SOCIAL ECONOMIC FACTORS INFLUENCING ADOPTION OF LIVESTOCK PRODUCTION TECHNOLOGIES IN KENYA: A CASE OF "MIFUGO NI MALI" RADIO PROGRAMME MAKUENI COUNTY

ARON MUKIIRI RINGERA

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DECLARATION

I declare that this research project report is my original work and has not been submitted for an award in any other university or college

Signature: ……. Date……..

REG. No. L50/69608/2013

ARON MUKIIRI RINGERA

This research project report has been submitted for examination with my approval as the University Supervisor.

Signed…… Date ……

DR. FRONICA MONARI
School of business and Economics
Jaramogi Oginga Odinga University of science and technology

DEDICATION

This research project report is dedicated to my parents Geoffrey M'Ringera and Harriet Kabiti for their bringing up and inspiration.

In the same strength I wish to dedicate the study to members of my nuclear family namely my wife, Irene Kagendo my son, Collins Mutugi and daughter, Feslista Nkatha for their support during the period of my study.

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ABBREVIATIONS AND ACRONYMS

ASALs	:	Arid and Semi-Arid Lands
CBO	:	Community-Based Organization
CIDP	:	County Integrated Development Plan
DOI	:	Diffusion of innovation
FAO	:	Food and Agriculture Organization
FFS	:	Farmer Field Schools
GFRAS	:	Global Forum for Rural Advisory Services
GoK	:	Government of Kenya
ICT	:	Information and Communication Technology
MTEF	:	Medium Term Expenditure Framework
NACOSTI	:	National Commission for Science Technology and Innovation
NGO	:	Non-Governmental Organization
SPSS	:	Statistical Package for Social Sciences
SSA	:	Sub Saharan Africa

ABSTRACT

The level of livestock improvement technologies disseminated and adopted by the target audience needs to be investigated. Information dissemination is slowly gaining momentum as a complimentary factor in promoting agriculture in the rural areas. The study sought to establish the social economic factors influencing adoption of livestock production technologies in Makueni County in Kenya. The specific objectives were to: establish influence of training on adoption of livestock production technologies in Makueni County in Kenya, establish influence of cost of implementation on adoption of livestock production technologies in Makueni County in Kenya, establish influence of farmer attributes on adoption of livestock production technologies in Makueni County in Kenya and establish influence of dissemination of information on adoption of livestock production technologies in Makueni County in Kenya. Descriptive research design was utilized in this study. The target population was 129 including livestock farmers registered in "Mifugo ni Mali" programme and livestock extension officers in Makueni County. The sample size was 86 respondents. The data was collected using questionnaires. The collected data was sorted, cleaned and analyzed to give frequencies and inferential statistics by use of using Statistical Package for Social Sciences (SPSS Version 25.0). The study found that training greatly influence adoption of livestock production technologies in Makueni County, Kenya (43%). The study also established that on farm training of farmers influence adoption of livestock production technologies in Makueni County, Kenya to a great extent (Mean = 4.114). The study concluded that dissemination of information (Pearson correlation coefficient = 0.836) had the greatest influence on adoption of livestock production technologies in Makueni County, Kenya, followed by training (Pearson correlation coefficient = 0.769), then farmer attributes (Pearson correlation coefficient = 0.774) while cost of implementation (Pearson correlation coefficient = 0. 0.672) had the least effect on adoption of livestock production technologies in Makueni County, Kenya. The study recommends that there is a need for the county government of Makueni in conjunction with national government of Kenya to come with strategies of reducing the cost of implementing the livestock production technologies. The study further recommends that there is need for farmers and extension officers to be trained on livestock production technologies and other technologies that can positively contribute to high productivity among farmers. Further studies are recommended on; effect of government support on adoption of livestock production technologies and another area would be on the challenges facing the farmers in adoption of livestock production technologies.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Agriculture is an important sector of the world economy. According to Food and Agriculture Organization (FAO), (FAO, 2005) 2.57 billion people depended on agriculture, hunting, fishing or forestry for their livelihoods at the beginning of the new millennium. In their findings Mwombe, Mugivane, Adolwa and Nderitu (2014) adds that the main source of livelihood in Africa that is depended by over 70% of the total population is small scale agriculture. However, agricultural practices without technology are meaningless. Technological renaissance in agriculture started Mesopotamia, Egypt then spread to other countries such as China, Parts of America (Swanson and Rajalahti, 2010). Agricultural extension evolved in nearly four thousand years though its full utilization became in full force over the last two decades (Swanson & Rajalahti, 2010). The current agricultural extension works were first described by Oxford and Cambridge University programs in 1867 that saw the extension of the learning programs into the neighboring communities (Swanson & Rajalahti, 2010). According to Global Forum for Rural Advisory Services (GFRAS, 2012), extension services are important to farmers since they enable them take up innovations that will improve their production while protecting the environment. Agricultural extension can simply be translated to the positive effects on knowledge, adoption, and productivity. Since then, the initiatives of the "modern" extension started spreading in majority of the world's countries in 1950s and 1960s (Obisesan, 2014).

Technology is one of resources for agricultural production. According to Meijer, Catacutan, Ajayi, Sileshi and Nieuwenhuis (2015), definitions of technology differ widely, depending on whether the intent is to embrace the totality of human works, in all societies and during allepochs. Obisesan (2014) reported that technology is a design for instrumental action that reduced the uncertainty in the cause and effect relationships involved in achieving a desired outcome. Technology comprises of two components, hardware and soft-ware. The hardware consists of physical tool that embodies technology. The software consists of information base for the tool. In Mbashilas' classification (2012), "technology–as–objects" encompasses the entire range of fabricated items intended for some use or other, including tools, utensils, utilities, apparatus and machines. Kushwah, Singh and Singh (2017), "technology–as–process", includes most importantly the activities we commonly denote as making and using.

The key element here is that of skill defined as ‘proficiency in the use of artefact’. Khanal (2013) distinguished technique from technology. Technique refers to skills, regarded as capability of particular human subjects, and technology means a corpus of generalized, objective knowledge, insofar as it is capable of practical application.

There are number of factors that influence the extent of adoption of technology such as characteristics or attributes of technology; the adopters or clientele, which is the object of change; the change agent(extension worker, professional); and the socio-economic, biological, and physical environment in which the technology take place. Farmers have been seen as major constraint in development process. They are innovators or laggards. Socio-psychological trait of farmers is important (Mwombe, Mugivane, Adolwa & Nderitu, 2014). The age, education attainment, income, family size, tenure status, credit use, value system, and beliefs were positively related to adoption. The personal characteristics of extension worker such as credibility, having a good relationship with farmers, intelligence, emphatic ability, sincerity, and resourcefulness, ability to communicate with farmers, persuasiveness and development orientation (Odira, 2014). The biophysical environment influences the adoption. The conditions of the farm include its location, availability of resources and other facilities such as roads, markets, transportation, pests, rainfall distribution, soil type, water, services and electricity. For instance, farmers whose farms were irrigated were the earliest adopters of new rice varieties, while those without water were the late adopters. The innovation diffuses slowly if product price is low (Oswald, 2019).

Agricultural extension is a cost-effective way that is utilized by the farmer with a return rate of 13-500% thus improving farmer productivity and income (GFRAS, 2012). However, the return rate is directly proportional to the uptake of the technology that is both economically and socially inclined (Morton, Bandara, Robinson, & Carr, 2012). Each extension programs has different diverse goals which translate to varying levels of strengths and weaknesses and therefore a farmer must be well knowledgeable of the type of programme to use before the adoption (Mbashila, 2012). Agricultural extension links farmers to research institutions. Agricultural extension in Kenya can be traced back during the colonial period in the colonial agricultural policy of 1945, which outlined the supply of agricultural advice to both small scale and large scale farmers using the available extension methods and services. Training is a key aspect for agricultural extension which can be offered in well-organized conferences or through the media (Mburu, 2013). Trainings that do not require attendance are ideal for farmers such as women who lack the time and ability to travel for training due to

engagements in other activities. The benefits of the extension services after training is measured by the ability to adopt new practices solve problems and embed themselves dynamically in agricultural value chains (Manfre & Nordehn, 2013).

The major factors influencing adoption of innovations are age, farming experience and household size. New technological extension services will remain meaningless unless adopted by the farmers. The increasing advancements in Information and Communication Technology (ICT) have the potential to increase agricultural productivity. This is achievable through communications to the rural farmers who are majorly the main contributors of agriculture, provision of capacity building, enhancement of accessibility to markets and credit, scaling up interventions in the extensions development and restructuring extension services (Lokshina, Durkin & Lanting, 2019). According to Manfre and Nordehn (2013) study findings there is a heavy reliance on local radio for agricultural information and an almost religious trust in radio by the farmers. There is a need for the government to educate small-scale farmers on ICTs to enable them to acquire agricultural information that can develop skills to improve and increase their farm output (Mburu, 2013).

Globally, in Japan, agricultural agencies actively facilitate integrated knowledge creation and sharing initiatives in agriculture based institutions (Zakaria, & Nagata, 2010). In Kenya, there was a goal set to achieve modern, innovative and competitive agricultural sector with a growth rate of 7% per year through the intervention of the Agriculture Sector Development Strategy of (2010- 2020). This strategy's main aim was to increase production as well as efficiencies in marketing mostly for the small-scale farmers whose production was believed to account for 70% of marketed (Djane & Ling, 2015).

According to George, Simba and Yonah, (2014) it is important to take into consideration non-technological factors in order to introduce the technology into agriculture such as the role of teachers in an educational technology project, information. In delivering extension services (animal husbandry), extension officers also need information from farmers, such as animal profile information to give informed advice; hence farmers' recording keeping is a crucial aspect in delivering extension services. The adoption process has five recognized stages: Awareness or Knowledge, Interest or Persuasion, Evaluation or Decision, Trial or Implementation and lastly Adoption or Confirmation (Van den Ban & Hawkins, 1988). A study by Davis (2008) notes that understanding and utilization extension is just beyond the transfer of technology to its facilitation and training to learning. Further, it includes assisting

farmers to form farmer groups, handling marketing issues and partnership with other agricultural agencies to offer quality extension services to the farmers. Therefore, agricultural extension entails the support and facilitation of farmers with an aim of solving problems, obtaining information, skills, and technologies so as to improve their livelihoods and well-being (Davis, 2008).

In Africa, where large population lives in rural areas, improved dairy production can provide employment opportunities to the youth and women thus improving household level food security, reduce rural urban migration and increase of national income. Therefore, investment in the dairy sector creates more job opportunities as it is labour intensive and alleviates poverty than other agricultural sectors. It is particularly significant in addressing many challenges faced by youth and women in rural areas (Sanga, Kalungwizi & Msuya, 2013).

Women have been at the center of the target for reaching the smallholder farmers. However, participatory developments have been low though showing potentials of growth in the recent past (FAO, 2010). Various adoptions of new technologies are influenced by various aspects. For instance, Jera and Ajayi (2008) ascertained that dairy herd size, land holding size, membership to a dairy association and agro-ecological locations influence farmers levels of adopting fodder bank. In addition, sex, age, education and size of household are less likely to influence the levels of technology adoption in agriculture. However, with Mmofa and David (2015) states that; age, education level, type of farming, location and sex of the farmers were important aspects to farmers in their perception to climate change and drought.

