

**Bridging the Gap between Technological Possibilities and
the People.
The Case of Citrus Farming Makueni District, Kenya.**

**A Research Project Submitted to
Larenstein University of Applied Sciences
in Partial fulfillment of the Requirements for
the Degree of Master of Development,
Specialization Training, Rural Extension and
Transformation**

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Acronyms

AMREF: African medical research foundation
AREEC: Agricultural research extension education council
CCF: Christian children funds
CRS: Catholic relief services
CSO: Civil society organization
CIG: Common interest groups
DAO: District agricultural officer
DASS: Decentralized agricultural support structure
DFID: Department for international development
DFST: District farmers' systems trials
FEW: Frontline extension worker
GOK: Government of Kenya
HCDA: Horticultural crops development authority
ICRISAT: International crops research institute for semi-arid tropics
IFAD: International funds for Agricultural developments
KARI: Kenya agricultural research institute
KAPP: Kenya Agricultural productivity project
KWFT: Kenya women finance trust
K-REP: Kenya rural enterprise program
MAP: Makueni Agricultural project
NALEP: National livestock extension program
NASEP: National agricultural sector extension policy
NMK: Njaa marufuku Kenya

1 Euro=100 Kenya shillings

Dedication

To my departed mother, Beatrice Mumo.

Abstract

This study was conducted in the eastern province of Kenya, Makueni district. The district was selected due to the large numbers of farmer who grow citrus. 20 farmers who grow citrus were selected of which 10 were farmers who grow both the grafted citrus and non grafted citrus to find their perception on knowledge circulation in the farming communities.

3 extension workers were also interviewed to find the role in knowledge circulation. The findings from this research reveal that a lot of learning takes place amongst the farmers themselves. In fact 55% of the learning occurs through farmer to farmer knowledge exchange while the 10 % learning occurs through the formal government extension services. The study also found that Knowledge circulation is also enhanced by other development partners working in the rural areas.

The findings show that land size, availability of inputs and other off farm activities the farmer engage in have implication on the numbers of citrus trees planted by farmers. The findings show that the extension service in Kenya is slowly adopting new approach to enhance knowledge circulation. Extension service has adopted the group approach as opposed to the individual farm visits. This has been due to the structural adjustment program which led to under funding in the extension department. A lot of reforms are also taking place in the extension department to ensure a better flow of information and knowledge to the farming communities. Extension is acting as the coordinating unit within the district for all the other development partners working in the district. The government extension service is no longer the sole provider of information and knowledge to the farming communities in the district.

CHAPTER ONE - INTRODUCTION

1.1 Background information

Conventional extension has been seen as an ongoing process of getting information to people (the communicative dimension) and the assisting those people to acquire the necessary knowledge, skills, and attitudes to utilize effectively this information and technology (educational dimension) (Leeuwis, 2004). Without a proper understanding of the various actors and their interlinkages, it is impossible to contribute to change in the farming communities. As a result, conventional extension has come under increasing scrutiny. Today there is a growing acceptance of the need to involve local people as active partners in all aspects of research and developmental process. (Chambers, 1994)

In this research which was conducted in the Makueni district of Kenya the investigator set out to explore role played by the extension personnel and the farming communities in knowledge circulation pertaining to citrus farming.

Time and again the extension have been criticized for overly putting more emphasis on the technological aspects of innovations. This is often done without due considerations on the learning processes involved among the diverse groups of farmers in the community. The perception about how knowledge circulation among diverse farmers appears elusive to the extension personnel and other development partners in the rural areas. The factors underlying knowledge circulation need to be pinpointed by the extension service providers in the rural area. Attributes that enhance or deter knowledge circulation within communities have to be identified if the benefits of technological progress have to be realized.

Farmers in Makueni district grow a wide range of citrus crops in Makueni district, this include rough lemon, tangerine, Washington navel and the non grafted citrus. The most intriguing question still remains-; what are farmers' perceptions towards growing of citrus and what is the district extension department doing to enhance knowledge circulation pertaining to citrus innovation.

In this particular research the investigator needed to find out the process of knowledge circulation within the domains of citrus farming among small scale farmers in the district. Besides the issues concerning grafting other management practices were also considered in the research.

The purpose of the research was to bridge gaps between development professionals and resource poor farmers, and find new ways to understand local knowledge, strengthen local capacities in order to meet local needs.

The study was carried out in Makueni district of Kenya.

Makueni district was chosen because it is suitable for the growth of citrus crop and there have been a lot of promotional activities on citrus farming in the district. The area has few cash crops which can be compared to citrus in terms of returns to investments in the long run.

The district lies within the arid and semi arid zones of the country. It is generally a low-lying district, rising from about 600m above sea level at Tsavo to about 1,900m above sea level on Kilungu and Mbooni Hills. Kilungu and Mbooni Hills, whose formation is of granite rocks, are situated to the west of the District but Chulu Hills low lying along the southern border in Kibwezi Division are the major land features.

To the south of the District are low-lying grasslands. The perennial Athi River and its main tributaries, Kambu, Kiboko and Mtito Andei, mainly drain Makueni District. A few streams arise from the hills of Kilungu and Mbooni, but their flow becomes irregular further down in the low-lying areas. The Chulu Hills also drain their off water in the Athi River.

Each year the District experiences two main rains seasons. The long rains of March/April and the short rains of November/December. The hill masses generally experience cool temperature and 800mm-

1200mm of rainfall per year, while the lower parts are hot and receive between 200mm-900mm of rainfall per year.

Most parts of the District experience high temperatures of between 24-30 degrees Celsius during the day and low temperatures of between 15-20 degrees Celsius at night. During the May-October dry season, extreme heat is experienced in the low-lying parts of the District causing high evapo-transpiration, while the high-altitude areas experience cool temperatures.

Citrus farming in Kenya provides an economic resource for employment of the local people and the national economy. The citrus production supports other sectors of the economy and provides a livelihood to thousands of people in Kenya. The district has mostly small scale farmers. The main crops grown here are maize, beans, peas, cassava, sorghum and millet. Citrus is grown in a wide range of soils of different geological origin. The soils in the district range from loam to sandy soils. There are a number of fruit trees grown in the district. These includes mangoes, pawpaw and citrus. The land terrain is undulated and a number of seasonal rivers cut through the area of intended study.

1.2 The case for Makueni district and justification for the research

The ministry of agriculture(MOA) Makueni district is responsible, and has the mandate to work and contribute to the well being of rural farm families. This is either directly by providing the necessary information and skills to the farmers concerned with citrus farming or indirectly by providing a framework in which information, skills and knowledge will be able to reach the citrus farmers effectively and efficiently. The extension workers have a big role in ensuring that they are information brokers and provide proper liaison with the citrus farmers to maximize productivity. It is therefore imperative that they know and identify the most effective methods suitable to bridge the gap between sources of knowledge and skills to the farming communities where its needed. This will contribute to much needed change in the practices and modes of communication amongst the farming communities and strengthen linkages with the research stations which are part and parcel of processes of knowledge circulation.

The district under consideration falls under the medium to low potential zone that experiences low rainfall. This consequently leads to farm productivity levels barely enough to meet the subsistence requirements. The long dry spells experienced in the district coupled with high temperatures throughout the year also means commercial farming of foods crops such maize and beans which is the staple food for the region is also not very viable. Therefore the citrus innovations in the district would contribute an alternative avenue of getting income for the farming communities, given that this are perennial crops. Citrus is a considerably drought resistant crop.

The region under consideration is underdeveloped compared to other regions in Kenya. Interventions that target ways of increasing the income levels of the farming community would go a long way in improving their livelihoods. The increase in the income among the farming communities would be an good indication that would usher in progress and development within the region. This would ultimately turn around the perception of the farmers who view agriculture with increasing contempt.

