

**DETERMINANTS OF ADOPTION OF MODERN TECHNOLOGIES IN
BEEKEEPING PROJECTS: THE CASE OF WOMEN GROUPS IN KAJIADO
COUNTY, KENYA**

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DECLARATION

This is to declare that this Research Project Report is my original work and has not been submitted before for the award of any degree in this or any other University.

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DEDICATION

This Research Project Report is dedicated to my family, for their understanding, support and encouragement throughout my studies.

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I wish to acknowledge and thank my Lecturers who taught and prepared me ready to undertake this research project. The lecturers were instrumental in preparing me in order to make me equipped to undertake this project. The research project report would not have been possible and successful without the support and guidance of my supervisor, Dr Peter Keiyoro who offered me diligent ideas and guidance throughout the proposal preparations, corrections and production of the final document. I also feel highly indebted to my family- my wife, children and siblings who offered me invaluable moral and material support during the study period.

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ABBREVIATIONS AND ACRONYMS

ASAL –Arid and Semi-arid land

IAR4D- Integrated Agricultural Research for Development

Km – Kilometre

Kg – Kilogramme

Ksh – Kenya Shillings

KBA- Kenya Beekeepers Association

KTBH Kenya Top Bar Hive

PTD – Participatory Technology Development

NARO- National Agricultural Research Organisation

SPSS – Statistical Package for Social Sciences

CLPO- County Livestock Production Officer

ABSTRACT

Modern technologies in beekeeping have advanced over the years. However, it has been observed that satisfying the basic needs of the rural people to improve their living standards by adopting modern beekeeping technologies is still a challenge despite these technological advances. This is due to the relative slow adaption rates of the new technologies. This study was, therefore, designed to find out the determinants of adoption of modern technologies in beekeeping projects in Kenya, with particular emphasis on the women beekeeping groups in Kajiado County in Kenya. The objectives of the study were to establish the social/cultural factors that influence adoption of modern beekeeping technologies; determine how managerial factors influence adoption of the new technologies; assess how institutional factors influence the adoption and also determine the influence of economic factors on adoption of modern beekeeping technologies. The target population for this study were the beekeeping women groups in Kajiado County in Kenya where a sample size of 116 respondents were drawn. The study employed descriptive research design with the use of personal interviews, questionnaires, observation guides and key informant interview guides to collect data from the sampled respondents. The collected data was cleaned, edited, coded and then entered into SPSS (version 21) for analysis. The findings of the study revealed that socio-cultural factors highly influenced adoption of beekeeping technologies among the women beekeeping groups in Kajiado County. Among the social /cultural factors identified were sex of the house hold head, marital status, education levels, size of the house hold, size of land and cultural beliefs. Further, the study revealed that managerial skills (human, technical and conceptual skills) are very necessary for adoption of modern technologies; and that they are acquired through training and awareness creation. It was also found out that institutions like finance institutions and extension services do positively influence adoption of new technologies through farmer education and capacity building. The study further revealed that economically, movable comb hives (New technology) produced higher net returns per colony compared with local hives (Old technology) and that adoption of new technologies increased farmers yields and net benefits. The study therefore, concluded that social/cultural factors, managerial skills, institutional and economic factors actually do influence adoption of new beekeeping technologies in one way or the other and therefore recommended that Extension Officers responsible for introducing new technologies should always address these factors before and during introduction of new technologies.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

According to Kukonza et al (2009), improving the living standards of rural people through modern beekeeping is still a challenge despite the technological advances. The beekeeping enterprise among other initiatives in Agriculture and Livestock farming had not received sufficient attention in the past, as it does presently (Matami, 2008). It has been promoted widely in many countries as a major rural development engine (Bees for development 2000). Not only does the practice of beekeeping has intrinsic health benefits through providing a food source of great nutritional value; but it also requires relatively few inputs and capitalizes on a readily supply of pollen and nectar from crops they pollinate. Beekeeping is therefore, emerging as a very successful agricultural practice for rural areas in developing countries mainly due to its economic benefits from its products (Kukonza, 2009). For example, in Uganda honey, beeswax, propolis, royal jelly and bee venom are major financial products (Karealem et al, 2007), with pollination as the major biodiversity benefits (Delaplane et el, 2008).

Gichora, (2003) notes that beekeepers in regions such as Baringo county in Kenya had continued to practise traditional methods of beekeeping despite the introduction of modern beekeeping methods in nearly thirty years before her study. The Tugen people could count on one another to keep traditional beekeeping practises alive since all of them had either received instructions from a family member or a local beekeeper.

Kajiado county of Kenya (the location of this study) is a semi-arid area that is characterised by rough terrain. To the north, the escarpments of the Great Rift Valley rise to form the Ngong hills. The escarpments then stretch southwards to the Eastern side. On the floor are several hills and valleys forming a hilly and rough terrain with some areas having long stretches of grassland plains. Most of the land is covered by grass and shrubs forming shrub vegetation with acacia species being the most prevalent tree. This kind of vegetation is favourable for beekeeping. The main ethnic community found in Kajiado County is the Maasai with a population of 508,758, (2009, population census). Population growth rate is 4.6 per cent; Household size is 4.2; Geographical area of 21,903 Km²; average annual income US \$400 in paid income; with infant mortality of 45/1000. (ICROSS, 2005 courtesy of RELMA, 2005)

The main economic activity among the Maasai in Kajiado County is pastoralism (keeping cattle, goats, sheep and donkeys). However, beekeeping activity has become a lifeline to this community known for the importance they have attached to their cattle for many generations. The recurrent droughts have left the Maasai with little alternative but to diversify their economic activities. Mbae, (2010) notes that when modern hives were initially introduced, the honey harvesters had to brave the angry bees without any protective clothing but by having modern equipment, they now harvest conveniently and obtain more honey. Culturally, in the Maasai community, men dominate women but beekeeping is now empowering women (Mbae, 2012). The modern hives have also, by the nature of their management, been beneficial to the Maasai by conserving the environment around them.

1.2 Statement of the Problem

The Kenya Government, realizing the potential of the Beekeeping agricultural sub- sector of the country, established the beekeeping enterprise as a source of livelihood for rural Kenyans.

The main objective of the approach was to introduce improved beekeeping technologies (modern hives, honey extractor, honey presses, smoker, veil, glove etc.) which were initially imported from abroad for the beekeepers and to assist beekeeping training for farmers and extension officers. Before then beekeepers in Kenya were only using traditional beehives, which were inconvenient to undertake internal inspection and feeding, and had no facilities to accommodate supers (honey chambers) to separate brood and honey.

Crane (1990) noted that modern technologies in beekeeping allow higher honeybee colony management and give higher yield and quality honey. The improved box hive has components like brood chamber, super (honey chamber), inner and outer cover. It has advantages over the tradition hive in that it gives high honey yield in quality and in quantity. The other advantages of improved box hive are its ease in swarming control by increasing supers and the ability to move bees from place to place in search for honeybee flowers and pollination services (Crane, 1990).

In order to improve honey yield in quantity and quality, Agricultural and Rural Development Officers and various Non-Governmental Organizations have introduced improved box hives. Ehui *et al.* (2004) in their study on adopting social science revealed the difficulties of developing a universal model of the process of technology adoption with defined determinants and hypothesis that hold true everywhere, because of socio- economic and ecological distinctiveness of different sites and dynamic nature of most of the determinants. Further, Kerealem, (2007) stated that adoption rate of an improved technology is often low in the country and his study suggested the importance of further investigating factors influencing the adoption of improved hives and new technology. It is therefore evident that, there is some knowledge gap and it is recommended that repeated studies on determinants of adoption of new technologies under

different conditions be carried out. It is, however, noted that so far there has not been adequate information on the determinants of technology adoption, socioeconomic and socio-psychological factors influencing adoption of beekeeping technologies, and the financial benefits of adoption of the new technologies in Kenya. This information is therefore vital and lacking for beekeeping development and research investigation is required into this area (Crane, 1990). Based upon the aforementioned information, therefore, this study was relevant in order to find appropriate answers on determinants of adoption of modern technologies in beekeeping.

1.3 Purpose of the Study

The purpose of the study was to assess the determinants of adoption of modern technologies in beekeeping projects, taking the case of women beekeeping groups in Kajiado county of Kenya.

1.4 Objectives of the Study

The objectives of the study were therefore to:

- i. Establish the Social/Cultural factors that influence adoption of modern beekeeping technologies among the women beekeeping groups.
- ii. Determine how managerial skills influence adoption of modern beekeeping technologies among the women beekeeping groups.
- iii. Assess how the institutional factors influence the adoption of modern beekeeping technologies and
- iv. Determine the influence of economic factors on adoption of modern beekeeping technologies among the women beekeeping groups.

1.5 Research Questions

The study sought to answer the following broad questions:-

- i) How do Social/Cultural factors influence adoption of modern beekeeping technologies among the women beekeeping groups?
- ii) How do managerial skills influence adoption of modern beekeeping technologies?
- iii) How do institutional factors influence adoption of modern beekeeping technologies among the women beekeeping groups?
- iv) How do economic factors influence adoption of modern beekeeping technologies?

1.6 Significance of the Study

The findings of the study are of great significance to farmers who practice beekeeping in Kenya. By using results of the study, key stakeholders in this industry will be in a better position to understand the effects of determinants of adoption of modern technologies in beekeeping and be conversant with the best approaches to implement beekeeping practices they adopt in their pursuit for increased production and effective performance of their enterprises. Although the study investigated the determinants of adoption of modern beekeeping technologies, the results depicted general situations of the effects of adoption of new technologies in all other enterprises in agriculture; hence equipping the managers of various organizations with vital knowledge concerning adoption of these new technologies on the performance of their organizations. This study is therefore important to policy makers in Government as well as management and membership of the agricultural industry and its recommendations are useful in contributing to an improved performance of the industry envisaged in Kenya's "Vision 2030" medium term plan.

The findings of this study are expected to be of great value to various researchers involved in research and policy making. The documented report of the study can be easily acquired from the

library and it can equip the learners with more knowledge and skills in adoption of modern technologies in beekeeping in Kenya. The study further makes contributions to literature on new technology adoption which is part of articles useful to researchers who want to further the study; and to other wider stakeholders in academic circles.

1.7 Delimitations of the Study

The study was designed to assess the determinants of adoption of modern technologies in beekeeping projects. The scope of the study was limited to beekeeping where special focus was on women beekeeping groups in Kajiado County in Kenya. It involved collecting information from beekeeping farmers and major stakeholders in the industry, on adoption of modern technologies. The groups in Kajiado County were relevant for data required as time was a limiting factor that inhibited collecting data from all beekeeping farmers in the whole country. The study focused on the available literature on modern beekeeping technologies.

1.8 Limitations of the Study

The study encountered various limitations that tended to hinder access to information that it was seeking. The main limitation of the study was its inability to include a large number of beekeeping farmers due to time limits. The limitation was overcome by focusing on determinants of adoption of modern technologies in beekeeping projects within specific registered women beekeeping groups in Kajiado County. The study would have covered more beekeeping practices across all counties so as to provide for a more broad based analysis, but time and resources were limiting. The researcher also encountered other challenges such as non-cooperation by farmers who practise beekeeping; as many of them were illiterate to semi-illiterate and were not easy to convince to fill questionnaires. Language barrier was also a limiting factor because many of the

respondents were illiterate as indicated before. However, the researcher trained and engaged local interpreters who were able to interpret English into the local language and was then able to convince the respondents to answer. Further, respondents felt that the information they gave could be used to portray negative image of their approach or be used for competition purposes. The researcher, nevertheless, assured the respondents of privacy measures that the findings would be accorded and that it was to be used only for academic purposes.

1.9 Assumptions of the Study

The study assumed that the respondents were available to answer the questions put to them in the questionnaires. This happened as evidenced by the high return rate of the questionnaires received. The researcher also presupposed that the data collection instruments were measuring the desired constructs; and that the respondents were available and understood and answered the questions correctly and truthfully.