In Kenya, there are institutions whose mandates is to provide necessary information to farmers. In the Medium Term Expenditure Framework (MTEF) 2012/13 – 2014/15, one of the mandates of the ministry of Livestock is provision and facilitation of extension services Republic of Kenya (2011). According to Kenya agriculture research bill 2012 part VI,31.(1), research institutions are required to achieve three main goals in agriculture extensions; first to identify and disseminate appropriate systems, mechanisms and technology options with an aim of improving agricultural production. Secondly, to provide answers to existing and foreseeable problems that face the crop, livestock, forestry and fisheries production and thirdly to collaborate with other research organizations and institutions to disseminate new agriculture technologies and research results. Food security bill 2014, part II- 5 (2)(m) states the National and County governments are required to Provide an opportunity for the public to develop their understanding, skills and capacity necessary for achieving equitable and

effective participation in the formulation, implementation and monitoring of any policies, strategies or programme interventions aimed at realizing food and nutrition security.

The Kenya Agricultural sector development strategy 2010-2020 defines extension system as '*a product of gradual evolution in extension management practices and the entry of the private sector, non-governmental organizations (NGOs) and civil society players over time in response to changes in economic policies*' (Government of Kenya, 2010). While there continues to be demand for extension services, an evaluation by World Bank found limited progress in institutional development and an extension approach that was neither efficacious nor financially sustainable, Gautam (2000). Since agricultural extension is an activity of sub sequential achievement, it should be noted that several factors have to be put in place such as price. The most cost-effective means of communication in disseminating extension knowledge is the through the media and more specifically the radio since it largely listened in the rural areas where farming is highly practiced (Garforth, 1998).

In Makueni County, Livestock production is largely dependent on the farmers' behavior uptake of modern livestock production technologies as well as their socioeconomic characteristics status. These statuses includes training levels on livestock husbandry, experience, exposure to information, contact with extension agents, knowledge on improved dairy technologies and education levels. Increase in productivity in dairy animals is constrained by inadequate feeds, losses from livestock diseases, inadequate access to inputs and extension services in most of Eastern and Southern Africa. There has reduced adoption of improved breeds, modern breeding systems, and use of concentrates, fodder production, and fodder conservation methods (Makueni County Government, 2013). The current research was designed to assess the adoption levels of these modern livestock production technologies and its impact on livestock production and how socioeconomic factors influence adoption of livestock production technologies in Makueni County.

1.2 Statement of the Problem

There has not been sufficient literature supporting how Social economic factors influence the level of livestock improvement technologies adoption by farmers. There have been various agricultural extension methods applied in Kenya namely; Individual farm visit, Educational tours, Demonstrations, Field days, Courses, Farmer Field Schools (FFS), On-farm trials, Barazas, communication technology, Group visit and Mass media (Nduru, 2011). The radio programmes fall under the mass media method. Kenya Agricultural sector

development strategy 2010-2020 recognizes the reduced effectiveness of extension services and low absorption of modern technology as key challenges to agricultural production

Information dissemination is slowly gaining momentum as a complimentary factor in promoting agriculture in the rural areas given the fact that most households do not have electricity connection to use the television. However, the challenge remains of whether the programmes aired to the farmers are relevant and have any relationship to rural development and productivity (Nakabugu, 2000). A study by Speranza (2010) on how agro-pastoralists in Makueni County, Kenya adapt their livestock production to climate variability and change involving 127 agro-pastoral households revealed that one-third of the households have inadequate feeds, and livestock diseases are major challenges during non-drought and drought periods. Other challenges facing the farmers in adoption of livestock production technologies Makueni County are inadequate training regarding the technologies, high cost of technology implementation and scarce dissemination of information regarding the available livestock production technologies.

Various studies have been done in relation to adoption of livestock production technologies. For instance, Matiri (2019) examined adoption of modern dairy technologies and its impact on milk production in Nzaui Sub-County, Makueni County, Kivunzya (2018) examined the characterization of livestock production systems and its contribution to the food security in Kitui County, Kenya and Kinyangi (2014) did a study on factors influencing the adoption of agricultural technology among smallholder farmers in Kakamega North Sub-County, Kenya. However none of the studies linked social economic factors with adoption of livestock production technologies. Therefore this study sought to bridge this gap by establishing social economic factors influencing the adoption of livestock production technologies in Makueni County in Kenya.

1.3 Purpose of the Study

The purpose of this study was to investigate social economic factors influencing the adoption of livestock production technologies in Makueni County in Kenya.

1.4 Objectives of the Study

The study was guided by the following objectives:

i. To establish influence of training of livestock farmers on adoption of livestock production technologies in Makueni County in Kenya.

ii. To establish influence of cost of implementation on adoption of livestock production technologies in Makueni County in Kenya.
iii. To establish influence of farmer attributes on adoption of livestock production technologies in Makueni County in Kenya.
iv. To establish influence of dissemination of information on adoption of livestock production technologies in Makueni County in Kenya.

1.5 Research Questions

The study sought answers to the following research questions:

i. How does training of livestock farmers influence adoption of livestock production technologies in Makueni County in Kenya?
ii. How does cost of implementation influence of adoption of livestock production technologies in Makueni County in Kenya?
iii. How do farmer attributes influence adoption of livestock production technologies in Makueni County in Kenya?
iv. How does dissemination of information influence on adoption of livestock production technologies in Makueni County in Kenya?

1.6 Significance of the Study

The study findings will to contribute to the advancement of knowledge to the extension service providers on the best way to reach livestock keepers for the optimal implementation of technologies disseminated through radio programmes. Majority of households have radio sets in Kenya, therefore it is expected that by disseminating extension messages through radio broadcasts the, targeted audience will be reached. There are programmes broadcasted through radio targeting livestock keepers hence the need to determine the level of their adoption and be able adjust for the future programmes.

The study findings may give an in-depth insight on the challenges to the livestock keepers which limit the adoption of technologies disseminated through radio broadcast. The stakeholders in Agricultural extensions services including broadcasting stations, County and National governments would learn from the findings of this study on the best ways to disseminate extension messages. The study finding may provide literature for the academia and researchers in the field of agricultural extension.

1.7 Delimitation of the Study

This study was carried out in Makueni County in Kenya. This study established the social economic factors influencing adoption of livestock production technologies in Makueni County in Kenya. The study specifically established the influence of training of livestock farmers, cost of implementation, farmer attributes and dissemination of information on adoption of livestock production technologies in Makueni County in Kenya. The respondents comprised of livestock farmers and livestock extension officers in Makueni County. The study was carried out in a period of three months.

1.8 Limitations of the Study

The encountered limitation was the low ability of the sampled livestock keepers to remember the various messages received through the various broadcast sessions. To overcome this limitation explanation was offered on the said messages and when they were broadcasted. The extension messages broadcasted through the 'Mifugo ni Mali' programme (in English – Livestock is wealth) targeting the livestock were: Watering harvesting for Livestock , Animal feed conservation, Animal diseases control ,Housing and Shelter of Livestock, , Care of the New born and Feeding of the animal.

1.9 Basic Assumptions of the Study

The study assumed that there were no serious changes in the composition of the target population that might influence the effectiveness of the study sample. This study also assumed that the respondents would be honest, cooperative and objective in their response to the research instruments and was available to respond to the research instruments in time. Finally, the study assumed that the authorities in the various offices would grant the required permission to collect data from various stakeholders.

1.10 Definition of Significant Terms Used in the Study

The following are the definitions of terms that were used throughout this study:

Adoption of livestock production technologies: is the acceptance or approval of a new product or innovation or technology that enhances the livestock production

Farmer Attributes: are qualities or characteristics that a farmers possesses or have and include Education, age, Gender, and household size and also farming experience

Training: is the understanding and skills acquisition on what you do or intend to do. It is the continuous process of improving oneself as it improves performance of farmers and the entire agricultural sector

Cost on Implementation: is the total amount of resources used while executing or adopting a livestock production technology.

Dissemination of Information: is the means by which facts about the livestock production technologies are distributed to the farmers and other agricultural stakeholders.

1.11 Organization of the Study

This study was organized in five chapters. Chapter one describes the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations of the study, basic assumptions of the study, definition of significant terms used in the study and the organization of the study. Chapter two comprises literature review on study research topics namely; awareness of livestock production technologies, technology type and attributes, Challenges and the level of adoption of livestock production technologies. Chapter three consists of the research methods to be used in carrying out the study that is; research design, location of study, target population, sampling procedure and sample size, research instruments, validity and reliability of research instruments, data collection and data analysis techniques. Chapter four comprises of data analysis, presentation, interpretation and discussion. The chapter five comprise of the summary, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on factors influencing adoption of livestock production technologies. It discusses the key diverse spectrum of views about factors. The chapter is thus structured into theoretical, conceptual and empirical review. The chapter also presents the knowledge gap the study seeks to fulfill.

2.2 Adoption of Livestock Production Technologies

Technology refers to mechanism/process of using inputs to produce output and to the extent that such processes reduce the amount of inputs needed to produce the given unit of output, such a technology would be deemed to enhance productivity. Besides technology, productivity improvement can also result from efficiency with which technologies are used (Nkamleu, et al., 2010). There is a concurrence in literature that adoption is a sequential process as opposed to a simultaneous event. The process of adoption is characterized by the decision stage that is followed by the intensity stage. A smallholder farmer may consider the specific attributes of the technology in the first step. Subsequently, the second step which is the outcome is manifested in the intensity of adoption. The main assumption is that the smallholder farmer will choose and adopt new technologies that will bring minimal disruption to environment and yields. Further, smallholder socioeconomic characteristics such as asset endowments (livestock owned), contact with extension and years of experience also influence the decision on adoption of technologies and the intensity of adoption of technologies (Shikuku, Valdivia, Paul, Mwongera, Winowiecki, Läderach & Silvestri, 2017).

Increasing agricultural productivity among small holders in developing countries will depends on the levels adoption of new technologies and innovations. Adaptation requires local learning and modifying general scientific principles and technologies to fit specific contexts. This new approach has been recognized as the method of poverty reduction and human development in developing countries. Agricultural production has remained low in the Sub Saharan Africa (SSA) than other regions due to low adoption of technologies (UNDP, 2012). Animal breeding programs in Kenya have largely aimed at improving dairy productivity, shortening calving intervals and enhancing herd fertility among other goals. There is no explicit breeding policy in Kenya but there are various generic policy statements guide breeding programs in the country. Generally, the policy statements aim at increasing

dairy productivity through breeding and selection implemented via wider use of artificial insemination (AI) and bull camps. A further goal is the production of high-yielding and diseases resistant cattle types. The objective is therefore not to eliminate the indigenous gene but to integrate exotic gene to improve productivity while retaining the disease breeds resistance and local adaptability traits of the indigenous gene (Lima, Hopkins, Gurney, Shortall & Kaler, 2018).

One animal breeding technology that has widely been promoted by government is artificial insemination (AI). Until the mid-1980s, there was a well-organized dairy cattle breeding system subsidized by the government that contributed to growth of the smallholder dairy farming system (FAO, 2011). Consequently, AI was used effectively to accelerate uptake of dairy farming by upgrading the local zebus. However due to reduced government involvement in breeding activities, there has seen a gradual replacement of government AI provision by private players, albeit at a slower rate. Nevertheless, private AI services remain quite underdeveloped and this together with the perceived high cost of the service, has led to frequent use of bulls of unknown breeding value across the country. In spite of many years of research and extension efforts, agricultural technologies adoption by farmers has been very low and especially those dealing with livestock. The use of embryo transfer has remained at a low level overall but is common in those stud herds where breeding bulls are produced, particularly those that sell to AI centers. It has also provided a method for importing genes from overseas while keeping down transport costs. Generally, ET is less expensive than live animal importations but it is wholly dependent on the number of calves born per 100 embryos implanted (Nyasimi, Kimeli, Sayula, Radeny, Kinyangi, & Mungai, 2017).