The issues of knowledge circulation require a multi-faceted approach, i.e. besides the extension service, other stakeholders should be involved. It was basically assumed that knowledge and innovations originate from scientists, are transferred by extension workers and other intermediaries, and are applied by agricultural practitioners (leewuis, 2004). The aspect of farmer to farmer knowledge exchange has important implications on the learning and transfer of knowledge and skills across the communities. The extension workers are supposed to provide technical advice to citrus farmers (both men and women) in groups or as individual farmers in aspects of management of the citrus crop. The most interesting aspect is to what extend do the extension workers provide this facilitation and learning

amongst the citrus farmers? Are there obvious indications that learning and facilitation is done purely by extension personnel? Then what role should the extension service provide to stimulate knowledge circulation in citrus farming communities? What indication is there on the side of the farmers to show that learning and facilitation is done by the extension workers?

Against this background the learning attributed amongst the farmers themselves becomes a leading aspect that needs further investigation. We must then understand the methods and modes of learning among the citrus farming communities. In the same line of thinking we need to find out the motivation behind this mode of learning among the farmers. On the other hand the methods farmers learn is also crucial in understanding how knowledge circulates across the citrus farming communities.

Besides the role played by MOA, other development actors have also been identified in the district. Their specific tasks, mandates and their capabilities have important contributions to the build up of knowledge and learning processes for the citrus farmers in Makueni district.

How other development agencies collaborate with the Government extension service in service provision has direct implications on the level and effectiveness of the knowledge and skills attributed to the citrus farmers. To understand the citrus farming practices among the farmers there is the technical aspects involved and the learning itself and the different actors that enhance knowledge circulation.

What remains a big challenge is the collaboration and learning among the different development actors and their role in knowledge circulation in the citrus farmers. Secondly, its not clear who among the development partners has an edge over the other in projecting learning and knowledge circulation among the citrus farming communities. This is attributed to the different packaging of information and styles of delivery by the different actors. There is also the probability that conflicting information is delivered to the farming communities thereby leaving the farmers in a dilemma on what choices are available for them.

1.3 Problem description

Extension services have been decentralized in Kenya in an effort to bring their services closer to the farming communities. The ratio of extension worker to the farmer has gone up in recent years in Kenya. The ratio of extension to farmer is 1:1681 according to the annual extension reports 2006. The mission and objective of the Extension department is to spur institutional development in the Extension service provision and sustained increase in agricultural productivity. The Extension service has good intentions in assisting farmers to identify and analyze the innovation challenges and opportunities in citrus farming, though the overall end result is seemingly elusive. The extension department of makueni district is concerned about the slow progress that has been achieved in terms of how knowledge and skills are circulating among farmers engaged in citrus farming.

A consensus exists that extension services if functioning effectively, improve agricultural productivity through providing farmers with information that helps them to optimize their limited resources. According to. Muyange M. and Jagne T. S (2006) extension provision is generally skewed towards high agricultural potential regions and high value crops. Remote areas with sporadic rainfall patterns and low value crops with little marketable surplus are poorly served.

The grafted citrus innovations were introduced to the farming communities in Makueni district in the early 1980s' and since then the circulation of knowledge and skills of the grafted citrus innovations has been slow. The knowledge of grafting citrus is confined to a few farmers and the rest are not picking up the innovation. There are farmers who still grow both varieties of citrus i.e the grafted citrus and the non-grafted citrus. The non-grafted citrus are of lower quality and fetch a lower price compared to the grafted citrus. The presence of a suitable climatic condition favorable for growth of citrus and the fact that the region has few cash crop is an additional reason for farmers to grow grafted citrus crops. Citrus is a perennial crop which adapts well in areas with low rainfall.

Apparently we have a viable avenue for economic growth in the region in grafted citrus farming as a source of income yet many farmers don't seem to be interested. The pace at which the knowledge and skills concerning citrus innovations is circulating is slow. This trend is worrying the extension personnel given that the area in question is arid and with no other cash crop suitable for farming in the region. This consequently leaves the farming communities with thin options when it comes to sustainable livelihood strategy given the intermittent nature of the rainfall patterns in Makueni district. People are turning to other livelihood coping strategies like migrating and off farm diversification activities etc this is because agriculture is increasingly becoming uneconomical. Subsistence farming is practiced and barely sustains the families throughout the year. The farmers grow crops like maize, beans, cassava, and cowpeas all of which are drought tolerant.

The World bank(1998) points out that knowledge production in the society is accelerating while at the same time the accessibility of such knowledge tends to improve in view of the rapid development in information & communication technologies(i.e. the internet) at least for those who are "connected" and have sufficient resources. There is generation of agricultural knowledge and information from the research centers that is reaching the extension department at the district level, but the same knowledge and information is fragmented and locked up at the district extension level. In this context we have more knowledge concerning citrus farming at the research station/district extension service ("supply high") and "less demand" at the farmers' level. This imbalance does affect knowledge circulation across the farming communities engaged in citrus farming.

1.4 Research problem

Against the above mentioned problem description we actually know very little about the experiences and perception of farmers engaged in citrus farming innovations. Therefore it is imperative to look at the citrus innovations from the farmers' perspective before drawing conclusions about changes that are deemed necessary in Extension service delivery system. For instance we don't know how many farmers have engaged in the grafted citrus innovation. We still do not know of their experiences pertaining to this innovation and the knowledge circulation processes among the farmers growing the various types of citrus crops. Analyzing the described situation in the perspective of adopters and non adopters is an old approach of looking at the farming communities bearing in mind the many complexities that surround the farmers. Then, is there a different way of looking at this research problem which is more respectful to farmers as the principal actors in innovation that takes knowledge circulation and creation into account? This research has looked at the link between district Extension department and experiences of the farmers in processes of knowledge circulation pertaining to various citrus innovations.

1.5 Objective of the study

The objective of the research is to review and analyze the role played by the extension personnel and the farming community in knowledge circulation pertaining to citrus farming innovations in Makueni district of Kenya.

1.6 Research questions

- 1) What is the perception of the farmers about citrus farming?
 - a) What considerations are important to the farmers' in decisions making concerning citrus farming?

- b) What are the bottlenecks in citrus farming as perceived by the farmers and how important is citrus grafting according to their criteria.
- 2) What is the role of the Extension personnel in knowledge circulation pertaining to citrus farming?
- a) What knowledge and skills do the extension personnel have in citrus farming?
 - b) What constraints hinder Extension personnel in their role in knowledge circulation in the farming communities?
 - c) What is the Extension department doing to enhance the performance of the extension personnel in participatory acquiring of skills and knowledge?

CHAPTER TWO - LITERATURE REVIEW

In this chapter the researcher is outlining what other authors have said concerning the following concepts. These concepts are listed below

- Knowledge circulation,
- Farmers' organizations
- Social learning,
- Farmer to farmer communication

2.1 Introduction.

One of the most important functions of Extension is to bridge gap between research centers and the farmers in terms of introduction of improved methods of agricultural productivity. In other words successful communication is central to an extension worker when projecting trajectories of change in the farming communities. An extension worker's job does not end with merely informing the farmers about improved practices, he should ensure practical application (by the farmers) of the result of research and field trials.

Extension officer's efficiency can be measured:-

- (a) By the speed or quickness with which the gap between what is known and what is done by the farmers is bridged.
- (b) By the number of farmers practicing new innovations and
- (c) Also by the number of farmers and communities that engage the new practices.

2.2 Knowledge circulation

A number of authors have different schools of thought concerning knowledge. According to leeuwis (2004) "knowledge is regarded as the body of mental inferences and conclusions that people build from different elements of information, and which allows them to take action in a given context". Knowledge is valuable information from human mind including reflections and synthesis context. The type of knowledge, the relevance of the knowledge, and the channel of circulating the knowledge are all vital when we talk about knowledge circulation. The various actors engaged in knowledge circulation, the package of the knowledge and skills, understanding the complexities of the farming communities have definite implications to the acceptance and pace of an innovation by the farming communities.