1.10 Definition of Significant Terms as used in the Study

Adoption: The choice to acquire and use a new invention or innovation.

Beekeeping: Is a commercial undertaking of rearing honey bees for its products.

Beehive: A box like or dome shaped structure in which honeybees are reared and kept

Brood Chamber: The section of a hive in which honeybees rear their young .In Langstroth hive it is the bottom box.

Determinants: A factor that decides, causes, affects or influences whether or how something happens.

Economic factors: Are any considerations that are relevant to a decision and that involve economic variables such as price and wages.

Institutional factors: Institutional factors are those factors focusing on the deeper and more resilient aspects of social structure. In the context of this report they encompass Institutions such as Financial, Training and Extension Institutions. .

Social/ cultural factors: Socio/ cultural factors are the larger scale forces within societies and cultures that affect thoughts, behaviours, and feelings of individual members of those societies and cultures. Examples of socio/ cultural factors include aesthetics (appearance), language, law, politics, religion, values, attitudes, social organizations, reference groups, family, a person's role and status in their society, technology and material culture.

Managerial skills: The ability to make business decisions. The common skills include human skills, technical skills and the conceptual skills.

Modern technology: .In the context of this study modern technology will mean the use of improved technologies in beekeeping involving movable comb hives, the movable frame hives and their accessories(smoker, catcher box, hive-tool, bee brush),protective clothing, honey extraction and straining equipment; and the acceptable seasonal management and colony inspection techniques.

1.11 Summary

The Introduction chapter gives a brief background of the study which set the stage and put the topic in perspective and contains general statements about the need for the study. The Chapter gives a statement of the problem which defined the root problem and elaborates why the problem is significant to the study; it gives the purpose of the study, objectives of the study, research

questions, significance of the study, delimitations of the study, limitations of the study, assumptions of the study and finally concludes with the definition of significant terms.

1.12 Organization of the Study

The study was organized into five Chapters. Chapter One introduces the background of the study, the statement of the problem and describes the specific problems addressed through researchable objectives and questions while giving an outline of the whole study. Chapter Two presents a review of literature regarding determinants of adoption of modern beekeeping technologies and relevant research associated with the problem being addressed in the study. It also gives a theoretical approach in relation to the study. Chapter Three presents research methodology entailing research design, target population, sample size and sampling procedure, research instruments, pilot testing, validity and reliability of the instruments, data collection procedure, data analysis techniques and ethical considerations. Chapter Four involves data analysis, presentation and interpretation while Chapter Five presents conclusions and recommendations drawn from the findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provided an extensive literature and research information related to the determinants of adoption of modern beekeeping technologies. The literature review summarizes a diverse spectrum of views about new technology adoption. The chapter was therefore structured into theoretical, conceptual and empirical review.

2.1.1 An Overview of Beekeeping Practices

Modern beekeeping in Europe, (the modern system of managing honey bees), emerged about the 18th century when European understanding of bee colonies and their biology made it possible to construct movable comb hives so that honey could be harvested without destroying the entire colony Crane (1999). According to Crane (1999) these methods were perfected in Northern America where the European honeybee was being reared by immigrants from Europe. Africa remained on tradition beekeeping (the old system of managing honeybees) and it has the longest history of traditional beekeeping. Honey hunting and use of traditional beehives is still thriving in many countries of Africa.

Paterson (2006), states that beekeeping in Kenya is as old as its history and has always been a predominantly male occupation. This can be explained by several factors. Culturally, beekeeping has been generally considered to be an exclusively male domain and male beekeepers sometimes even objected to women becoming beekeepers. There are also a number of practical constraints that hitherto hindered women from participating in this economic

activity. First, handling traditional log hives required physical strength. Two, it was often necessary to climb trees (where hives are hung) to harvest honey. Beekeeping had, therefore, not been considered suitable for women for these modesty reasons. Harvesting honey from traditional beehives also required long absences from home, which conflicts with women's domestic chores.

In a study report by Gok,(2004) on the honey value chain to identify how beekeeping farmers could position themselves in the development of the agricultural sector, it was revealed that limited value addition was being realised due to minimal investment in technological and market development initiatives. The same report indicated that the low priority given to the sector had also affected the scale of production and productivity of beekeeping. It was therefore necessary to explore ways to encourage technological innovation in the honey sector as a means of alleviating rural poverty. It is within this context that an opportunity for women to participate in the honey value chain was recommended. This would be achieved by introducing modern top bar hives as an appropriate beekeeping technology for women as the hives require less physical activity and can be installed closer to their homes (Kigatiira,1979)

According to the Gok (2004) report, the third element of the intervention focused on the empowerment of women with appropriate beekeeping equipment and supporting the creation of women groups within associations. The reason for encouraging women to work in groups has been because modern beehives require intensive monitoring and management, which is better organised in a group. Moreover, the high cost of the technology is unaffordable for individual group members.

In order to address the challenge of the high cost of modern beehives, women groups needed to source additional funding for the intervention including grants, from the Non-governmental organizations and the Central Government to support capacity development for beekeepers. The Government of Kenya through the Ministry of Agriculture, Livestock and Fisheries Development has been facilitating follow up training for women beekeepers in Kenya on group management and modern beekeeping skills (Gok, 2004)

The approach towards new technology has been encouraged since the incomes and expenditures made by women would be managed as a group. In this way, they would be able to hold each other accountable and generate independent incomes to boost their existing household income sources. Revolving funds would make the modern beehives affordable to the women groups. One of the immediate outcomes of the intervention would be an increase in the number of women beekeepers. From its experience, the Government has found that women's groups are consistent in honouring their contractual obligations as compared to individuals. Gichora (2003) notes that it is for the reasons above that the Government through the Ministry of Agriculture, decided to focus on supporting women beekeeping activities through its input services facility as it was more likely to recoup its investments. The Government through the Ministry dealing with Apiculture formulated an objective to enhance women participation from 10% to 40%. So far more than 33% women participation has been achieved, of which slightly more than 60% have established themselves in producer groups within the value chain (Gichora, 2003). The modern top-bar beehive generates higher incomes from beekeeping than the traditional beehive due to its higher yield. Furthermore, the technology provides women with higher quality honey that is more popular with consumers (Kimalu, 2002). Due to the safety net provided by participating in

women's groups, most female beekeepers are able to stockpile their honey and sell it when prices are higher, instead of during the harvest period when prices for high quality honey are low. In this way they are able to re-invest more income in food production, hence contributing to food security and improved household incomes. In conclusion this intervention shows that integration of women in beekeeping value chain has had a positive effect on household income, food security and employment (Kukonza, 2009)

Kimaji (2002) stated that relationships established between women's producer groups and processors' associations have strengthened the value chain as a whole. The provision of input technology service to women's groups through a revolving fund combined with embedded management skill training provided by the beekeepers' associations has been the key driver of success of this model. It has provided women with the opportunity to access technology in a more affordable manner hence contributing to the development of the beekeeping sector. The use of the top-bar beehive has also been appreciated by male beekeepers since it contributes to household requirements such as health and education, enabling men to spend a larger proportion of their income on other needs. Still, the key challenge is to ensure that the technology continues to stay affordable for women beekeepers and that adequate capacity development is provided for good management of modern beehives. These challenges are partly responsible for the marginal adoption of this technology in the country in comparison to traditional beehives. It is important to note that, the market trends indicate that demand for modern hives is growing, driven by rising demand from processors for more and better quality honey. Consequently, the market is driving the possibility of up scaling this model (Nafula, 2008).

2.1.2 Beekeeping technologies in Kenya

Majority of beekeepers in Kenya still use traditional production systems which mainly comprise of hollow log hives (Cramb, 2003). These hives constitute the single largest number of hive types in the country estimated at 1,273,000 with 73% of the hives concentrated in the eastern part of the country Mwabu (2002). Other traditional hives include the bark hives made of bark that has been peeled from the trunk of a tree. Honey harvesting is normally done at night and it sometimes involves stripping naked before climbing the trees on which the hives are hanging (Porter, 2002)

However, many of the old and experienced traditional beekeepers have abandoned the practice due to various reasons which include increased human population which has opened up natural bee habitats for cultivation. Vandalism, frequent and severe droughts have resulted in a significant decline in honey bee populations. A variety of indigenous hard wood tree species are used in making traditional hives. The hives are made of pieces of logs measuring 1.0-1.5 metres. They can be of uniform diameter or sometimes narrowing towards one side with the walls made as thin as possible in order to reduce the overall weight of the finished product (Nightingale, 2006). In communities like the Akamba and their close neighbours living in eastern Kenya, the whole log is hollowed out from end to end. The openings at both ends are usually closed with wooden planks. One of the planks, normally at the narrower end is provided with bee entrances and fixed while the other is removable and has no entry holes. This is the opening through which the beekeeper can access the inside of the hive during honey harvesting (Matami, 2008).

In some other communities living in the Rift Valley, the log is split lengthwise and the two sections hollowed out into troughs. The two sections are then fitted together and, as observed by

Porter (2002), the inside is accessed by way of a trap door cut into the base of the hive. After the hives are well seasoned, they are usually baited with suitable materials, e.g. beeswax, propolis or leaves of some plants like the ocimum and scharicum spp, before they are placed on trees. Hives are hung either horizontally or at an angle. The hives are placed such that the bee entrance faces away from the prevailing wind (Nightingale, 2006).

The traditional hives are placed high up on trees by means of a hooked pole or placing them between suitable tree branches and left to be occupied by wild swarms. Honey harvesting is normally done at night when the bees are less aggressive. Hives can be worked up the trees or lowered to the ground by means of a rope. The honey is usually stored away from the hive entrance. This is the end from which the harvesting starts, moving towards the opposite side. Smoke, which has the effect of mollifying the usually aggressive bees, is provided by a traditional torch made of dried bark or other suitable material. Once the honey has been removed, the hive is hoisted back to its place. Since this type of hive has only one chamber with fixed combs, the honey, wax, pollen and brood are all removed together during harvesting greatly compromising the quality of the final product. Very little or no routine colony management is practiced under the traditional system. Colony management is often limited to harvesting honey and rebating hives with suitable bee lures to enhance occupation. The harvesting methods employed by traditional beekeepers may lead to the loss of a substantial number of bees, thus reducing the strength of individual colonies and the potential number of feral swarms. The marketable honey quantity is affected by quality, which in turn is affected by simple, sometimes crude methods in handling bees (Kimalu et al, 2002)

Modern beekeeping practices involve the use of improved technologies which are easy to manipulate and manage. The main types of hives used are the movable comb hives and the movable frame hives. Other accessories that go together with modern beekeeping include the catcher box, protective clothing, smoker, hive tool, bee brush, the honey extracting and refining equipment. Improved management practices are also part of the improved beekeeping technology and include seasonal management routine, colony inspection. Colony division, artificial feeding and pest control.

The invention of the movable-comb hive is the work of the ancient Greek beekeepers who used basket hives in which a series of bars were used to form the top of the hive (Mann, 1976). These types of hives are designed to allow the combs to be removed, inspected and returned back to the hive. The Kenya Top Bar Hive (KTBH) designed in the 1970s, is a modification of the Greek basket hive with movable, interchangeable top bars. The hive is basically one chamber wooden box; with the sides sloping inward at an angle of 120 degrees to the horizontal. This design ensures that the bees do not attach combs to the sides of the hive. The hive accommodates 26 top-bars which are 48 cm long and 3.2cm wide with the underside fitted with a strip of beeswax to act as a starter comb and guide the bees in comb construction. The lid is made of a timber frame covered with a light gauge galvanized iron sheet. The KTBH has a number of advantages over the traditional log hive in that combs can be easily removed for inspection and returned to the hive. The honeycombs can be removed without interfering with the brood nest. Honey quality is improved since pollen and brood combs are separated from the harvested honey. There is improved pest control and the low hanging height makes it easier and faster for various management operations.