The livestock product marketing system in Kenya can be divided into two sub-systems, formal and “informal”. The collective marketing approach is meant to enhance market access for smallholder dairy farmers who individually may not have sufficient volumes to attract the interest of processors (Kruse, 2012). To avoid the problems of under capacity operation that was evident in several chilling plants, EADD came up with a model aimed at increasing volumes that would profitably sustain the chilling plants. The idea was a hub approach with several productivities enhancing services bundled around the business of the chilling plants. Such services include provision of AI services for upgrading stocks, dedicated extension service for training farmers on feed interventions, animal husbandry practices and animal healthcare services among others (Kruse, 2012).

Improved technology plays a major role in dairy production because it is applicable anywhere as long as traditional constraints are abated (Njarui *et al*., 2009). Therefore, with improved techniques in feeding, breeding and animal health, milk productivity is likely to be a major determinant for income generation among smallholder farmers. What farmers gain from new agricultural technology has a positive effect on the poor households by raising their income, while indirectly raising employment and wage rates on landless labourers. This ultimately lowers the price of food staples as the producers of the food are also the consumers (Nyasimi, Kimeli, Sayula, Radeny, Kinyangi, & Mungai, 2017).

Gillespie *et al*. (2014) studied how the adoption of new technologies was influenced by socioeconomic characteristics such as; age, education, farm size and diversification. The relationship between socioeconomic characteristics of farmers and the decision to adopt has been shown in several studies. Ghimire et al. (2014) noted that the adoption of the new improved rice varieties was significantly influenced by education, access to seed, land ownership and technology characteristics. The impact of adopted new technology on crop productivity is another factor that influences the adoption of technology alongside environmental and biophysical factors (Food and Agriculture Organization for United Nations, 2015). A study by Lambert et al. (2015) showed that the adoption of agricultural technologies by farmers was significantly influenced by the scale of operation, access to information and participation in other programs.

2.3 Training of Livestock Farmers and Adoption of Livestock Production Technologies

Training is the understanding and skills acquisition on what you do or intend to do. It is the continuous process of improving oneself as it improves performance of farmers and the entire agricultural sector. The purpose in any organization is to equip the employees with relevant skills that they lack to be able to perform their duties well and achieve the set goals of the organization at large. It is imperative that agricultural training and extension programmes be intensive enough to promote adoption not only of improved yield-raising technologies, such as improved seeds, but also of fertility-restoring and conservation technologies (Asfaw, Di Battista, & Lipper, 2016).

Training is a fundamental aspect when it comes to livestock production. The ultimate aim of every training and development program is to add value to human resource. Any training and development program that would not add value should be abandoned. Mountney (2017) argues that farmers should therefore make training and development of their continuous

activity. Without training, acquisition of skills can be difficult and without skills organizations will not achieve its objectives through people. Mountney (2017) further notes that, some organizations see training as an expensive venture and may put restriction on training and utilize the money for other activities in the organization.

Synergies need to be created between government departments, non-governmental organizations, researchers, donors and local communities in implementing programs that promote smallholder farmers' adoption of technologies which can increase agricultural productivity and reduce environmental degradation and the deterioration of soil quality. Major problems in sub-Saharan Africa is that year after year extension workers who are hardly afforded in-service training, and are loosely linked to research, continue to disseminate the same messages repeatedly to the same audience. A situation has consequently arisen where the disseminated messages to the majority of the extension audience, have become technically redundant and obsolete (Obisesan, 2014).

Many project leaders take on their first financial management duties without benefit of formal training. Through proper financial management skills, a Community-Based Organization (CBO) can consistently have good tracking and reporting systems hence this further helps uncover inefficiencies in the overall financial management approach. Concerning training and development, what's good for people is good for the organizations in which they work. What's good for people's development is good for organizational performance, quality, effective management and control, and therefore good for the organization (Okunlola, Oludare, Akinwalere, 2011). Training session could aim at developing or improving one of the project leader's competencies. Rightly, organizations are facing great pressure to change these days - to facilitate and encourage whole-person development and fulfillment - beyond traditional training. Many organizations face the challenge of developing greater confidence, initiative, solutions-finding, and problem-solving capabilities among their people (Schewe & Stuart, 2015).

Adoption of improved agricultural technologies involves a process in which awareness is created, attitudes are changing and favourable conditions for actual use of recommended practices are provided to the farmers (Lemma & Trivedi, 2012). Agricultural development strategy at the smallholder level requires some change in knowledge and management skills, which calls for training on improved agricultural practices. It has been a usual trend, such that little is done to follow up and trace back if trained farmers do put in practice the skills they learned, even to establish the extent to which improved farming skills are practiced by

farmers and constraints which trained farmers do face leading to them failing to exercise what they learnt. Farmers' training programmes may operate with an assumption that farmers will put into practice the improved practices they were taught while in reality there might be other factors limiting them. It is important to follow the degree by which the ultimate beneficiaries are actually changing and depicting any problems that have occurred so that measures and or modifications could be advanced to ensure increased use of improved practices (Murai & Singh, 2011)

2.4 Cost of Implementation and Adoption of Livestock Production Technologies

Cost on Implementation is the total amount of resources used while executing or adopting a livestock production technology, high cost of technology as a hindrance to adoption. High cost of labor, other inputs and unavailability of demanded packages and untimely delivery as the main constraints to fertilizer adoption. Cost of hired labor was also reported by Dibraa (2015) as one among other factors constraining adoption of fertilizer and hybrid seed in Embu county Kenya. Off farm income has been shown to have a positive impact on technology adoption. This is because off-farm income acts as an important strategy for overcoming credit constraints faced by the rural households in many developing countries (Chapota, Fatch & Mthinda, 2014).

Off-farm income is reported to act as a substitute for borrowed capital in rural economies where credit markets are either missing or dysfunctional (Diiro, 2013). According to Diiro (2013) off- farm income is expected to provide farmers with liquid capital for purchasing productivity enhancing inputs such as improved seed and fertilizers. For instance, her study when analyzing the impact of off-farm earnings on the intensity of adoption of improved maize varieties and the productivity of maize farming in Uganda, Diiro reported a significantly higher adoption intensity and expenditure on purchased inputs among households with off-farm income compared to their counterparts without off- farm income. However not all technologies has shown positive relationship between off-farm income and their adoption. Some studies on technologies that are labor intensive have shown negative relationship between off-farm income and adoption.

Farmers' decisions about whether and how to adopt new technology are conditioned by the dynamic interaction between characteristics of the technology itself and the array of conditions and circumstances. Diffusion itself results from a series of individual decisions to begin using the new technology, decisions which are often the result of a comparison of the

uncertain benefits of the new invention with the uncertain costs of adopting it. An understanding of the factors influencing this choice is essential both for economists studying the determinants of growth and for the generators and disseminators of such technologies (Djane, & Ling, 2015).

As overhead costs are there no matter how much milk is produced, they are major components of farm costs for low production farms. However, the more milk the farm produces, the lower the overhead costs per kg of milk produced. Overhead costs can then be diluted by increasing farm output. The average cost of production highlights the gains that can be made from having a farm large enough to spread the overhead costs and produce each unit more cheaply than is possible with a smaller sized operation. This is called achieving economies of scale. In addition to the inefficiencies arising from being too small, there can also be inefficiencies from being too large (Hailu, Khan, Pittchar, & Ochatum, 2017). For example, poor farm management can reduce farm output and have a dramatic effect on-farm costs. With higher total overhead costs per hectare of land, the smallholder farmer (with say eight milking cows and one hectare of forage crop) has to spend more before his costs start to cover the variable inputs such as fertilizer and weed control, which are the important inputs to increase forage yields. Therefore, for the same amount of money spent per ha, the larger farmer is at an advantage with a greater proportion of his investment covering the variable production costs (George, Simba, & Yonah, 2014).

2.5 Farmer Attributes and Adoption of Livestock Production Technologies

Farmer Attributes are qualities or characteristics that a farmer possesses or have and include Education, age, Gender, and household size and also farming experience. Human capital of the farmer is assumed to have a significant influence on farmers' decision to adopt new technologies (Agwu, Ekwueme, & Anyanwu, 2013). Most adoption studies have attempted to measure human capital through the farmer's Education, age, Gender, and household size. Education of the farmer has been assumed to have a positive influence on farmers' decision to adopt new technology. Education level of a farmer increases his ability to obtain; process and use information relevant to adoption of a new technology (Lavison, 2013). For instance a study by Okunlola *et al*. (2011) on adoption of new technologies by fish farmers and Angello (2015) on adoption of organic fertilizers found that the level of education had a positive and significant influence on adoption of the technology. This is because higher education influences respondents' attitudes and thoughts making them more open, rational and able to

analyze the benefits of the new technology. This eases the introduction of a new innovation which ultimately affects the adoption process (Sanga, Kalungwizi & Msuya, 2013)

Age is also assumed to be a determinant of adoption of new technology. Older farmers are assumed to have gained knowledge and experience over time and are better able to evaluate technology information than younger farmers (Kariyasa & Dewi, 2011). On contrary age has been found to have a negative relationship with adoption of technology. As farmers grow older, there is an increase in risk aversion and a decreased interest in long-term investment in the farm. On the other hand younger farmers are typically less risk-averse and are more willing to try new technologies. Adoption of genetically modified maize increased with age for younger farmers as they gain experience and increase their stock of human capital but declines with age for those farmers closer to retirement (Amwata, Nyariki, & Musimba 2015).

Gender issues in agricultural technology adoption have been investigated for a long time and most studies have reported mixed evidence regarding the different roles men and women play in technology adoption. In analyzing the impact of gender on technology adoption, Odira (2014) had found no significant association between gender and probability to adopt improved maize in Ghana. They concluded that technology adoption decisions depend primarily on access to resources, rather than on gender and if adoption of improved maize depends on access to land, labor, or other resources, and if in a particular context men tend to have better access to these resources than women, then in that context the technologies will not benefit men and women equally. On the other hand gender may have a significant influence on some technologies. Gender affects technology adoption since the head of the household is the primary decision maker and men have more access to and control over vital production resources than women due to socio-cultural values and norms (Ngongo, 2016)

Household size is simply used as a measure of labor availability. It determines adoption process in that, a larger household have the capacity to relax the labor constraints required during introduction of new technology. Farm size plays a critical role in adoption process of a new technology. Many authors have analyzed farm size as one of important determinant of technology adoption. Farm size can affect and in turn be affected by the other factors influencing adoption. Some technologies are termed as scale-dependant because of the great importance of farm size in their adoption. Small farm size may provide an incentive to adopt a technology especially in the case of an input-intensive innovation such as a labor-intensive or land-saving technology. Farmers with small land may adopt land-saving technologies such

as greenhouse technology, zero grazing among others as an alternative to increased agricultural production (Bello, & Obinne, 2012).

2.6 Dissemination of Information and Adoption of Livestock Production Technologies

Dissemination of Information is the means by which facts about the livestock production technologies are distributed to the farmers and other agricultural stakeholders. Acquisition of information about a new technology demystifies it and makes it more available to farmers. Information reduces the uncertainty about a technology's performance hence may change individual's assessment from purely subjective to objective over time (Nazri, Hassan, Parhizkar, Hassanpour & Yasin, 2012). Exposure to information about new technologies as such significantly affects farmers' choices about it. Mwombe, Mugivane, Adolwa and Nderitu (2014) indicate how, provided a technology is profitable, increased information induces its adoption. However, in the case where experience within the general population about a specific technology is limited, more information induces negative attitudes towards its adoption, probably because more information exposes an even bigger information vacuum hence increasing the risk associated with it (Hart, 2018).

The small scale farmer's choice and decision to adopt any modern agricultural technology requires different types and forms of information and knowledge about the technologies available because, for any technology adoption decision making process to be concluded, access and availability of viable information is very critical. First the farmers must appreciate that the technologies exist; second the farmer know that the technologies are beneficial if adopted and lastly the farmer must understand how to apply the knowledge about the technology effectively on his farm during the adoption process. The three stages require access to credible information to guide the adoption decision making process. Therefore, there must be a smooth flow and access to information from the available information sources to the farmers through effective and efficient communication channels (Irungu, Mbugua & Muia, 2015).