Knowledge is the understanding of or information about a subject which has been obtained by study or experience, and which is either in person's mind or possessed by people in general (Cambridge dictionary, 2007)

According to Peter drucker (2005) knowledge has been defined as information endorsed with relevance and purpose. It is valuable precisely because somebody has added knowledge context, meaning, and a particular interpretation, added their own wisdom to it, and considered its larger implications. Some knowledge is tacit –it exists symbolically in the human mind and can be made explicit only with difficulty.

In this research the term knowledge circulation is used to refer to various citrus innovations, that is the researcher is concerned about how knowledge and skills concerning citrus innovation circulate across the farming communities in Makueni district. The other important aspect to the researcher was concerned with are the various development actors and the specific roles they play in knowledge

circulation. When we talk about knowledge in citrus farming the following are some of the important areas under consideration (see Box 1 & 2)

Box 1: Recommended citrus technologies to farmers

Production Inputs.

Acquiring of the citrus seedling is the starting point in the establishment of an orchard. This can also be done by conversion of already grown citrus plants by grafting technique. The already established plant stock is called the root stock. The part to be grafted on the rootstock is called the scion. Scion has the desirable qualities of the citrus which are chosen from a Washington navel of high productivity. This is a technical undertaking that requires careful demonstration by extension personnel, on how it should be done, and follow up sessions to allow for a proper graft to form. This initial cost of establishing an orchard may be high but decrease as the trees mature.

Citrus diseases and pests.

There are a wide range of diseases that affect citrus crop depending on the season and the farming practice in place. This include bacterial diseases, fungal diseases, nematodes, viral diseases, viroids, graft transmissions pathogens, phytoplasma and spiriplasmal diseases.

Most mites, insects, and nematodes that attack citrus cause economic damage to the farming communities. The farmers' needs to understand when to apply specific management practices and the local condition that contributes to the prevalence of diseases & pests and ways to avert them. The farmer needs to be aware of the diseases and their control methods and the particular pesticides to be used.

Favorable conditions include-:

- Ideal design of orchard (wide distance for good ventilation)
- Diversity of crops used for intercropping
- Resistant varieties
- Know-how & experience of the farmer

Harvesting season

The harvesting season for citrus in Makueni district lasts for 3-4 months between the months June and September. This period call for increased labor requirements from the farmer for proper harvesting and packing of the citrus crop to ensure that the fruits reach the market in perfect condition. Conventional citrus takes around 6 years to reach maturity age. At this stage the productivity is low and higher yields can only be expected in subsequent years. The grafted citrus takes a short time to mature reaching first fruition at 4 years with high quality fruits.

Intercropping

The optimal spacing requirements for citrus is 4meters by 4meters or 156 tree per ha. This spacing allows the farmer to practice intercropping especially with maize, beans or any other crops in between the rows. This is done because citrus is harvested only once per year. The rows between the trees are used to produce maize or beans for the farmers to rip maximum benefits. The intercropping provides the farmers with crops for subsistence use as they look forward to harvesting the citrus crop for the market. The intercropping should be done to ensure plant density which permeates optimal light interception and aeration.

Some months before planting the trees farmers need to sow in vigorous legumes and mulch them before establishing the orchard. This will enrich the soil with organic matter and nitrogen fixation, both stimulating soil microbial activity.

Box 2: Conti; Recommended citrus technologies to farmers

Soil cover systems

A permanent soil cover is an important component in orchard cultivation system. Locally adapted leguminous crops e.g. cover crop help to restore degraded soils; they successfully suppress weeds, fix nitrogen and prevent erosion. They also help avoid competition between the cover crop and citrus. Suitable management of the cover crop is necessary. There are several measures including -:

- Mulch the cover crop before dry season to avoid competition with citrus trees
- Reduce the percentage of living soil coverage to optimally adapt the soil, the crop and the climate conditions. One possible solution is the sandwich system whereby the farmer plants crops in between the rows of the citrus trees and mulch the rows which have the citrus.
- Weed control:- regular mowing of the orchard is strongly recommended either by hand weeding or by mulching.

Supplying nutrients.

This is done when necessary on the basis of soil and leaf analysis. The supply of nutrients can be done by application of right quantities of commercial fertilizers around the citrus trees e.g. urea at 120 grams per tree. Suitable strategies have to be planned according to soil condition and stage of plant growth e.g. application have to be applied 2-4 weeks before the expected nitrogen demand of the trees (2-4 weeks before flowering). The recommended nitrogen requirement for citrus is 50kg per ha.

Water requirement

Citrus are water conserving plants thus capable of withstanding long periods of drought as they have leaves covered with epicuticular wax. The designated area of research of a semi arid region with low amounts of rainfall therefore the citrus trees should be mulched to prevent water loss.

Pruning

As the trees grow the inner and lower branches become shaded. Most of the fruiting occurs in the outer periphery of the canopy whereas the inner parts suffer from shading having bad or no fruit set. The problem can become especially severe in high density planting. Therefore a yearly pruning is essential to maintain light and air penetration since a good aeration also contributes to the prevention of pest and diseases. It is also advisable to maintain the tree height at no more than twice the planting distance in the rows.

Marketing aspects

The region under consideration is frequented by middlemen and merchants at the peak harvesting period who ferry the fruits to major cities in Kenya. These fruits are also sold at the local market that is open once a week. However the question of finding the appropriate marketing chain and a good selling price remains a contentious issue for the farming communities. What are the chances that farmers can form a producer organization to assist them in the marketing of the citrus? What regulations exist for exporting of citrus? What do the farmers have to invest more in order to increase citrus production at a lower cost? These are some of the key technical questions that influence the farmers decision on whether to plant citrus or not plant in the district.

2.3 Social learning

Social learning theory focuses on the learning that occurs within a social context. It considers that people learn from one another, including such concepts as observational learning, imitation, and modeling. This theory incorporates aspects of behavioral and cognitive learning. Behavioral learning assumes that people's environment (surroundings) cause people to behave in certain ways. Cognitive learning presumes that psychological factors are important for influencing how one behaves. (Bandura, 1977)

Lenning and Ebbers (1999) define learning communities as an intentionally developed community that will promote and maximize learning. "Learning communities are effective when participants emphasize active, focused involvement in learning and collaboration that stimulates and promotes the group and group members' learning". They continue to argue that education is most successful as a social process and is deeply rooted in our understanding of community and democracy.

Progress particularly in relation to sustainable development, hinges on a society capacity for different sectors and interests to be able to constructively engage with each other. This is of critical importance for leadership of civil society organization (CSO) and civil society activism. We believe that effectiveness of civil society will hinge on its capacity to engage individuals and organizations across all sectors in processes of critical reflection and learning. Overtime the techno-economic decisions that really impact on society have come to rest predominantly with scientists, bankers, and corporate managers and both with either the citizenry on the one hand or with elected government on the other. (Bawden et al. 2007)

According to Bawden (2007) as parliamentary democracy slowly spreads across the globe, so the distance grows between the world of expert policy making and world of public opinion 'resulting in a continuing decline in quality of public participation in their own affairs and erosion of self governance. This has led to lack of mutual support and significant gap that separates public from the expert. In the farming context the expert (extension worker) and the farmer tend to talk in different languages making sustainable agricultural production elusive. Therefore since farmers have the same constraints and problems then learning from one another become crucial in achieving sustainable farm productivity (Leeuwis, 2004)

Institutions that assist in the process of public judgment remains very thin on the ground. Furthermore, experts do not always agree on matters of mutual interest, which leaves citizen in the position of not knowing who to believe. It not just about participation, but one of critical reflection and dialogue and acts that challenge roles, power structure, taboo etc. (Bawden, 2007)

Science is no longer sole source of knowledge for action for modern society, at the same time religious beliefs become pluralistic and thus unacceptable as a basis to focused political decisions 'rights will become real only if citizens are engaged in the decisions and processes which affect their lives (DFID 2000).