Movable-frame hives are the most advanced hives in design to date and are used by commercial beekeepers in many parts of the world (Patterson, 2006). The first movable frame hive was designed by an American clergyman, the Reverend Langstroth in 1851. The invention by Langstroth, and the patenting of the artificial comb foundation by Melhring in 1857, revolutionized beekeeping and put it on a commercial footing (Mann, 1976). The frames can be removed, inspected and when full of honey, extracted and returned to the hive for the bees to continue filling them with honey.

The Langstroth hive is the most popular of the frame hives and is used in various parts of Kenya. The key components of this hive include the bottom board, the brood chamber, queen excluder and the top cover. The Langstroth has a number of advantages compared to other types of hives found locally. The frames make the combs strong hence minimizing breakage. Moreover, the honey can be extracted and the frames returned to the hive leading to higher yields. Honey quality is enhanced due to the use of a queen excluder. However, they are more expensive than the traditional or top bar hives. The Langstroth hives require more management skills and the comb foundation frames are prone to attack by wax moth Paterson (2006).

Multi-chambered top bar hives have also been developed and are in use in various parts of the country. These hives have some advantage over the single chamber type in that the honey and the brood are kept separate. The hives have similar measurements to the Langstroth but have top bars instead of the standard frames and are in some instances wrongly referred to as 'Top-Bar Langstroth' (Muriuki, 2010). Frame hives have been successful in the cooler parts of Africa where there is an abundance of bee forage and are managed by experienced beekeepers.

However, they have had limited success in general and in most cases, the yields obtained do not justify the additional capital and management requirements (Patterson, 2006). The last decade has seen a tremendous growth in the number of Langstroth hives in Kenya. However these hives are not necessarily better than either the traditional or top bar hives and their potential for better yield and quality depends very much on good management practices (Carroll, 2006). Nevertheless, use of modern beekeeping technology encourages better bee management and aims at higher success than can be hoped for by the exclusive use of traditional methods (Kigatiira, 1976)

Rearing bees in houses is a new technology in beekeeping. Honeybees are kept in houses to protect them from adverse weather, predators and vandals. The bees can access their hives through holes in the wall that lead to each hive. According to Paterson (2006), bees are more manageable when kept in a bee-house because more aggressive guard bees will remain outside the bee-house while the hive is being manipulated. Another advantage is that this method of beekeeping has the possibility of increasing the carrying capacity of small pieces of land since a small house (5x5m) can take up to ten hives. However, it should be noted that a secure bee-house can be expensive to construct.

2.2 The concept of Adaptation of New Technology

According to Feder (2005) adoption is classified into individual and aggregate adoption according to its coverage. Individual adoption refers to the farmer's decisions to incorporate a new technology into the production process. Aggregate adoption is the process of diffusion of a new technology within a region or population. The study on modern beekeeping technology adoption refers to the first type of adoption. Salim, (2006), states that the adoption pattern to a

technological change in agriculture is not uniform at the farm level. It is a complex process, which is governed by many socio-economic factors. The farmers' socio-psychological system and their degree of readiness and exposure to improved practices and ideas i.e. changes like the awareness and attitude of farmers towards improved agricultural technologies and the institutional factors which act as incentives/disincentives to agricultural practices and the farmers' resource endowment like the land holding size and labour are some of the factors of considerable importance in bringing about the technological change in agriculture.

Adoption is viewed as a variable representing behavioural changes that farmers undergo in accepting new ideas and innovations in agriculture. The term behavioural change refers to desirable change in knowledge, understanding and ability to apply technological information, changes in feeling behaviour such as changes in interest, attitudes, aspirations, values and the like; and changes in overt abilities and skills (Rogers, 2003)

Feder et al, (1985) defined adoption as the degree of use of a new technology when a farmer has full information about the technology and its potential. The author also defined aggregate adoption as the process by which a new technology spreads or diffuses within a region. Rogers (2003) defined adoption as the mental process through which an individual passes from first hearing about an innovation to final adoption. Rogers and Shoemaker (1971) defined adoption as a decision to make full use of new ideas as the best course of action available. The decision of whether or not to adopt a new technology hinges upon a careful evaluation of a large number of technical, economic and social factors. The authors further explained that adoption or rejection of an innovation is a decision to be made by an individual. According to Dasgupta (2009), the term adoption is the continued use of a recommended idea or practice by individuals or groups

over a reasonable long period. Hagmanm (2003) also defined technology adoption as a decision to apply an innovation and to continue to use it.

2.3 Social/cultural factors and Adaption of modern technology

According to Kenya Beekeepers Association (KBA, 2005) conference proceedings report, social/cultural factors that influence adoption of modern technology are many and may include: sex of the household head, marital status, and size of the household among other factors. Adoption of modern technology will therefore have to take into consideration such factors. This indicates that farmers with large family size, for example, may opt more for technology adoption. This in turn implies that technology adoption will increase hive products which contribute to satisfy the needs of their families. Farm experience may help the farmer to get more understanding of management practices of the farm activities. Similarly education level of adopters of improved technology could be higher than non-adopters of the technology, implying that there is influence of the variable in making adoption decisions. It implies therefore, that education level of the beekeeper is positively associated with adoption of improved modern technology of beekeeping (KBA, 2005)

Spielman, (2005) states that a beekeeping activity can be undertaken on small land size and that one of the relative advantages of beekeeping activity is that it does not require fertile land and uncultivated land is also suitable for beekeeping. Hence, for landless farmers having just an apiary site is sufficient for engaging in the activity. Endrias Geta ,(2003) noted that beekeepers positively perceived improved box hive as a good opportunity for beekeeping improvement His results revealed that beekeepers who had positive perception of the technology, adopted the technology more. This revelation is supported by a World Bank (2007) study which found that

positive perception influences adoption positively. The study of Endrias Geta,(2003)) on factors influencing adoption of soil conservation measures in south Ethiopia, Gununo area also explains that perception of soil conservation problem influenced positively the adoption of soil conservation technology.

In a European Commission manual (1997), it is stated that since some communities who are beekeepers are traditionally unwilling to compromise traditional practises for modern beekeeping practices, culture has been found to have great influence on the adoption of modern technology. There are both positive and negative cultural characteristics that influence adoption. Other indicators that influence adoption are timing of the project, training, age of the beekeeper, education status of the beekeeper, own land holding status, status of the beekeeper, average household size and household assets. These are all socio/ cultural factors that stand to be key determinants of adoption of technologies in beekeeping (European commission,1997).

2.4 Managerial skills and adaptation of modern technology

Fischer, (1996) observed that every beekeeper needs to possess managerial skills which are vital to implement modern technology. These skills can be acquired through training and awareness creation. Before doing something right, beekeepers need to observe it done right. This principle of psychomotor learning presupposes that observing is not just seeing, but it is a way of looking that must be learned to acquire managerial skills (Fischer, 1996). Training beekeepers in modern beekeeping methods requires them to find their own personal method for working with bees. Thus the teacher needs not be limited as long as the objective of training is met. In this way, every participant is given time to acquire their own beekeeping method while identifying themselves with a person who acts the way they want to learn. Beekeeping training, if it is to be

effective, best takes the form of vocational education. No wonder traditional beekeepers best learnt it on the job Fischer, (1996)

Beekeeping training cannot be replicated from one place to another because every country, area and location has different starting points which need to be identified in advance. The main question should be whether there is need for beekeeping training. Once a target group has been constituted, it can be homogeneous or heterogeneous depending on what members have in common. It is not desirable that a group is too heterogeneous, for example, comprised of men and women, literate and semi-illiterate people, children mixed with adults and so on. Other factors to take into consideration are that a group of women might prefer to be under female trainers while the opposite may be true of men. Training planners can decide on the level of homogeneity of the groups they want, sometimes splitting a larger group into more homogeneous groups to their advantage for example, a children's group, or an adult group, Fischer (1996) .

2.5 Institutional factors and adaptation of modern technology

The major role of the institution of extension services in many countries in the past was seen to be transfer of new technologies from researchers to the farmers (Ban et, al 1996) Today, it is seen more as a process of helping farmers to make their own decisions by increasing the range of options from which they can choose, and by helping them to develop insight into the consequences of each option.

Extension plays a great role in popularizing farm technologies. Currently, everyone is found in competitive globalized world, hence, to make the farmer competent, it is expected that extension officers work more closely with farmers than any other times. As noted by Haggmann, et al (2003) the role of extension includes building the capacity of farmers and farmer organizations to

pursue their development goals by articulating high quality demand for services which can be effected by offering need-based practical training and close follow up which enable them to examine their farming environment and comparing with other farming situations. This, in turn, develops farmers' aspiration for change through adopting different farm technologies that is suitable to their farming system (Hess, 2007). Extension also helps linking farmers and farmer organizations to other support agencies including access to financial institutions, markets, input supply institutions and systems; creating platforms for their interaction and facilitating negotiation between different stakeholders.

This capacity also helps farmers to search for new knowledge and technologies as well as creating partnerships that enhance application of the knowledge and technologies. It facilitates farmers for collective and individual learning about innovations to enhance community's capacity to innovate. Collective action helps to find appropriate solution, hence grouping different actors in learning and experimenting together and sharing experiences that enhance them to understand more about the technology (Hess, 2007).

Enhancing technology dissemination and adoption is part of an innovation system that starts with the technology development process itself. The concepts of participatory technology development (PTD) and now integrated agricultural research for development (IAR4D) indicate a shift from supply driven to more collaborative ways of generating and disseminating relevant agricultural technologies. This therefore, means that the responsibility to promote technologies cannot be left to extension agencies alone but rather it is a collective responsibility of researchers, extension agents, farmers and other service providers. Engaging in such collective responsibility demands new skills for integration and working together in partnership with key stakeholders. Skills for doing so have to be clearly identified and deliberately built in the

systems (National Agricultural Research Organization NARO, 2004). Rural knowledge management that links various actors who have and seek knowledge to bring together their knowledge and experiences is also vital for beekeepers (Doss et al, 2003)

2.6 Economic factors and adaptation of new technology

The probability of adopting new technology will depend on the difference in profitability between the new and old technologies, and the ability of the farmer to perceive the advantages and efficiently utilize the new technology (Behera, 1999). As noted by Gavaian and Gemechu (1996), high yields are not sufficient conditions to persuade farmers to adopt a technology. With technology application, farming must be basically profitable or at least more profitable than other alternatives. Behera and Mahapatra (1999) in their study on income and employment generation for small and marginal farmers through integrated farming system, which included field and horticultural crop (agro- forestry), poultry, mushroom, apiculture and biogas enterprises, found out that apiculture produced the highest return per unit.

Ambrosini et, al , (2002) in their study on the therapeutic effects of propolis in livestock farming, examined the role of beekeeping as a source of valuable food and off-farm income in rural areas of developing countries. The valuable beekeeping products included honey, beeswax and propolis. The study discussed the potential of propolis as a therapeutic agent against human and poultry (particularly fowls) diseases, owing to its antibacterial, anti-fungal, antiviral, anti-protozoa, anti-helminthic, antioxidant and immune enhancing properties, as an antibiotic additive for cheese, and as a dietary supplement for humans and animals. Ayalew (1990) using partial budgeting analysis indicated that added cost (reduced return) and increased return (reduced cost) accounted for both the home made and institutionally prepared Kenya top Bar hive (KTBH).

According to Kerealem (2005) movable comb top bar hives result in higher net return per colony compared with local hives.

2.7 Theoretical Framework:

According to Leeuwis, (1993), adoption theories try to fill the gaps created by focusing economic models on interest and profit maximization among agricultural men and women. They also try to fill the gaps created by economic models failing to conceptualize the social dimensions of knowledge, information, communication and rationality and the limited ability of economic models to explain decisions and capture complexity of farmer's attitudes and behaviour towards new technology.