Efficient communication is facilitated by the existence of effective communication channels. Communication channels facilitate the passing of information to the farmers within a community setup with the purpose of influencing knowledge and assessment of the technologies available to the farmers during the adoption process (Kebebe, 2019). There are many different types of information sources available to farmers through which they can access information on modern agricultural technologies so as to facilitate the adoption

process. The information sources mentioned were categorized into four groups namely; face-to-face communication sources, community social networks sources, mainstream media sources and modern ICT tools information sources. Extension officers are also an important information source as they facilitate the passage of information to farmers and thus, enabling the adoption process of new technologies by farmers (Khanal, 2013).

Access to information through the extension officers in the rural context is a more effective method of reaching many farmers than other mainstream media channels. This means that the direct contact between the extension personnel and the small scale farmers greatly boosts the adoption and uptake process of the modern and emerging innovations by farmers (Kushwah, Singh & Singh, 2017). Kipserem, Sulo, Chepng'eno and Korir (2011) also agrees that person to person communication between the extension personnel and the small scale farmers has traditionally been the most important available form of information source to the small scale farmers. Community social networks where information is passed through other farmers, neighbors, work mates and friends for instance, from one farmer who is more knowledgeable about some farming practices to other farmers who are less knowledgeable and exposed on the same practices is another important information source on new technologies to small scale farmers at the community level (Levi & Janina, 2015).

Modern technologies are spread faster when communicated in wider and bigger social networks because they involve many people. 21 Mass media through mainstream communication channels for example; Radios and Television sets are other sources of information and communication channels available to small-scale farmers for obtaining information and knowledge about the existing modern agricultural practices. Mass media is more effective in creating awareness because with the advent of modern ICT tools mass media channels distribute their contents digitally in local dialects (Toborn, 2011).

Agricultural extension, which depends to a large extent on information exchange between and among farmers on the one hand, and a broad range of other actors on the other hand, has been identified as one area in which ICTs can have a particularly significant impact. Extension agents as intermediaries between farmers and other actors in the agricultural knowledge and information system are especially well-placed to make use of ICTs to access expert knowledge or other types of information. According to Gakuru et al., (2009), ICTs have become increasingly integrated into the dissemination of agricultural information throughout Africa. Traditional forms of ICTs such as radio and television have become more prevalent in advisory service provision by producing programmes that feature agricultural

information. National ministries of agriculture have attempted to integrate ICTs into the delivery of information and have established district information centres providing agricultural information (Lokshina, Durkin & Lanting, 2019).

2.7 Theoretical Framework

This section discusses the theoretical foundation on which the study is anchored. The study was grounded on system theory, stakeholder theory and theory of change.

2.7.1 Innovation Diffusion Theory

This study was anchored at the Rogers's theory on adaptation and diffusion of innovation (DOI) which was developed in 1962. This theory brings guidance and understanding on the uptake of new agricultural technologies and communication development for farmer decision-making models in the tropics (Meijer *et al*., 2015). The spread of innovation through channels is influenced by five main elements (Dibraa, 2015; Rogers, 2003) which include; innovation, communication channels, time, social system and human capital. This forms the five categories of the adopters; first are the innovators who are the people to be the first ones in trying nee innovation, ventures and new ideas. The second category is the early adopters who are the opinion leaders equipped with the knowledge for the need to change and willing to adopt new ideas that accommodate the change. The third category is the Early Majority who are rarely leaders and mostly needs to be proved through success stories and evidence that the new innovation works for them. The fourth group is the Late Majority who are skeptical to change and adopts technology after it has been tried by many people. The last is the fifth group called the Laggards who are conservative and bound by traditions. They are difficult to bring them on board and can only be easily convinced by statistics, peer pressure and fear appeals (Rogers, 2003).

The Diffusion of Innovations theory was the leading theory in agricultural extension post World War II until the 1970s. It is still used today in agricultural extension, particularly when extension is concerned with an adoption of a particular technology (i.e. technology transfer approach to extension) (Aizstrauta, Ginters & Eroles, 2015).This theory is relevant to this study as it assists in understanding how social economic factors such as training, cost of implementation, farmer attributes and dissemination of information lead to successful adoption of livestock production technologies

Rogers's theory on adaptation and diffusion of innovation Figure 2.1 is a suitable theoretical model considered for this study.

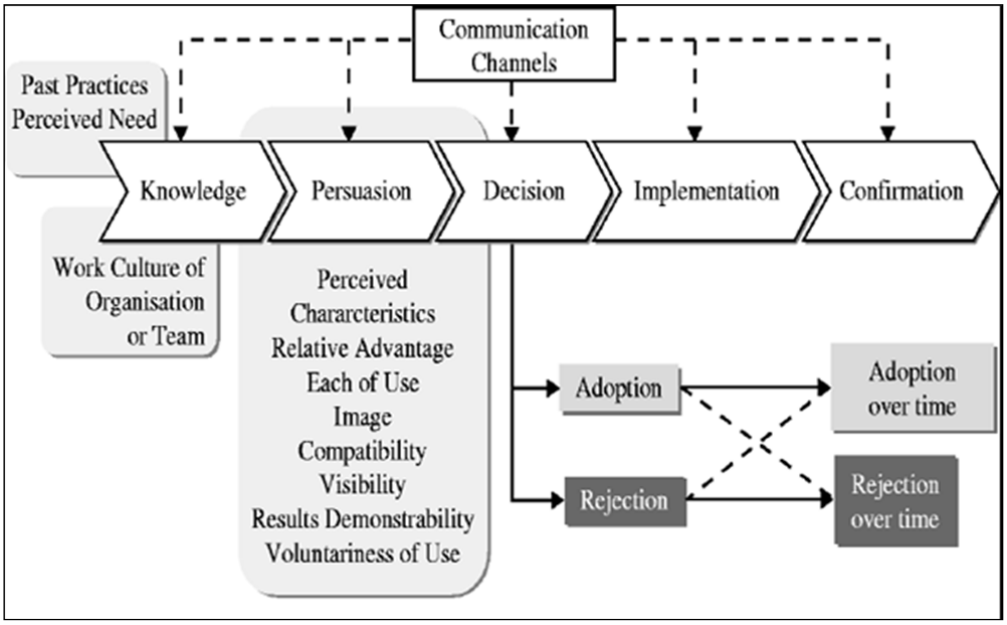

Figure 2.1: Adaptation and diffusion of innovation Theoretical Framework

Source: This is Google's cache of https://extensionaus.com.au/extension-practice/diffusion-of-innovations-theory-adoption-and-diffusion/. It is a snapshot of the page as it appeared on 14 Jul 2018 10:23:44 G.

2.8 Conceptual Framework

A conceptual framework is a figure that shows the relationship between the dependent variable and the independent variable. In this study the dependent variable is adoption of livestock production technologies while the independent variables include; cost of implementation, farmer attributes, training and dissemination of information.

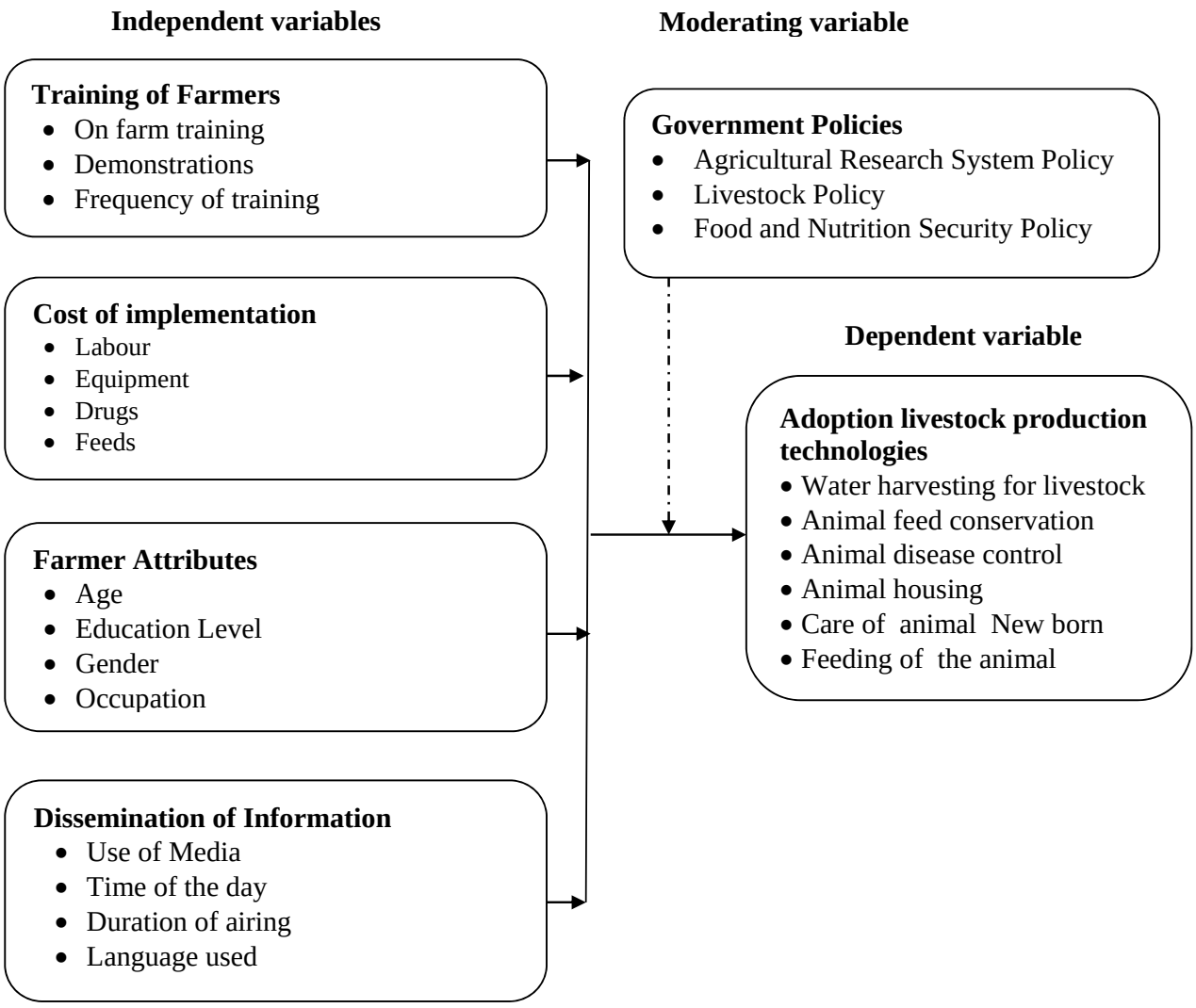

Figure 1: Conceptual framework

The framework presents the independent and dependent variables. The independent variable will include training, cost of implementation, farmer attributes and dissemination of information and the dependent variable is adoption of livestock production technologies. The independent variables (training cost of implementation, farmer attributes and dissemination of information) have a relationship with dependent variable (adoption of livestock production technologies) as shown in the conceptual framework.

The dependent variable will be adoption of livestock production technologies which will be measured using water harvesting for livestock, animal feed conservation, animal disease control, animal housing, care of animal new born and feeding of the animal.

