to individual farmer for multiplication of improved stock for distribution to other farmers. This approach was mainly top-down and did not succeed because it limited farmers' involvement and there was a disconnect between farmers' needs and the service being provided (Ministry of Agriculture (MoA), 2001). To address the key constraints limiting the spread of Dairy Goats in Nyando District, Livelihood Improvement and Family Empowerment (LIFE) Project introduced Study Circle (SC) as an alternative Strategy to Disseminate Dairy Goat Technologies among smallholder farmers. In spite of the success shown during the pilot period in Miwani Division with the few farmers in the area, it was not clear how the SC as a strategy would influence the Dissemination of Dairy Goat Technologies in the larger Nyando District as a whole.

1.3 Purpose of the Study

The purpose of this study was to investigate the influence of Study Circle extension strategy and characteristics on dissemination of DGT among smallholder farmers in Nyando District, Kenya.

1.4 Objectives of the Study

In order to achieve the purpose of this study, the following specific objectives guided the study:

1. To describe the procedures in the dissemination of DGT among smallholder farmers in SC and those not in SC in Nyando District
2. To determine the dissemination of DGT among smallholder farmers in SC and those not in SC in Nyando District
3. To compare the dissemination of DGT between smallholder farmers in SC and those not in SC in Nyando District
4. To assess the influence of SC extension strategy on dissemination of DGT among smallholder farmers in Nyando District
5. To examine the influence of SC characteristics on dissemination of DGT among smallholder farmers in Nyando District.

1.5 Hypotheses of the Study

To achieve the objectives of this study, the following null hypotheses were tested at alpha level of 0.05:

- Ho₁. There is no statistically significant difference in the level of dissemination of DGT between smallholder farmers in SC and those not in SC in Nyando District
- Ho₂. SC extension strategy does not significantly influence the level of dissemination of DGT among smallholder dairy goat farmers in Nyando District.
- Ho₃. SC characteristics (membership, gender composition, networking capacity and cohesiveness) do not significantly influence the level of dissemination of DGT among smallholder farmers in Nyando District.

1.6 Significance of the Study

The findings of this study may be important to extensionists, LIFE project, smallholder farmers, government policy makers and researchers in re-formulating strategies to improve the existing conventional approaches as well as refinement of the SC strategy with a view to making it more effective in up-scaling agricultural technologies. The extension personnel may use the findings to devise strategies for improving farmer participation in learning of technologies and on ways to enhance cohesiveness in the groups that they deal with. This may lead to high dissemination and hence adoption levels of technologies and subsequently improved farm productivity. The results from this study are likely to be generalized to other SC groups of smallholder farmers in Kenya. The study was expected to yield the following outcomes:

1. Influence of SC extension strategy in enhancing dissemination of agricultural technologies
2. MSc thesis
3. Publications in Journals, Conferences and Proceedings

1.7 Scope of the Study

The study was carried out in Muhoroni and Nyando Divisions of Nyando District and involved all smallholder farmers introduced to dairy goat technologies initiated by LIFE project.

It mainly focused on the influence of study circle extension strategy and its characteristics on dissemination of dairy goat technologies. The SC characteristics studied were membership, gender composition, age, networking capacity and cohesiveness (registration of the group, possession of a bank account and frequency of meetings). The study also focused on indicators of knowledge, skills acquired on dairy goat production and milk output and shows how they were applied in relation to specific DGTs. In this way it was possible to link the influence of SC to dairy goat production in Nyando district, which MoLFD says, has potential.

1.8 Limitations of the Study

The following were the limitations of the study:

- i. Some of the Study Circle groups were formed recently and could not fully exhibit dissemination and adoption capacity. This was addressed by sampling dairy goat farmers from LIFE project pilot divisions only.
- ii. The study involved sampling people's opinions that varied from time to time, place to place. This was addressed by having a large sample that was randomly selected.

1.9 Assumptions of the Study

The study made the following assumptions:

- i. The existing SC groups had equal access to technology developed and disseminated by public and private institutions.
- ii. The SC groups had similar levels of interaction with other stakeholders
- iii. Agro-ecological circumstances, social, political, institutional and policy factors were common to all dairy goat farmers in Nyando district.

1.10 Definition of Terms

For the purposes of this study, the following operational terms applied:

Dairy goat technologies: The combination of knowledge, inputs and management practices that is deployed together with productive resources for desired dairy goat production (Arnon, 1989). In this study, it was measured by level of adoption of DGT such as knowledge acquired and skills applied.

Dissemination: Dissemination is the act of transferring knowledge from a source to a recipient by sending messages through channels that link them (Adams, 1982). In this study, the transfer of knowledge of DGTs from the source (i.e. research station) to the farmers in the study area as measured by Adoption levels, knowledge/skills of dairy goat acquired and output. Farmers Group Dissemination Index (FGDI) was used to measure this.

Cohesiveness: According to Oxford English Dictionary, Cohesiveness is a social unit causing or helping people to stick together easily or well. In this study, the term refers to the degree of mutual affection among members and their attraction to the group, which ensures that members remain together, undertake joint activities and support one another.

Conventional extension approach: This involves the transfer of new ideas, knowledge, skills or innovations to improve the farmers' livelihoods. It is in most cases the main source of agricultural information enabling the farmers to be able to acquire the knowledge necessary in order to make appropriate and informed decision on whether or not to adopt a new technology (GOK, 2005). In Kenya extension service provision, the technology is generated in research station (KARI) and transferred through MOA extension services. In this study, it is a Ministry of Agriculture operated extension service, which was the current system in existence before the introduction of SC pilot project in Nyando. It's basically a top-down approach which utilizes the TOT model. This involves the use of a wide range of methods such as field days, demonstrations, tours, meetings, circulars, shows or radio.

Influence: It is either positive or negative effects of one factor on another or effect of an "agent" on another (Yukl, 1989). In this study, it was the level of implementation of dairy goat technology learnt through the Study Circle extension strategy.

Innovation: Is the application of knowledge (old or new) that creates value for end-users. It spurs completion and contributes to socio-economic development. It is a continuous process (Leeuwis, 2004). In this study, passing of the dairy goat technology through SC extension strategy was perceived as critical in the smallholder goat farmers' decision to adopt the dairy goat technology, and hence improved livelihoods.

Output: According to Oxford English Dictionary, output is the amount of something that a person, a machine, or an organization produces. In this context, it refers to the milk production levels of the dairy goat.

SC characteristics: Characteristics, according to Oxford English Dictionary, is the typical feature or quality of a person or something. In this study, it refers to a set of salient factors that identify Study Circle such as how long the SC has been in existence, how many members it has, its gender composition and networking capacity.

Smallholder farmer: Refers to farmers owning farms less than 2ha (World Bank, 2001). In this context, it refers to smallholder farmers with between 2-5 dairy goats.

Study Circle: Is a facilitator-guided non-formal adult education group of 7-12 people who informally come together for the purpose of acquiring knowledge in order to learn new ideas/technologies (Kindstrom, 2000). In this context, it refers to smallholder livestock production groups organized by LIFE project for the purpose of acquiring knowledge to learn DGT through SC extension strategy.

Up-scale: Expose a technology to a wider group of farmers than was initially exposed during technology development, with the aim of equipping them with knowledge on the technology and encouraging adoption (Arnon, 1989). In this study, it is the use of dairy goat technology by wider group of farmers for increased adoption within and without the SC farmers.

Value addition: According to Oxford English Dictionary, value addition is to increase the worth of something in terms of money or other goods for which it can be exchanged. In this study, it is the processing of milk into products such as Sour Milk ("*Mala*"), Yoghurt, Cheese, Ghee etc, for the market.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter summarizes literature related to importance of extension services, participatory and group extension approaches, study circle, study circle for livestock production practices, technologies in dairy goat production, dissemination and adoption of technologies, group extension methods in Study Circle strategy, the theoretical and conceptual framework that illustrates the relationship between the dependent and independent variables and how the study was used to determine the influence of independent variables on the dependant variable.

2.2 Importance of Extension Services

Extension aims to teach rural people how to improve their level of living by their own efforts, through making wise use of natural resources at their disposal in better systems of farming for the benefit of the individual, the family, the community and the nation (Saville, 1965; Bradfield, 1971). This is supported by Swanson and Claar (1984) who indicated that farmers cannot successfully adopt a new technology unless they are aware of it and learn to incorporate it into their farming systems. According to Roling (1988) extension objectives can be explained in relation to the problem solving cycle. It assists a client in becoming aware of the symptoms, in formulating the problem, in identifying the causes, in generating alternative solutions and in choosing and implementing an appropriate one. Agricultural extension aims to improve knowledge of farmers, and to change their attitude and behaviour (MoA, 2001). Efficient and effective extension is an important service for increasing agricultural productivity (Government of Kenya (GOK), 2004; IFAD, 2004).

2.3 Participatory and Group Extension Approaches

Initially extension services were often structured and operated on the assumption that farmers are largely passive, illiterate, ignorant and therefore they are unable to innovate or to integrate new cropping and livestock practices into their farming systems (Technical Centre for Agriculture and Rural Cooperation (CTA), 1997). The results of extension services tended to be poor, because rural people did not feel ownership of ideas imposed on them (Jurgen *et al*, 2000; Teixeira, 2004)). There was therefore need to develop approaches that would involve farmers in

identifying their real problems and ensure their active participation in the learning process. The participatory approaches emerged in the late 1980s after it was realized that most technologies developed by researchers alone were inappropriate for smallholder farmers (Jurgen *et al.*, 2000).

Before this time, extension service was supply-driven with inadequate participation of the beneficiaries and was for all practical purposes, a public monopoly. It did not give enough consideration to socio-economic circumstances of the farmer, including his/her knowledge and experience, on-farm and off-farm activities (MoA, 2001). The service had not been spared from the transitional challenges of economic liberalization and public sector structural reforms. The government of Kenya and other stakeholders (SH) had used several extension approaches (GOK, 2005). These included model farm approach, farmers' training centres, catchment's approach, Training and Visit (T&V) among others (Onyango, 1987; Venkatesan, 1995). The above extension approaches achieved minimal success but largely had not been effective in meeting farmer's demand for extension services as expected. Due to this, the government has embraced participatory and demand-driven approaches to effectively tap farmers' participation and private sector contribution in running extension services (GOK, 2004), for example, Agricultural Information Technology Response Initiative (ATIRI).

Participatory approaches are "learner-centred". They emphasize self-directed learning and are commonly used with adults (Rogers, 1969; Teixeira, 2004)). The fundamental principle of this approach is that adult learning can be optimized when the learner is put in control of his or her learning. Rogers also indicates that adult learners require learning that is relevant to their needs and involves activities that encourage self-direction. The stimulus-response theory was used to develop these approaches, which ensure that farmers were active, rather than passive listeners or viewers. In this theory, frequency of repetition is important in acquiring skills, and for retention through over-learning (Dilts, 1986). In repetition, desirable or correct responses are rewarded. Generalization and discrimination suggest importance of practice in varied contexts, so that learning becomes important to a wider range of stimuli (Dilts, 1986). Amudavi (1993) indicate that strong farmer participation is essential if farmers' goals and problems are to be identified properly. Mwangi (2004) while reporting experiences with participatory approaches in Kisii, indicated that farmers were much more interested in and got more involved in experimenting with solutions that lay within their own capacity than experimenting with conventional high-input solutions.

Prior to the enactment of the National Agricultural Extension Policy of 2001 in Kenya, the extension system had evolved through use of various formal and *ad hoc* approaches, mainly determined by externally donor funded projects and programs (GOK, 2005). From the general/conventional agricultural extension approaches in the 1960s and 1970s the system has evolved through the Integrated Agricultural Development (IAD) approach (up to 1981/82), Training and Visit (T & V) to Farming System Approach (FSA) up to 1998. Parallel to the approaches, the Commodity Specialized Approach (CSP) was predominantly used in the large export commodity sub-sectors spearheaded by commodity boards and private companies. These approaches were elaborately executed by collaborative network consisting of researchers, extensionists and farmers. However, they never achieved much because they were highly demanding on manpower, time and financial resources (MOA, 2001).

Until 1998, public extension services were provided by the then Ministry of Agriculture and Rural Development (MoARD) through the National Extension Program (NEP I and II), funded by the Kenya Government, IFAD and the World Bank (MoARD, 2002). The program ended since it was agreed that the communicated technologies no longer reflected farmers' demands and that the approach adopted in reaching the farming community through contact farmers had not been effective (GOK, 2004). Soil Conservation Branch, had for more than 15 years built up a complementary effective extension service on land and water management aspects in 52 districts. This was achieved through the National Soil and Water Conservation Program (NSWCP). The program had used participatory techniques to determine the kind of extension support farmers demanded. It had adopted a catchment (focal) area approach to reach all interested farmers during an intensive one-year support period (GOK, 2005). Effective guidance and backstopping to field staff was facilitated by "bottom-up" activity based planning and budgeting (MoA, 2001). In 1998, the MoARD decided to adopt and extend the NSWCP approach to advisory services on crop and livestock production.

The main reasons for the failure of past approaches, among others, were limited involvement of farmers as they adopted Transfer-of-Technology (TOT) model which is a largely top-down delivery system, lack of fitness of the technology to the existing farming systems, low level of farmers schooling and experience in testing and adopting technologies (Asiabaka *et al*, 2002; Ocholla, 2002). Some of the extension approaches that have been used with varying degrees of success include Focal Area Approach (FAA), Farming Systems Approach (FSA),

Farmers' Field Schools (FFS), Multidisciplinary Mobile Extension Teams (MMET) and Integrated Rural Development Approach (IRDA) (GOK, 2005).

According to GOK (2005), given the current thinking on new approaches, the government has embraced participatory and demand-driven approaches to effectively tap farmers' participation and private sector contribution to run extension services. In participatory extension, farmers take part in design, determine management conditions and implement and evaluate the experiments (Chambers, 1989). Participatory approaches are conceptualized on the assumption that they support local innovation and adaptation, enhance local capabilities, and so are more likely to generate sustainable processes and practices (Pretty & Chambers, 1996). Processes in the approaches foster independence, creativity, self-reliance, self-criticism and self-evaluation. Facilitators and not teachers guide the learning process. The FFS, National Agriculture and Livestock Extension Program's (NALEP) Shifting Focal Area Approach (SFAA) are area based and encompass key tenets of participatory and demand-driven extension approaches. SC is a strategy within these broad participatory approaches. They have been used with varying degree of success. Desirable attributes associated with them include market and value addition orientation; demand-driven and beneficiary led; group approach for cost-effectiveness in terms of farmer empowerment and coverage; clear accountability mechanism; in-built sustainability mechanism such as cost-sharing with beneficiaries; pluralism in service delivery and enterprise diversification among other advantages.