2.7.1 Theory of psychological field

The main proponent of the psychological theory is Kurt Lewin,(1986). The proposition of the theory is that human behaviour is seen as a result of the interplay of diverse forces that create a set of circumstances through the dynamic interaction of man and his environment. According to the psychological field theory of Kurt Lewin, the interaction of situational forces with the perceived environment can be described as a field of forces towards modernization, a system in tension or a psychological field. Human behaviour can be described as follows:

A farmer in his subjectively perceived environment feels something is worth striving for targets. He/she then mobilizes his/her personal powers to achieve this goal. When something negative or undesirable occurs, he/she activates his personal powers in the same way to avoid the negative situation. Ways of reaching targets and avoiding negative situations can be blocked or impeded by barriers or inhibiting forces (lack of knowledge, uncertainty about outcome, insufficient capital, cultural practices, lack of opportunities for scaling up of innovation etc) which are the key determinants to adoption of modern technologies.

2.7.2 Theory of Behavior Modification

The main proponent of behaviour modification theory is Albretch et al, (1987). The main tenets of the theory are inhibiting forces. Forces negatively influencing behavioural change e.g. lacks of subsidies, limited liquidity for labour hiring, buying herbicide, seeds of legumes for soil coverage, lack of machinery, and limited knowledge. Driving forces conducive to positive target (adoption) e.g. financial assistance, technical advice, training, provision of inputs, financial assistance, linkage with market outlets, etc . Behaviour (adoption) is thus seen as resulting from the psychological field of inhibiting and driving forces hence these forces are present in a state of equilibrium or disequilibrium with varying degrees of tension between them. Once such forces are identified in the farmers decision making process, the chances of diffusion can be estimated and consequences for promotion programs concluded (Hoffmann, 2006).

The adoption theories have laid more emphasis on the individual farmers approach towards the adoption of new modern technologies and the possible limiting factors towards the adoption of the new approach. Examples are lack of financial assistance and cultural influences which are also attached to the socio/ cultural factors, information and attitude.

2.8 Conceptual framework

A conceptual framework is an element of the scientific research process in which a specific concept is defined as a measurable occurrence or in measurable terms that basically give clear meaning of the concept (Mugenda and Mugenda ,2003). It is a diagrammatic presentation of the relationship between dependent and independent variables. In the study, the dependent variable was adoption while independent variables were social/ cultural, economic, institutional factors and management skills.

Independent Variables (Determinants)

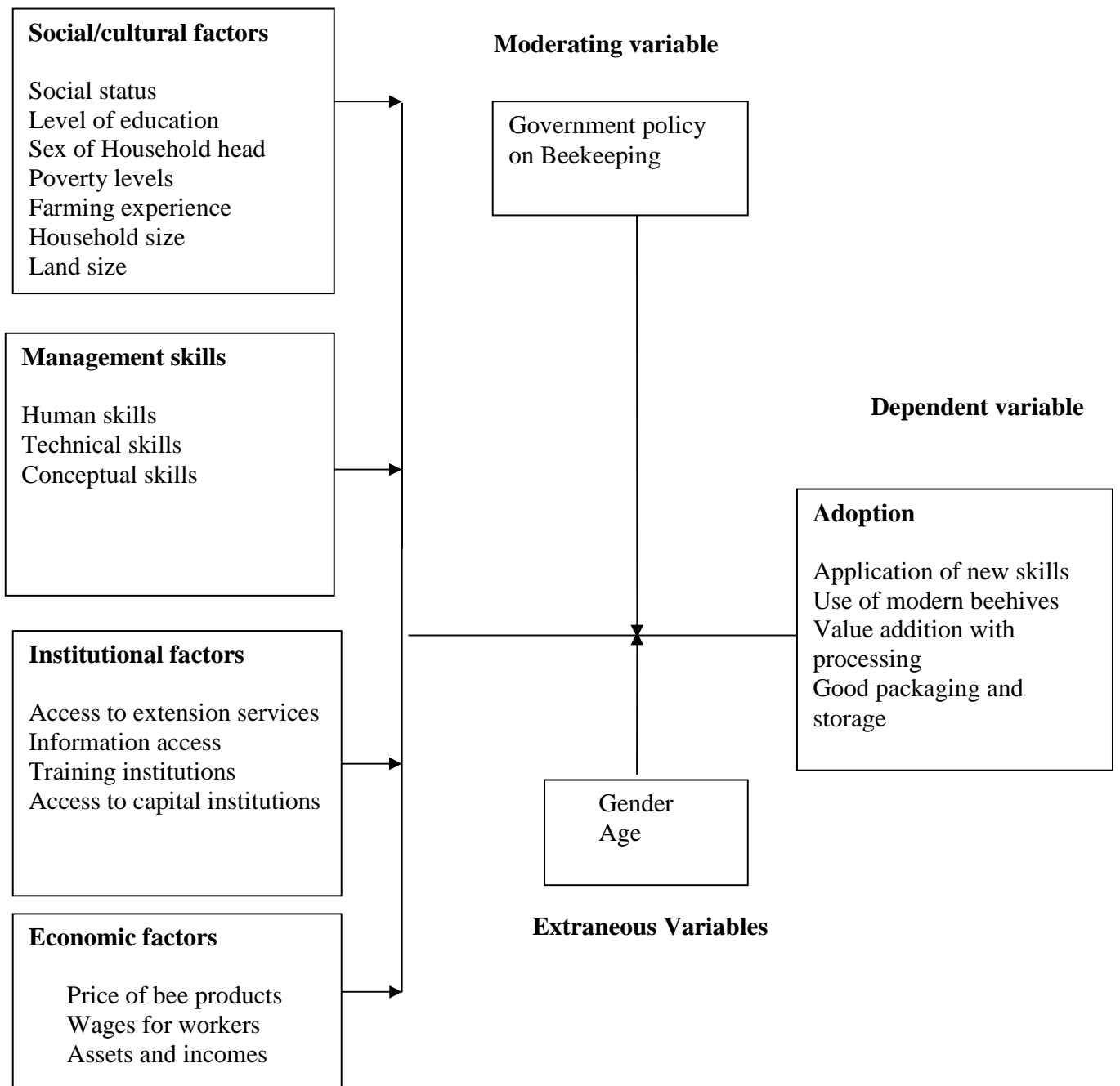


Figure 1 Conceptual framework

2.9 Knowledge gap

Many studies on adoption of agricultural technologies have been undertaken in various disciplines in different parts of the world. Most of these studies, however, have tended to focus on the adoption of improved technologies in agriculture such as improved seed varieties, use of fertilizer, soil and water conservation methods. The studies have however used variables similar to those used in this study. It was particularly noted that in studies on determinants of agricultural technology adoption conducted in Mozambique, (Uaiene et al. (2009) it was reported that households with access to credit and extension advisory services as well as members of agricultural associations were more likely to adopt to new agricultural technologies. Households with higher levels of education were also more likely to adopt. Mwanthi (2009) carried out an assessment of technology adoption among agro pastoral households in south eastern Kenya .The findings of the study revealed that participation in project activities, gender of household head, and managerial skills had a positive significant effect on adoption.

Research on the determinants of adoption of a recommended package of fish farming was conducted in selected villages in eastern Tanzania (Wetengere, 2010). The findings revealed that access to resources is a key factor that determines the adoption of a recommended package of a technology and farmers allocate resources to activities which contribute to household food and income security. Farmers are likely to adopt a complete package of a recommended technology if household resources such as land, labour, cash income, knowledge and other inputs like feeds, fertilizers, water and seeds are forthcoming from the existing farming system. Factors influencing adoption of conservation tillage in Australian cropping regions were evaluated by D'Emden et al. (2008). Results from the study indicated that perceptions associated with shorter-term crop production benefits under no-till, such as the relative effectiveness of pre-emergent

herbicides and the ability to sow crops earlier on less rainfall were influential. Increased cropping extension activities were also strongly associated with no-till adoption. While carrying out studies on determinants of adoption of improved box hive in the Tigray region of Ethiopia, Workneh (2007) found out that use of credit, perception, the education level of house hold head and practical knowledge of the technology were positively influencing adoption decision of improved hives.

Demeke (2003) studied the factors influencing adoption of soil conservation practices in north western Ethiopia and observed that farm size and perceptions of benefit from conservation measures positively and significantly affected farmers' decision to adopt conservation structures. Studies on the factors influencing adoption of improved maize and fertilizer technologies were carried out in Embu District, of Kenya (Ouma et al., 2002). Analysis of the results using maximum likelihood estimation logistic regression model indicated that the agro-ecological zone, gender, use of manure and hiring labour influenced adoption. Degu et al. (2000) carried out studies on the adoption of seed and fertilizer packages and the role of credit in smallholder maize production in Sidama and north Omo zones, Ethiopia. The analysis of factors affecting the adoption of improved maize showed that the number of agro- ecological zones, extension services, use of credit, and membership of an organization all significantly influenced the probability of adoption. Significant factors affecting the adoption of fertilizer were off-farm income, the use of hired labour, credit and being a contact farmer.

Makokha et al. (1999) carried out studies on farmers' perception and adoption of soil management technologies in western Kenya and found out that farmers' characteristics such as

participation in field days and demonstration, attendance at workshops, seminars and contact with extension workers, and leadership position have significant influence on perception and hence adoption decisions. In their study of adoption of agricultural innovation in developing countries, Feder et al. (1985) listed the factors that influence technology adoption as credit, farm size, risk, labour availability, human capital and land tenure. The authors too noted that education can also directly facilitate technology adoption, by increasing access to information about alternative market opportunities and technologies.

It was therefore clear that the review of the available literature as recorded above, clearly showed that many studies had been undertaken on determinants of adoption of modern technologies in the agricultural field all over the world; though seemingly little had been done on the determinants of adoption of modern technologies in the field of beekeeping. This created a knowledge gap and therefore justified the need for this study to be carried out. Furthermore, various researchers including Kerealem, (2007) and Ehui et al (2004) had recommended repeated studies on determinants of adoption of modern technologies under different conditions.

2.10 Summary of the reviewed literature

The Chapter on literature review summarised the diverse spectrum of views about new technology adoption in different fields. These views included an overview of Beekeeping practices in Kenya; the technologies of beekeeping available in Kenya; the concept of adoption of new technology; theoretical framework review and adoption theories in agriculture.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology which was used to carry out this study. It further describes the type and source of data, the target population, sampling methods and the techniques that were used to select the sample size. The chapter describes how data was collected and analysed. The methodology in the study gave guidelines for information gathering and processing.

3.2 Research Design

Orodho (2003) defined a research design as the scheme, outline or plan that is used to generate answers to research problems. According to Kombo and Tromp (2006), research design can be thought of as the structure of research. The research problem in this study was studied through the use of a descriptive research design. According to Cooper and Schindler (2003), a descriptive study is concerned with finding out the what, where and how of a phenomenon. This study therefore was able to generalize the findings as the determinants of adoption of modern technologies in beekeeping projects in Kenya.

The main focus of the study was quantitative. However some qualitative approach was used in order to gain a better understanding and possibly enable a better and more insightful

interpretation of the results from the quantitative study. This method deals with the intense investigation of problem solving situations in which problems are relevant to the research problem. The underlining concept is to select several targeted cases where an intensive analysis identifies the possible alternatives for solving the research questions on the basis of the existing solutions applied in the selected study. The researcher attempts to describe and define a subject, often by creating a profile of group of problems (Cooper & Schindler, 2003)

3.3 Target population

According to Ngechu (2004), a population is a well-defined set of people, services, elements and events, group of things or households that are being investigated. According to Mugenda and Mugenda (2003) a population is defined as a complete set of individuals, cases or objects with some common observable characteristics. The common observable characteristics in the Kajiado women beekeeping groups were that they are all beekeepers.