2.9 Summary of Literature Review

There is a concurrence in literature that adoption is a sequential process as opposed to a simultaneous event. The process of adoption is characterized by the decision stage that is followed by the intensity stage. The main assumption is that the smallholder farmer will choose and adopt new technologies that will bring minimal disruption to environment and yields. Adoption of improved agricultural technologies involves a process in which awareness is created, attitudes are changing and favourable conditions for actual use of recommended practices are provided to the farmers. Agricultural development strategy at the smallholder level requires some change in knowledge and management skills, which calls for training on improved agricultural practices. It has been a usual trend, such that little is done to follow up and trace back if trained farmers do put in practice the skills they learned, even to establish the extent to which improved farming skills are practiced by farmers and constraints which trained farmers do face leading to them failing to exercise what they learnt

2.10 Knowledge Gap Matrix

Various studies have been done in relation to adoption of livestock production technologies as summarized in Table 2.1.

Table 2.1: Research Gaps

Author (Year)	Title/Topic	Objective	Methodology	Findings	Research Gap
Matiri, E. K. (2019)	Adoption of modern dairy technologies and its impact on milk production in Nzaui sub-county, Makueni county	To evaluate the extent of adoption of modern dairy technologies and its impact on milk production in Nzaui Sub-County of Makueni County	Cross-sectional descriptive survey design	The study found that there is need for gender-specific interventions to enhance increased adoption of improved livestock technologies by farmers especially in regards to access to improved germplasm by all farmers	The study focused on adoption of modern dairy technologies while the current study focuses on livestock production technologies in general
Kivunzya, A. N. (2018)	Characterization of livestock production systems and its contribution to the food security in Kitui County, Kenya	The objective of this study was to describe livestock production systems used and the role of livestock in household food security in Kitui County.	Descriptive research design	The study found that Feed shortage, water supply during dry spell, livestock marketing, poor access to extension services, unimproved livestock productivity, poor health	This study was on Characterization of livestock production systems and not adoption of livestock production technologies

				services and poor packaging of information on weather to the farmers were the major constraints to livestock production system	
Kinyangi, A. A. (2014)	Factors influencing the adoption of agricultural technology among smallholder farmers in Kakamega North Sub-County, Kenya	The purpose of this study was to examine factors influencing the adoption of agricultural technology among small holder farmers in Kakamega North Sub-County, Kenya	The study adopted an exploratory research design	The study found that Capital and credit facilities had positive and significant association on the adoption of agricultural technology but at varying degrees; results indicated that training has a marginally positive and significant influence on the adoption of technologies among smallholder farmers	The study focused on agricultural technology while the current study focused on specifically livestock production technologies
Ngongo, R. N. (2016)	Factors influencing the adoption of modern agricultural technologies by	The aim of the study was to find out the factors influencing the adoption of modern agricultural	Descriptive survey was employed as the research design	The study established that hat low access to resources, extension services and agricultural research centers	The study focused on adoption of modern agricultural technologies in

	small scale farmers: The case of Thika East Sub-County, Kenya	technologies by small scale farmers.		and their research products negatively influences the adoption of modern agricultural technologies within Thika East sub-county	general while the current study focused on specifically livestock production technologies.
Mwamuye, M. K. (2013)	Factors Influencing Adoption of Dairy Technologies in Coast Province, Kenya.	A cross sectional survey was conducted	The study sought to determine the factors influencing the adoption of dairy technologies among the Mijikenda community of coastal Kenya	Findings indicated no relationship between labor and market availability and adoption of the four technologies. The critical challenge to adoption of zero grazing was inadequate labor. Napier grass establishment was mainly constrained by inadequate and unreliable rainfall.	The study focused on Dairy Technologies while the current study focused on livestock production technologies in general

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter has the following subtopics: study site, research design, target population, sample and sampling procedure, research instruments, pilot testing of instruments, validity, reliability, data collection procedure, data analysis, operationalization of variables and lastly ethical considerations.

3.2 Research Design

Descriptive research design was utilized in this study. Descriptive research was used since it is helpful at making careful observations and detailed documentation of a phenomenon of interest Anol, (2012). The study aimed to investigate the level adoption of technologies disseminated through radio broadcasts, where data was collected in respect to the study variables or situation according to the respondent. Descriptive research design was ideal for this study since it gave the characteristics of the target population with their opinions as they were in their natural state.

3.3 Target Population

Rubin and Rubin (2008) emphasized that to ensure credibility of research, the researcher should interview people who understand and have deeper information about the issue. This is because the credibility of the interviews depends on the knowledge ability of the interviewees or participants of the study. According to Sekaran and Bougie (2010), a population is the total collection of elements about which we wish to make inferences. The target population for this study comprised, livestock farmers in Nguu/Masumba ward registered under the 'Mifugo ni Mali' radio programme and livestock extension officers in Makueni County who are conversant with subject under study as shown in Table 3.1.

Table 3. 1: Target Population

Categories	**Population**
Farmers	100
Livestock Extension officers	29
Total	**129**

3.4 Sample Size and Sampling Procedure

The study sample size and sampling procedure are discussed as follows.

3.4.1 Sample Size

Sampling is a deliberate choice of a number of people who are to provide the data from which a study drew conclusions about some larger group whom these people represent. The sampling frame describes the list of all population units from which the sample was selected (Boddy, 2016). Sample size is the number of units that were chosen from which data were gathered. A sample size of 86 respondents was arrived at by calculating the target population of 129 with a 95% confidence level and an error of 0.05 using the below formula taken from Nassiuma (2000) formula was used as shown;

$$n = \frac{N\,(cv^2)}{Cv^2 + (N-1)\,e^2}$$

Where ***n***= sample size

N = population (129)

Cv= coefficient of variation (0.8)

e= tolerance of desired level of confidence (0.05) at 95% confidence level)

$$n = \frac{129\,(0.8^2)}{0.8^2 + (129-1)\,0.05^2} = 86$$

Table 3.2: The Sample Size

Categories	Target Population	Sample size
Livestock Farmers	100	67
Livestock Extension officers	29	19
Total	**129**	**86**

3.4.2 Sampling Procedures

Sampling Procedures are processes or techniques of choosing a sub-group from a population to participate in the study; it is the process of selecting a number of individuals for a study in such a way that the individuals selected represent the large group from which they were selected. Stratified random sampling is unbiased sampling method of grouping heterogeneous population into homogenous subsets then selecting within the individual subset to ensure representativeness. The goal of stratified random sampling was to achieve the desired representation from various sub-groups in the population. In stratified random sampling, subjects are selected in such a way that the existing sub-groups in the population are more or

less represented in the sample (Kothari, 2004). The study selected 19 respondents using purposive technique for the livestock extension officers who possessed the information necessary for the study (Mugenda & Mugenda 2003) and simple random sampling technique to select 67 individual farmers.

3.5 Research Instruments

Questionnaires were used to collect primary data for this study. Data collected through the use of questionnaires is easy to analyze (Mugenda and Mugenda, 2003). Questionnaires are designed in accordance to the objectives under study, in that the questions asked answered all the research questions and hence achieved the objectives. In this study, both closed- ended and open -ended questions were designed and administered to the respondents which were aimed at capturing the descriptive nature of the research and the feelings and opinions of the participants which was in accordance with (Anol, 2012) suggestions for including both open ended and closed ended questions in a questionnaire. Standardization in scoring and assessing the respondents uniformly as outlined by (Marczyk, *et al*., 2005) was achieved by having a similar questionnaire for all the respondents and inducting the research assistants who were engaged during the study.

3.5.1 Pilot Testing of Research Instruments

The study carried out a pilot test to test the validity and reliability of the questionnaires in gathering the data required for purposes of the study. Pilot testing refers to putting of the research questions into test to a different study population but with similar characteristics as the study population to be studied (Kumar, 2011). According to Zikmund (2010), pilot testing should be conducted to a sample equivalent of 10% of the total population in the study. In consideration to this, 13 questionnaires were administered to farmers chosen at random.

3.5.2 Validity of Research Instruments

According to Anol, (2012) external validity or generalizability is simply the observed associations being generalized to the population under study. The data collection instruments were refined after the pilot testing to improve validity and reliability. Marczyk et al., (2005, pp.66) put simply that validity has a relationship with the research methodology since it increases the accuracy and usefulness of findings. It eliminates and controls confounding variables that help in giving confidence in the study findings. Marczyk *et al*., (2005) further says that validity offers the degree at which the research results are generalized to other

factors like time, locations and participants. Validity of the research instruments was confirmed by the supervisor and experts in livestock production.

3.6 Data Collection Procedure

The respondents were alerted in advance on the day of the questionnaires administration. To ensure correct translations research assistants engaged were those who were fluent in the local language. Marczyk, et al. (2005, pp.199) argues that data is the unripe fruits of the researcher which provides information to be used to explain happenings as they are and make prediction. Those who were educated enough to read, understand and write were allowed to fill the questionnaires on their own while those who needed help were guided through the filling process by the research assistants. The questionnaires were delivered to the respondents by the researcher assisted by the research assistants.

3.7 Data Analysis Techniques

According to Lokshina, Durkin & Lanting (2019) data analysis is a process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making. After the data collection, the researcher pre-processed the data to eliminate unwanted and unusable data which was contradictory or ambiguous, developed a coding scheme by creating codes and scales from the responses which was then be summarized and analyzed. Data was analyzed using Statistical Package for Social Sciences (SPSS Version 25.0). All the questionnaires received were referenced and items in the questionnaire were coded to facilitate data entry. After data cleaning which entailed checking for errors in entry, descriptive statistics such as frequencies, percentages, mean score and standard deviation were estimated for all the quantitative variables and information presented inform of tables. The qualitative data from the open ended questions was analyzed using conceptual content analysis and presented in prose. Inferential data analysis was done using Pearson correlation analysis. Pearson correlation analysis was to establish the relationship between the independent and dependent variables.

3.8 Ethical Considerations

Authorization was sought from National Commission for Science Technology and Innovation (NACOSTI), to be allowed to carry this research. The authority was granted before embarking on data collection. Studies involving human beings have some levels of risks involved according to Marczyk *et al*. (2005) the risks ranges from minor discomfort or some sort of embarrassment especially for too personal questions such as drugs and sexuality to

major discomforts of physical and emotional feelings. The respondents need to be informed that their views will be used for the purpose of the study only Mugenda and Mugenda (2003). The respondents were informed that identifying information regarding the study will not be shared with anyone not associated with the study.

3.9 Operationalization of Variables

The operationalization of variables was shown in Table 3.3.

Table 3.3: Operationalization of Variables

Objectives	Variable	Indicators	Measurement	Measurement scale	Tools of analysis	Type of analysis
To establish the influence of training of livestock farmers on adoption of livestock production technologies in Makueni County in Kenya.	Training of farmers	• On farm training • Demonstrations • Frequency of training	Primary data Frequencies	Ordinal	Percentages Mean score Arithmetic mean Standard deviation	Descriptive statistics Pearson correlation analysis
To establish the influence of cost of implementation on adoption of livestock production technologies in Makueni County in Kenya.	Cost of implementation	• Labour • Equipment • Drugs • Feeds	Primary data Frequencies	Ordinal	Percentages Mean score Arithmetic mean Standard deviation	Descriptive statistics Pearson correlation analysis
To establish the influence of farmer attributes on adoption of livestock production technologies in Makueni County in Kenya.	Farmer attributes	• Age • Education Level • Gender • Occupation	Primary data Frequencies	Ordinal	Percentages Mean score Arithmetic mean Standard deviation	Descriptive statistics Pearson correlation analysis

To establish how dissemination of information influence adoption of livestock production technologies in Makueni County in Kenya.	Dissemination of information	• Use of Media • Time of the day • Duration of airing • Language used	Primary data Frequencies	Ordinal	Percentages Mean score Arithmetic mean Standard deviation	Descriptive statistics Pearson correlation analysis
	Adoption of livestock production technologies	• Water harvesting for livestock • Animal feed conservation • Animal disease control • Animal housing • Care of animal New born • Feeding of the animal	Primary data Frequencies	Ordinal	Percentages Mean score Arithmetic mean Standard deviation	Descriptive statistics Pearson correlation analysis

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter discusses the findings obtained from the primary instrument used in the study. It discusses the characteristics of the respondents, their opinions on social economic factors influencing adoption of livestock production technologies in Makueni County, Kenya. In order to simplify the discussions, the researcher provided tables that summarize the collective reactions of the respondents.