There is a significant gap, therefore, between the old models and the current participatory approaches, which are being encouraged all over the world (MoA, 2001). It is when communities are involved in problem diagnosis, planning, appraisal, implementation and Monitoring and Evaluation (M & E) of projects that they are sustainable (Amudavi, 1993; Asiabaka *et al.*, 2002). This is why the government developed a policy paper on Strategy for Revitalizing Agriculture (SRA) that aims at reversing the declining trends in agricultural production by introducing new approaches that are participatory (GOK, 2004). There is, thus an increasing appreciation for the need to use demand-driven and participatory extension approaches in an effort to establish sustainable and cost effective extension strategy such as SC to empower farming community (Kindstrom, 2000).

2.4 Study Circle Extension Strategy

Study Circle is facilitator-guided non-formal adult education groups of 7-12 people who informally come together to talk, listen and share their thoughts on a topic of mutual interest for the purpose of acquiring knowledge on new ideas (Kindstrom, 2000). The SC facilitator introduces an activity, clarifies the process and sets participants to work by asking open-ended questions. The SC training does not only focus on one technology but incorporates special topics, covering a wide field depending on the participants' interest with the final objective of being able to develop into a strong marketing group. The farmers are involved on the choice of technologies for learning and in the suggestion of special topics. In the SC strategy a dialogue is created among the farmers and between farmers and organizers/facilitators.

The working of SC participants in smaller groups of about 12 members during any process helps to ensure that each member participates in the various activities. The work in a SC must start from the participants' experiences and knowledge (ACTAF, 2005). The work and the progress of a SC are characterized by co-operation and companionship of working together towards mutually shared and resolved objectives (Markham, 1999). The strategy is tailored in such away that the farmers take up an active role in particular learning process thus controlling their own destiny. SC strategy empowers farmers with knowledge for decision-making because facilitators do not answer questions directly but make farmers think for themselves (Van de Fliert et al. 1996). Answering a question directly is considered a lost opportunity for learning. The participants assist each other instead of competing (Kindstrom, 2000). They bring their experiences for discussion in their area of interest and come up with appropriate approach to problem solving. They share the progress and setbacks of their joint work (ACTAF, 2005).

According to Kindstom (2000), such study situation provides security for all and contributes to openness. The participants' active contribution is the basis on which SC is built. They cannot share responsibilities as participants without acting and personally having an opinion. The work in the SC is built around the participants' search for knowledge. As opposed to conventional education that is based on a hierarchical model, in which the teacher disseminates knowledge from the top down, a SC involves interaction in which all participants contribute. It is a vivid, active process that relates knowledge to action and social change, to development and creativity. The participants thus understand the strength, power and pleasure in creating a project together. Kindstrom described the strategy as good for men and women to

increase and develop their self-esteem together. Kindstrom (2000), also found that in a meeting there are often some people who make their voices heard and some people who are shy and quiet. The SC extension strategy helps to overcome such tendencies and improves self-confidence among all the participants. Groups with both men and women also show that you do much better if you cooperate than if you are working separately. It is a good way to show that gender is not for women only; it concerns both men and women.

Kindstrom (2000) further indicates that learning in SC setting is not passive and requires a commitment to active thinking and learning. By allowing each participant an equal opportunity to speak, all members of the group can gain from each other's unique wisdom and experience. This process of discussion among equals is as important as the content of the discussions; the sharing of ideas is a dialogue, not a debate. Understanding, not agreement is the objective. The strategy is ideal for community adult learning of new technologies such as dairy goat. The main goal of a SC is for the group to strive to become a community whose members can more easily work and share together. The more circles of understanding they have, the greater the opportunity of building diverse community-wide networks that can develop solutions to socio-economic problems.

According to Markham (1999), there is no one model for organizing a SC so community needs and resources are considered and a program adopted accordingly. The organizer selects the topic and determines the probable depth of the study, but the participants take ownership of the SC and eventually determine where and how far its implementation goes. Little attention has been made to generate information regarding how SC characteristics such as age, membership, gender composition, group cohesiveness and networking capacity influence dissemination of technologies. The study therefore, assists in making recommendations to help enhance the use of SC as a participatory extension strategy in technology dissemination. Study Circle has traditionally been used in Sweden for sharing ideas and opinions and in dealing with socio-economic issues (Kindstrom, 2000). It is an effective way of facilitating expensive educational opportunities since learners take responsibility for their own action. It is thus, a more effective participatory strategy to technology dissemination.

2.4.1 Rationale for Formation of Study Circles

Successful Study Circles build mutual interactive participation where people are involved in the identification of the project, deliberate on action to be taken and there is active formation or strengthening of local groups. The work in a SC must start from the participants' experiences and knowledge. Beginning with their everyday experiences, with identified problems, they bring new knowledge into the study circle (Kindstom, 2000). According to Amudavi (1993) and the World Bank (1999), participation is an important tool through which people have a "buy-in" benefit into a project. People commitment is enhanced and there is a sense of ownership in the project. The importance of sharing information has been noted by other researchers since current agricultural problems are human challenges that require more than just technology for their resolution (Hersterman & Thorburn, 1994). Eberle and Shroyer (1997) emphasize that working with clusters of farmers is much more effective than working with single farmers to multiply impacts. SC also creates opportunities that would not be available if farmers operated independently; examples include collective purchase of inputs and collective marketing of produce (Groverman, 1994). Furthermore, SC leverage institutional resources, hence encouraging members take collective action and demand for representation and services from external agencies. Such actions in-turn, facilitate farmers believing in them and in their ability to control their own destiny. Consequently, solutions are not likely to be mechanistic or recipe driven but rather evolve after exclusive thinking and consultation (Coston, 1999).

2.4.2 Use of Study Circle Extension Strategy by LIFE Project in Nyando District

Study Circles' farmers were formed by LIFE Project through strong linkages, collaboration and networking mechanism with identified extension providers, both public and private, such as MoL&FD, MoA, Vi Agro-forestry and farmers' representatives. According to GOK (2005), this minimizes duplication of efforts and enhances complementarities. It also increases efficiency in resource utilization. In Nyando District, a critical mass of 7-12 farmers (SC) with a common interest and pleasure in creating a livelihood together were thus formed with the hope of multiplying the impacts, in this case, dairy goat production.

The dairy goat SC farmer then contacted the study organiser who guided them in choosing a leader and making a study plan. The members were then trained on demanded DGTs with the technical support of the project staff. Where demanded technical support was not

available from the project staff, other extension providers were consulted. The study plan was used as the checklist for the assessment of the SC objectives. Farmers not in SC, however, were those who had never received and participated in SC groups.

2.5 Study Circle for Livestock Production Technologies in Nyando District

Exotic dairy goat development in Nyando District started in the late 1990s with the introduction of dairy goat breeds by Heifer International (HPI) (Ministry of Livestock & Fisheries Development (MoLFD), 2005). The initial projects were mainly aimed at multiplying improved stock for distribution to farmers. The farmers were not directly involved in designing and executing the project. Despite huge financial investment by HPI in this endeavour, only a total of 85 exotic dairy goats were available in the District by 2000 (MoLFD, 2005). Major improvement on dairy goat sector were not realised until 2002 under Livelihood Improvement and Family Empowerment (LIFE) Project. The Project initiated a new strategy known as Study Circle (SC) that was community-based and farmer-led. The strategy used Participatory Approaches (PA) to provide advisory services on Dairy Goat Technologies (DGT) such as management, disease control, breeding and husbandry.

Research and development of new technologies that respond to clients needs is important in ensuring a vibrant extension service (GOK, 2005). For the technology to reach the intended clients, it is equally important to have effective dissemination strategies. This is why LIFE project started SC to smallholder farmers in Nyando as it is built around the participants' search for knowledge. There is an inquiring and searching approach to new superior technologies through skilled SC leaders and experience of the participants. A report by GOK (2005) indicates that technology development and dissemination in Kenya has been public sector driven. For this arrangement to work, a well functioning linkage and feedback system between research, extension and clients is necessary.

Goats have multiple purposes, providing food, generating cash income or bartered exchanges of commodities, directly benefiting some of the world's poorest people (ILRI, 1999; Richards, 2002; Ahuya *et al.*, 2005; Odhiambo, 2006 & Taye, 2006)). Studies done by Ahuya *et al.*, (2005) showed that goats have increasingly become important sources of milk, especially to the resource-poor small-scale farmers who cannot afford dairy cattle. The small ruminants (sheep and goats) contribute 30% of red meat while goats contribute 4% of total milk production in

Kenya (Ahuya *et al.*, 2005). The development of an efficient goat industry is, therefore, an ideal strategy for poverty reduction especially among the resource-poor smallholder farmers and pastoralists.

According to GOK (2004), 80% of milk produced in the country is by smallholder farmers. Statistics by the Ministry of Livestock and Fisheries Development (MoLFD, 2005) indicates that unfavourable weather conditions and limited arable land have led to a drop in livestock production in Nyando. Milk and meat production has dropped from 17million litres and 1,516 tons to 10.4million and 1,410 tons in 2003 to 2005 respectively. This has led to development of livestock enterprise such as dairy goat that requires limited land and pastures. MoLFD further recorded that pure dairy goats have increased from 108 to 194 in 2003 to 2005 respectively (Table 1). According to MoLFD (2005), the main constraints to dissemination of these technologies include limited collaboration with extension stakeholders, lack of utilization of available information, lack of organized market channels, low managerial skills and competition among various stakeholders. SC facilitates an interaction between various stakeholders in which all participants contribute thus minimizing duplication of efforts. It is a dynamic process based on the experience of the participants, the skills of the SC leader and the quality of the study material. Therefore, SC reveals the considerable scope that exists for farmer-driven services, farmer-to-farmer extension and farmer led-change.

Table 1: Dairy Goat Population Trend in Nyando District

Year	Pure dairy goats	Local/crosses goats
2003	108	112,200
2004	139	117,350
2005	194	118,600
2006	228	122,000
2007	385	125,000

Source: Livestock Production Annual Report, Nyando, 2007.

2.5.1 Role of Women in Extension

In many parts of the developing world, rural women play a significant role in agricultural production, performing most of such reproductive roles as feeding the family, fetching water and firewood, cooking and cleaning the children. Other factors held constant, extension services are more efficiently utilised by female than male farmers. This is because of the critical role women play in agriculture – in household food production, marketing, post – harvest activities, livestock production, and several pre – and post – harvest tasks. Besides, they provide the bulk of the agricultural labour – force in many countries (World Bank, 2001).

In Kenya, women provide over 80% of the agricultural labour (MoA, 2001; Ocholla, 2002), performing such roles as planting, weeding, harvesting and marketing of the produce. Consequently, when a new innovation is associated with roles a community perceives to be for women, it will probably attract few men, hence, possibility of low use by male. The World Bank recommends that in implementing livestock projects, it is worth noting that women are generally concerned with raising small stocks and in processing activities, while men are responsible for large animals and marketing of the produce (World Bank, 2001).

2.5.2 Group Extension Method in Study Circle Strategy

In the Conventional group approach, the extension workers use group techniques like meetings, field days, demonstrations, and tours (Bradfield, 1971; Maunder, 1973; Mwangi, 2004). When informational and innovative meetings are used, for the most part, the audience plays a passive role by listening to one or more presenters (Kang & Song, 1984). Learning is therefore sometimes hindered by audience boredom and lack of participation. Group size varies from group to group and can be as high as 50 members. The Conventional approach views farmers as end-users of technologies, who must be persuaded into adopting research outputs, rather than as partners in the process (Hakiza *et al.*, 2004). The group format in SC provides an efficient way of ascertaining consensus opinions about the relevance of technologies being tested. Working with groups rather than individual farmers is more conducive to effective extension because the competition among groups has been a major factor in facilitating the dissemination of extension recommendations (Kang & Song, 1984; Van den Ban & Hawkins, 1985; Bindlish & Evenson, 1993; Venkatesan, 1994). Through such groups as SC, farmers also contribute ideas for new technology options or for modification of existing options (Heinrich, 1993).

Groups are important in keeping farmers in the foreground and in creating a spread or multiplier effect with relevant improved technologies (Norman et al., 1989). This is one of the aims of initiating SC strategy in a community. Experience suggests that extension agents tend to act as a cementing force when they seek and work with already existing groups and this helps to keep the group together (Bindlish, & Evenson, 1993; Ssewamala, 2004)). Kindstrom (2000) indicates that SC is designed for groups of 7-12 participants. A group of people with a common interest forms the core of SC (Gallagher, 2003). The group could be an established one, such as self-help, women's group or youth group. Tapping farmers' own knowledge and experience expressed through sharing on topics of mutual interest and discussion is one of the strong points in SC (Hakiza *et al.*, 2004). SC tends to strengthen existing groups or may lead to the formation of new groups.

2.5.3 Factors for Group Cohesiveness in Study Circle

It is reported by Mwagi (2004) that working in close physical proximity to other group members facilitate interaction, which leads to higher group cohesiveness. Mwagi, further indicate that groups that engage in participative decision-making are generally more cohesive than those that do not. The attractiveness of a group is partly determined by its composition because members of a group may find difficulties to get along with each other if they are very different in status, values, attitudes, abilities, cultural background or interests (Yukl, 1989; Mwagi, 2004).

Highly cohesive groups sometimes foster a phenomenon called "groupthink" (Yukl, 1989). In a group discussion, any expression of doubt about a preferred alternative is inhibited by "self-censorship" as well as social pressure from other members (Yukl, 1989; Forsyth, 1990). The group strives to maintain the illusion of internal harmony by avoiding open expression of disagreement (Yukl, 1989). The adverse effects of groupthink can be avoided if the leader is aware of the potential problem and takes steps to increase critical evaluation of alternatives under considerations (Yukl, 1989; Forsyth, 1990; Mwagi, 2004). SC facilitates interaction among members and homogeneity of interest since individuals of common interest come together to start a study circle.

2.5.4 Group Leadership in Study Circle

Forsyth (1990) reports that studies done on behaviour that make up the role of leadership fall into two general clusters: relationship behaviours and task behaviours. Relationship behaviours address the feelings, attitudes and satisfactions of the members of a group. Task behaviours, in contrast, pertain to the problem at hand rather than the personal satisfactions of the group members. Forsyth (1990) further indicates that newly formed groups, groups beginning a new project, or groups with many new members will work most effectively with a high-task/low relationship leader. In moderately mature groups the high relationship/low task style is most effective.