As Dietz and his colleagues have suggested, devising ways 'to sustain the earths ability to support diverse life including a reasonable quality of life for humans involves making tough decisions under uncertainty, complexity, and substantial biophysical constraints as well as conflicting human values and interests' (Dietz et al 2003)

For any act of development towards a more sustainable world ought to be moral and Intellectual development of all actors who should be involved in the act. In other words, the central theme of development of sustainability should be the critical learning capabilities of multi-stakeholder constituencies who are facing complex problematic matters of common concern. (Bawden, 2007)

The farmers' willingness to participate actively in learning collectively among themselves and incorporation of other actors is prime to achieving sustainable agricultural productivity. If farmers are unable to innovate collectively in response to changing environment or in attempts to influence the manner by which those environments evolve, run the risk at the very least of some form of collective crisis and at worse of the annihilation of their society.

Shift from the production to people centered development (participation & societal learning for development) when we talk of societal learning we emphasis the idea of bringing together different stakeholders(actors) who have an interest in a particular problem situation and engaging them in processes of dialogue and collective sense making for action.

This form of social learning as Cornwall and Gujit (2004) declare, entails more than simple group based learning, but rather, bringing together a range of unlikely comrades in multi-stakeholder processes for fact finding, negotiation, planning, reassessing and refocusing.

Societal learning is the process by which communities, stakeholders groups or societies learn how to innovate and to adapt in response to changing societal & environmental conditions. Societal learning actively engages different groups, communities and multi-stakeholders constituents in a communicative process for understanding problematic situations, interpersonal conflicts and societal dilemmas and paradoxes, and of creating strategies for improvements. To be more specific leeuw(2004) defines social learning as 'a move from multiple to collective or distributive cognition'.

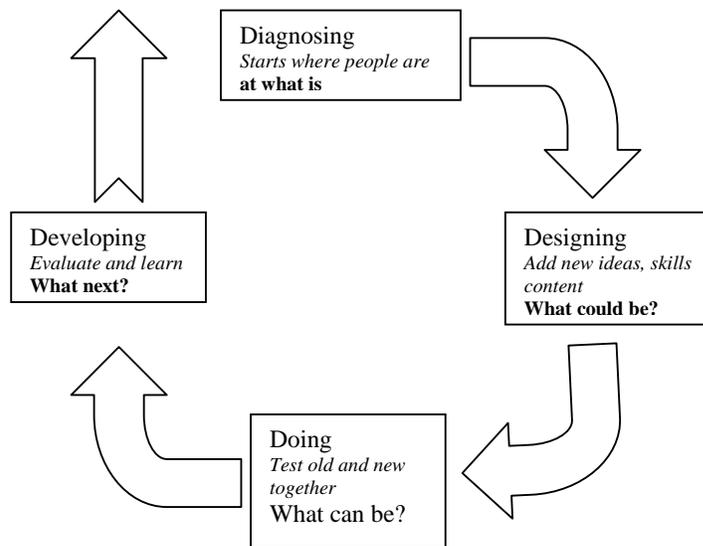


Figure 1 Individual and social learning cycle framework

Source: (Brown et al. 2003, Kolbs et al.1995)

Participation for social learning

There is no societal learning if no actions have been put in place to bring about institutional changes required in current governance and democratic system that enable a free flow of ideas, open dialogue, and new partners between unlikely allies.

Limitation of existing institutions and mechanism of governance and experimental with multilayered learning oriented and participatory form of governance need to be understood.

In what ways can civil society foster greater participation learning in our system of governance?

- a) Citizenship strengthening –emphasis of societal learning being on helping people to understand their rights and be able to constructively and effectively engage in claim making , collective action , governance and political processes.
- b) Trust /dignity/culture /identity: where people learn through interactions to have mutually respective social relationships and engendered trust in others based on positive experiences.
- c) Learning in this case focuses more on developing and living an alternative model of human interaction than is locally dominant. Civil society also needs to be active in civil society organization (CSO) governance, programming, monitoring and accountability. Societal learning focuses both on organizational learning in terms of strategizing but also on learning how to enact democracy within the organization that profess to represent citizens. This requires CSOs to learn about being responsive to the right values, aspirations, and interest and priority needs of their constituencies.
- d) Citizen participations in local developments and service delivery: CSOs focus on building local capacities and critically questioning the existing inadequate services, have vision about alternatives and then design implement & monitor these.
- e) Citizen participation in advocacy & structural change: in which citizens call society at large or particular power holder to debate about unjust policies or implementations. This requires internal learning about best strategies but also as a level for broader societal learning about issues that are the focus of advocacy efforts.
- f) Citizen participation in economic life: Engaging the poor, vulnerable in their terms and for their needs and making the concept of pro-poor economic growth a reality. Here learning is internal on strategies, negotiation capacities and indeed vision for an economic alternative –that is learning about the alternative model. The power cube framework enabled a deep questioning of civil society participation in terms of three analytical dimensions –place, space and dynamics of power.

Problems in the context of farming invariable demand co-operation between a number of different groups operating at a number of different levels including individuals, communities, specialist and government. (Dyball et al, 2007)

All these actors can contribute to resolving the problems but their different backgrounds and relation to the problem results in them constructing the problem in different ways.

Farmers problems are multi-dimensional and cannot be fully grasped using current analytical frameworks. Not only must we acknowledge that different actors and groups see common problems with different perspectives, but we must recognize that actors have different social power bases. These power relations change with context e.g. farmer exercises great deal of power at local community but be disempowered & marginalized in a board meeting in the offices of government agricultural agency.

Reflection and reflexivity

Social learning is a process of iterative reflection that occurs when we share our experiences, ideas and environment with others. The importance of reflectivity –reflecting the value of what we know and how we know it, leads to new understandings is crucial component for successful social learning. Reflective learning process is depicted as a learning cycle (kolbs et al, 1995). The cycle provides a framework for continuous reflection on our action and ideas and the relationship between our knowledge behaviors and values.

In practice these reflection processes are at:

- 1) Personal level through setting goals and critically monitoring processes and outcomes.
- 2) Interpersonal level, through briefing and debriefing within groups
- 3) Community level through creating a common vision, identifying priorities and setting performance indicators to be assessed
- 4) Social level, through evaluating and auditing the impacts of laws regulations and markets. This type of learning forms foundation of a number of social learning approaches e.g. participatory rural appraisal (PRA), Participatory learning and action (PLA) etc

Reflecting is important for social change because it can reveal the ways in which theoretical, cultural, institutional and political context affect learning processes actions and values. To the invisible in us we need to do monitoring and evaluation or in other cases collaboration can provide a catalyst for recognizing differences, challenging us to consider new knowledge and insights or rethink our assumptions. (Dyball et al, 2007)

Systems orientation & systems thinking:

Systems thinking offers a powerful way of understanding the dynamics of change in complex situations typical of human interactions with their environment. By clearly identifying what relevant parts or variable, bounded across which dimensions of time and scale, each individual or group has selected, it becomes possible to identify points of disagreements. Systems thinking is concerned with state of variable that comprise the system and with the processes that account for the change in the value of the variable across a given period of time. Systems thinking favors solution that are self sustaining in that they arise from the structure and properties of the system as whole. To understand systems we are compelled to look for patterns rather than events and for processes rather than end points, monitoring evaluating; feedback from effect & outcome of decisions.

We have to accept that surprise and change are endemic to the dynamics of the systems that concerns us, and a system may change its fundamental behaviors quite suddenly. A belief that complex systems can be manipulated with a high degree of certainty is a delusion. In other words the inherent behavior of the system that environment manager seeks to manage necessitates a commitment to ongoing social learning across diverse groups.