4.2 Response Rate

The study sought to establish whether the response rate was adequate for data analysis to be conducted. The findings for response rate were as illustrated in Table 4.1.

Table 4.1: Response Rate

	Frequency	**Percent**
Returned Questionnaires	79	91.9
Not Returned Questionnaires	7	8.1
Total	**86**	**100.0**

The researcher administered 86 questionnaires out of which only 79 were returned fully filled. This resulted to a return rate of 91.9% which was adequate for data analysis as confirmed by Saunders (2011) who argued that a response rate for statistical analysis should be more than 50%.

4.3 Reliability of Research Instruments

Reliability of research instruments was tested. Instrument reliability on the other hand is the extent to which a research instrument produces similar results on different occasions under similar conditions. A construct composite reliability co-efficient (Cronbach alpha) of 0.7 or above, for all the constructs, is considered to be adequate for this study (Rousson, Gasser & Seifer, 2012). The following were the reliability findings in Table 4.2.

Table 4. 2: Reliability Analysis

	Cronbach's Alpha	No. of items
Dissemination of information	0.817	3
Training of Livestock Farmers	0.831	4
Cost of implementation	0.718	4
Farmer attributes	0.614	4
Totals	**2.98**	**15**

From the findings, the training was the most reliable with an alpha value of 0.831, followed by dissemination of information with an alpha value of 0.817 then then cost of implementation an alpha value of 0.718 while farmer attributes was the least reliable with an alpha value of 0.614. This illustrates that all the four variables were reliable as their reliability values exceeded the prescribed threshold of 0.7.

4.4 Background Information

The study sought to enquire on the respondents' general information including gender, their age, and their highest level of education as well as their number of years they have been practicing Livestock production. This general information is presented in various sections.

4.4.1 Gender of the Respondents

The respondents were asked to indicate their gender. The results are as shown in the Table 4.3

Table 4.3: Gender of the Respondents

	Frequency	Percent
Male	52	65.8
Female	27	34.2
Total	**79**	**100.0**

As per the results, 65.8% of the respondents were male while 34.2% were female. This shows that the study obtained more information on the subject under study from male respondents but also female respondents participated in data collection. This improved the quality of the data collected as a result of varied responses from all the genders.

4.4.2 Respondents' Age

The respondents were required to indicate their age bracket. The study results are as shown in Table 4.4.

Table 4. 4: Respondents' Age

	Frequency	Percent
20-30 years	6	7.6
31-40 years	17	21.5
41-50 years	33	41.8
Above 50 years	23	29.1
Total	**79**	**100.0**

As per the above findings, majority of the respondents as shown by 41.8% indicated that they were aged between 41-50 years, 29.1% indicated they were aged between above 50 years, 21.5% indicated they were between the age of 31-40 years while 7.6% indicated they were between the age of 20-30 years. This implies that all the age groups were covered in data collection and hence the data collected could be relied upon in establishing social economic factors influencing adoption of livestock production technologies in Makueni County in Kenya.

4.4.3 Respondents' Highest Level of Education

The respondents were also asked to indicate their highest level of education. The findings are as illustrated in Table 4.5.

Table 4.5: Respondents' Highest Level of Education

	Frequency	Percent
No formal education	16	20.3
Certificate	29	36.7
Diploma	17	21.5
Degree	17	21.5
Total	**79**	**100.0**

The findings show that majority of the respondents had attained a certificate as shown by 36.7%. Further, 21.5% indicated that they had a diploma, 21.5% indicated they had a degree while

20.3% indicated they had no formal education. This implies that all the respondents had the required academic qualification to participate in giving information on social economic factors influencing adoption of livestock production technologies in Makueni County in Kenya.

4.4.4 Respondents' Number of Years in Livestock Production

The respondents were required to indicate the number of years they have been practicing livestock production. The findings are as illustrated in Table 4.6.

Table 4. 6: Respondents' Number of Years in Livestock Production

	Frequency	Percent
Below 2 years	13	16.5
2 to 3 years	21	26.6
3 to 4 years	25	31.6
More than 5 years	20	25.3
Total	**79**	**100.0**

As per the above findings, majority of the respondents as shown by 31.6% indicated that they had been practicing livestock production for 3 to 4 years, 26.6% indicated that they had been practicing livestock production for 2 to 3 years, 25.3% indicated that they had been practicing livestock production for more than 5 years while 16.5% indicated that they had been practicing livestock production for less than 2 years. This implies that all the age groups were covered in data collection and hence the data collected could be relied upon in establishing social economic factors influencing adoption of livestock production technologies in Makueni County in Kenya.

4.5 Training of Livestock Farmers and Adoption of Livestock Production Technologies

The study sought to establish how training of farmers influence adoption of livestock production technologies in Makueni County, Kenya. The researcher requested the respondents to indicate the extent to which training of farmers influence adoption of livestock production technologies in Makueni County, Kenya. The opinions of the respondents were used to come up with the findings in the Table 4.7.

Table 4.7: Influence of Training of Farmers on Adoption of Livestock Production Technologies

	Frequency	Percent
Low extent	5	6.4
Moderate extent	23	29.1
Great extent	34	43.0
Very great extent	17	21.5
Total	**79**	**100.0**

	VLE	LE	ME	GE	VGE	Mean	Std Dev.
On farm training	0(0%)	0(0%)	16(20.3%)	38(48.1%)	25(31.6%)	4.114	0.716
Demonstrations	0(0%)	36(45.6%)	39(49.4%)	4(5.1%)	0(0%)	2.595	0.589
Frequency of training	0(0%)	0(0%)	13(16.5%)	24(30.4%)	42(53.2%)	4.367	0.754
Composite Mean and Std. Dev.						**3.692**	**0.686**

As per the results, most of the respondents indicated that training greatly influence adoption of livestock production technologies in Makueni County, Kenya as shown by 43%, moderately as shown by 29.1%, very greatly as shown by 21.5% and lowly as shown by 6.4%. Therefore from the findings it's clear that training greatly influence adoption of livestock production technologies in Makueni County, Kenya.

From the findings, the respondents indicated that on farm training as illustrated by a mean score of 4.114 and frequency of training as shown by a mean score of 4.367 greatly influence adoption of livestock production technologies in Makueni County, Kenya. Additionally, the respondents indicated that demonstrations as shown by a mean score of 2.595 influence the adoption of livestock production technologies in Makueni County, Kenya to a moderate extent.

4.6 Cost of Implementation and Adoption of Livestock Production Technologies

The study sought to establish the influence of cost of implementation on adoption of livestock production technologies in Makueni County in Kenya. The researcher required the respondents

to indicate the extent of influence that cost of implementation had on adoption of livestock production technologies in Makueni County, Kenya. The findings were as shown in Table 4.8.

Table 4.8: Extent of Cost of Implementation Influence

	Frequency	Percent
Low extent	12	15.2
Moderate extent	6	7.6
Great extent	33	41.8
Very great extent	28	35.4
Total	**79**	**100.0**

	VLE	LE	ME	GE	VGE	Mean	Std. Dev.
Labour cost	0(0%)	0(0%)	8(10.1%)	44(55.7%)	27(34.2%)	4.241	0.625
Equipment cost	0(0%)	41(51.9%)	16(20.3%)	22(27.8%)	0(0%)	2.760	0.866
Cost of drugs	0(0%)	4(5.1%)	23(29.1%)	30(38%)	22(27.8%)	3.886	0.877
Feeds expenses	0(0%)	14(17.7%)	41(51.9%)	24(30.4%)	0(0%)	3.127	0.686
Composite mean and Std. Dev.						**3.504**	**0.764**

From the study Table 4.7 shows that 41.8% of the respondents indicated that cost of implementation influence adoption of livestock production technologies in Makueni County, Kenya greatly, to a very great extent as shown by 35.4%, to a low extent as shown by 15.2% and to a moderate extent as shown by 7.65. This implies that cost of implementation greatly influence adoption of livestock production technologies in Makueni County, Kenya.

From the findings, the respondents indicated that equipment cost as shown by a mean of 4.241 influence adoption of livestock production technologies in Makueni County, Kenya to a great extent. The respondents also indicated that cost of drugs as shown by a mean of 3.886 greatly influences the adoption of livestock production technologies in Makueni County, Kenya. However, the respondents indicated that feeds expenses as shown by a mean of 3.127 and equipment cost as shown by a mean of 2.760 moderately influence adoption of livestock production technologies in Makueni County, Kenya.

4.7 Farmer Attributes and Adoption of Livestock Production Technologies

The study further sought to assess the influence of farmer attributes on adoption of livestock production technologies in Makueni County in Kenya. The respondents indicated the extent to which farmer attributes influence adoption of livestock production technologies in Makueni County, Kenya. The findings are summarized in Table 4.9.

Table 4.9: Extent of Farmer Attributes Influence

	Frequency	Percent
Low extent	10	12.7
Moderate extent	22	27.8
Great extent	31	39.2
Very great extent	16	20.3
Total	**79**	**100.0**

	VLE	LE	ME	GE	VGE	Mean	Std. Dev.
Age	0(0%)	4(5.1%)	12(15.2%)	29(36.7%)	34(43%)	4.177	0.874
Education Level	0(0%)	0(0%)	31(39.2%)	20(25.3%)	28(35.4%)	3.962	0.869
Gender	0(0%)	0(0%)	41(51.9%)	38(48.1%)	0(0%)	3.481	0.503
Occupation	0(0%)	3(3.8%)	15(19%)	45(57%)	16(20.3%)	3.937	0.740
Composite Mean and Std. Dev.						**3.889**	**0.747**

From the findings, 39.2% of the respondents indicated that farmer attributes influence adoption of livestock production technologies in Makueni County, Kenya to a great extent, 20.3% indicated very greatly and 27.8% indicated moderately while 12.7% of the respondents indicated that farmer attributes influence adoption of livestock production technologies in Makueni County, Kenya to a low extent. This implies that farmer attributes greatly influences adoption of livestock production technologies in Makueni County, Kenya.

As per the results, the respondents indicated that age as shown by an average of 4.177, education level as shown by a mean of 3.962 and occupation as shown by a mean of 3.937 influence adoption of livestock production technologies in Makueni County, Kenya to a great extent.

However, the respondents also indicated that gender as shown by a mean of 3.481 moderately influence adoption of livestock production technologies in Makueni County, Kenya.

4.8 Dissemination of information and Adoption of Livestock Production Technologies

The study sought to examine the influence of dissemination of information on adoption of livestock production technologies in Makueni County in Kenya. The respondents were asked to indicate the extent to which dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya. The findings were presented in the Table 4.10.

Table 4.10: Extent of Dissemination of information Influence

	Frequency	**Percent**
Low extent	6	7.6
Moderate extent	9	11.4
Great extent	64	81.0
Total	**79**	**100.0**

	VLE	**LE**	**ME**	**GE**	**VGE**	**Mean**	**Std Dev.**
Use of Media	(0%)	0(0%)	6(7.6%)	40(50.6%)	33(41.8%)	4.342	0.716
Time of the day	66(84%)	13(16%)	0(0%)	0(0%)	0(0%)	2.165	0.373
Duration of airing	0(0%)	0(0%)	16(20.3%)	38(48.1%)	25(31.6%)	4.114	0.618
Language used	0(0%)	4(5.1%)	12(15.2%)	39(49.4%)	24(30.4%)	4.051	0.815
Composite Mean and Std. Dev.						**3.668**	**0.631**

The respondents indicated that the dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya to a great extent as shown by 81%. Further, 11.4% of the respondents indicated to a moderate extent and 7.6% to a low extent. Therefore,

this implies that dissemination of information greatly influence adoption of livestock production technologies in Makueni County, Kenya.