A leadership style approach to the theory of leadership considers autocratic, democratic and Laissez-faire styles (Johnson & Johnson, 1975). Democratic leaders tend to involve the group in decision making, let the group members determine work methods, make overall goals known, and use feedback as an opportunity for helpful coaching (Bartol & Martin, 1991). In autocratic style the leader tends to make unilateral decisions, gives orders to group members, and sometimes give feedback that is punitive (Johnson & Johnson, 1975; Bartol & Martin, 1991). Bartol & Martin describe a laissez-faire leader as one who generally gives the group complete freedom, has very little participation and avoids giving feedback. Studies done indicate that while work is equal in the groups with autocratic and democratic leaders, work quality and group satisfaction were higher in the democratic groups (Bartol & Martin, 1991).

Johnson and Johnson (1975) recommend that groups should adopt a functional leadership approach. The basic ideas of this theory is that any member of a group may become a leader by taking actions that serve group functions and any leadership function may be fulfilled by different members performing a variety of relevant behaviours. Yukl (1989) also recommends that leadership should be shared because a group will be ineffective if the leader is either too passive or too domineering.

2.6 Dissemination of Technologies in Dairy Goats in Nyando District

Dissemination is the process of transferring knowledge from a source to a recipient by sending messages through channels that link them (Adams, 1982). This is an important aspect of technology transfer and adoption in that it helps in creating awareness among potential users of the technology. The activities of extension agents in agriculture constitute dissemination of

information as it involves informing farmers' on agricultural technologies such dairy goats. According to Arnon (1989), effective dissemination of known practices can greatly accelerate development though present dissemination is beset with a number of problems including lack of utilization of available information on agricultural technologies. Arnon noted that attempts to disseminate information are often not oriented to the needs, capabilities and desires of the target audience. Dissemination of a technology is a prerequisite for economic development in the third world (Lattimore, 1986). Singh (1983) stated that it brings about technological change that increases economic prosperity. However, the development of new agricultural technologies and their efficient transfer is complex and successful adoption is dependent on many factors (FAO, 2002). Muntemba and Chimedza (1995) reported that the dominant route for dissemination of technology puts women at the end and extension workers generally direct information at men who selectively pass it along to women often in diluted form. This makes the women who are the majority farmers unaware of new technologies. SC improves men's and woman's self-esteem to work together by building self-confidence among all participants.

LIFE Project, (2005) show that some of the DGT disseminated in Nyando District through SC included improved housing units, fodder and fodder trees establishment, disease and pest control, clean milk production and agribusiness. Dairy goat farmers involved in SC were provided with breeding stock and technical skills on the above technologies that they could not, otherwise, exploits from within the members. These technologies were pegged on the farmers, socio-economic status, gender and cultural backgrounds to enhance adoption and diffusion. However, how specific SC characteristics and involvement in the SC affects dissemination and adoption of these technologies are not known.

2.7 Adoption Process

Rogers (1995) describes adoption as a mental decision-making process through which an individual passes from first hearing about an innovation to final adoption. In the process, various stimuli about the innovation reach the individual from communication sources. Rogers gives the adoption stages as: awareness, interest, evaluation, trial and finally adoption. According to Rogers (1995) and Mwangi (1998) the characteristics of innovations that will influence their adoption include: Relative advantage compared to other innovations, compatibility with other existing values and past experience; complexity in its usage, triability in terms of

experimentation on a limited basis and the degree of observability of the results of an innovation. It is reported by Sanghi (1989) that improved equipment for fertilizer was introduced and demonstrated for castor in Telangana region of India, but subsequently the farmers did not adopt it because of high cost of equipment. Adoption is higher for farmers belonging to farmers' group that have contact with extension agencies (Adesina *et al.*, 2000). Study Circle provides a forum through which the above attributes of a technology passes through before adoption. It encourages contact/linkages with other service providers in extension and related services and technologies.

2.8 Theoretical Framework

Dissemination and adoption of dairy goat technologies can be based on four theories: perceived attribute theory, innovation decision process theory, transfer of technology model and technology characteristics user context models. However, the Perceived attribute theory and innovation decision process theory were found to be most suitable for this study. Perceived attribute theory assumes five attributes upon which an innovation is judged. The technology can be adopted if it can be tried out, its results can be observed, has an advantage over other innovations or the present circumstances, it is not overly complex to learn or use, it fits in or is compatible with the circumstances into which it will be adopted (Rogers, 1983).

Potential adopters of a technology progress over time through five stages in the diffusion process. First, they must learn about the innovation, second, they must be persuaded of the value of the innovation for them to decide to adopt it. The innovation must then be implemented, and, finally, the decision must be reaffirmed or rejected (Rogers 1995). A technology is transferred from its source (research systems) to final users through agents' medium (extension systems) and its diffusion in potential user-communities depends mainly on personal characteristics of the potential individual user (Rogers 1983). Characteristics of technology underlying user's agro-ecological, socio-economic and institutional context affect the adoption decision and diffusion process (Biggs, 1990; Negatu & Paikh, 1999; Scoone & Thomson, 1994). Decision to implement the technologies was reflected in knowledge, skills acquired on dairy goat production and output as proxy to dissemination (Figure 1). Parveen and Leonhauser, (2004) followed the same procedure to measure women empowerment in Bangladesh by developing a cumulative empowerment index (CEI), while Maxwell, (1995) followed the same procedure to measure food insecurity by developing a Cumulative Food Security Index (CFSI).

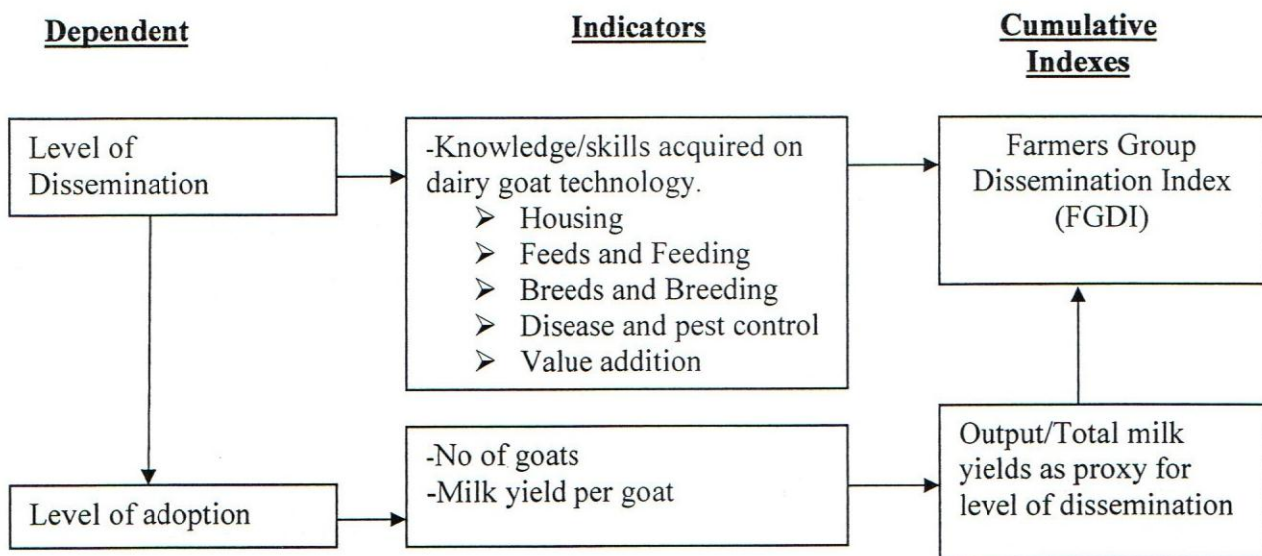


Figure 1: Procedures for compounding of scores from indicators into indices. (Adopted from Parveen & Leonhauser, (2004) Framework for Empowerment).

2.9 Conceptual Framework

This study was based on Rogers’s innovation decision process theory and perceived attribute theory to study the influence of Study Circle Extension Strategy on Dissemination of Dairy Goat Technologies in the study area (Figure 2). The dependent variable was the Dissemination of Dairy Goat Technologies. This was measured by output, knowledge, skills and practices acquired in DGT. The independent variable was SC Extension Strategy and its characteristics (size, gender composition, age, networking capacity and cohesiveness). The scores obtained from indicators of knowledge, skill acquired on dairy goat technologies (housing, feeds & feeding, breeds & breeding, disease & pest control and value addition) and output were compounded into dairy goat knowledge indicator (DGKI), dairy goat skills indicator (DGSI) and dairy goat output indicator (DGOI) respectively using geometric mean indicated in the formulae below:

$$DGKI = Wi (X_a \cdot X_b \cdot X_c \dots X_n)^{1/n}$$

$$DGSI = Wi (X_a \cdot X_b \cdot X_c \dots X_n)^{1/n}$$

$$DGOI = Wi (X_a \cdot X_b \cdot X_c \dots X_n)^{1/n}$$

Where X_a ----- X_n were the scores obtained from indicators of dissemination, $1/n$ was the n th root of the total number of indicators for dissemination and w_i was the weighted factor which were assumed to be uniform for all contributing factors or intuitively allocated based on perceived factor contribution to dissemination. Institutional factors, Agro-ecological conditions and policy environment were assumed to be common to all dairy goat farmers in the study area. The choice of the two divisions was to help control for any agro-ecological differences.

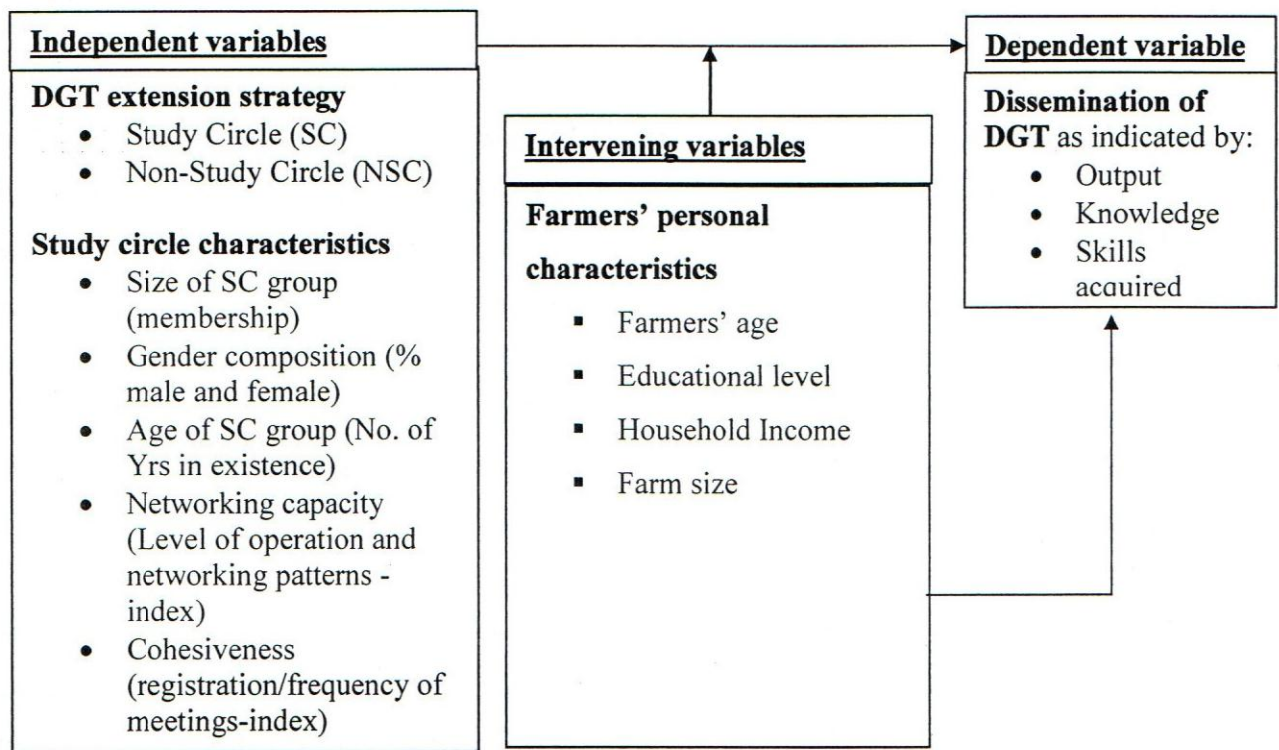


Figure 2: Conceptual Framework showing the Independent, Dependent and Intervening Variables in the Dissemination of DGTs among Smallholder Farmers in Nyando District.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the specific procedures of how the research was done. It describes the research design, study location, population of the study, sample size, sampling procedures, instrumentation, validity, reliability, data collection, data organization and analysis. Justification for the choice of specific techniques used in the study is also presented.

3.2 Research Design

The study adopted a survey design and used an *ex-post facto* research approach. This design takes care of events that have already occurred. The design was selected for this study because the SC strategy had been implemented in the study location without the researcher's involvement in manipulation of treatments. Kathuri & Pals (1993) recommend this type of research for a study in which the researcher examines the effects of a naturalistically occurring treatment after that treatment has occurred. According to Wiersma (1995) survey involves studying a situation as it is in an attempt to explain why the situation is the way it is. Surveys are important in research and have been found to be useful in describing the characteristics of a population under study (Kathuri & Pals, 1993; Fraenkel & Wallen, 2000). They are cost effective and exploratory enabling the researcher to make inferences into the level of cause and effect (O'Connor, 2002). Data were collected through structured questionnaire. The study was designed to investigate the influence of SC strategy on dissemination of dairy goat technologies in Nyando District. The key dependent variable for the study was dissemination of dairy goat technology measured by Farmers Group Dissemination Index (FGDI). This was operationalized in terms of Dairy Goat Knowledge Index (DGKI), Dairy Goat Skills Index (DGSI) and Dairy Goat Output Index (DGOI). This study involved comparing the dissemination index between SC groups with the NSC groups.

3.3 Study Location

The study was carried out in Nyando District, which is one of the 12 districts in Nyanza Province. The district covers a total area of 1,168.4km² with a total population of 332,137 people giving an average population density of 284.4 persons per Km² (GOK, 2002). It borders Kisumu

District to the west, Nandi District to the north, Kericho District to the east and Rachuonyo District to the south (Appendix I). The district has a small shoreline to the southwest where it touches Lake Victoria. It lies between longitude $34^{\circ}41'$ East and latitudes $0^{\circ}23'$ South and $0^{\circ}50'$ South (GOK, 2003). The district altitude ranges from 1800m above sea level in Nyabondo Plateau to 1100m above sea level along Kano Plains and experience bimodal rainfall with long rains received between March and May and short rains coming in September to November. The mean annual rainfall ranges between 600mm to 1630mm while temperature ranges between 20°C to over 35°C (GOK, 2002). The study was carried out in Nyando and Muhoroni Divisions of the District where smallholder farmers were involved in dairy goat production initiated by LIFE project as a pilot area for the SC sites.