Integration and synthesis:

The pursuit of sustainability the environment management requires a holistic and integrative framework from which to investigate the world, rather than one divided observation into a selected set of elements. Frameworks that represents patterns linking people roles and responsibilities such as population flow charts, and informal networks deals with forms of horizontal integrations. Vertical, horizontal, place and issue based integration are equally necessary in creating social learning process. Under some circumstances integration has become synonymous with processes & concepts as different as co-ordination, collaboration, cooperation, systems, synthesis holistic unity and consensus. The goal is not a single consensus nor the lowest common denominator but a search for rich tapestry that measures together diverse ideas to reveal the nature of the complexity. Age cohort, gender and expert groups have their own internally agreed interpretations of the way the world is. Communities have their own shared memories and first hand experiences, specialist work in particular ethical positions & skills instilled during training. Organizations have internal loyalties & types of expertise demanded by the management. In a shared integrated understanding, remedial actions will be necessary to reconcile these very different interpretations of the same reality.

Negotiation and collaboration:

Negotiation is at every interface with and between elements of social learning since every group has its own identity, created by defining a core area of interest and establishing boundaries that distinguish it from the other. A construction approach to negotiation assumes that conflict generates opportunities for

learning. Competing opinions and evidences are to be welcomed as creating conditions for generating new knowledge. Conflict is an inevitable part of change. It is not a sign of failure of people or a system. Conflict is a step towards a solution – its not a signal to give up. Conflict is shared –its not a sole responsibility of any person or group. Conflict is part of a process it is not an outcome, barrier or excuse. Conflict is a matter for negotiation not the end of the line. To achieve sustainability collaboration is required for all the decisions making sectors. Community consultations by researchers and government and community referencing in the law have become standard practices. Each contributing group to recognize & respect the form of evidence held by other knowledge tradition.

Participation and engagement;

Different forms of participation can contribute to social learning and a mix of approaches may be needed over the life of a project or programme. Social learning is by definition based on existing ethics and values about how the world should be.

Social learning in environmental management is essentially about managing change. The more we build up our knowledge matrix through shared understanding the greater the insights we can gain. Management of the issues for sustainability requires integrations of our thinking across disciplines, sectors and knowledge groups. It is not about one way of doing things or knowing. Sustainability is about relationships, dependencies, and networks that can facilitate such integrations in environmental management. Ultimately this systems orientation is intended to lead to greater equality between social groups as well as a holistic approach to decisions making that affect social and ecological systems.

The illustration below shows different levels of knowledge and how they influence individual farmer or farm family.

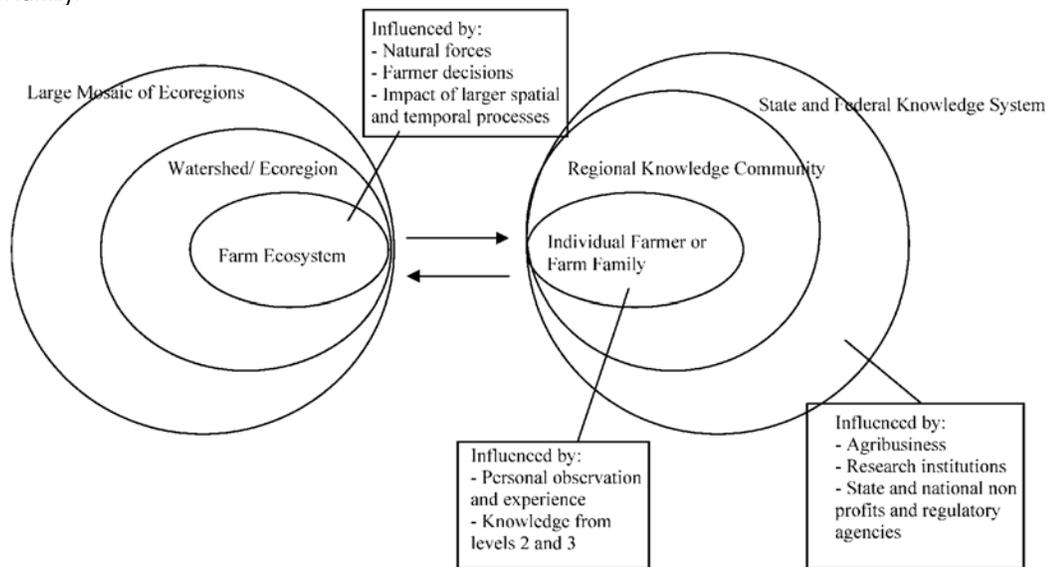


Figure 2 Different knowledge levels

Source: Folkes and berkes 1998

2.4 Farmer to farmer knowledge exchange

Individual farmers usually have much expertise based on experience, on farm experimentation, and/or training which could be relevant to other farmers. Farmers are often aware of this and as a result there often informal means of farmer-to-farmers (i.e. horizontal) exchange of knowledge and information.

Typically, markets, work parties, funerals, bars, celebrations, community meetings, and church services provide opportunities for farmers to talk about agriculture. Moreover farmer-to-farmer knowledge communication for innovation can be seen as a way to optimally use the available knowledge, experience and skills of farmers in a community. This has several advantages:-

Farmers tend to speak the same language, literally and culturally, as their colleagues, and are faced with similar constraints and problems as fellow farmers which may enhance the credibility of their advice and views. Moreover, in the case of temporary projects, using farmer to farmer communication for innovation can improve the long-term impact on sustainability of project efforts (Ileuwis, 2004)

2.5 Agricultural knowledge and information system

Agricultural knowledge circulation is a system that links rural farming communities and institutions to promote mutual learning and generate, share and utilize agriculture-related technology, knowledge and information. The system integrates farmers agricultural educators, researchers and extensionists to harness knowledge and information from various sources for better farming and improved livelihoods.

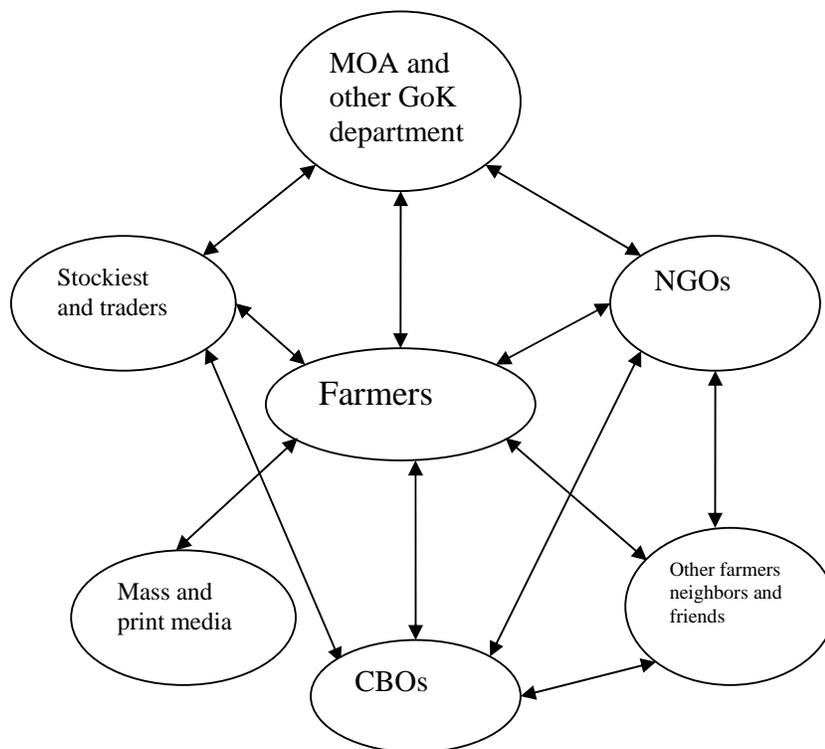


Figure 3 Agricultural knowledge and information system(AKIS) paradigm

Source: F.W. Ndungu et al

2.6 Aspects of farm innovations

Attributes of innovations.