Target population as described by (Borg and Grall, 2009) is a universal set of study of all members of real or hypothetical set of people, events or objects to which an investigator wishes to generalize the result. The target population in this study composed of one county livestock production officer (C.L.P.O), one member from each key stakeholders Dupoto e maa, Neighbours Initiative Alliance, German Agro Action, Maasai Community Development, ASAL Management and women beekeepers from 72 registered women beekeeping groups in Kajiado.

Table 3.1 Target population

Category	Target population
County Livestock Production Officer	1
Neighbour Initiative Alliance	1
German Agro Action	1
Maasai Community Development	1
ASAL Management	1

Dupeto-e maa	1
Women Beekeepers	720
Total	726

3.4 Sampling Procedure and sample size

A sample is a representative portion of an entire population under study. The portion is also expected to fully represent the characteristics of the entire population and free of bias thus reducing sampling variability. Sampling is a process of choosing the units of the target population which are included in the study. This is normally done because a complete coverage of the population is not practically possible. Slavin, (1984) observed that due to limitations in time, resources and energy, a study can be carried out from carefully selected sample to represent the entire population.

The study applied Fisher's formula to come up with a sample size. According to Mugenda and Mugenda (2003). Fisher's formula gives a derivation of a constant N which is adjusted depending on the target population. The study then applied simple random sampling to come up with the right interval on which the respondents were randomly picked. The researcher used purposive sampling to select one County Livestock Production Officer and one member each from other key informants from the Key stakeholders. Purposive sampling allows a researcher to use cases that have the required information with respect to the objectives of the study (Mugenda and Mugenda, 2003). The study used Fisher's formula to calculate the sample size based on the sample for proportions:

$$n = \frac{Z^2 \times P \times Q}{E^2}$$

Where: n = the desired sample size

Z = the value corresponding to the level of confidence required (in this case 1.96 corresponding to 95% level of confidence)

P = estimated level of an attribute that is present in the population (0.1 variability)

Q% = estimated level of the attribute that is not present in the population

E% = desired level of precision (in this case 5%)

The adjusted minimum sample size was collaborated by use of the formula for correlation for finite populations. This was computed as:

$$\frac{1.96^2 \times 0.1 \times 0.9}{0.05^2}$$

$$= 138$$

This was adjusted using the formula:

$$n_1 = \frac{n_0}{1 + (n_0/N)}$$

Where: n_1 = adjusted minimum sample size

n_0 = minimum sample size as arrived at in the previous formula

N = the total known population

$$n^1 = 138 / 1 + (138 / 720) = 116 \text{ (Sample size)}$$

A simple random sampling technique was used in selecting the 116 women to participate in the study.

3.5 Methods of data collection

The study collected data information from women beekeeping groups in Kajiado County. Primary data is gathered directly from respondents and for this study the researcher used semi-structured questionnaires (consisting of close and open-ended questions). Data was collected using questionnaires as this enabled the researcher to collect information more easily and within reasonable time (Kombo and Tromp, 2006).

The semi-structured questionnaires addressed both quantitative and qualitative aspects of the information in the study. Secondary data collected from journals and reports filed with the Ministry of Agriculture Livestock and Fisheries Development complemented the findings obtained from the primary data sources. The researcher used Key informant interview guides where respondents were asked questions and gave immediate feedback, Key informant interviews were held with six key stakeholders in Kajiado County which involved purposively picking one individual representative from stakeholders of Dudoto Mead, Neighbours Initiative Alliance, German Agro Action, Maasai Community Development, ASAL Lands Management and the Ministry of Agriculture, Livestock and Fisheries representatives.

3.5.1 Oral interviews / Questionnaires

An interview is a purposeful discussion between two or more people. The use of oral interview can help the researcher to gather valid and reliable data that is relevant to the research questions and objectives. Oral interviews were conducted on the 116 women representatives from each of the groups.

3.5.2 Key informant interviews

This study used key informant interviewees that were purposefully selected. The purpose of key informant interviews was to have open-ended, in depth interviews with key informants from local level stakeholders about their views on adoption of new technologies in beekeeping. This entailed development of an interview guide with a series of open ended interview questions under research objectives that was be posed to individuals selected for their knowledge and experience.

3.5.3 Observations

Patton, (1990) defined observation as the systematic description of events, behaviours, and artefacts in the social setting chosen for study. Observations enable the researcher to describe existing situations using the five senses, providing a "written photograph" of the situation under study. The researcher employed observations to collect some of the critical information on the beekeeping technological approaches among the beekeepers in Kajiado.

3.5.4 Review of Secondary data

A review of current literature and all relevant documents related to determinants of adoption of modern beekeeping technologies had been done. Information obtained from these documents allowed for the researcher to triangulate and verify the data collected from the field. This was done as part of the literature review. Selected literature from Kajiado County government key stakeholder officers was reviewed so as to provide site specific information on beekeeping technologies adoption.

3.6 Validity of the Instruments

Mugenda and Mugenda (2003) defined validity as the accuracy and meaningfulness of inferences based on the research results. It is hence the ability of instruments to measure what they are intended to measure. To enhance content validity, the research instruments in this study were appraised. A pilot study was conducted with one of the women beekeeping groups in Kajiado. Ambiguous questions were modified or discarded after the respondents had submitted their filled questionnaires.

3.7 Reliability of the Instruments

Regarding the reliability of the research instruments, the questionnaires were pre-tested. The split half procedure was used to test the reliability of the instruments during the pilot-testing. This procedure was chosen over other methods because of its simplicity. The open ended and structured instruments were scored by giving a mark for relevant responses and a zero (0) for irrelevant and blank responses. The selected instruments were divided into two halves, taking the odd-numbered against the even numbered items. After administration to the pilot group, separate scores were assigned to every respondent on the two halves. The scores of the halves were therefore analysed, computed and then correlated. The coefficient was calculated using the Spearman-Brown prophecy formula as indicated below:

$$\text{Reliability of scores on total test} = \frac{2 \times \text{reliability for } \frac{1}{2} \text{ test}}{1 + \text{reliability for } \frac{1}{2} \text{ test}}$$

3.8 Methods of Data Analysis

This section discusses the techniques that were used to analyse data and test the variables. Before processing the responses, data preparation was done on the completed questionnaires by cleaning, editing, coding, and entering the data. Data collected was then analysed using

descriptive statistics. The descriptive statistical tools helped in describing the data and determining the respondents' degree of agreement with the various statements under each factor. Data analysis was done using SPSS (version, 21) and Microsoft excels to generate quantitative reports which were presented in form of tabulations, percentages, mean and standard deviation.

3.9 Operationalization Definition of Variables:

Table 3. 2 Operationalization Definition of Variables

Objectives	Variables	Indicators	Measurement scale	Tools of Analysis	Type of Analysis
To establish the social/ cultural factors that influence adoption of modern beekeeping technologies among the women beekeeping groups	Independent Social/ cultural factors	Social status level of education poverty levels farming experience House hold size Land size.	Nominal or dinal Interval	Mean Std Dev. Frequency Percentages	Descriptive Statistics
Determine how managerial factors influence adoption of modern beekeeping technologies	Managerial Skills	Human skills Technical skills, Conceptual skills	Nominal ordinal	Mean Std Dev Frequency Percentages	Descriptive Statistics
Assess how the institutional factors influence adoption of modern beekeeping technologies	Institutional factors	Access to extension services Information access, Training institutions Access to capital	Nominal	Mean, Std Dev Frequency Percentages	Descriptive Statistics
Determine the influence of economic factors on adoption of modern beekeeping technologies.	Economic factors	Price of products Wages Incomes & assets	Nominal	Mean/Std Dev Frequency Percentages	Descriptive Statistics
Adoption of modern beekeeping technologies.	Dependent variable	Application of new skills Using modern beehives Value addition with processing Good packaging	Nominal and ordinal	Mean, standard deviation, frequency and percentages	Descriptive statistics

3.10 Ethical issues

Mugenda & Mugenda (2003) defines ethics as that branch of philosophy which deals with one's conduct and serves as a guide to one's behaviour. Since researchers are people genuinely concerned about other peoples' quality of life, they must be people of integrity who will not undertake research for personal gain or research that will have a negative effect on others. In order to obtain the required information, it was therefore necessary to guarantee respondents' anonymity. The respondents' names were not recorded in the final project report. The researcher committed himself to release accurate research findings irrespective of the findings from the study.

CHAPTER FOUR

DATA ANALYSIS,PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the data analysis, presentation and interpretation. In addition, the chapter discusses the findings from the research questions that were under investigation, to find out whether social/cultural factors, managerial skills and institutional factors determine adoption of modern technologies in beekeeping projects among the women beekeeping groups. The findings were presented using frequency tables for easy analysis and interpretations. Statistical analysis of the findings was done using frequencies and percentages.

4.2 Questionnaire Response

Out of the 116 questionnaires that were issued to the women beekeeping groups, 71 of them were correctly filled and returned. This represented a response rate of 61%. For the rest of the 45 questionnaires, some were incorrectly filled while others were not submitted and therefore they were disqualified. The rejected ones represented 39% of the total questionnaires which were issued. The response rate was considered adequate as according to Idrus and Newman (2002) a response rate of 50% is good enough for social studies.

4.3 General Information on the respondents

This was basically the information on the population interviewed in this study. It is the demographic characteristics of the sampled population. The research sample included the demographic characteristics of the sampled population. This section has analysed gender issues, education, professional information and work experience for all the respondents in the study.

4.3.1 Analysis of Gender

The study sought to find out gender distribution among women bee keeping groups. The results are shown in Table 4.1 below:

Table 4. 1 Gender of the respondents

Gender	Frequency	Percentage
Females	71	100
Total	71	100

The findings from the table revealed that 100% of the respondents were women. This was as expected because the respondents were all members of women groups.

4.3.2 Analysis of Age

The study sought to establish the age distribution among the women beekeeping groups with the distribution as shown in table 4.2 below:

Table 4. 2 Age of the respondents

Age	Frequency	Percentage
18-35 years	3	4.23
36-50 years	33	46.48
50 and above	35	49.30
Total	71	100

The findings from the study revealed that majority 49.3% of the respondents were aged 50 and above, 46.48% of the respondents were of the age between 36-50 years while 4.23% of the respondents were aged between 18-35 years. The analysis indicated that the young generation was yet to fully engage in beekeeping.

4.3.3 Analysis of Marital status

The researcher wanted to establish the marital status among women beekeeping groups, the results were as shown in the table 4.3 below:

Table 4. 3 Marital status

Marital status	Frequency	Percentage
Single	3	4.23
Married	64	90.14
Others	4	5.63
Total	71	100

The findings indicated that majority 90.14% of the respondents were married, 5.63% of the respondents reported other status while 4.23% of the respondents were singles. This was an indication that most of the respondents keeping bees were married.

4.3.4 Distribution according to Education levels

The researcher sought to find out education levels of women. Table 4.4 shows the education level of the respondents.

Table 4. 4 Education levels of Respondents

Education levels	Frequency	Percentage
none	30	42.25
Primary	30	42.25
Secondary	8	11.27
University/College	3	4.23
Total	71	100

From the data collected the findings revealed that majority 42.25%, of the respondents did not have any formal education, an equivalent number 42.25% had primary level education, 11.27% of the respondents had secondary education while 4.23% of the respondents possessed

University/college qualifications indicating that most beekeepers (85%) were either illiterate or had primary level of education.

4.3.5 Experience in beekeeping in the Groups

The study sought to find out the beekeeping experiences within the women groups. Table 4.5 shows results on the experience in beekeeping of the respondents in their respective groups.