3.4 Population of the Study

The target population consisted of all the 261 farmers involved in the dairy goat production in Muhoroni and Nyando Divisions of the District. The sample population was 118 farmers consisting of 59 farmers from each sub-group. The accessible population was 110 farmers that composed of 50 SC farmers and 60 NSC farmers. LIFE project purposively selected these farmers to form a critical mass for future up scaling of the technologies in the district. The 60 NSC farmers were used for comparison purposes only.

3.5 Sampling Procedures and Sample Size

The sampling unit in this study was the dairy goat farmers in the study area. Sampling was done purposively among the dairy goat farmers from the two Divisions of Nyando and Muhoroni because this is where SC pilot project was carried out. A sample of 59 NSC farmers was achieved after working out a proportionate sample for each Division as per the formula used for choosing the sample for SC participants. A simple random sampling was used in selecting the Non-SC respondents through the use of a table of random numbers. According to Gall *et al* (2007) proportionate stratified random sampling ensures that no sub-group is omitted from the sample and avoids overloading in certain sub-populations. Simple random sampling gives each sub-group an equal chance of representation in the study.

3.5.1 Sample Size

The formula recommended by the Leads (1989) was used to calculate the sample size as given below: $N = (Z \div e)^2 (P) (1-P)$

Where: N = sample size

Z= standard score corresponding to a given confidence interval

e = proportion of sampling error in a given situation

P = estimated proportion from population mean having characteristic being measured

In our case, P=0.04. Since 4% of milk produced is by dairy goat farmers (Ahuya *et al*, 2005). Confidence level is 95 %.

$$\begin{aligned} \text{Thus, } N &= (1.95 \div 0.05)^2 (0.04) (1-0.04) \\ &= (1536.64) (0.04) (0.96) \\ &= 60 \end{aligned}$$

This gave a total of 120 farmers which was used in the study. This was above the minimum number of 100 recommended by Kathuri and Pals (1993), Fraenkel and Wallen (2000) for survey type of research in social sciences. The extra number of 20 was necessary to cater for attrition, dropouts and non-responses as a threat to internal validity. Table 2 shows the respective sample sizes per division.

Table 2: Sample Sizes per Division

Division	Number of SC trained farmers			Number of Non-SC farmers		
	Number	Proportion	Sample Size	Number	Proportion	Sample size
Nyando	37	0.52	31	100	0.53	32
Muhoroni	34	0.48	29	90	0.47	28
Total	71	1	60	190	1	60

3.6 Instrumentation

Data was collected using structured questionnaire (Appendix II). This type of items refer to question which are accompanied by a list of all possible alternatives from which respondents select answers that best describe the information required. The item in the questionnaire had been constructed based on the objectives of the study. Each item in the questionnaire was developed to address a specific objective, or hypothesis of the study. In this study, a closed

ended questionnaire was used. Some of the merits of using a closed ended questionnaire are that: it is easier to analyse since the questions are on an immediate useable form; they are easier to administer because each item is followed by alternative answers; and lastly they are economical to use in terms of time and finances. Its major demerit are that they are more difficult to construct because categories must be well thought out and that responses are limited since the respondents are compelled to answer questions accordingly to the researcher's choice. The questionnaire for the study elicited data on the following: dissemination of DGT, Milk yields, SC characteristic, knowledge and skills acquired on dairy goat production and how they influenced the ability of SC farmers to make autonomous decisions and continue with activities beneficial to them. This tool is appropriate for this study as it is typically efficient, economic and practical when large samples are used (Fraenkel & Wallen, 2000; Kathuri & Pals, 1993).

3.6.1 Validity

Validity is the accuracy and meaningfulness of inferences, which are based on the research results, in other words it is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study (Mugenda & Mugenda, 2003; Fraenkel & Wallen, 2000). To ensure the instrument accurately measured the variables of interest to the study, each of the items in the questionnaire was discussed with the peers, research supervisors, and other lecturers in the department of Agricultural Education and Extension of the University, in relation to the study objectives. Attention was given to how each of the specific study objectives was captured in the questionnaire, and modifications made as deemed necessary to ensure content and face validity.

3.6.2 Reliability

Reliability of an instrument refers to the stability of an instrument over time or the level of internal consistency (Mugenda & Mugenda, 2003; Fraenkel & Wallen, 2000). The researcher pilot-tested the instrument with a small group of 30 smallholder farmers similar to the sample surveyed in the study. A guideline by Kathuri and Pals (1993) was used to decide on 30 farmers. This was done in Miwani Division of Nyando District, which had similar characteristics (SC & Non-SC farmers) to the study location and is 20 km away from study location that avoided contamination of the respondent studied. Data collected from the pre-test were used to calculate

the Cronbach's reliability coefficient. The result of this test showed a co-efficient of 0.89 which is above the acceptable threshold of 0.7. This means the instrument was reliably testing what it was intended for.

3.7 Data Collection Procedures

The researcher upon satisfying the requirements of Egerton University Graduate School board of examiners obtained a research permit from the Directorate of Research in the Ministry of Higher Education, Science and Technology to conduct research in Nyando District (Appendix III). This was followed by a visit to the District Commissioner, District Agricultural Officer and District Livestock Production Offices, Nyando District to notify the office of the proposed research.

A series of meetings were held with the Divisional Livestock Extension Officers (DLEO) of the two divisions who arranged for subsequent meetings with the Frontline Extension Workers (FEW) of the study sites. The FEW helped the researcher to locate and identify the farmers who participated in the research. Dates for meeting the farmers on their own farms were arranged. The researcher thereafter administered questionnaire to them. Farmers' expectations of any financial rewards were answered by the FEW who explained to them that the survey was purely for academic reasons and not for financial gain hence they should not expect payments. Farmers were met at their homes and a face-to-face mode of questionnaire administration adopted.

3.8 Data Analysis

The questionnaire was coded, summarized and checked for any possible errors. Quantitative and qualitative data were collected from the respondents. Data was then entered into the computer for program of the Statistical Package for Social Sciences (SPSS) for quantitative and qualitative data analysis. Both descriptive and inferential statistics were employed in the data analysis of all the variables studied. Data was first subjected to descriptive analysis in order to describe the influence of the SC group. The descriptive statistics that were generated included frequencies, percentages, means and standard deviations. These statistics were used to describe the results of data analysis for independent variables in all the five objectives formulated for the study. The purpose was to enable the research to meaningfully describe a distribution of scores of measurements using a few indices or statistics.

The inferential statistics used in the study included t – test, Chi-square (X^2) and linear regression. The purpose of inferential statistics was to enable the researcher generalise the results from the sample to population. Hypothesis testing technique was used to generalise from the sample to population. Inferential statistics therefore are concerned with determining how likely it was for the results obtained from a sample to be similar to results expected from the entire population.

The researcher compounded scores obtained from indicators of knowledge, skill acquired on dairy goat technologies and output to obtain dairy goat knowledge indicator (DGKI), dairy goat skills indicator (DGSI) and dairy goat output indicator (DGOI) respectively. The compounded indices obtained ranged from 1 – 3, where 1 was low and 3 was high. This enabled the researcher to make further comparisons. Information from DGKI, DGSI and DGOI was compounded to come up with Farmers Group Dissemination Index (FGDI) for each group using the formula:

$$FGDI = (DGKI \times DGSI \times DGOI)^{1/3}$$

Where: DGOI is Dairy goat output indicator

DGSI is Dairy goat skills indicator

DGKI is Dairy goat knowledge indicators

$1/3$ is 3rd root of the three indicators for dissemination

The FGDI was used to compare the dissemination between the two groups. To test the difference in dissemination of dairy goat technologies between the farmers' groups in hypothesis 1, t-test was used. A t-test was used to determine whether there was a significant difference between the means of the two groups of independent samples, that is, SC and NSC. Independent samples are samples that are randomly formed, that are formed without matching. In such samples the members of one group are not related to members of the other group in any systematic way other than that they are selected. Hypothesis 2 was tested using chi-square (X^2) at probability $\alpha = 0.05$ significance level. This was in order to investigate significant influence of SC extension strategy on dissemination of DGTs. Hypothesis 3 was tested using Linear

Regression. Regression was used to explore the influence of study circle characteristics on dissemination of dairy goat technologies. Table 3 summarizes the specific analysis procedures that were used based on the various hypotheses.

Table 3: Summary of Data Analysis Procedures

Hypothesis	Independent Variables	Dependent variable	Statistical Procedures
Ho ₁ . There is no statistically significant difference in the level of dissemination of DGT between smallholder farmers in SC and those not in SC in Nyando District	DGT Extension Strategy <ul style="list-style-type: none"> • Farmers in SC • Farmers not in SC 	Dissemination of DGT as indicated in FGDI by: <ul style="list-style-type: none"> • Output • Knowledge • Skills 	Descriptive Statistics: Frequency, means, standard deviation, percentages Inferential Statistics: t-test
Ho ₂ . SC extension strategy does not significantly influence the level of dissemination of DGT among smallholder dairy goat farmers in Nyando District.	DGT Extension Strategy <ul style="list-style-type: none"> • Farmers in SC • Farmers not in SC 	Dissemination of DGT as indicated by level of dissemination: <ul style="list-style-type: none"> • None • Low • Moderate • High 	Descriptive Statistics: Frequency, means, standard deviation, percentages Inferential Statistics: Chi-square (X^2)
Ho ₃ . SC characteristics do not significantly influence the level of dissemination of DGT among smallholder farmers in Nyando District	SC Characteristics: <ul style="list-style-type: none"> • Age • Membership • Networking capacity (Index) • Gender composition 	Dissemination of DGT as indicated in FGDI by: <ul style="list-style-type: none"> • Output • Knowledge • Skills 	Descriptive Statistics: Frequency, means, standard deviation, percentages Inferential Statistics: Multiple linear regression

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents and discusses the results of this study based upon the formulated objectives and hypotheses in chapter one. The study investigated the influence of study circle as an extension strategy on dissemination of dairy goat technologies among smallholder farmers in Nyando District. The results are presented in the chapter according to each study objective and hypotheses. The chapter also present results of tests of hypotheses using inferential statistical procedures.

4.2 Description of the Study Sample

The sample population was 118 respondents from the two divisions. During the actual research a total of 110 farmers were interviewed. The remaining 8 farmers were not found at home. An attempt by the researcher to trace or replaced them was not successful. The results of the study sample for the research are presented in Table 4.

Table 4: Description of Study Sample

Division	SC Farmers (N = 50)		Non-SC Farmers (N = 60)	
	Frequency	Percentage	Frequency	Percentage
Nyando	29	58	34	57
Muhoroni	21	42	26	43
Total	50	100	60	100

4.3 Study Circle Characteristics

The study area had 19 SC, 9 in Muhoroni and 10 in Nyando Divisions, with a total membership of 595 persons of which 387 were females (LIFE, 2005). Out the 595 members, 71 were involved in dairy goats, whose SC characteristics were investigated in the study. The main SC characteristic investigated in the study were size, gender composition, age of the SC, level of operation (networking capacity) and cohesiveness (frequency of meetings, registration and leadership). The following sub-section provides details of the findings of the study by sub-section.

4.3.1 Size, Age and Duration in the Study Circle

The size of the SC groups was measured by membership (number of members) of the group. The respondents were asked how many farmers/members they were in the SC. The analyzed data indicates that the minimum size was 15, the maximum size was 45 and the mean size was 23, hence majority of the SC groups had 23 members. The sum total size was 1139. Some of these SC were existing groups that were converted to SC hence the larger size. A study about groups carried out in Botswana by Heinrich (1993) indicates that groups should not exceed 40 members if they are to be manageable and to facilitate interaction between farmers and researchers. Burkey (1996) reports that groups of less than 10 are unviable and that groups of more than 25 quickly become unparticipatory.

Age of the SC was measured by number of years in existence/formation. The respondents were asked to indicate which year the SC was formed. They were also asked to indicate how long they had been members of the SC. Majority of the respondents joined the SC in the year 2005. This could be due to the influence of SC pilot study done in the district in 2002. The overall mean age was 11 years. The younger SC was 5 years old while the older was 19 years old. These were existing groups that were converted to SC. Sixty eight percent (68%) of the participants joined SC after the year 2002 probably through the initiative of LIFE project. The minimum time a member has remained in the group was 4 years; maximum was 18 years while average time was 8.5 years. Time a member has remained in a group is important because it has an effect on group cohesiveness. A high number of new members joining an existing group are likely to lower group cohesiveness because they will take time to be acquainted with each other. A newly formed group is also likely to have low group cohesiveness. A group with majority of old members is likely to be more cohesive because members have established norms to keep them together. Studies show that older existing active groups are stable due to their cohesiveness, income generating activities and strong linkages with other service providers (LIFE, 2005 & Rogers 1995). This enables them to develop contacts with external organizations for resource and technical know-how, for example through proposal writing, but retain decision on how resources are utilized.

The study, however, did not capture the ages of the respondents and therefore could not indicate which age groups were attracted to SC. Burkey (1996) indicates that groups with

members of same or similar age groups tend to have similar interests. A summary of group distribution by size, age and years a member has remained in SC is represented in Table 5 while Figure 3 shows proportions of respondents by year of joining SC.