This attributes are; relative advantage of the innovations compared to others, compatibility of the innovation –how can the innovation align itself with the requirements of the farmers. Complexity of the innovation –this refers to the simplicity of the innovation, Triability –this refers to the extend to which an innovation can be implemented on the farm by the farmers, Observability – this refers to the extend to which an innovation can realized.

Multiple source of innovation.

This model emphasis that agricultural innovations do not only originate from research findings in laboratories but from multiple sources. These sources include the farmer, innovative research practitioner, private corporations, and also from the extension agents. Therefore farmers should not be seen as recipients of innovations .The farmers have their tacit knowledge and rely on it for their innovations.

Diverse interests among farmers.

Farming communities have different interests, their different age groups, gender differences, farm sizes, farming styles, land tenure positions and ethnicity. Communication interventionist should understand these differences in relation to broader issues (e.g. introducing a pest control measure) instead of taking the farming community as an homogeneous group of people (Roling, 1988).

Sustainable livelihood approach

People purse different range of activities to realize different outcomes (good health, food security, sources of income). This implies that people do not only engage in farming for their livelihood. A farmer may choose not to engage in farming and engage in other livelihood activities. A livelihood is attributed to availability of assets, capabilities and strategies (Ellis, 2000). People are likely to engage in other activities outside agriculture therefore low adoption should not imply that people are laggards.

Generation of innovation

An innovation has to undergo different stages before it takes roots and is fully accepted by the farming communities. The first stage is the discovery stage, characterized by emergency of a concept or result that establishes the innovation. The second essential stage is development, where the discovery moves from the laboratory to the field and is scaled up, commercialized and integrated with the other elements of the production process.

It should also be noted that new innovations are likely to emerge in response to scarcity and economic opportunities e.g. labor shortage will induce labor saving technologies.

On the other hand the presence of a support framework and policy spurs innovations in the right direction. This usually creates an enabling environment for innovations to be implemented by the farming communities. The method of passing the skills and knowledge to the farmers has relevant implications on the spread of innovations across a community.

2.7 Farmers organizations

Farmers organization are defined as those agrarian interest groups formed by farmers to help them meet their professional/or social objectives. The farmer associations are internally or externally initiated and are geared towards improving the well being of the farmers.

It has to be noted that formation of farmers organization as a social process have both benefits and costs for the actors involved. One such cost may be that least organized farmers, who often happen to be resource-poor or women farmers, are discriminated against by the agricultural knowledge and information systems. This may occur where commercial farmers, seeing the social change taking place and recognizing the need for the new knowledge more strongly than other farmers, organize themselves and use knowledge and information systems for their own ends. A farmer organization may not necessarily serve the interests of all its members usually the least affluent ones, may be discriminated because the organization may be hijacked by a few members, the leaders, for their own benefit or non stated objectives. Also some farmer organization may not necessary operate for the benefit of the farmers if it is not their primary objective.

Farmers organizations are formed with individual farmers as members and around local interest, to provide vital services to its members. They are usually more commercial in character and their function include input supply and marketing as well as seeking solutions to problems associated with their enterprises. The annual general meeting are highest decision making body and leaders are elected in such meetings.

The farmer groups may be for crop associations such as maize, mangoes, citrus, sisal etc. Usually at village level farmers interested in a particular crop organize themselves into crop associations. In most cases they are formed to pool financial resources or joint marketing. However other incentives include the procurement of credits and input packages. This is because its easier and cheaper to obtain them in a group rather than as individual farmer

Farmer's and non governmental bodies working in the rural areas play a critical role in improving economic and livelihood opportunities of their members – conditioning and securing access to resources and opportunities, and to technical services (such as agricultural research and extension). Where such organizations are weak or non-existent the Poor's access to external resources and knowledge tends to be more limited, having a direct impact on livelihood opportunities. Support for farmers' organizations therefore remains critical to the achievement of sustainable livelihoods.

Strong local organizations are key to building sustainable livelihoods. Farmers' organizations have, when the conditions are right, been able to ensure that farmers have a voice in agricultural service delivery. They can be effective vehicles for empowerment of their members, where empowerment refers to people taking control of the development process. Farmers organizations have the potential to empower individuals (Farmers Organization members) and strengthen a community in its relations with outsiders and the wider society (including international agencies, political authorities and central government).

Effective mechanisms for collaboration between actors is essential. Nevertheless, power relationships between the actors are complex. Farmers' organizations that develop their own objectives and dynamic, gaining access to secure and diverse funds, often gain the power to request or demand agricultural services that are appropriate to their needs. However, government may sense a threat to its authority from overtly political farmers' organizations and in this case public sector bodies may not wish to work in collaboration with them.

CHAPTER THREE - RESEARCH STRATEGY AND METHODOLOGY

3.1 Study area

This research was conducted in Kenya in the eastern province of Kenya in Makueni district (fig.1 shows the location of Makueni district in Kenya). The district headquarters is about 200 km from Nairobi, the capital city of Kenya. The district headquarters is situated in Wote town and the population of the district is 912,689 people according to the 1999 Kenya population census. The district is connected to Nairobi by a network of bituminized road link and an earth road linking it to the Emali town to the east of the country. The major economic activity of the people of Makueni district is smallholder subsistence farming with average landholding of about 1.5 ha per farm family. The subsistence farmers depend on rain-fed agriculture in order for the crops to yield well since the region most often experience intermittent rainfall patterns. The region has a bimodal rainfall pattern, which is between April-may (long rains) and November-December (short rain).

The common crops grown in this Makueni district include cereal (maize, finger millet, and sorghum), legumes (beans, cowpeas, pigeon peas), and vegetables (kales, cabbages, onions), for those farm families located near seasonal rivers. The fruit crops grown include pawpaw, guavas, mangos, bananas and citrus. The livestock kept by the farm families include the local breeds of cattle, goats, sheep, and chicken. The farmers use this as a source of food and income.

The district has other non-governmental organization working in the region collaborating with the government extension department in service delivery to the farming community. These non-governmental bodies include: world vision, Kenya agricultural production project (kapp), *njaa marufuku* Kenya, world vision, Kenya agricultural productivity project (KAPP), African medical research foundation (AMREF) etc.

The region under study has some farmers growing citrus and mangoes as a cash crop given that the district has no other cash crops that can thrive well in a semi arid region.

The study was undertaken in three divisions in Makueni district. These were Kathonzweni division, Kaiti division and Wote division which are known for their citrus production.