Table 4. 5 Experience in beekeeping

Experience in beekeeping	Frequency	Percentage
Less than One year	1	1.41
One to two years	3	4.23
Three to five years	6	8.45
Five years and above	61	85.92
Total	71	100

The findings indicate that, majority 85.92% of the respondents had five years and above of experience, 8.45% of the respondents had experiences ranging between three to five years, 4.23% of the respondents between one to two years, while 1.41% of the respondents had less than one year.

4.3.6 Income generating Activities for the groups

The study sought to know whether the women groups were solely dependent on beekeeping.

Table 4.6 shows the respondents' responses on income generating activities.

Table 4. 6 Income generating Activities

Response on Income generating activities	Frequency	Percentages
Yes	68	95.77
No	3	4.23
Total	71	100

From the findings majority 95.77% of the respondents reported that they are engaged in other income generating activities, while 4.23% of the respondents reported they have no other income generating activities apart from beekeeping.

4.3.7 Average monthly incomes from Beekeeping Engagement

The researcher was keen to find out the incomes being generated from new technologies in beekeeping. Table 4.7 shows the findings on the average monthly incomes from beekeeping among the women.

Table 4.7 Average Monthly Incomes

Average Monthly income from beekeeping	Frequency	Percentage
Below Kshs 10,000	7	9.86
10,000-15,000	40	56.34
16,000-25,000	23	32.39
26,000-35,000	1	1.41
Total	71	100

The findings revealed that majority 56.34% of them earned between Kshs 10,000-15,000, 32.39% of the respondents reported to earn between 16,000-25,000, 9.86% of the respondents earned below 10,0000, while 1.41% of the respondents earned 26,000-35,000. This was an indication that majority of these farmers earn between 10-16000 KShs which was a good average harvest from one to two hives.

4.4 Social/Cultural factors influencing adoption

Among the factors that the researcher was investigating were the social-cultural factors influencing adoption of modern technologies in beekeeping. The findings of the study were as indicated in the section below:

4.4.1 Social/ Cultural factors influencing adoption of new technology

The study sought to establish the social/ cultural influence on adoption of new technologies. The results were as shown in table 4.8 below;

Table 4. 8 Cultural factors influencing adoption of new technologies

Cultural factors on new technology adoption	Mean	Std Dev
Sex of household held	4.01	0.792
Marital status	4.14	0.798
size of household	3.61	0.594
size of land	3.77	0.897
cultural beliefs	4.19	0.785

From the findings majority of the respondents strongly agreed that cultural beliefs influence adoption of new technologies. This was shown by a mean score of 4.19. Respondents also strongly agreed that Sex of the household head influences the adoption of new technologies as shown by a mean score of 4.01. Marital status equally influenced the adoption of new technologies as shown by a mean score of 4.14. Other factors contributing towards the adoption of new technologies were size of land and size of the household as shown by a mean score of 3.77 and 3.61 respectively. This implies that sex of the household head, marital status, size of household, size of land and cultural beliefs strongly contribute to influence adoption of new technologies in beekeeping.

Key informant interviews held with the field officers revealed that farmers who are young in age were reported to be more willing to adopt modern technologies faster. Women heading families were also fast in adopting modern technologies among women beekeepers. The interview further revealed that farmers with large family size opt for the adoption of new technologies faster as compared to those with small families. Small land size was also positively rated, confirming Spielma (2005) who stated that a beekeeping activity can be undertaken on small

land size and that one of the relative advantages of beekeeping activity is that it does not require fertile land and uncultivated land is also suitable for beekeeping and therefore , for landless farmers, having just an apiary site is sufficient for engaging in the activity

4.4.2 Aspects of social/ cultural factors influencing technology adoption

The study had sought to find out those aspects of social/cultural factors that influence adoption.

Table 4.9 below shows the findings of the aspects of social cultural factors and their contributions in the adoption of new technology:

Table 4. 9 Aspects of social/ cultural factors influencing technology

Aspects of social cultural factors and technology	Mean	Sd Dev
Farmers having large families easily opt for new technologies	3.32	0.824
New technology adoption increases hive products (honey, beeswax, propolis, pollen, royaljelly , beesvenom) which contribute to satisfy the needs of the families	4.26	0.505
Farm experience helps farmers to get more understanding of management practices of the farm activities	4.33	0.476
Education level of beekeepers is positively associated with adoption	4.09	0.658

From the findings as shown in the table, majority of the respondents strongly agreed that farm experience helps farmers to get more understanding of management practices of the farm activities as was shown by a mean score of 4.33. Respondents also strongly agreed that new technology adoption increases hive products which contribute to satisfy the needs of the families as was shown by a mean score of 4.26. It was also revealed that education level of beekeepers is positively associated with adoption and farmers having large families easily opt for new technologies as indicated by mean scores of 4.09 and 3.32 respectively. The implication here is that farmers having large families easily opt for new technologies and that new technology adoption increases hive products which contribute to satisfy the needs of the families; while farm

experience helps farmers to get more understanding of management practices of the farm activities; and education level of beekeepers is positively associated with adoption.

4.4.3 Influence of size of land on new technology adoption

The study sought to find out the influence of size of land on new technology adoption. Table 4.10 shows the findings on the influence of size of land on new technology adoption.

Table 4. 10 size of land and new technology adoption

Size of land and new technology adoption	Mean	St Dev
Beekeeping activity can be undertaken on small land size	4.07	0.568
One of the relative advantages of beekeeping activity is that it does not require fertile land and uncultivated land is suitable for beekeeping	4.38	0.488
Landless farmers having just an apiary site is sufficient for engaging in beekeeping.	4.16	0.696

The findings show that majority of the respondents strongly agreed that landless farmers having just an apiary site is sufficient for engaging in beekeeping as this was shown by a mean score of 4.16. Other respondents strongly agreed that one of the relative advantages of beekeeping activity is that it does not require fertile land and uncultivated land is suitable for beekeeping as shown by a mean score of 4.38. Others strongly agreed that beekeeping activity can be undertaken on small land size. The implication is that beekeeping activity can be undertaken on small land size and that one of the relative advantages of beekeeping activity is that it does not require fertile land and uncultivated land is suitable for beekeeping.

Table 4. 11 Responses on Culture as an influence of Modern technologies

The table 4.11 below shows results of responses collected from the respondents on whether Culture influences the adoption of modern technologies:

Response on influence of culture on technology adoption	Frequency	Percentage
Yes	69	97.18
No	2	2.82
Total	71	100

The findings revealed that majority 97.18% of the respondents agreed that culture influences technology adoption, while only 2.83% of the respondents did not agree.

4.4.4 Key drivers influencing adoption of new technologies

The study sought to establish the key drivers influencing adoption of new technologies. The findings were as shown in the table 4.12 below;

Table 4.12 Key drivers influencing adoption of new technologies

	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Availability of finance	68	95.77	3	4.23
Timing of project	31	43.66	40	56.34
training needs	70	98.59	1	1.41
Age of the bee keeper	57	80.28	14	19.72
Education level	57	80.28	14	19.72
Own land holding status	43	60.56	28	39.44
Average household size	54	76.06	17	23.94
House hold asset e.g. livestock	39	54.93	32	45.07

From the findings majority 98.59% of the respondents reported training needs as a key driver in influencing modern technology in bee keeping, 80.28% of them reported age of the beekeeper, 80.28% reported educational level, 76.06% reported average household size, 54.93% reported household assets like livestock while 43.66% of the respondents reported training as a driver influencing adoption of the new technology. The implication of the results was that the major drivers influencing adoption of new technology in beekeeping include training needs, availability

of finance, education level, age of beekeeper, average household size and timing of the project in that order.

4.5 Managerial skills and modern technologies

Among the factors that the researcher was also investigating were the influence of managerial skills on modern technologies. The results of the findings of the study were as indicated in the section below:

4.5.1 Influence of managerial skills in adoption of modern technologies

The study sought to establish the influence of managerial skills in adoption of new technologies.

Table 4.13 shows the findings of the influence of managerial skills on new technologies.

Table 4.13 Influence of Managerial skills on adoption of new technologies

Influence of managerial skills in new technology	Mean	Std Dev
Managerial skills are very vital to adopt modern technologies	4.57	0.577
Managerial skills are acquired through training and awareness creation	4.56	0.499
Training beekeepers in modern beekeeping methods requires them to find their own personal style in working with bees and adopt appropriate strategy	3.95	0.801
Every participant in training should be given time to acquaint to the new beekeeping technology	3.73	0.792
For beekeeping training to be effective, it should preferably take the form of vocational education	4.02	0.792
Managerial training cannot be replicated from one place to another	4.08	0.996
Our group of women sometimes prefer to be trained by female trainers	3.08	1.284

From the findings, majority of the respondents strongly agreed that managerial skills (human, technical and conceptual skills) are very vital to implement modern technologies as shown by a mean score of 4.57. Other respondents strongly agreed that managerial skills are acquired through training and awareness creation as shown by a mean score of 4.56. Moreover, others agreed that managerial training cannot be replicated from one place to another because every

area and location has different needs which need to be identified in advance as shown by a mean score of 4.08. This implies that managerial skills are very vital to implement modern technologies and that managerial skills are acquired through training and awareness creation and that the training cannot be replicated from one place to another because every area and location has different needs which need to be identified in advance.

An interview with the County Data Analyst revealed that farm experience helps a farmer to get more understanding of the management practises of the beekeeping activities it was further revealed that the education level of a beekeeper is associated with adoption of a new technology in beekeeping. These finding were supported by Fischer (1996), who observed that every beekeeper needs to possess managerial skills which are vital to implement modern technology. These skills can be acquired through training and awareness creation. Before doing something right, beekeepers need to observe it done right. This principle of psychomotor learning presupposes that observing is not just seeing, but it is a way of looking that must be learned to acquire managerial skills.

4.6 Influence of Institutional factors on adoption of modern technologies

The researcher wanted to find out whether Institutional factors influence adoption of new technologies. The findings of the study were as indicated below:

4.6.1 The Institution of extension services

The study sought to establish the influence of extension services in adoption of modern technology. Table 4.14 shows the findings of the influence of the institution of extension services.

Table 4. 14 influence of the Institution of extension services on adoption

Institution of extension services	Mean	Std.Dev
Extension services is seen more as a process of helping farmers to make their own decisions	4.39	0.572
Extension plays a great role in popularizing farm technologies	4.45	0.501
To make the farmer competent, it is expected that extension officers work more closely with farmers	4.40	0.523
Building the capacity of farmers can be effected by offering need-based practical training and close follow up.	4.46	0.556
Institutional services develop farmers' aspiration for change through adopting different technology.	4.23	0.596
Extension services create platforms for beekeepers interaction.	4.30	0.55

The findings indicated that majority of the respondents agreed that extension services play a great role in popularizing farm technologies as was shown by a mean score of 4.45. Consequently respondents agreed that building the capacity of farmers can be done by offering need-based practical training and close follow up as shown by a mean score of 4.46. Similarly the respondents strongly agreed that extension services create platforms for beekeepers interaction and facilitate negotiations between the different stakeholders. The meaning of this is that the institution of extension services includes building the capacity of farmers that can be effected by offering need-based practical training and close follow up; and that extension services create platforms for beekeepers interaction and facilitate negotiations between the different stakeholders. Eventually, the institutions of extension services develop farmers' aspiration for change through adopting different beekeeping technologies.

An interview separately held with an Extension Officer revealed that extension services play a positive role in popularising farm technologies. These findings were further confirmed by a key informant interview with a Ranch Manager who equally reported that extension services play a positive role in popularising farm technologies.

4.6.2 Access to institutional facilities of Farmers interest

The study sought to establish from the respondents on whether they have access to institutional facilities of their interests. Table 4.15 below shows the results obtained.

Table 4. 15 Access to institutions

Response to access to institutions	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Access to extension services	71	100.00	0	-
Information access to your group	49	69.01	22	30.99
Training facilities	68	95.77	3	4.23
Access to finance institutions	47	66.20	24	33.80

From the findings 100% of the respondents reported that they have access to extension services. 49% reported that they have Information access, 68% reported that they have access to training facilities and 47% have access to finance institutions. This implies that respective women groups have access to extension services, information, training facilities and financial institutions.