Table 5: Descriptive Statistics of the SC by Size, Age and Duration in SC

	Minimum	Maximum	Mean	Total
Size/Membership	15	45	23	1138
Age (Yrs)	5.0	19.0	11.4	
Duration in SC (Yrs)	4.0	18.0	8.5	

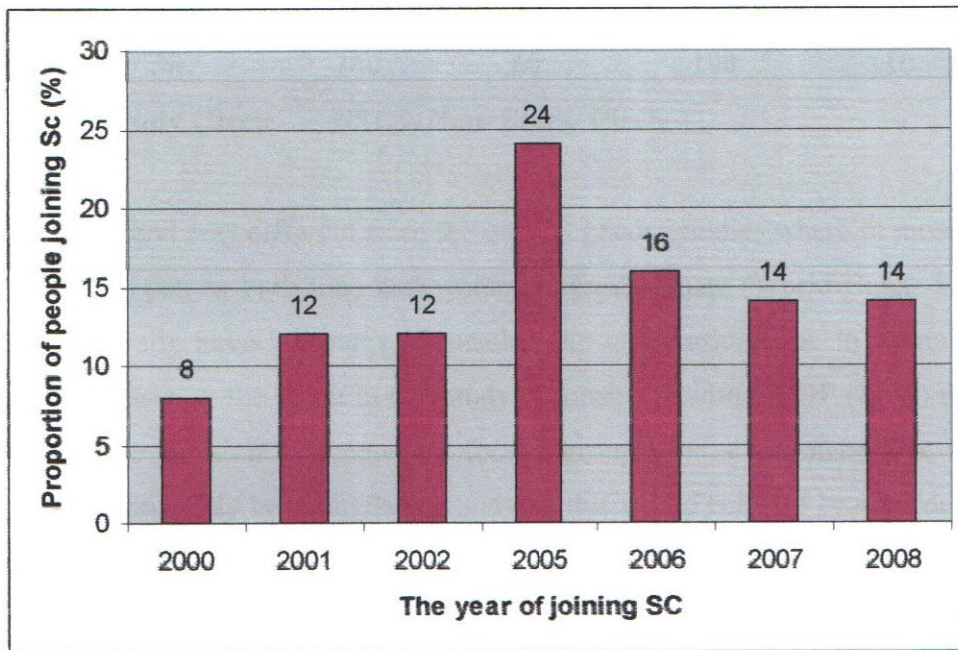


Figure 3: Distribution of Respondents by Year of Joining the SC

4.3.2 Gender Composition of the Study Circle

The respondents were asked to indicate the number of males and females in their SC group. Analysed data indicates of the 110 respondents, there were 71% females and 29% males hence most of the study farmers were generally females. Among the SC respondents 86% were females, while 14% were males compared to NSC respondents of which 58% were females and 42% were males. The farmers' registration into SC programme indicates that 65% of the farmers were females (LIFE, 2005). Therefore, the sampled farmers for this study also followed the same

were females (LIFE, 2005). Therefore, the sampled farmers for this study also followed the same trend. This reveals that informal groups have more women than men. In Nyando District women are the ones who are more involved in farming activities, hence more likely to take initiatives in the formation of informal groups. The distribution of respondents by gender is shown in Table 6.

Table 6: Distribution of Respondents by Gender in Nyando District

Gender of respondents	SC Respondents		NSC Respondents		Total Respondents	
	n	%	n	%	n	%
Males	7	14	25	42	32	29
Females	43	86	35	58	78	71
Total	50	100	60	100	110	100

Key: SC – Study Circle NSC – Non- Study Circle

The trend was different from the normal gender studies where in most rural development programmes open to both men and women, men dominate (World Bank, 1993). Traditionally, women generally have low rates of membership and participation in formal groups and social networks. However, the result in this study is consistent with UNDP (1999) that reported that by improving the position of women in formal groups and social networks, society as a whole would simultaneously be strengthened and that this would enhance broader development aspect.

4.3.3 Networking Capacity of the SC

Networking capacity was measured by network pattern of the groups. The respondents were asked if their SC was a member of a network or not. They were to indicate the type of network their group was linked to. The types of networks considered were location, division, and district, national and other networks (Table 7). Almost all the SC had some level of networks (98%). Also that 64% had District networks while 36% had divisional networks. According to World Bank (1993), this may limit their livelihood diversification aimed at acquiring incomes and accumulating wealth from external sources such as remittances and/or transfers nationally or internationally from outside.

Table 7: Level of Operation and Network Pattern of the Study Circle

	n	%
Member of a Network	49	
Location	0	0.0
Division	18	36.0
District	32	64.0
National	0	0.0
Others	0	0.0
Total	50	100.0

4.3.4 Cohesiveness of the Study Circle

Cohesiveness was in an attempt to examine the influence of SC characteristic on dissemination of DGTs in objective three. The instrument to assess cohesiveness had five items covering registration of the group, period of a member's stay in the group (respondents' likelihood to retain membership), mode of choosing SC leaders, group meetings and SC linkages with institution/service providers. To examine the influence of cohesiveness as reflected by registration of the group, the respondents were asked to indicate whether their group was registered with Department of Social Services or not. Figure 4 shows registration of SC group by Social Services. Data analysis results indicate that a higher proportion of respondents (94.0%) were registered compared to 6.0%, which was not registered. This revealed that SC group had remained more cohesive as reflected by the number of registered groups. Registration of group contributes to group cohesiveness as well as enhancing their capacity to source for funds and assistance from micro finance organizations and Government agencies such as *Njaa Marufuku* Kenya and Youth Funds.

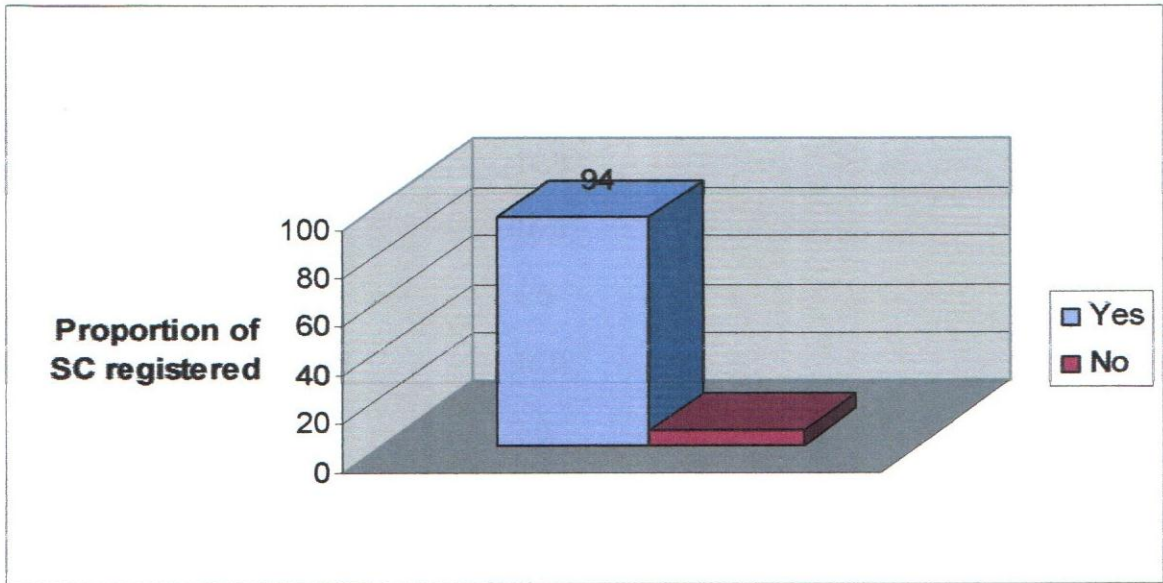


Figure 4: Registration SC Groups by Department of Social Services

To examine the influence of cohesiveness as reflected by how long a member had remained in SC, the respondents were asked when their SC was formed and period stayed in SC. This was indicated by the number of years they had been members. Results of data in Table 8 reveal that all the members had stayed in the group for more than 4 years. Majority (36%) had stayed for 8 years. The members therefore, had remained in SC for at least 4 years. The implication of this is that SC groups could be more cohesive if members are likely to remain in the group because of better satisfaction. Group members are rational decision makers and hence they are unlikely to retain their membership in a group that does not achieve its objectives (Rogers, 1995).

To examine the influence of cohesiveness as reflected by how SC leaders were chosen, respondents were asked to indicate how their group leaders were chosen. The option given to chose from were; democratic, self-imposed, by provincial administration or extension staff. Data analysis indicated that all the SC groups (100%) held democratic elections. None had their leaders imposed on them, decided by provincial administration or extension staff.

Table 8: Period Stayed in the SC Group

Years in SC	n	%
4	7	14.0
6	8	16.0
7	2	4.0
8	18	36.0
9	1	2.0
10	2	4.0
12	8	16.0
14	1	2.0
15	1	2.0
18	2	4.0
Total	50	100.0

This, therefore, reveals that the SC strategy is better at developing leadership skills concerning sharing leadership matters among the group members. The SC strategy puts strong emphasis on equality among members of a group. Johnson and Johnson (1975) recommend that groups should adopt a functional leadership approach. The basic ideas of this theory is that any member of a group may become a leader by taking actions that serve group functions and any leadership function may be fulfilled by different members performing a variety of relevant behaviours. Yukl (1989) also recommends that leadership should be shared because a group will be ineffective if the leader is either too passive or too domineering.

To examine the influence of cohesiveness as reflected by frequency of SC meetings, the respondents were asked to indicate how often their SC had group meetings. Data analysis results (Table 9) indicated that a higher proportion of respondents met frequently (84%). The proportion of respondents who never met at all was 2%, 2% rarely met and 12% met very frequently. This revealed that SC groups had remained more cohesive as reflected by the

frequency of meetings held. Regular group meetings contribute to group cohesiveness as well as enhancing dissemination and adoption of technologies.

Table 9: Frequency of Study Circle Group Meetings

Level of meetings	n	%
Never	1	2
Rarely	1	2
Frequently	42	84
Very Frequently	6	12
Total	50	100

Influence of cohesiveness through linkages with institutions was measured by frequency of contact with the institutions for various reasons helpful to the SC group. Respondents were asked to rate the general contact of the group with the institution. They were to rate the contact either as never, rarely, moderately, frequently or very frequently. The results of data analysis presented in Table 10, indicate that the respondents had linkages with other SC (88%), NGOs (94%) and Government Ministries (94%). There were no linkages with government credit services (e.g. Agricultural Finance Cooperation [AFC]), micro finance institutions, marketing agencies and other organizations. This could be because most Study Circle farmers found SC to be very useful to them since most of the technical and financial information they needed was sourced and brought to the SC as opposed to seeking them from elsewhere. They also reported that SC had helped them to expand their agricultural knowledge and practices. However, this reveals that some improvements are required so as to motivate SC groups' linkages with government credit services (AFC), micro finance institutions and marketing agencies for such reasons beneficial to them as funds acquisition. One of the strategies to achieve this would be through proposal writing and development of farm business plans to address the emerging issues.

Mwagi (2004) reported that regular group meetings, regular elections of group officials, networks with other stakeholders and working in close physical proximity to other group members contribute to group cohesiveness as well as enhancing adoption of technologies. This facilitates interaction, which lead to higher group cohesiveness. Mwagi, further indicate that groups that engage in participative decision-making are generally more cohesive than those that

do not. Studies by Normen *et al* (1989) indicate that the more homogenous the group is in terms of self-defined interests and perceived problems, the more effective the process is likely to be. It is further reported by Burkey (1996) that groups will be most effective when they have a large degree of homogeneity, especially in terms of socio-economic status, although other factors such as age, religion and group size may also play role.

Table 10: SC Linkages with Institutions

Institution	Linkages (%)									
	Never		Rarely		Moderately		Frequently		Very frequently	
	n	%	n	%	n	%	n	%	n	%
Other SC	0	0	4	8	44	88	2	4	0	0
Farmer groups	0	0	0	0	0	0	0	0	0	0
NGOs	0	0	0	0	0	0	47	94	3	6
Govt. line ministries	0	0	0	00	0	0	47	94	3	6
Microfinance	46	92	4	8	0	0	0	0	0	0
Govt credit services (AFC)	43	86	0	0	7	14	0	0	0	0
Marketing agencies	50	100	0	0	0	0	0	0	0	0
Other organizations	9	18	32	64	2	4	7	14	0	0

4.4 Dissemination of Dairy goat Technology

Dissemination in this case was measured by adoption levels of DGT (as proxy for dissemination). The respondents defined technologies adoption as the farmers' decision to use new idea/knowledge, skills in dairy goat production practices and total milk output. The level of knowledge acquired, skills applied and milk yields/output was assessed through both direct observations by the researcher and responses by respondents. These were then compounded into Farmers Group Dissemination Index (FGDI) using a geometric mean indicated in the following formula below. The results obtained for both SC and NSC respondents are presented in Table 11.

$$FGDI = (X_1 \times X_2 \times X_3 \dots \times X_n)^{1/n}$$

Where: X_1 is Dairy goat output indicator (DGOI)

X_2 is Dairy goat skills indicator (DGSi)

X_3 is Dairy goat knowledge indicators (DGKI)

$1/n$ is nth root of the total number of indicators for dissemination

Table 11: Comparisons of FGDI between Study Circle and Non Study Circle Participants

Group	DGKI		DGSi		DGOI		DGDI	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
SC	1.82	0.20	2.14	0.18	2.54	0.58	2.13	0.20
NSC	0.99	0.30	1.86	0.17	2.66	0.59	1.66	0.23

The FGDI for both the respondents ranged between 1 and 3. The mean was between 1.66 and 2.13. The FGDI was categorized into 3 categories (e.g., 1 = Low, 2 = Medium, 3 = High), which was done on the basis of obtained score for each dissemination. With respect to DGKI, DGSi and DGOI, the mean score for SC and NSC was 1.82, 2.14, 2.54 and 0.99, 1.86, 2.66 respectively. The grouping was done to ease scoring of the parameters. High mean attracted a higher score for that parameter hence a higher influence. The highest possible score for this parameter were three. Dissemination was measured using parameters in the practices of Dairy Goat Technologies such as fodder establishment, dairy goat feeding, housing, breeding, clean milk production and value addition. Non Study Circle participants had low dissemination while Study Circle participants had medium dissemination. The SC Extension Strategy, therefore, had more influence on the dissemination of DGT than NSC. These findings confirmed that SC extension strategy is quite effective on influencing dissemination of technologies.

Table 12: Comparisons of Level of Dissemination of DGT between SC and NSC Farmers in Nyando District

	Dissemination of dairy goat technologies				Total
	None	Low	Moderate	High	
SC:					
Number	0	22	28	0	50
Percent	0	44	56	0	100
NSC:					
Number	0	60	0	0	60
Percent	0	100	0	0	100
Total:					
Number	0	82	28	0	110
Percent	0	74.5	25.5	0	100

Key: SC = Study Circle

NSC = Non-Study Circle

Comparisons of dissemination between SC and NSC participant is presented in Table 12. The results show that all the groups of respondents had some level of dissemination. No group had none or high dissemination. However, the disseminations were generally low especially among NSC farmers. Forty four percent (44%) of SC farmers had low dissemination while 56% had moderate dissemination. On the other hand, among the NSC farmers, 0% had moderate dissemination and 100% low dissemination. In total, 74.5% of all the respondents interviewed had low dissemination, 25.5% had moderate dissemination while 0% had high dissemination. Although the SC participants had recorded low scores in dissemination, they were better than NSC farmers. The main reason for the above trend can be explained by the fact that dairy goats were newly introduced into the study area. Most farmers were probably still in the awareness creation stage in the adoption continuum. Therefore, the results were encouraging as learnt through the researchers' observation and farmers' reaction. For example, bucket feeding, clean milk production and concentrate feeding were attracting the attention of most SC farmers. There is a high possibility of adoption of these technologies in the future.