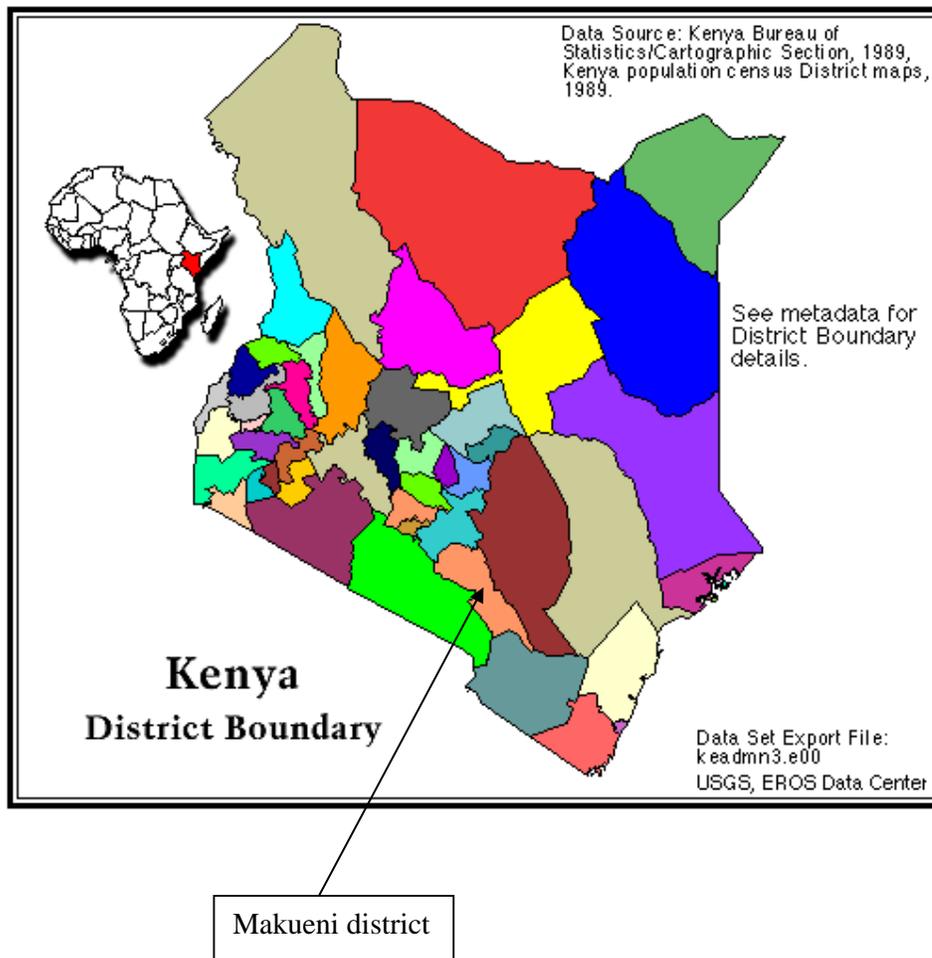


Figure 4 Map of Kenya showing study area

Source: Kenya bureau of statistics/cartography section , Kenya population census district maps

3.2 The target respondents

Given that the researcher sets out to find out about the process of knowledge circulation among the citrus farming communities, the key respondents are the citrus farmers. The farmers have hands on experience on farming practices and understand how knowledge circulates within the communities. On the other hand the extension personnel working within the district are also targeted as respondents since they advise the citrus farmers on better methods of farming. The extension personnel are considered because they act as information brokers and serve to interpret research findings to the citrus farmers. It was also deemed necessary to include extension personnel since their level of skills and knowledge determines whether knowledge flow is hampered or enhanced within the citrus farmers.

The district agricultural officer(DAO) was targeted as a key respondent since he heads the entire extension organization in Makueni district. The organization aspects were considered to find out what strategies have been put in place to enhance knowledge circulation in the citrus farming communities. The organizational changes that have taken place in the extension department have direct implications on the service delivery system to the citrus farming communities. On the other hand the constraints that hinder the extension performance in terms of knowledge circulation were considered.

3.3 The sample size

The sample size of this research was twenty farmers (20) chosen in three divisions that is Wote division, Kathonzeni division, and Kaiti division. The researcher was introduced to one contact farmer and via this farmer was able to reach out and interview the rest of the citrus farmers.

The sample size of twenty farmers had 11 men and 9 women in two distinct categories. One sample consisted of farmers who grow purely the Washington navel type of citrus and the other sample of farmers consisted of farmers who grow both the Washington navel and the non grafted type of citrus.

The information from either of the farmers was collected using interview technique. Besides the farmers the researcher selected 3 extension staffs who were equally interviewed. The DAO of Makueni district was the last persons to be interviewed. A complete list of all the respondents is attached as an annex (Annex 4)

3.4 Research strategy

According to Verschuren, p and Doorewaard, h, 1999 a research having less than 30 respondents qualifies to be called a case study. This number is also justifiable considering the time allocated from data collection to drafting the final report. The time constraint also justifies the small number of farmers the researcher interviewed (20 citrus farmers)

The researcher had the entire checklist inclined to finding out the enhancers and the constrains facing the processes of knowledge circulation in the citrus farming communities. The results from the respondents were generalized to give the trends in terms of knowledge circulation.

The researcher had to go out to the field to collect the qualitative empirical data using research tools elaborated in the next part of this report. The importance of such a small number of respondents is to give an in-depth picture of the situation of knowledge perceptions among the farmers communities engaged in citrus farmers.

3.5 Research tools

The data collected in this research project was of three types-:

- Literature reviews
- Interviews
- observations

a) Literature review

This research tool was used by the researchers to find out what other researchers have found concerning the topic being investigated. It enabled the researcher to understand what work has been done so far in the topic under consideration. On the other hand the researcher was able to justify his/her findings since earlier researchers have documented similar findings. The sources of literature are basically obtained from text books, websites, and proceedings from workshops, unpublished documents and articles from the journals.

b) Interviews

The researcher had designed a checklist for the farmers who grow citrus in the district. The interview was conducted by the researcher using semi-structured interviews with the two categories of farmers outlined previously, who are engaged in citrus farming. The interviews were necessary since the researcher was dealing with farmers with little formal education and others had little or no exposure to modern farming practices.

The researcher had discussed the different interviews questions with a number of people to ensure that the respondents understood it the same way, that is it was pre-tested prior to the actual interviews. The sample size of the farmers in study was composed of both male and female farmers.

One focused group discussion was conducted with four farmers which also gave an additional input to the data collected. The advantage of a focused group discussion is that opinions from different farmers can be tabled and discussed resulting in new ideas.

The researcher went ahead to interview three extension workers. This was deemed necessary since the extension workers are knowledge brokers in rural areas. The extension forms a vital link between research station and the farmers and therefore has a direct bearing on how knowledge and information circulates. The researcher also interviewed the DAO. This was because the DAO represents the entire extension organization in the district. The measures which are implemented at the district level reflect the ministry's directives from the national headquarters.

c) Observations

Observation as a research tool was used to access the visible factors (Technical aspects) that are important considerations when farmers are engaged in citrus farming. This include things like disease infections in citrus, soil variables, plant heights maturity, pruning aspects of the plants and plant water requirements at certain stages of their life. Observation as a tool is very handy at the stage in which grafting is done using the rootstock of the rough lemon and the scion of the desirable citrus.

3.6 Data analysis

In the analysis of the qualitative data the researcher started by ordering, coding of the data and extraction of thematic issues. Answers provided by the informants were carefully grouped putting into consideration the purpose of the question. This was followed by a rough categorization of answers that seem to belong together and coded them with key words. Thereafter the answers were listed all as per code. Then finally the findings were interpreted and presented in graphs, table and matrixes depending on which was appropriate. From this diagrams then conclusions were drawn.

3.7 Research limitations

The main constraint the investigator faced was lack transport to the citrus farmers' farms. The available means of transport was a motorcycle and the researcher had to cater for the travel costs.

For the researcher to be able to interview the citrus farmers, some introduction was needed to establish a rapport with the first contact farmer. It was a grueling task to look for someone to accompany the researcher since a number of staff were on annual leave. In fact in the first introduction to the citrus farmers the researcher was accompanied to the field by a social services officer since there was no extension workers in the field. Then the introduction of the researcher to the subsequent farmer was done via the farmer already interviewed.

The actual data collection took two weeks and was conducted between mid July and mid August 2008. But before it was done, a lot of logistical problems had to be sorted out. The single extension worker at

the divisional headquarters had to call a contact farmer where the researcher was to start the farmers interview. Arrangements were also made on how the researcher was to proceed on with the research after interviewing the first citrus farmer.

The researcher was to interview five extension staffs in order to get a balanced idea about their perception on knowledge circulation within the district concerning citrus farming. The absence of some of the extension staffs meant that the researcher had to organize for the particular staff to be summoned up for the interview. This was a time consuming task and also very inconveniencing to the staffs who were already on their annual leave. The researcher eventually managed to interview three extension staffs instead of the intended five.

The other difficult faced was that the farmers felt that the researcher understood a lot about citrus and that he was there to train them on better management practices. Therefore some of the farmers withheld some information concerning what they always did. There were other farmers who thought that after an interview they were to receive financial compensation which was not the case. There were others who thought that a researcher of masters level is heavily funded.