4.6.2 Aspects of collective responsibilities to achieve adoption

The study sought to establish some aspects of collective responsibilities in achieving adoption of new technologies among the women beekeepers. The table 4.16 below shows the findings.

Table 4. 16 Aspects of collective responsibilities to achieve adoption

Aspects of collective responsibilities	Mean	Std Dev
Responsibility to adopt technologies cannot be left to extension agencies alone but it's a collective responsibility of researchers, extension agents, farmers and other service providers.	4.6761	0.5007
Engaging in collective responsibility demands new skills for integration and working together in partnership with key stakeholders.	4.6056	0.54717
Rural knowledge management that links various actors who have and seek knowledge to bring together their knowledge and experiences is vital for beekeepers	4.5783	0.450

The findings indicated that majority of the respondents strongly agreed that responsibility to adopt technologies cannot be left to extension agencies alone but it's a collective responsibility of researchers, extension agents, farmers and other service providers. This was shown by a mean score of 4.67. Respondents also strongly agreed that engaging in collective responsibilities demands new skills for integration and working together in partnership with key stakeholders, as was shown by a mean score of 4.60, while others reported that rural knowledge management links various actors who have and seek knowledge to bring together their knowledge and experiences which are vital for beekeepers as shown by a mean score of 4.57. The findings implied that responsibility to adopt technologies cannot be left to extension agencies alone but it's a collective responsibility of researchers, extension agents, farmers and other service providers and that engaging in collective responsibility demands new skills for integration and working together in partnership with key stakeholders.

4.7 Response to Economic factors influencing adoption of new technologies

The study also sought to find out the economic factors influencing adoption of modern technologies. Table 4.17 shows the findings on economic factors influencing adoption of modern technologies among the women beekeepers.

Table 4. 17 Economic considerations that influence adoption of modern technologies

Economic considerations	Mean	Std Dev
The probability of adopting new technology will depend on the ability of farmers to perceive the application and advantages of the new technology.	4.28	0.539
High yields are not sufficient conditions to persuade beekeepers to adopt a technology	4.21	0.532
Adoption of new technologies should increase farmers yield and net benefits.	4.38	0.517
For new technology to be applicable, beekeeping must be basically profitable or at least more profitable than other alternatives	4.38	0.594
Adoption of new technologies should increase farmers yield and net benefits.	4.28	0.613
Economic incentives and good prices are the most important determinants of the time farmers wait before adopting new technology	4.26	0.505
Movable comb top bar hives result in higher net return per colony compared with local hives.	4.54	0.501
The probability of adopting new technology will depend on the difference in profitability between the new and old technologies	3.98	0.768

From these findings majority of the respondents strongly agreed that movable comb top bar hives (new technology) produced higher net returns per colony compared with local hives (old technology) as shown by a mean score of 4.54. Other respondents strongly agreed that adoption of new technologies should increase farmers yield and net benefits and that for new technology to be applicable, beekeeping must be basically profitable or at least more profitable than other alternatives. This implies that movable comb top bar hives result in higher net returns per colony compared with local hives and that adoption of new technologies increases farmers yield and net benefits. Economic reasons, therefore, demand that for new technology to be applicable beekeeping must be basically profitable or at least more profitable than other alternatives and that adoption of new technologies should increase farmers yield and net benefits among other benefits.

From the key informant interviews held with an Extension Officer, Farm Manager, and Project Coordinator it was found out that the economic considerations that make it easy to adopt modern technologies were appropriate Government policies, good prices, reasonably priced hives, increased production, ready markets, available extension services, higher profits accrued from the sales of honey and less labour required.

4.8 Summary

The Chapter has presented quantitative data analysis of the study using frequencies and percentages, means and standard deviations. The findings were in line with the objectives of the study and revealed how social-cultural factors, managerial skills, institutional factors and economic factors influence the adoption of modern beekeeping technologies among the women beekeeping groups.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This Chapter presents the summary, discussions, conclusions and recommendations of the study findings from the questionnaires and interview guides which were both administered to the women beekeeping groups and the key informants from the stakeholders. The Chapter discusses the findings in relation to the literature review and the objectives identified for the study. The recommendations drawn were based on the outcomes of the study.

5.2 Summary of the Findings

The results from the study indicated that majority (49.3%) of the respondents were aged 50 years and above, and that 46.48% of the respondents were aged between 36-50 years, while 4.23% of the respondents were between 18-35 years. This indicated that the more aged and experienced beekeepers were more engaged in beekeeping than the younger farmers. Majority (90.14%) of the respondents were married, 5.63% of the respondents reported other status (divorced, widows), while 4.23% were singles. In education, majority (42.25%) of the respondents did not have any formal education; an equivalent number (42.25%) of them were of primary education; 11.27% of the respondents had attained secondary education, while only 4.23% of the respondents had University or college qualifications. This was an indication that the young and more educated people are yet to fully engage in beekeeping. In terms of experience in beekeeping, 85.92% of the respondents had five years and above of experience in beekeeping, 8.45% between three to five years, 4.23% between one to two years, while 1.41% of the

respondents had less than one year experience. In the area of income generation, majority (95.77%) of the respondents reported that they were engaged in other income generating activities other than beekeeping, while 4.23% did not have any other income generating activities apart from beekeeping. With regard to income generation from beekeeping alone, majority 56.34% of them earned a monthly income of between Kshs 10,000-15,000, 32.39% earned between shillings 16,000-25,000; 9.86% earned below 10,000, while 1.41% of the respondents earned 26,000-35,000. This was an indication of a good harvest from beekeeping. The study revealed relative levels of influence on adoption of new technologies by social/cultural factors, institutional factors, economic factors and managerial skills. These findings are discussed in the following sections.

5.3 Discussions on the Findings

The findings of the study answered the research questions since the influence of social-cultural factors, managerial skills, institutional and the economic factors have been quantified by descriptive statistics. The discussions and related literature were presented for each of the four variables of the study:

5.3.1 Social/Cultural factors

Social/cultural factors were found to influence adoption of beekeeping technologies among the women beekeeping groups in Kajiado County. The social /cultural factors identified were sex of the house hold head, marital status, size of the house hold, size of land, education level, experience in beekeeping, social status and cultural beliefs. All these factors were found to strongly influence adoption of new technologies in beekeeping among farmers. These findings confirmed the report of the Kenya Beekeepers Association (K.B.A., 2005) which suggested that

some of the social/ cultural factors affecting adoption of new technologies could be sex of the household head, marital status and size of the household among others. Spielman, (2005) also stated that a beekeeping activity can be undertaken on small land size and that one of the relative advantages of beekeeping activity is that it does not require fertile land and hence, for landless farmers having just an apiary site is sufficient for engaging in beekeeping activity.

In the European commission journal (1997) it is reported that there are both positive and negative cultural characteristics that influence adoption. It is further reported that other indicators that influence adoption of new technologies are timing of the project, age of the beekeeper, education status of the beekeeper, own land holding status, status of the beekeeper, average household size and household assets which are all socio- cultural factors that stand to be key determinants of adoption of technologies in beekeeping.

5.3.2 Managerial Skills

The study revealed that managerial skills largely determined adoption of modern beekeeping technologies among the beekeeping women in Kajiado County. It indicated that managerial skills are very necessary for adoption of modern technologies; and that they are acquired through training and awareness creation. Managerial training cannot be replicated from one place to another because every area and location has different needs which need to be identified in advance. This revelation is confirmed by Fischer (1996), who observed that every beekeeper needs to possess managerial skills which are vital to implement modern technology. Before doing something right, he says, beekeepers need to observe it done right. This principle of psychomotor learning presupposes that observing is not just seeing, but it is a way of looking that must be learned to acquire managerial skills Fischer (1996).

This study also revealed that training beekeepers in modern beekeeping methods requires them to find the best method in working with bees. Thus the teacher needs not be limited as long as the objective of training is met. In this way, every participant is given time to acquire the new beekeeping method while identifying themselves with a method they want to learn. Beekeeping training, if it is to be effective, best takes the form of vocational education. The main question should be whether there is need for beekeeping training. Once a target group has been constituted, it can be homogeneous or heterogeneous depending on what members have in common (Fischer, 1996).

5.3.3 Institutional factors

The study revealed that institutions like financial institutions and extension services do positively influence adoption of new technologies. Extension services include building the capacity of farmers that can be achieved by offering need-based practical training and close follow up. This revelation is supported by Ban et,al (1996) who concluded that extension services create platforms for beekeepers interaction and facilitate negotiations between the different stakeholders. Institutional services develop farmers' aspiration for change through adopting different beekeeping technologies (Ban et, al 1996)

Hess, (2007) established that the responsibility to promote technologies cannot be left to extension agencies alone but it's a collective responsibility of researchers, extension agents, farmers and other service providers. He said that engaging in collective responsibility demands new skills for integration and working together in partnership with key stakeholders. Haggmann, et al.(2003) also noted that the role of extension includes building the capacity of farmers and farmer organizations to pursue their development goals by articulating high quality demand for services which can be effected by offering need-based practical training and close follow up

which enable them to examine their farming environment and compare with other farming situations. This, in turn, develops farmers' aspiration for change through adopting different farm technologies that is suitable to their farming systems.

5.3.4 Economic factors

The study found out that economically, movable comb top bar hives (New technology) produced higher net returns per colony compared with local hives (Old technology) and that adoption of new technologies increased farmers' yields and net benefits. The study further revealed that for new technology to be applicable, beekeeping must be basically profitable or at least more profitable than other alternatives. This revelation is supported by Behera,(1999) who concluded that high yields are not sufficient conditions to persuade farmers to adopt a new technology and that with new technology application, farming must be basically profitable or at least more profitable than other alternatives. Ambrosini et, al (2002) considered beekeeping as a source of valuable food and off-farm income in rural areas. Some of the valuable beekeeping products include honey, beeswax and propolis. His study revealed that propolis (a highly valued beekeeping product) is a therapeutic agent against human and poultry (particularly fowls) diseases, owing to its antibacterial, anti-fungal, antiviral, anti-protozoa, anti-helminthic, antioxidant and immune enhancing properties.

5.4 Conclusions of the Study

This study was carried out to investigate the determinants of adoption of modern beekeeping technologies among the women beekeeping groups in Kajiado County. The study sought to answer four basic questions including the social/cultural factors that influence adoption of modern beekeeping technologies, managerial skills influencing

adoption of new technologies, institutional and economic factors that influence adoption of new technologies in beekeeping projects. In answering these questions the study concluded that social/cultural factors including sex of the household head, marital status of the farmer, size of the house hold, size of land, education levels, social status and cultural beliefs strongly contribute in influencing adoption of new technologies. The study also concluded that managerial skills (human skills, technical and conceptual skills) have vital influence on adoption and that managerial skills are acquired through training and awareness creation. In addition, the study concluded that institutions such as extension services positively influence adoption of new technologies through building capacity of farmers, acquired by offering need-based practical training. With regard to economic factors the study concluded that movable comb hives (modern technology) produced higher net returns per colony compared with local hives (old technology) and that adoption of new technologies increase farmers' yields and net benefits

5.5 Recommendations

It is evident that social-cultural factors, economic factors, institutional factors and managerial skills influence adoption of modern beekeeping technologies. The study found out that all the identified factors do influence adoption of modern technologies in beekeeping in one way or the other as discussed in this report. Following the findings of this study, therefore, the researcher makes the following recommendations:

- i) That there is need for Training and Extension Officers in Agriculture and Livestock production to address socio-cultural factors, managerial skills, economic and institutional factors before and during the process of introducing new beekeeping technologies.