4.4.1 Dairy Goat Production

Aspect of dairy goat production considered in the study included number kept, amount of milk produced and level of use of dairy goat husbandry practices (technologies) on the farm. Table 13 indicates number of dairy goats kept by the respondents. Number of dairy goat kept by respondents varied between 1 and 4. Majority of the respondents had 2 – 3 does. Fifty two

percent (52%) of SC participants had 2 does while 34% had three (3) does. Forty point one percent (40.1%) of NSC participants had 2 does while 28.3% had 3 does. Few SC and NSC participants kept 1 or 4 does. Six percent (6%) of SC participants kept one (1) doe while only 8% kept 4 does. Among the NSC participants, 18.3% and 13.3% kept 1 and 4 does respectively. Total numbers of goats kept were 264 does and 41 bucks. Out of this, 122 does (46%) and 11 bucks (27%) were kept by SC farmers while 142 does (54%) and 30 bucks (73%) were kept by NSC farmers.

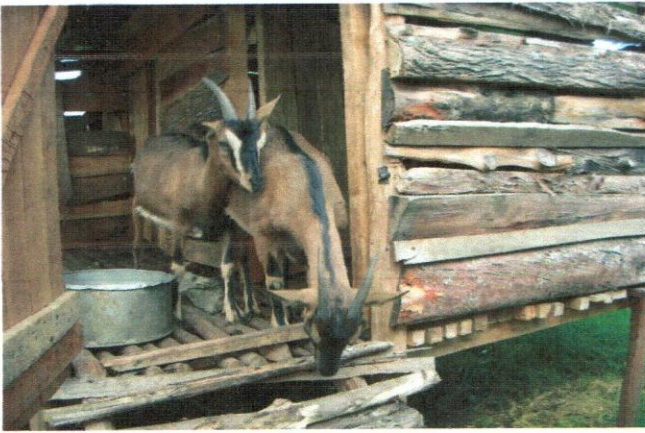
Table 13: Number of Dairy Goat Kept by the Respondents

No. of Does	Study Circle Farmers (N = 50)			Non-Study Circle Farmers (N = 60)		
	n	%	Total	n	%	Total
1	3	6	3	11	18.3	11
2	26	52	52	24	40.1	48
3	17	34	51	17	28.3	51
4	4	8	16	8	13.3	32
TOTAL	50	100	122	60	100	142

This trend could be explained by the fact that most dairy goats kept by NSC were crosses, mainly F1 (Foundation) and F2 (Intermediate) while SC farmers, on the other hand, mainly kept exotic dairy goats such as Alpine, Sanaan and Toggenburg, which were mainly Appendix (F3) and Pedigree (F4) and are expensive to acquire. Plate 1 gives a pictorial presentation of some of the dairy goats kept by both SC and NSC farmers in the study area.



- A sample of an F1 cross-bred doe (Foundation) kept by NSC farmers in the study area with an average milk yield of 1litre/day/doe



- A sample of a Toggenburg doe kept by SC farmers in the study area with an average milk yield of 3litres/day/doe

Plate 1: Dairy Goats Kept by the Respondents

The respondents were asked to indicate the amount of milk yields they produced on the farm as a way of comparing performance/production between the two groups. Amount of milk produced by each respondent daily on the farm varied between 1litre and 8litres. Table 14 shows the distribution of the two groups of farmer by the total amount of milk produced.

Table 14: Milk Production by the Respondents

Amount per day (Litres)	SC Farmers (N=60)		Non-SC Farmers (N=60)	
	n	%	n	%
1.0-1.9	2	4.1	8	13.6
2.0-2.9	4	8.2	29	49.1
3.0-3.9	16	32.7	6	10.2
4.0-4.9	15	30.6	10	16.9
5.0-5.9	4	8.2	4	6.8
6.0-6.9	7	14.2	1	1.7
7.0-7.9	1	1.0	1	1.7
8.0-8.9	1	1.0	1	1.7
Total	50	100	60	100

The study found that 32.7% of SC respondents produced between 3.0 – 3.9 litres per day while only 10.2% of NSC farmers produced the same amount. Also that 49.1% of NSC respondents produced between 2.0 – 2.9 litres per day compared to 8.2 % SC farmers. Total amount of milk produced by SC respondents was 196 litres (52%) while Non-study circle respondents produced 184 litres (48%). Thus, on the basis of milk yields, SC respondents were better than NSC. Use of dairy goat husbandry practices (technologies) was considered in the study area as the extent to which each of the technologies was picked up and practised by the farmer. Figure 5 shows presentation of dairy goat technologies practiced by both SC and NSC respondents on the farm. SC respondents had the highest number of farmers practising the technologies (above 72%) except for use of A.I that was 14%. SC was imparting knowledge to SC members better than NSC; it explains why NSC farmers had the least number of farmers practicing the technologies.

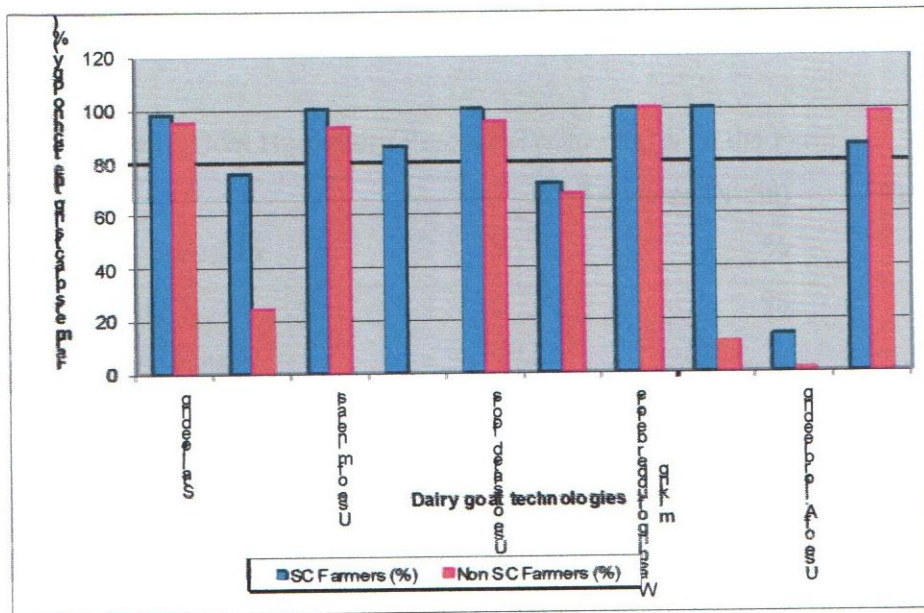


Figure 5: Dairy Goat Husbandry Practices/Technologies

Dairy goat technologies considered in the study areas included feeding, use of concentrates, minerals, housing, clean milk production, castration and goat mating. The technologies were considered for the purpose of comparing between the experimental and control group. This is reflected by results presented in Table 15.

The results indicated that of the 110 respondents, SC were using several technologies namely, concentrate feeding (76%); minerals (100%), bucket feeding (86%), slated housing (100%), sanitary pail/clean milk production (72%) and castration of males (100%), while among the Non-Study Circle respondents, 24.6% were using concentrate feeding, 0% bucket feeding and 11.7% castrate males. There was generally low use of Artificial Insemination (A.I) among both SC and NSC respondents at 14% and 1.7% respectively. Majority of the respondents used group bucks, SC at 86% and NSC at 98%. The generally low use of A.I services for mating may be due to high costs and the fact that most semen available in the market is for large ruminants.

Table 15: Dairy Goat Husbandry Practices Technologies on the Farm

Management practices	SC-Farmers (N=50)		Non SC-Farmers (N=60)	
	n	%	n	%
Feed type: Stall	49	98	57	95
Free range	1	2	3	5
Concentrate feeding: Yes	38	76	14	24.6
No	12	24	43	75.4
Use minerals: Yes	50	100	56	93.3
No	0	0	4	6.7
Kid feeding: Suckle	7	14	60	100
Bucket	43	86	0	0
Housing Type: stall/slatted	50	100	57	95
Others	0	0	3	5
Sanitary pales: Yes	36	72	41	68.3
NO	14	28	19	31.7
Washing udder: Yes	50	100	60	100
No	0	0	0	0
Castrate male: YES	50	100	7	11.7
No	0	0	53	88.3
Goat mating: A.I	7	14	1	1.7
Group buck	43	86	59	98.3

The results of the analysed data of the 110 respondents indicated that SC strategy was better at dissemination of knowledge to farmers for decision-making compared to NSC. If farmers join SC they are exposed and therefore show difference from those not exposed. This is because the NSC is like a control group. The main reason for the above trend was due to the fact that most of the technical information they needed was sourced and brought to SC as opposed to seeking them to expand their agricultural knowledge and practices. This is in conformity with Kindstom (2000) who in his documentation of the application of SC found that the strategy fosters learning with intention that members would increase their control over the technologies.

The SC strategy also empowers farmers on how to seek for information from relevant sources so as to solve those problems for which they do not have ready answers.

4.4.2 Knowledge Acquired on Dairy goat Production

A farmer's level of knowledge of basic goat rearing principles and practices on fodder establishment (improved fodder), feeding (nutrition), goat housing, goat breeds, goat breeding, disease and pest control (health), clean milk production and value addition can explicitly explain how best the technology was disseminated. The farmer by way of his/her experience in goat rearing acquires certain knowledge and skills, which are useful in decision-making regarding the use of dairy goat technology. The instrument developed had items to test the level of knowledge acquired in goat rearing, and to relate this with the technology dissemination. The farmers' knowledge acquired on dairy goat technologies is shown in Figure 6. There was average level of application of the technologies by the respondents. Knowledge acquired on dairy goat production was measured by level of application of improved dairy goat husbandry practices as low, average and high. Data analysis results (Table 16) indicate average knowledge acquisition.

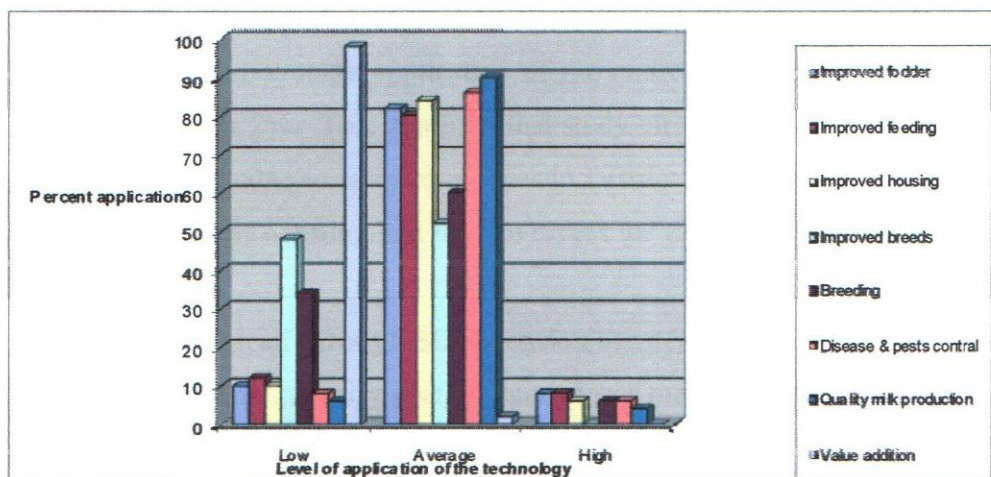


Figure 6: Farmers' Knowledge Acquired on Dairy Goat Production

Table 16: Level of Application of Knowledge Acquired

Dairy Goat Husbandry/Technology	Low		Average		High	
	n	%	n	%	n	%
Growing improved fodder	5	10	41	82	4	8
Improved feeding	6	12	40	80	4	8
Improved housing	5	10	42	84	3	6
Improved breeds	24	48	26	52	0	0
Modern breeding	17	34	30	60	3	6
Improved disease & pest control	4	8	43	86	3	6
Quality milk production	3	6	45	90	2	4
Value addition	49	98	1	2	0	0

Results relating to specific knowledge on dairy goat husbandry indicate that over 60% of the SC farmers had average application of the entire husbandry considered except for value addition which was 2%. This confirms that study circle extension strategy was imparting new and relevant knowledge to farmers in Nyando District. Probably amount of milk produced was just enough for home consumption thus no excess for value addition.

4.4.3 Skills Acquired through SC Extension Strategy on Dairy Goat Production

Skills acquired on dairy goat production was measured as new skills acquired through SC extension strategy on dairy goat production under the selected scale where 1=Low, 2 = Average and 3 = High. The acquired skill considered in the study included fodder establishment and management, feed rations, housing, breed selection, breeding, vaccination, spraying/dipping and clean milk production. The results are presented in Table 17.

Table 17: Level of New Skills Acquired on Dairy Goat Technologies

Dairy Goat Technologies	Low		Average		High	
	n	%	n	%	n	%
	Fodder est & mgt	4	8	42	84	4
Feed rations	45	90	5	10	0	0
Housing	4	8	43	86	3	6
Breed selection	9	18	41	82	0	0
Breeding	6	12	41	82	3	6
Vaccination	39	78	11	22	0	0
Spraying/dipping	3	6	44	88	3	6
Clean milk production	2	4	46	92	2	4

The results shows that SC farmers acquired on the average new skills in fodder establishment and management (84%), housing (86%), breed selection (82%), breeding (82%), spraying (88%) and clean milk production (92%) but not in feed rations (10%) and vaccination (22%) which are specialized techniques that require professional training. Accordingly, majority (over 82%) of the farmers had acquired new skills (good understanding) of the basic goat rearing principles and practices (DGT) they were tested on. The skills acquired on fodder establishment and management, housing, breed selection, breeding, spraying/dipping and clean milk production was average. However, farmers interviewed responded that they were aware and interested in incorporating these technologies into their farming system. In general SC farmers had acquired better skills on all the new technologies.