From the results, the respondents indicated that use of media as shown by a mean of 4.342 and duration of airing information as illustrated by a mean score of 4.114 influence adoption of livestock production technologies in Makueni County, Kenya to a very great extent. The respondents also indicated that language used in information disemination as depicted by a mean of 4.051 greatly influence adoption of livestock production technologies in Makueni County, Kenya, while time of the day of dissemination of information as shown by a mean score of 2.165 influence adoption of livestock production technologies in Makueni County, Kenya to a low extent.

4.9 Adoption of Livestock Production Technologies

The respondents were asked to specify the trends of various aspects of Adoption of Livestock Production Technologies in Makueni County, Kenya for the last 5 years. Their responses were as shown in Table 4.11.

Table 4.11: Trend of Adoption of Livestock Production Technologies Aspects

	VLE	LE	ME	GE	VGE	Mean	Std Dev.
Water harvesting for livestock	(0%)	12(15.2%)	31(39.2%)	36(45.6%)	0(0%)	3.304	0.722
Animal feed conservation	0(0%)	0(0%)	9(11.4%)	42(53.2%)	28(35.4%)	4.241	0.645
Animal disease control	0(0%)	32(40.5%)	33(41.8%)	14(17.7%)	0(0%)	2.772	0.733
Animal housing	0(0%)	0(0%)	6(7.6%)	45(57%)	28(35.4%)	4.279	0.598
Care of animal New born	0(0%)	0(0%)	30(38%)	45(57%)	4(5.1%)	3.671	0.571
Feeding of the animal	0(0%)	3(3.8%)	6(7.6%)	9(11.4%)	61(77.2%)	3.620	0.789

From the findings, the respondents indicated that animal housing as shown by a mean of 4.279, animal feed conservation as shown by a mean of 4.241, care of animal new born as shown by a mean of 3.671 and feeding of the animal as shown by a mean of 3.620 have improved for the last five years. The respondents also indicated that water harvesting for livestock as shown by a mean of 3.304 and animal disease control as shown by a mean of 2.772 have been constant.

4.10 Pearson Correlation Analysis

According to Ward (2013), correlation technique was used to analyze the degree of association between two variables. Pearson correlation coefficient was used to determine the strength and the direction of the relationship between the dependent variable and the independent variable. The analysis using Pearson's product moment correlation was based on the assumption that the data is normally distributed and also because the variables are continuous. The findings are as illustrated in Table 4.12.

Table 4. 12: Correlation Matrix

		Adoption of livestock production technologies	Training of livestock farmers	Cost of implementation	Farmer attributes	Dissemination of information
Adoption of livestock production technologies	Pearson Correlation	1				
	Sig. (2-tailed)	.				
Training of livestock farmers	Pearson Correlation	.672	1			
	Sig. (2-tailed)	.019	.			
Cost of implementation	Pearson Correlation	.579	.513	1		
	Sig. (2-tailed)	.016	.009	.		
Farmer attributes	Pearson Correlation	.641	.423	.327	1	
	Sig. (2-tailed)	.011	.015	.014	.	
Dissemination of information	Pearson Correlation	.708	.533	.520	.431	1
	Sig. (2-tailed)	.001	.008	.001	.013	.

As per the findings, the study found that there is a positive relationship between adoption of livestock production technologies in Makueni County and training of livestock farmers as shown by correlation coefficient of 0.672. The study also established a positive relationship between

adoption of livestock production technologies in Makueni County and cost of implementation as shown by correlation coefficient of 0.579.

The study further established that there is a positive relationship between adoption of livestock production technologies in Makueni County and farmer attributes as expressed by correlation coefficient of 0.641 and a positive relationship between adoption of livestock production technologies in Makueni County and dissemination of information as illustrated by a correlation coefficient of 0.708. This shows all variable were significant in determining the influence of implementation of quality management system on adoption of livestock production technologies in Makueni County.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the discussion of key data findings, conclusion drawn from the findings highlighted and recommendation made there-to. The conclusions and recommendations drawn are focused on addressing the objective of the study.

5.2 Summary of the Findings

The study sought to establish how training of farmers influence adoption of livestock production technologies in Makueni County in Kenya. The study found that training greatly influence adoption of livestock production technologies in Makueni County, Kenya. The study also established that on farm training of farmers influence adoption of livestock production technologies in Makueni County, Kenya to a great extent. The study further established that on farm training and frequency of training greatly influence adoption of livestock production technologies in Makueni County, Kenya. Additionally, the study found that demonstrations influence the adoption of livestock production technologies in Makueni County, Kenya to a moderate extent.

The study sought to establish the influence of cost of implementation on adoption of livestock production technologies in Makueni County in Kenya and found that cost of implementation influence adoption of livestock production technologies in Makueni County to a great extent. The study established that equipment cost influence adoption of livestock production technologies in Makueni County, Kenya to a great extent. The study also found that cost of drugs greatly influences the adoption of livestock production technologies in Makueni County, Kenya. The study further established that feeds expenses and equipment cost moderately influence adoption of livestock production technologies in Makueni County, Kenya.

The study further sought to assess the influence of farmer attributes on adoption of livestock production technologies in Makueni County in Kenya and found that farmer attributes greatly influences adoption of livestock production technologies in Makueni County, Kenya. Moreover, the study established that age, education level and occupation influence adoption of livestock

production technologies in Makueni County, Kenya to a great extent. The study further established that gender moderately influence adoption of livestock production technologies in Makueni County, Kenya.

The study sought to determine the influence of dissemination of information on adoption of livestock production technologies in Makueni County in Kenya. The study found that dissemination of information greatly influence adoption of livestock production technologies in Makueni County, Kenya. The study found that use of media and duration of airing information influence adoption of livestock production technologies in Makueni County, Kenya to a very great extent. The study found that language used in information disemination greatly influence adoption of livestock production technologies in Makueni County, Kenya, while time of the day of dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya to a low extent.

5.3 Discussion of Findings

This section links the summarized findings to the literature in chapter two of the project.

5.3.1 Training and Adoption of Livestock Production Technologies

The study found that training greatly influence adoption of livestock production technologies in Makueni County, Kenya. The study also established that on farm training of farmers influence adoption of livestock production technologies in Makueni County, Kenya to a great extent. The study further established that on farm training and frequency of training greatly influence adoption of livestock production technologies in Makueni County, Kenya. Additionally, the study found that demonstrations influence the adoption of livestock production technologies in Makueni County, Kenya to a moderate extent. These findings concurs with Lemma and Trivedi (2012) who argues that adoption of improved agricultural technologies involves a process in which awareness is created, attitudes are changing and favourable conditions for actual use of recommended practices are provided to the farmers Agricultural development strategy at the smallholder level requires some change in knowledge and management skills, which calls for training on improved agricultural practices. It has been a usual trend, such that little is done to follow up and trace back if trained farmers do put in practice the skills they learned, even to establish the extent to which improved farming skills are practiced by farmers and constraints which trained farmers do face leading to them failing to exercise what they learnt.

5.3.2 Cost of implementation and Adoption of Livestock Production Technologies

The study found that cost of implementation influence adoption of livestock production technologies in Makueni County to a great extent. The study established that equipment cost influence adoption of livestock production technologies in Makueni County, Kenya to a great extent. The study also found that cost of drugs greatly influences the adoption of livestock production technologies in Makueni County, Kenya. The study further established that feeds expenses and equipment cost moderately influence adoption of livestock production technologies in Makueni County, Kenya. These findings are in line with Dibraa (2015) who noted that high cost of technology as a hindrance to adoption. High cost of labour, other inputs, unavailability of demanded packages and untimely delivery as the main constraints to fertilizer adoption. Cost of hired labor was also reported by as one among other factors constraining adoption of fertilizer and hybrid seed in Embu county Kenya

5.3.3 Farmer attributes and Adoption of Livestock Production Technologies

The study found that farmer attributes greatly influences adoption of livestock production technologies in Makueni County, Kenya. Moreover, the study established that age, education level and occupation influence adoption of livestock production technologies in Makueni County, Kenya to a great extent. The study further established that gender moderately influence adoption of livestock production technologies in Makueni County, Kenya. These findings correlate with Sanga, Kalungwizi and Msuya (2013) who argues that farmers' attributes have an influence on adoption of technology. For instance Age is assumed to be a determinant of adoption of new technology. Older farmers are assumed to have gained knowledge and experience over time and are better able to evaluate technology information than younger farmers. On contrary age has been found to have a negative relationship with adoption of technology. As farmers grow older, there is an increase in risk aversion and a decreased interest in long-term investment in the farm.

5.3.4 Dissemination of information and Adoption of Livestock Production Technologies

The study established that dissemination of information greatly influence adoption of livestock production technologies in Makueni County, Kenya. The study found that use of media and duration of airing information influence adoption of livestock production technologies in Makueni County, Kenya to a very great extent. The study found that language used in

information disemination greatly influence adoption of livestock production technologies in Makueni County, Kenya, while time of the day of dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya to a low extent. These findings conform to Khanal (2013) findings that access to information through the extension officers in the rural context is a more effective method of reaching many farmers than other mainstream media channels. This means that the direct contact between the extension personnel and the small scale farmers greatly boosts the adoption and uptake process of the modern and emerging innovations by farmers. Community social networks where information is passed through other farmers, neighbors, work mates and friends for instance, from one farmer who is more knowledgeable about some farming practices to other farmers who are less knowledgeable and exposed on the same practices is another important information source on new technologies to small scale farmers at the community level.

5.4 Conclusions

The study concluded that training significantly influence adoption of livestock production technologies in Makueni County in Kenya. It was clear that that on farm training and frequency of training greatly influence adoption of livestock production technologies in Makueni County, Kenya. Moreover, demonstrations were found to moderately influence the adoption of livestock production technologies in Makueni County, Kenya.

The study further concluded that cost of implementation greatly and significantly influence adoption of livestock production technologies in Makueni County in Kenya. In this case equipment cost and cost of drugs have a great influence when it comes to adoption of livestock production technologies while feeds expenses and equipment cost moderately influence adoption of livestock production technologies in Makueni County.

The study concluded that farmer attributes significantly influence adoption of livestock production technologies in Makueni County in Kenya. The study revealed that the study age, education level and occupation of the farmer greatly influence the adoption of livestock production technologies in Makueni County in Kenya. Gender of the farmer moderately influences adoption of livestock production technologies in Makueni County, Kenya.

The study concluded that dissemination of information significantly influence adoption of livestock production technologies in Makueni County in Kenya. The study found that use of media and duration of airing information influence adoption of livestock production technologies in Makueni County, Kenya greatly. Also language used in information disemination have a great influence on adoption of livestock production technologies in Makueni County, Kenya while time of the day of dissemination of information lowly influence adoption of livestock production technologies in Makueni County.

5.5 Recommendations

The study recommends that there is a need for the county government of Makueni in conjunction with national government of Kenya to come with strategies of reducing the cost of implementing the livestock production technologies. This is because of high cost of implementation may lead to farmers buying cheaper animal drugs which are often expired and of doubtable efficacy. The study also recommends that there is also a need to increase farmers' capital and credit facilities and make these services accessible to the farmers.

The study further recommends that there is need for farmers and extension officers to be trained on livestock production technologies and other technologies that can positively contribute to high productivity among farmers. This can be done through workshops, seminars and on farm training to instill skills on various livestock production technologies. This will increase awareness on the availability and usefulness of the technologies.