- ii) Extension Officers tasked with the responsibilities of introducing new technologies should first explore the strengths, limitations or otherwise of these determinant factors in a particular area or region before introducing them.
- iii) Extension services, through practical on farm demonstrations and field days should be enhanced. Farmers should be educated and made aware of the consequences of the determinants of adoption of new technologies.
- iv) Policy makers and managers of beekeeping projects should always make appropriate policies and programs to deal with determinant factors identified in order to make new technologies acceptable and adopted.
- v) Further, there is need for both the Central and Devolved County Governments to invest in farmer education and training especially in the area of managerial skills, which the researcher found key to adopt new technologies.
- vi) The Government and Non-governmental organizations should avail financial support (credits) to farming groups in order to maximise on adoption of new technologies for profits and overall development.

5.6 Suggestions for further study

This study was carried out in Kajiado County with women beekeeping groups. The researcher suggests further studies in the following areas:

- i) Similar studies be carried out in different locations of different ecological zones to establish the determinants of adoption of new beekeeping technologies and for comparison purposes.
- ii) Studies involving both genders should be carried out to reduce the chances of bias in demographic factors.

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APPENDICES

APPENDIX 1: Questionnaire for Women Groups

The researcher is conducting an academic survey on Determinants of Adoption of Modern Technologies in Beekeeping Projects. You have been randomly selected to participate in this survey. Kindly give your honest opinion on all the items on the questionnaire. All information you give will remain strictly confidential and it will be used only for research purposes..

Kindly indicate the Name of your group..... (Optional)

Background Information

Gender male/ female (Tick)

Age

(18-35 years)

(36-50 years)

(50 and above)

Marital status

Single

Married

Others (specify).....

Number of dependants in your family.....

Education Level of respondent; (none) (primary) .(Secondary) (University/College) Tick

How long have you been in your group?

(Less than One year)

(One to two years)

(Three to five years)

(Five years and above)

Do you have any other income generating activity besides beekeeping?

Yes

No

What is your average monthly income on Beekeeping Project?

(Below 10,000 Ksh)

(10,000-15,000)

(16,000-25,000)

(26,000-35,000)

(36,000 & above)

SOCIAL-CULTURAL FACTORS

To what extent do the following factors influence adoption of new technologies in your beekeeping projects? Please indicate with an “ x” using a scale of 1-5 the influence each of the factors command in your group where 1=strongly disagree, 2=disagree 3= neutral, 4= agree, 5=strongly agree

socio-cultural factors	1	2	3	4	5
sex of the household head					
Marital status					
size of the house hold					
size of the land					
cultural beliefs					

To what extent do you agree with the following statements on adoption of modern technologies in beekeeping? Use a scale of 1-5 below where 1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5=strongly agree.

<i>Important information on social cultural factors.</i>	1	2	3	4	5
Farmers having large families easily opt for new technologies.					
New technology adoption increases hive products which contribute to satisfy the need of the families.					
Farm experience helps farmers to get more understanding of management practices of the farm activities.					
Education level of beekeepers is positively associated with adoption.					

The following statements relate to the size of the land available in relation to the adoption of new technologies in beekeeping projects. Kindly use the scale of 1-5 to rate them in the table below.

Where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

<i>Information on Land size</i>	1	2	3	4	5
Beekeeping activity can be undertaken on small land size.					
One of the relative advantages of beekeeping activity is that it does not require fertile land and uncultivated land is suitable for beekeeping.					
Landless farmers having just an apiary site is sufficient for engaging in beekeeping.					

Culture has been found to have great influence on the implementation of modern technologies in beekeeping enterprises

Agree

Disagree

The following is a list of key drivers influencing the adoption of new technologies in Beekeeping projects, kindly indicate the ones that affect your group.

<i>Key drivers on adoption of new technologies</i>	<i>(Tick where applicable)</i>
Availability of finance	
Timing of projects	
Training needs	
Age of the beekeeper	
Education level	
Own land holding status	
Average house hold size	
Household assets .e.g. livestock	

MANAGERIAL SKILLS

Managerial Skills are key to Technology adoption. The following information relates to training on Managerial skills in new technologies in Beekeeping. Kindly use the scale of 1-5 where 1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5= strongly agree, to agree or disagree with the information given.

<i>Information on Managerial skill acquisition</i>	1	2	3	4	5
Managerial skills are very vital to implement modern technologies.					
Managerial skills are acquired through training and awareness creation.					
Training beekeepers in modern beekeeping methods requires them to find their own personal style in working with bees and adopt appropriate strategy.					
Every participant in training should be given time to acquaint to their own beekeeping style while identifying themselves with a person who acts the way they want to learn.					
For beekeeping training to be effective, it should preferably take the form of vocational education.					
Managerial training cannot be replicated from one place to another because every area and location has different needs which need to be identified in advance.					
Our group of women sometimes prefer to be trained by female trainers.					

INSTITUTIONAL FACTORS

The institution of extension services is necessary for the transfer of new technologies in beekeeping, Using the likert scale of 1 to 5 provided as a measure of dispersion where 1=strongly disagree, 2=disagree, 3=not sure, 4=agree and 5=strongly agree, kindly rate the statements accordingly with regard to your group.

Important statement	1	2	3	4	5
Extension services is seen more as a process of helping farmers to make their own decisions by increasing the range of options from which they can choose, and by helping them to develop insight into the consequences of each option.					
Extension plays a great role in popularizing farm technologies.					
To make the farmer competent, it is expected that extension officers work more closely with farmers.					
Building the capacity of farmers can be effected by offering need-based practical training and close follow up which enable them to examine their farming environment and comparing with other farming situations.					
Institutional services develop farmers' aspiration for change through adopting different technology that is suitable to their beekeeping activities.					
Institutional services link farmers and farmer organizations to other support agencies including access to financial institutions, markets and input supply institutions.					
Extension services create platforms for beekeepers interaction and facilitate negotiation between the different stakeholders.					

The following information relates to the institutional factors. Kindly indicate those that your group has access to:

<i>Institutional factors</i>	<i>(Tick where appropriate)</i>
Access to extension services	
Information access to your group	
Training facilities	
Access to finance institutions	
Rules of operation in your group	
Norms relating to how your group operates	

Using a scale of 1 to 5 where 1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5=strongly agree. Kindly rate the following statements.

<i>. Important conclusions</i>	1	2	3	4	5
Responsibility to promote technologies cannot be left to extension agencies alone but it's a collective responsibility of researchers, extension agents, farmers and other service providers.					
Engaging in collective responsibility demands new skills for integration and working together in partnership with key stakeholders.					
Rural knowledge management that links various actors who have and seek knowledge to bring together their knowledge and experiences is vital for beekeepers					

ECONOMIC FACTORS

There are important economic issues that influence adoption of modern technologies in beekeeping, use the scale provided to rate the statements below, where 1=strongly disagree, 2=agree, 3=not sure, 4=agree, 5=strongly agree.

<i>Economic factors</i>	1	2	3	4	5
The probability of adopting new technology will depend on the ability of the farmer to perceive the advantages of the new technology.					
High yields are not sufficient conditions to persuade beekeepers to adopt a technology.					
For new technology to be applicable, beekeeping must be basically profitable or at least more profitable than other alternatives.					
Adoption of new technologies should increase farmers yield and net benefits.					
Economic incentives are the most important determinants of the time farmers wait before adopting new technology.					
Movable comb top bar hives result in higher net return per colony compared with local hives.					
The probability of adopting new technology will depend on the difference in profitability between the new and old technologies.					

List other economic drivers for adoption of new technologies in beekeeping projects;

APPENDIX 2: Key Informant Guide for the Five key stakeholders

The researcher is conducting an academic survey on the determinants of adoption of modern technologies in beekeeping projects. You have been randomly selected to participate in this survey. Your answers will remain strictly confidential and they will be used only for research purposes. Kindly answer the questions that follow:

Section A: Bio-data

Name of the respondent.....

Occupation of the respondent.....

Gender.....

Questions on the determinants of Adoption of modern technologies in beekeeping projects

1. What are some of the socio-cultural factors that you consider to influence adoption of new technology?.....
2. Do farmers with large family size opt more for adoption of new technologies in beekeeping than small families? Yes/No (Tick one)
3. Does farm experience help a farmer to get more understanding of management practises of beekeeping activities? Yes/No (Tick one)
4. Is education level of beekeepers associated with adoption of a new technology in beekeeping? Yes/No.....How?.....
5. It is generally agreed that beekeeping needs relatively small area, to set an apiary. Is this statement True/ False (tick one }
6. Does Extension service play a positive role in popularising farm technologies? Yes/No
7. Are Finance Institutions (Banks, NGOs,) in your area accessible to beekeepers? Yes/No (Tick one)
8. List some economic factors that make it easy to adopt technologies in beekeeping?

APPENDIX 3: Kajiado women Beekeeping Groups and Stakeholders involved in beekeeping

STAKEHOLDERS

Dupoto Emaa	Olemurkat bee keeping - Central
Neighbours Initiative Alliance	Oloolbelbel beekeeping - Central
German Agro Action	Namanga women group – Namanga sub-County
Maasai Community Development	Rombo Catholic women group – Loitokitok sub-County
ASAL Lands Management	Rombo-loitokitok group - Loitokitok
Groups	Oloontulugum group - Central
Olkenkei women group – Central sub-County	Sajiloni women group - Central
Oloshaiki women group - Central	Enkorika beekeeping – Central Sub- County
Enyorata-oroturok beekeeping society - Central	Enkorika beekeeping group - Central
Iimejooli/parmuat women group - Namanga	Nkoile beekeeping group
Enkaroni women groups - Central	Enkaroni beekeeping - Central
Olongosuni women group - Central	Oloyiankalani group - Central
Kikkuro bee keeping group - Central	Kikkuro/Oloontulunum - Central
Maturu bee keeping group - Central	Iimotio-Toroseiwomen group - Central
Olpirikata bee keeping group - Central	Elangata-wuas beekeeping group - Central
Torosei bee keeping group - Central	Torosei group - Central
Lesimiti bee keeping group - Central	Mashuru women beekeeping – Mashuru sub-County
Iimejooli bee keeping group - Namanga	Iibissel beekeepers -Namanga
Inkuseron bee keeping group - Central	Sajiloni beekeepers - Central
Osilalei bee keeping group - Central	Osarai welfare beekeeping - Mashuru
	Oloolbelbel beekeeping group - Central
	Naretisho bee keeping - Central

Naseremi women group - Namanga
Olmotaro women group - Central
Illasit youth group - Loitoktok
Illasit- Loitokitok - Loitoktok
Loitokitok women group - Loitoktok
Lenkobei community initiative - Magadi
LenokoNaboisho Education and dev – Isinya
Sub-County
Isinya beekeeping group - Isinya
Magadi women beekeeping group - Magadi
Emarti beekeeping - Magadi
Oloolbelbel women group - Central
Orgos women beekeepers - Central
Airstrip- Loitokitok beekeepers - Loitoktok
Elangata-Loitokitok women beekeepers –
Loitoktok Sub-County
Kimana-Loitoktok group - Loitoktok
Entonet-Loitoktok group - Loitoktok
Kimana-Loitoktok beekeeping women group -
Loitoktok

Kimana beekeepers - Loitoktok
Namelok-Loitoktok beekeepers - Loitoktok
Rongai woman beekeepers - Ngong
Rombo-Loitoktok women beekeepers -
Loitoktok
Olborsoit youth group – Magadi sub-County
Magadi beekeeping - Magadi
Umoja women group – Magadi Sub-County
Nasarumaa women group - Central
Orinie youth group - Central
Iimeeyu women group - Central
Tendawema - Central
Iaramatak youth group - Central
Elaramawomen group - Central
Oloipasei group - Mashuru
Noolarama women group - Central
Tumaini beekeeping group - Loitoktok
Namelok youth group - Loitoktok
Emasoi beekeeping - Central
Induat women beekeeping group - Isinya