4.4.4 Use of Dairy goat Technologies among SC Participants by Gender

Extent of use of dairy goat technologies among gender considered in the study included concentrate feeding, use of minerals, slated floor, bucket feeding, sanitary pales (clean milk production), castration and use of A.I. The technologies were considered for the purpose of comparing between the females and males. Results are presented in Figure 7. The results show that females performed generally better than males in the use of all the technologies. Of the 12 farmers who used concentrates, ten (83%) were females, 43 of the 50 respondents that used minerals, 43 (86%) were females, of the

seven respondents that used bucket feeding, five (71%) were females, of the 14 that used sanitary pails eleven (78.6%) were females. The best-used technologies were minerals, castration and slated floor of which female performed better than males, 86%, 85.7% and 86%, respectively. There was generally low use of technologies such as A.I, bucket feeding, concentrate feeding and use of sanitary pails. Castration of males, use of slated floor and minerals were the best especially among females. This indicated that females were better adopters of the technologies hence their good performance in all the technologies.

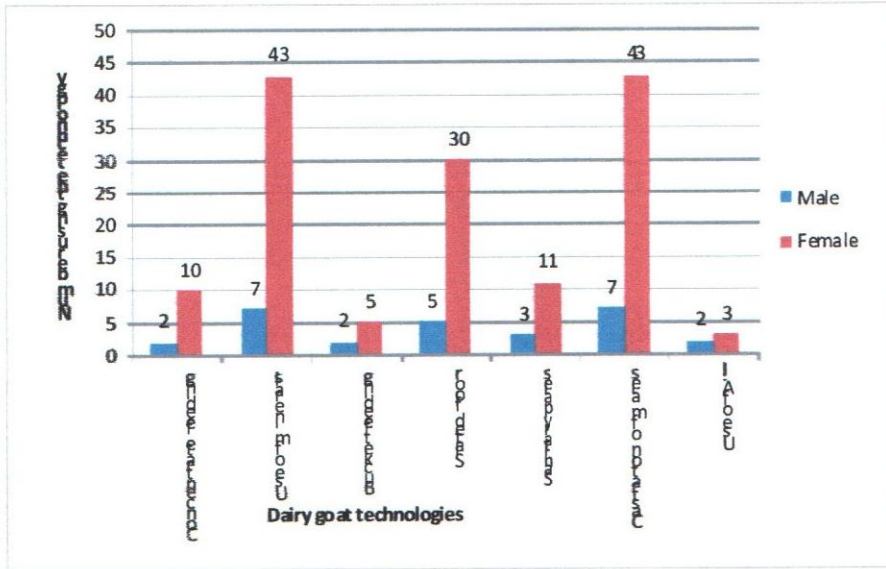


Figure 7: Comparative Dairy Goat Technology Use by Gender

4.5 Hypotheses Testing

Based on the statistical objectives of the study, the formulated hypotheses were tested in order to establish any significant difference in dissemination of DGT between SC and non-SC farmers.

4.5.1 Comparison of Dissemination of Dairy Goat Technologies

To enable a comparison on the dissemination levels of DGT, the following hypothesis was formulated.

H_{01} : *There is no statistically significant difference in the level of dissemination of DGT between smallholder farmers in SC and those not in SC in Nyando District.*

Table 18: T-test for Separations of Means between Study Circle and Non-Study Circle Farmers

		Levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference	
									Lower	Upper
Farmers dairy goat dissemination index (FGDI)	Equal variance assumed	0.103	0.749	12.032	108	0.000	0.497	0.04128	0.41490	0.57856
	Equal variance not assumed			12.185	107.778	0.000	0.497	0.04077	0.41593	0.57754

This hypothesis was tested using t-test. It was considered appropriate since it compared the performance between the two groups. The results are presented in Table 18 which reveal that the mean dissemination index for SC respondents was statistically significantly different from that of NSC respondents ($t = 12.032$; $df = 108$; $p = 0.000$) hence the null hypothesis is rejected and the obtained difference between the sample means is regarded as significant. The alternative hypothesis that there is significant difference is accepted.

The main reason for the above trend could be due to the fact that SC extension strategy is a group approach that encourages participation of the group members to work as a team. This is in conformity with the government policy to embrace participation and demand-driven approaches in extension to effectively tap farmers' initiatives and private sector contribution in running extension services (GOK, 2004). According to World Bank (1993) participation has been one of the critical successes in irrigation and livestock production among other projects. Group approach/participation helps members to develop contact with external organization for resources and technical know how but retain decisions on how resources are utilized, for example, through proposal writing (Amudavi, 1993). These groups, when well managed play a key role in empowering farmers by pooling them together so that they are able to benefit from economies of scale (MoA, 2004). This way the SC extension strategy was indicated to influence the dissemination of dairy goats' technologies in the District.

Other benefits associated with group approach to extension include provision of inputs and credit; processing and marketing of produce; collection and dissemination of marketing information to members; conducting membership education; provision of training on technical and organizational issues; and lobbying and advocacy on behalf of their members among other benefits (Groverman, 1994; MoA, 2004). These results further confirm studies by Eberle and Shroyer (1997) that working with clusters of farmers is much more effective than working with single farmers to multiply impacts. The findings are also in conformity with the description of SC strategy that it is based on active thinking and learning techniques and participatory training methods (Dilts & Pontius, 1998; Miagonstovich, 1999; Mwagi, 2004).

4.5.2 The influence of Study Circle Extension Strategy

The following hypothesis was formulated to test for significant influence of study circle extension strategy on dissemination of dairy goat technologies among smallholder farmers in Nyando District:

Ho₂. SC extension strategy does not significantly influence the level of dissemination of DGT among smallholder dairy goat farmers in Nyando District.

This hypothesis was tested using Chi-square (X^2) at probability $\alpha=0.05$. It was considered appropriate since it looked at comparative analysis of SC and NSC.

The results are presented in Table 19.

Table 19: Chi-Square (X^2) Test Result for the Influence of SC Extension Strategy on Dissemination of DGT among Smallholder Dairy Goat Farmers in Nyando District

	Value	df	Asymp. Sig. (2-sided)
Pearson chi-square	45.073(b)	1	0.000
Likelihood ratio	56.207	1	0.000
Linear-by-linear association	44.663	1	0.000

The Chi – square test results confirm that SC extension strategy has significant influence on dissemination of dairy goat technologies (Calculated $X^2 = 45.073$; tabulated $X^2 = 3.84146$; $df = 1$; p value 2-sided = $0.00 < 0.025$) hence the null hypothesis is rejected and the obtained difference between the two groups is regarded significant. The alternative hypothesis is accepted. SC extension strategy could have influenced dissemination of DGTs since it is participatory and encourages individual members' ideas and decisions on self defined interests. This is in agreement with the findings of World Bank (2001) that there are evidences that long economic and environmental successes are coming about when people's ideas and knowledge are valued and power given to them to make decisions independently. Further, participation is an important tool through which people have "buy-in" benefits into a project. That people commitments are

enhanced and there is sense of ownership in the project by the people hence adoption of the disseminated technologies.

4.5.3 Influence of Study Circle Characteristics

The following hypothesis was formulated to test for significant influence of study circle characteristics on dissemination of dairy goat technologies among smallholder farmers in Nyando District.

Ho₃. SC characteristics (membership, gender composition, networking capacity, cohesiveness) do not significantly influence the dissemination of DGT among smallholder farmers in Nyando District.

This hypothesis was tested using multiple regressions. It was considered appropriate since the researcher was looking at the contribution of each study circle characteristics, which included membership, gender composition, networking capacity and cohesiveness. The significance of β coefficient of the independent variable was tested at α level of 0.05. Linear model was used to estimate the line of best fit. Results are presented in Table 20.

Table 20: Result of multiple regression analysis of Study Circle characteristics

Model		Unstandardized coefficients		Standardize coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	31.430	25.960		1.211	0.232
	Age of SC	-0.015	0.013	-0.360	-1.138	0.261
	Membership	-0.004	0.005	-0.176	-0.783	0.437
	Gender composition (% women)	-0.122	0.354	-0.114	-0.345	0.731
	SC group networking index	0.226	0.247	0.208	0.917	0.364

R square (R^2) = 0.078

The regression model showed that all the variables were not statistically powerful since they came out with negative signs hence the null hypothesis is not rejected and the obtained influence of these characteristics on dissemination of dairy goat technologies is not significant.

The null hypothesis that there is no significant influence is accepted. The square of correlation coefficient (R^2) was used to show the percentage of the total variation of the dependent variable that is explained by the addition of the independent variable in the model. High R^2 would have been important for the model to help predict future dissemination of DGT in relation to study circle characteristics analysed in this study. There is, therefore, not enough evidence to support possible claim that study circle characteristics significantly influence dissemination of dairy goat technologies among the SC respondents. R^2 value = 0.078(7.8%).

These factors (age, membership, gender composition, networking capacity) accounted for 7.8% of the variation in Farmers' Group Dissemination Index (FGDI). These characteristics, therefore, do not predict dissemination. The strategy is important but the characteristics should not be used to predict the level of dissemination.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary and conclusions from the findings of the study. The chapter also highlights the methodology used in the study, location, sample population and research findings. Conclusions and recommendations are also discussed.

5.2 Summary of the Research Findings

The study was to investigate the influence of study circle on dissemination of dairy technologies in Nyando district. The study was necessary because the performance of dairy goat has remained low even after using multidisciplinary teams such as Heifer Project International to disseminate technologies to farmers. The low dissemination levels of the technologies affected the overall production of dairy goats in the study area. The study adopted a survey design and used an *expost-facto* research approach as it takes care of events that have already occurred. Data was collected from a sample of 110 farmers.

Based on the study objectives, hypotheses and data analysis, the following research findings are presented:

- (i) Dissemination of dairy goat technologies was generally low in the District. The study showed that 74.5% of the respondents had low dissemination while only 25.5% had moderate dissemination.
- (ii) Study Circle extension strategy influences dissemination of dairy goat technologies. A hypothesis formulated to capture level of dissemination of dairy goat technologies showed that, the performance of SC participants was higher than Non-SC participants. There was significant difference among the means of the two farmers' categories ($t = 12.032$; $df = 1.08$; $p = 0.000$). The attributes of the SC strategy that led to a better dissemination of the SC groups included the active involvement of the farmers in technology activities, teaching of special topics, regular meetings, democratic elections of officials, group dynamic activities and initiation of income generating activities.
- (iii) That SC Extension Strategy had significant influence in the dissemination of dairy goat technologies such as stall feeding, use of concentrates, minerals, bucket

feeding, sanitary pails for milking, washing of udder before milking, castration of males and control of mating ($X^2 = 45.073$; $df = 1$; p value 2 sided = $0.00 < 0.025$).

(iv) That Study Circle characteristics had no significant influence in the dissemination of dairy goat technologies (R^2 value = 0.078). Hypothesis on SC characteristics showed the variables were not statistically powerful in determining dissemination of DGTs. These characteristics only contributed 7.8% of the total variation of the dependent variable. Therefore, they cannot be used to predict future dissemination of DGTs.

5.3 Conclusions

In view of the findings of the study, the following conclusions are drawn:

1. Dissemination of DGTs in Nyando District is generally low. The fact that there was better dissemination among Study Circle compared to Non-Study Circle farmers in Nyando District implies there were more favourable conditions for the dissemination of the technology and the associated technology practices in SC groups of the study area than the other (NSC). This may not be the geographical suitability, but the dissemination pathway method used, hence more exposure to the technology and the associated technology practices. This led to the conclusion that there is need to enhance technology dissemination in the District using participatory group strategies.
2. From the study findings, it appears that dissemination of DGTs were better within SC participants than NSC participants. The implication of this is that there is need to mainstream SC into conventional extension approaches for enhanced dissemination of agricultural technologies that are sensitive to the local farmers' physical, economic, and socio-cultural environment and needs. This would translate to increased adoption of technologies hence productivity. SC extension strategy therefore needs improvement to be important in technology dissemination. Other factors could apparently be responsible.
3. By subjecting the responses from SC participants and NSC participants to t-test, the mean scores between the two farmers' categories showed a significant difference. It was shown that SC participants were better than NSC. This leads to the conclusion that SC strategy is superior to conventional method in dissemination of technologies and thus can greatly

accelerate development. The strategy fosters self-confidence among the participants and puts emphasis on joint decision-making.

4. By subjecting the responses from SC participant and NSC to t-test, the findings revealed that the obtained difference between the two groups was significant. This means that SC influences dissemination of technologies. The members of SC interact closely when carrying out joint activities, which help to cultivate an element of togetherness among the participants.
5. SC characteristics such as size, age, gender composition and networking capacity are not related to the dissemination of dairy goat technology and the associated technology practices. These factors were not statistically powerful in determining dissemination. Therefore, they cannot, in themselves, be used to determine effectiveness of SC in technology dissemination.

5.4 Recommendations

In the view of the above conclusions, this study makes the following recommendations:

1. Ministry of Agriculture and other Extension Service Providers should use Participatory Extension Strategies such as SC more in the Dissemination of Agricultural Technologies among farming communities.
2. A team of SC farmer facilitators should be identified from among the farmers who have participated in SC so that they can be utilized for up-scaling the SC strategy within the farming communities and also to improve on the strategy. This will complement extension work.
3. The dissemination of dairy goat technologies through SC strategy should be strengthened so that the farmers get an opportunity to understand and address emerging issues emanating from trying the technologies at the farm since the technologies are new to the respondents

5.5 Suggestion for Further Research

1. Institutional factors influencing dissemination and adoption of dairy goat technology using Study Circle extension strategy. These factors were not studied in this study but could have influence on the adoption of the technologies.
2. A study is done on the influence of policy and technology factors on dissemination and adoption of dairy goat technologies using Study Circle extension strategy.