The study also recommends that the county government needs to make sure that information about livestock production technologies are disseminated to every farmer. There is need for different stakeholders to create awareness on these technologies in the areas so that more farmers can embrace it to improve their living standards and income

The study further recommends that the extension services in Makueni county needs to be enhanced so that farmers can access to training improved livestock technologies. This can be achieved by posting more extension agents to the area since they are few in study site. The elderly farmers should also be given support by offering on farm training and also credit facilities. The study also recommends that the county government should mobilize youths to participate in livestock production by embracing the new production technologies.

5.6 Suggestions for Further Studies

This study was done in Makueni County only. Therefore there is a need for future studies to focus on other counties in Kenya and establish social economic factors influencing the adoption of livestock production technologies. There is a need to establish the effect of government support on adoption of livestock production technologies in Kenya.

Another area requiring further studies would be on the challenges facing the farmers in adoption of livestock production technologies. The study also recommends future studies to unearth other factors affecting adoption of livestock production technologies other than social economic factors.

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APPENDICES

Appendix I: Letter of Transmittal

ARON MUKIIRI RINGRERA

P.O. BOX 29040 – 00625

NAIROBI

TEPHONE: 0721566796

EMAIL: aronringera@yahoo.com

23rd July 2018

TO WHOM IT MAY CONCERN

RE: DATA COLLECTION REQUEST

I am a University of Nairobi post graduate student pursuing a Master of Arts Degree in Project Planning and Management.

So the purpose of this letter is to request to undertake the study in your locality and in collaboration with your institution. The study will be on, the level of adoption of livestock production technologies disseminated through radio broadcast, to be undertaken in Nguu/Masumba ward Kibwezi constituency, Makueni County in Kenya

The information and data gathered will be for my M.A. project. The data will be collected using questionnaires and all responses will be treated with confidentially.

Thank you.

Appendix II: Research Questionnaire for Livestock Farmers

Kindly answer the following questions by writing a brief answer or ticking in the boxes provided.

PART A: Background Information

1 Please indicate your gender: Female [ ] Male [ ]

2 Please Indicate your age bracket

20-30 yrs [ ] 31-40 yrs [ ]

41-50 yrs [ ] Above 50 yrs [ ]

3 Please indicate your highest level of education

Degree [ ] Diploma [ ]

Certificate [ ] No formal education [ ]

Any other (specify)……

4 Please indicate the number of years have you been practicing Livestock production.

Below 2 years [ ] 2 to 3 years [ ]

3 to 4 years [ ] More than 5 years [ ]

PART B: Training and Adoption of Livestock Production Technologies

5 To what extent does training of farmers influence adoption of livestock production technologies in Makueni County, Kenya?

Very great extent [5] Moderate extent [3] Very low extent [1]

Great extent [4] Low extent [2]

6 In your own opinion, how do the aspects of training of farmers influence adoption of livestock production technologies in Makueni County, Kenya?

……

……

……

7 To what extent do the following aspects of training of farmers influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Very low extent
On farm training					
On farm Demonstrations					
Frequency of training					

PART C: Cost of Implementation and Adoption of Livestock Production Technologies

8 To what extent do you think cost of implementation influence adoption of livestock production technologies in Makueni County, Kenya?

Very great extent [5] Great extent [4]

Moderate extent [3] Low extent [2]

Very low extent [1]

9 To what extent do the following aspects of cost of implementation influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Very low extent
Labour cost					
Equipment cost					
Cost of drugs					
Feeds expenses					

PART D: Farmer attributes and Adoption of Livestock Production Technologies

10 To what extent do farmer attributes influence adoption of livestock production technologies in Makueni County, Kenya?

Very great extent [5] Moderate extent [3] Very low extent [1]

Great extent [4] Low extent [2]

11 To what extent do the following aspects of farmer attributes influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Very low extent
Age					
Education Level					
Gender					
Occupation					

PART E: Dissemination of information and Adoption of Livestock Production Technologies

12 To what extent does dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya?

Very great extent [5] Moderate extent [3] Very low extent [1]

Great extent [4] Low extent [2]

13 To what extent do the following aspects of dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	**Great extent**	**Moderate extent**	**Low extent**	**Very low extent**
Use of Media					
Time of the day					
Duration of airing					
Language used					

PART F: Adoption of Livestock Production Technologies

14 What is the trend of the following aspects of adoption of livestock production technologies in Makueni County, Kenya for the last five years?

	Greatly Decreased	**Decreased**	**Constant**	**Improved**	**Greatly improved**
Water harvesting for livestock					
Animal feed conservation					
Animal disease control					
Animal housing					
Care of animal New born					
Feeding of the animal					

Thank You for Your Participation

Appendix III: Research Questionnaire for Livestock Extension officers

Kindly answer the following questions by writing a brief answer or ticking in the boxes provided.

PART A: Background Information

1. Please indicate your gender: Female [ ] Male [ ]
2. Please Indicate your age bracket

   20-30 yrs [ ] 31-40 yrs [ ]

   41-50 yrs [ ] Above 50 yrs [ ]
3. Please indicate your highest level of education

   Postgraduate [ ] Degree [ ]

   Diploma [ ] Certificate [ ]
4. Please indicate your years of experience in Livestock Extension.

   Below 2 years [ ] 2 to 3 years [ ]

   3 to 4 years [ ] More than 5 years [ ]

PART B: Training and Adoption of Livestock Production Technologies

5. To what extent does training of farmers influence adoption of livestock production technologies in Makueni County, Kenya?

   Very great extent [5] Moderate extent [3] Very low extent [1]

   Great extent [4] Low extent [2]
6. In your own opinion, how do the aspects of training of farmers influence adoption of livestock production technologies in Makueni County, Kenya?

……
……
……

7. To what extent do the following aspects of training of farmers influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Very low extent
On farm training					
On farm Demonstrations					
Frequency of training					

PART C: Cost of Implementation and Adoption of Livestock Production Technologies

8. To what extent do you think cost of implementation influence adoption of livestock production technologies in Makueni County, Kenya?

   Very great extent [5] Great extent [4]

   Moderate extent [3] Low extent [2]

   Very low extent [1]

9. To what extent do the following aspects of cost of implementation influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Very low extent
Labour cost					
Equipment cost					
Cost of drugs					
Feeds expenses					

PART D: Farmer attributes and Adoption of Livestock Production Technologies

10. To what extent do farmer attributes influence adoption of livestock production technologies in Makueni County, Kenya?

    Very great extent [5] Moderate extent [3] Very low extent [1]

    Great extent [4] Low extent [2]

11. To what extent do the following aspects of farmer attributes influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Very low extent
Age					
Education Level					
Gender					
Occupation					

PART E: Dissemination of information and Adoption of Livestock Production Technologies

12. To what extent does dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya?

    Very great extent [5] Moderate extent [3] Very low extent [1]

    Great extent [4] Low extent [2]

13. To what extent do the following aspects of dissemination of information influence adoption of livestock production technologies in Makueni County, Kenya?

	Very great extent	**Great extent**	**Moderate extent**	**Low extent**	**Very low extent**
Use of Media					
Time of the day					
Duration of airing					
Language used					

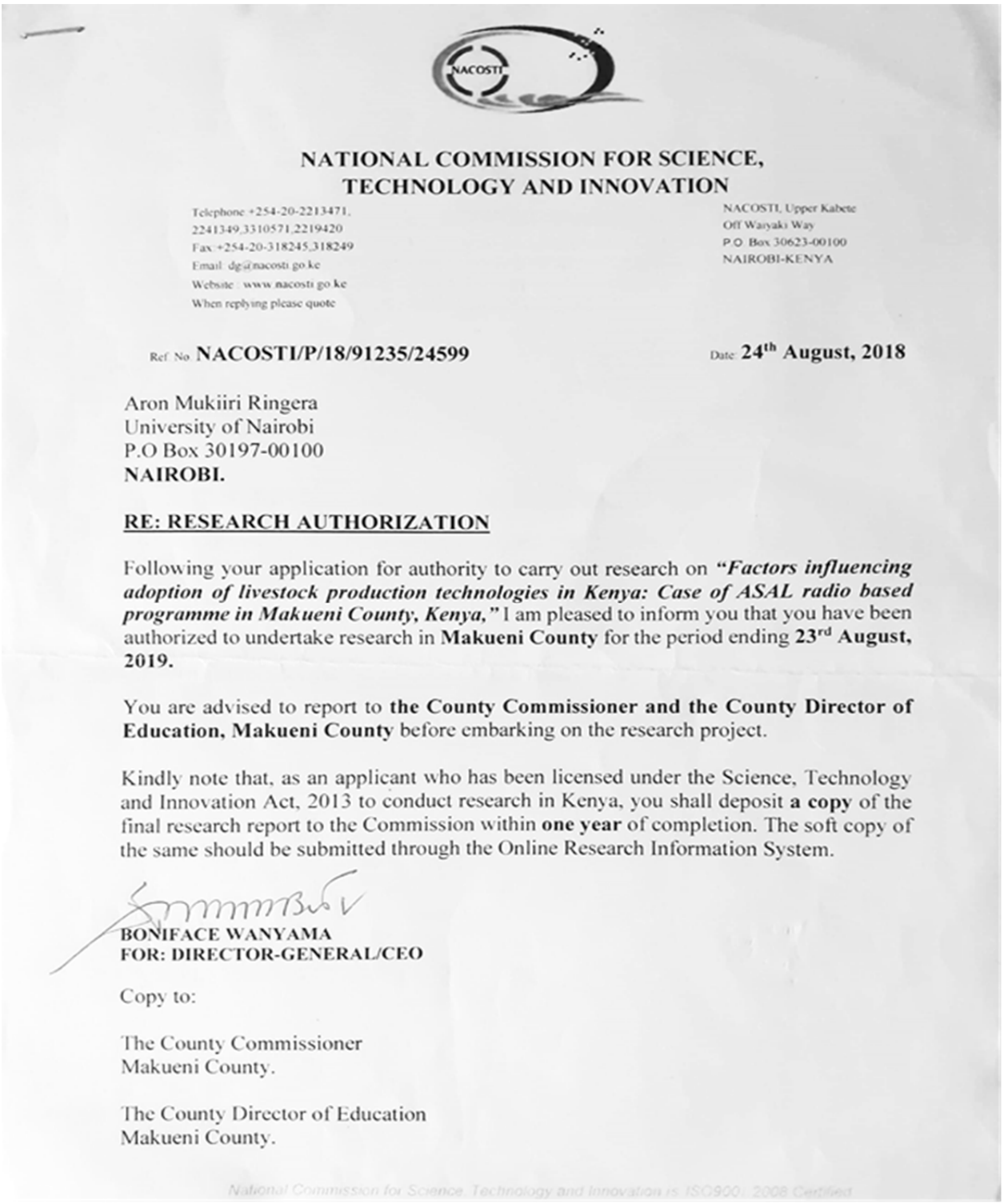
PART F: Adoption of Livestock Production Technologies

14. What is the trend of the following aspects of adoption of livestock production technologies in Makueni County, Kenya for the last five years?

	Greatly Decreased	**Decreased**	**Constant**	**Improved**	**Greatly improved**
Water harvesting for livestock					
Animal feed conservation					
Animal disease control					
Animal housing					
Care of animal New born					
Feeding of the animal					

Thank You for Your Participation

Appendix IV: NACCOSTI Research Permit



NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION

Telephone +254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/18/91235/24599**

Date **24th August, 2018**

Aron Mukiiri Ringera
University of Nairobi
P.O Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Factors influencing adoption of livestock production technologies in Kenya: Case of ASAL radio based programme in Makueni County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Makueni County** for the period ending **23rd August, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Makueni County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Makueni County.

The County Director of Education
Makueni County.