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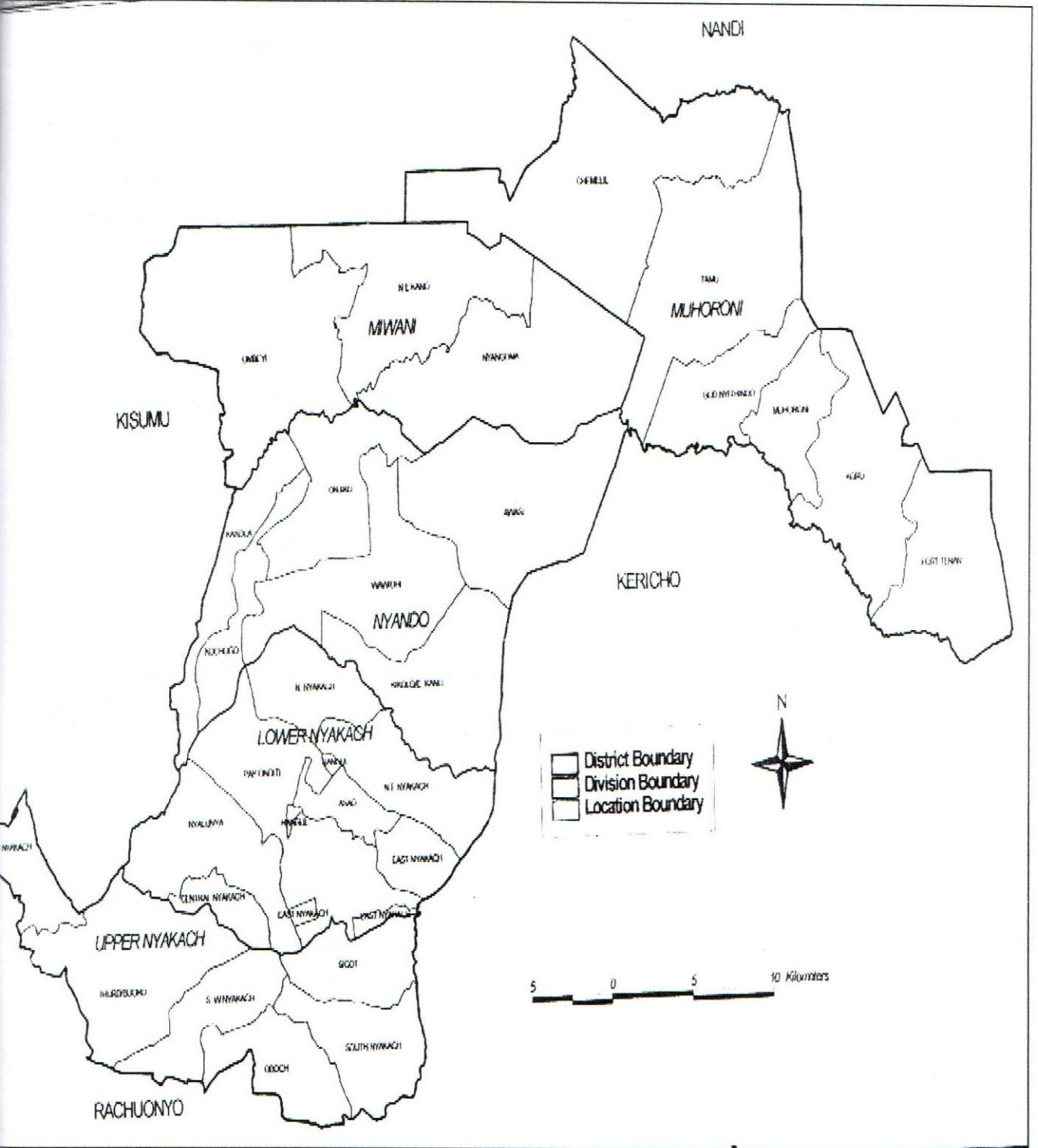
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APPENDICES

APPENDIX A: MAP OF NYANDO DISTRICT SHOWING STUDY SITES



APPENDIX B: QUESTIONNAIRE FOR SMALLHOLDER DAIRY GOAT FARMERS

You are kindly requested to participate in this study on **Influence of Study Circle Extension Strategy on Dissemination of Dairy Goat Technologies among Smallholder Farmers in Nyando District, Kenya**. The information you provide will remain confidential and will only be used for the purpose of this research and will form a basis for improvement of the Agricultural Extension in Kenya.

Questionnaire No. []

SECTION A: Study Circle (SC)

(1) Is the respondent a member of the SC group?

- Yes
- No

(2) If yes, is the SC group registered?

- Yes
- No

(3) (i) Which year was your SC formed? -----

(ii) How long have you been a member of study circle?-----Years

(4) How many farmers are you in the Study Circle? -----

(5) What is the gender composition of your SC members?

Males-----

Females-----

(6) How are the leaders of your study circle chosen?

- Members hold democratic Elections
- Leaders are self-imposed
- Provincial administration selects leaders for the study circle
- Extension staffs select leaders for the study circle

(7). How often does your study circle meet?

1. Never
2. Rarely
3. Frequently
4. Very frequently

(8) (i) Is your group a member of study circle network?

Yes

No

(ii) If yes, which type of network is your group linked to?

Location network

Division network

District network

National network

Others (specify)-----

(9) Indicate by ticking (√) to what extent your group has linkages with the following institutions..

Group/Institution	Frequency of Contact				
	Never (1)	Rarely (2)	Moderately (3)	Frequently (4)	Very Frequently (5)
Other SCs					
Other Farmer Groups					
NGOs					
Government Line Ministries					
Micro finance Organization					
Government Credit Services					
Marketing Agencies					
Other Organizations					

(10) How effective was study circle in influencing your perception on: - (Tick (√) against the appropriate activity under your perception).

Activity	NA=Not applicable (1)	IE=Ineffective (2)	EF=Effective (3)
Extension service			
Interaction with other farmers			
Adoption of recommended DGT			
Utilization of indigenous knowledge			
Group activity			

Knowledge Acquired in Dairy Goat Production

(11) How much new knowledge did you acquire from study circle on each of the following activities: - (Tick (√) against the appropriate activity under the selected scale where 1= low 2=average and 3=high).

Activity	Low (1)	Average (2)	High (3)
Fodder establishment			
Feeding of dairy goats			
Housing			
Breed selection			
Breeding			
Disease/pest control			
Clean milking production			
Making products from milk			

(12) How satisfied were you with the amount of knowledge acquired from study circle in each of the following topics? (Tick (√) against the appropriate topic under the selected scale where 1= low 2=average and 3=high).

Topic	Low (1)	Average (2)	High (3)
Fodder establishment			
Feeds and Feeding			

Housing			
Breed selection			
Breeding			
Disease and pest control			
Clean milking production			
Value addition			

(13) To what extent have you applied the knowledge acquired in the following activity in raising your dairy goats? (Tick (√) against the appropriate activity under the selected scale where 1= low 2=average and 3=high) (*Observation by enumerator*).

Topic	Low (1)	Average (2)	High (3)
Fodder establishment			
Feeds and Feeding			
Housing			
Breed selection			
Breeding			
Disease and pest control			
Clean milking production			
Value addition			

Skills Acquired in Dairy Goat Production

(14) In dairy goat production, how much new skill did you acquire from study circle in each of the following activity? (Tick (√) against the appropriate activity under the selected scale where 1= low 2=average and 3=high)

Activity	Low (1)	Average (2)	High (3)
Fodder establishment			
Feed rations			
Housing			
Breed selection			
Breeding			

Vaccination			
Spraying/dipping			
Clean milking production			

(15) How satisfied were you with the amount of skills acquired regarding the following activity in raising dairy goats? (Tick (√) against the appropriate activity under the selected scale where 1= low 2=average and 3=high).

Activity	Low (1)	Average (2)	High (3)
Fodder establishment			
Feed rations			
Housing			
Breed selection			
Breeding			
Vaccination			
Spraying/dipping			
Clean milking production			

(16) To what extent have you applied the skills in the following activities in raising your dairy goats? (Tick (√) against the appropriate activity under the selected scale where 1= low 2=average and 3=high) (*Observation by enumerator*).

Activity	Low (1)	Average (2)	High (3)
Fodder establishment			
Feed rations/conservation			
Housing			
Breed selection			
Breeding			
Vaccination			
Spraying/dipping			
Clean milking production			

(17) In view of your involvement in study circle, to what extent have you now visited the following for more information than before? ((Tick (√) where appropriate)

Visit to:	Not Visited (1)	Less than Before (2)	More than before (3)
Extension officers			
Agricultural show			
Research centres			
Others (specify)			

(18) Please rate by ticking (√) the number of how satisfied you were with the following study circle extension strategy activities

Study Circle extension Strategy Activity	Level of Satisfaction				
	Very Dissatisfied (1)	Dissatisfied (2)	Uncertain (3)	Satisfied (4)	Very Satisfied (5)
SC facilitators					
Field day organization					
Follow-up visits by SC facilitators					
SC educational tour					
SC training packages					
Group dynamics through SC					

(19) What suggestions do you have for improving the effectiveness of Study Circle Strategy for enhanced Dairy Goat Technology dissemination?

1. -----
2. -----
3. -----
4. -----
5. -----

SECTION B: Farmers Knowledge on Dairy Goat Technology

(20) Feeding (tick (√) most common)

(a) Feeding type

- Herded
- Paddock
- Tethered
- Stall fed
- Yard
- Free grazing

(b) How are your goats watered?

- Goats go to water
- Water is provided
- Both

(c) How frequent do you water your goats?

- Freely available
- Once a day
- Twice a day
- Others (specify)-----

(d) How is the water quality? (*Observation by enumerator*)

- Good/clear
- Muddy/not clear
- Salty
- Smelly

(e) (i) Do you feed concentrates? 1. Yes 2. No

(ii) If yes, how do you feed?

- Fed with fodder
- Separately
- Both

(f) How do you feed green fodder?

- Chaffed
- Unchaffed

(g) (i) Do you use crop residues? 1. Yes 2. No

(ii) If yes, how is it fed?

- Chaffed
- Unchaffed

(h) Do you use minerals? 1. Yes 2. No

(i) How do you feed the kids?

- Allowed to suckle
- Restricted suckling
- Bucket feeding
- Others (specify)-----

(21) Housing (tick (√) if present)

(a) Type of housing (*Observation by enumerator*)

- Stall
- Yard
- None
- Others (specify)

(b) Form of housing

- Roofed
- Solid wall
- Floor (a) concrete
 - (b) Wooden
 - (c) Earth
 - (d) Slated

(c) Cleanliness of housing structure

1. Clean
2. Satisfactory

3. Unclean

(22) **Milking of dairy goats**

(a) Place of milking

1. Stall
2. Common milking shed
3. Others (specify)

(b) Hours of milking

- A.M
- P.M
- Noon

(c) Are udder washed before milking? 1. Yes 2.No

(d) Are sanitary pails used for milking? 1. Yes 2.No

(e) How many dairy goats do you have?

Males.....

Females.....

(f) How many litres of milk do you get from your dairy goats per day? -----Litres

(23) **Management** (*tick (✓) one or more*)

(a) (i) Do you castrate?

- Yes
- No

(ii) If yes, say why?

- Control breeding
- Improve meet quality
- Better temperament
- Others (specify)-----

(b) At what age do you castrate?

- Less than 3 months
- 3-6 months
- 6-12 months

Over 12 months

(c) (i) Are your goats sold? 1. Yes 2.No

(ii) What are the reasons for culling/disposal/

Size

Conformation

Colour

Health

Body condition

Performance

Old age

Poor fertility

Others (specify

(24) Breeding (*tick (✓) one or more*)

(a) Primary reason for keeping bucks

Breeding

Socio-cultural

Capital revenue (hire)

(b) Give reason for choice in (a) above.

Size

Conformation/Shape

Colour

Horns

Performance

Availability (no choice)

Others (specify)-----

(c) How do you mate your goats/

Uncontrolled

Hand mating/AI

Group mating

(d) Age at first mating (in months) Males-----Female-----

Age of service after kidding-----

(e) Source of buck used in the flock

1. Own buck (bred)
2. Own buck (bought)
3. Buck donated
4. Buck borrowed
5. Communal area buck
6. A.I
7. Project buck

(25) How do you rate the knowledge acquired on dairy goat technologies through training packages from the following subject matter (Circle one using the key provided)

Key: 1. None 2. Low 3. Moderate 4. High 5. Very high

Dairy Goat Technology	Level of knowledge				
	1	2	3	4	5
1. Fodder and pasture establishment (Types, planting and use of inputs)	1	2	3	4	5
2. Feeding (Fodder, water and concentrates, Quality)	1	2	3	4	5
3. Housing (Type and form)	1	2	3	4	5
4. Cleanliness of housing structure	1	2	3	4	5
5. Milking of goats (Place, timing and sanitation)	1	2	3	4	5
6. Flock management (Castration, recording system, Culling and mating)	1	2	3	4	5
7. Breeds (Types and sourcing)	1	2	3	4	5
8. Breeding system (open, closed nuclear, buck circle or female migrates between flocks)	1	2	3	4	5
9. Pests and disease control (Vaccination, tick control etc)	1	2	3	4	5
10. Record keeping (Sales, fertility, survival traits, yearling and maturity weight)	1	2	3	4	5

Thank you for your cooperation

APPENDIX C: RESEARCH AUTHORIZATION

REPUBLIC OF KENYA



NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telegrams: "SCIENCETECH", Nairobi
Telephone: 254-020-241349, 2213102
254-020-310571, 2213123
Fax: 254-020-2213215, 318245, 318249
When replying please quote

Our Ref: **NCST/5/002/R/418/4**

P. O. Box 30623-00100

NAIROBI-KENYA

Website: www.ncst.go.ke

Date: **28th May 2009**

Mr. Osewe Daniel Ochieng
Egerton University
P.O. Box 536
EGERTON

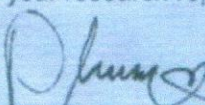
RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on, *Influence of Study Circle Extension Strategy on Dissemination of Dairy Goat Technologies among Smallholder Farmers in Nyando District*

I am pleased to inform you that you have been authorized to carry out research in Nyando District for a period ending 30th July 2009.

You are advised to report to the District Commissioner, the District Education Officer and the District Agricultural Officer, Nyando District before embarking on your research.

On completion of your research, you are expected to submit two copies of your research report to this office.


PROF. S. A. ABDULRAZAK Ph.D, MBS
SECRETARY

Copy to:

The District Commissioner
Nyando District

The District Education Officer
Nyando District

The District Agricultural Officer
Nyando District

THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss..... OSEWE DANIEL
OCHIENG

of (Address)..... EGERTON UNIVERSITY
P.O. BOX 536 EGERTON

has been permitted to conduct research in.....

..... Location,
NYANDO District,
..... NYANZA Province,

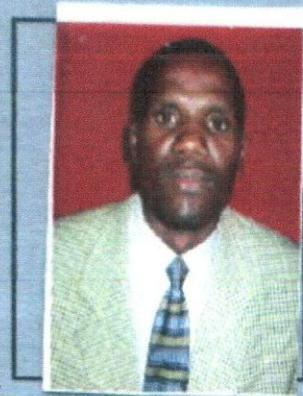
on the topic..... INFLUENCE OF STUDY CIRCLE
EXTENSION STRATEGY ON DISSEMINATION
OF DAIRY GOAT TECHNOLOGIES AMONG
SMALLHOLDER FARMERS IN NYANDO
DISTRICT

for a period ending..... 30TH JULY 09
....., 20.....

Research Permit No. NCST/5/002/R/418

Date of issue 28.5.2009

Fee received SHS.1000.00



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Applicant's
Signature

[Signature]
Secretary
National Council for
Science and Technology

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