CHAPTER FOUR - RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the findings of the field study that was conducted with the targeted respondents. The respondents were: Citrus farmers, Extension staff, and the district agricultural officer of Makueni district. These results are displayed using frequency tables and graphs. The farmers in this interview were grouped according to number of tree planted. The researcher also used other variable such as land size, gender and learning method to group the farmers.

4.2 Aspects farmers consider relevant in citrus farming

The findings on the aspects the farmers consider as important in citrus are provided below. These include citrus diseases, labour requirements, water requirements, grafting techniques, land sizes, intercropping requirements.

a) Availability of land:

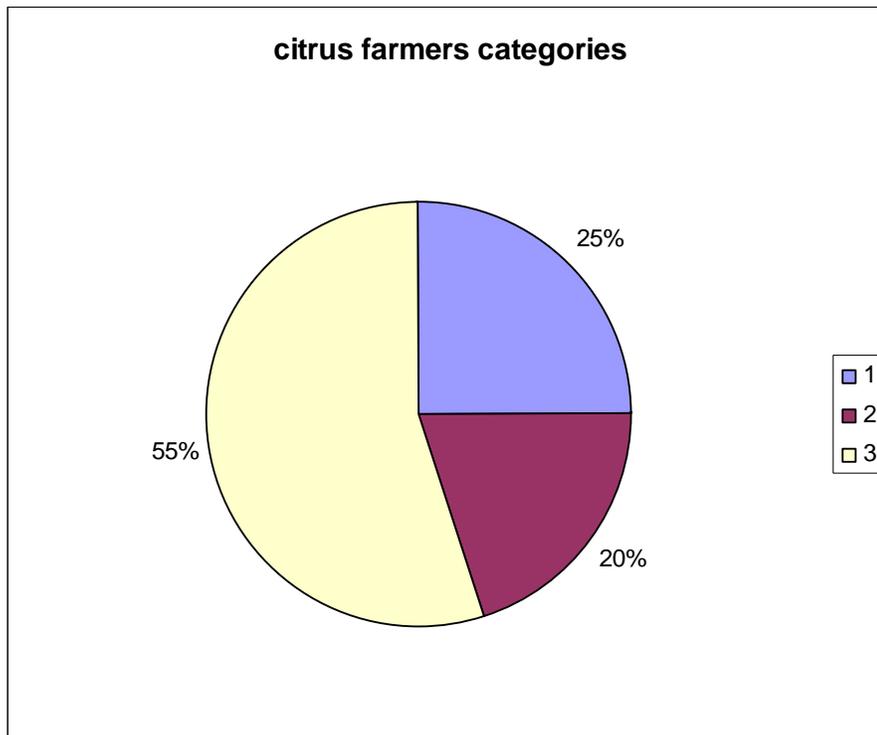
The average land ownership is about 6 acre per household in the district. Farmers engaged in citrus farming reported that land size was an important consideration in citrus farming. This they said was due to the large spacing needed for citrus planting. The farmers who had planted over 100 citrus trees had land sizes of over 20 acres of land.

Table 1 land size in relation to number of citrus planted

Citrus farmers	Land size	trees planted	percentage
5	6	0-50	25
4	>6-20	50-100	20
11	>20	>100	55
total	20		100

The pie chart below show that 55% of the citrus farmers had land sizes of more than 20 acres, 25% of the farmers had land size of between 6-20 acres and that 20% of the farmers had land sizes of up to 6 acres.

Figure 5 Citrus farmers categories



b) Labour requirements in citrus production:

All the twenty farmers said that labour is the most important consideration when deciding to venture in citrus production. The farmers said that the labour requirement are high especially in the initial stages of establishing a citrus farm. Farmer's labour is required for digging the holes for planting the citrus. In situations of extreme drought the farmers have to irrigate of the newly grafted citrus plants to avert loses due to withering.

c) Prompt disease control in citrus:

There are several diseases that affect citrus plants. These include bacterial disease, citrus cankers, citrus blight, citrus greening disease, aphids, and citrus rust. The 20 farmers interviewed said that timely disease identification and subsequent control of the diseases is principal to realization of a good harvest.

However there were differences in the methods of disease control used by the farmers. 18 farmers(9men and 9 females) said they used industrial chemicals to control disease infestations but 2 male farmers said they never used chemicals. They relied on some traditional methods of disease control. The two said that to control crawling insects from going up the citrus trees, they tie a rag dipped in used oil around the base of the citrus trees. For the control of citrus rust disease the two farmers scattered ash on the leaves of the affected citrus plants. The two farmers were aged over 45 years and had planted just a few citrus trees. To be exact one farmer had only 10 citrus tree which were planted over twenty years ago.

d) Grafting technique:

All the 20 farmers interviewed agreed that for citrus to be highly productive, the scion for grafting purposes should only be from a mature producing citrus tree. They said the scion should be from citrus

tree that is producing sweet fruits. On this aspect the farmers establish a nursery of rough lemon to provide rootstock that would form the base of the grafted citrus plants. Then after around one year the seedlings are transplanted to the farm. Once on the farm the grafting has to be done in two years time. The extension staff supported this idea of the farmers establishing a nursery of rough lemons to form the basis of the rootstock. The extension workers said that the citrus seedlings which are sold by commercial nurseries which have already be grafted do not pick up well in the farms. The extension staff said that the commercial seedlings take longer to reach maturity age than the seeding grafted locally within the farm settings. This according to extension staffs was attributed it to the acclimatization process of the citrus plant to the new farm settings.

The farmers said that grafting has to be performed by a person conversant with the technique. They said that a poorly done graft would just wither out, which the farmer considered a waste of time and money. The grafting was performed by the farmers themselves or a neighboring farmer who had acquired the grafting skills.

The said they had planted citrus for over ten years now and had learnt how to graft through long-term experience and observing how others were doing it. 9 of the 20 farmers said the grafting was performed by other experienced farmers. 'There are many farmers who have the skills and knowledge of grafting citrus' said one female respondent.

e) Availability of human capital:

All the 20 farmers interviewed stressed the crucial need for the availability of both skilled and unskilled labour force in the management of citrus farm. The farmers who are reported to have more than 100 citrus trees needed extra hired labour for weeding, pruning and spraying activities. It was also noted that the farmers who own a large number of citrus (>100 trees) had other sources of incomes. Notably there were two large farmers whereby one was in the teaching profession and the other was working for the town council of Makueni.

f) Availability of inputs:

The respondents indicated that they needed inputs such as chemical sprays to control citrus crop diseases and pests thereby ensuring the realization of a good fruit harvest. They needed the chemicals in the event of a disease outbreak to avert a total loss of the fruit output. A comparison of the need for chemical in the 1980s and in the 2000s shows that the need for chemical has risen sharply.

However the farmers who had less than twenty citrus trees indicated that they preferred to use traditional methods to control some specific diseases and pests. One male respondent was quoted to have said 'for the last four years I have never sprayed my citrus with industrial chemicals'. He owns 10 mature citrus trees and that to control crawling insect that destroys the flowering citrus he uses ash or used oil. He says he puts ash around the base of the plant or smears used oil around the base of the citrus tree.

g) Profitability of the citrus crop:

The farmers interviewed said that the citrus crop is fast turning to be a high value crop given the high demand it is commanding from the points of sale. The farmers reported to have been selling citrus fruits using sacks four to five years ago but today they sell per kilogram at ksh 15. The selling of the citrus in sacks used to discourage the farmers since the middle men could use an extended type of sack which meant low returns to the farmers.

However 'it takes at least 6 years to have a positive net income from citrus from planting date' commented one male respondent.

Cost of production differ markedly due to differences in soils, microclimates, ease of irrigation water, local availability of labour, and the technical and managerial skills of the farmer.

Moreover, market prices differs, overtime within the season, between citrus whole sale markets in different towns and between wholesale markets and other outlets. Consequently, within the citrus producing farmers there are great variation in profitability margin.

4.3 Farmers considerations in non-grafted citrus

In this research project it was realized that there are no farmers who have not started growing the grafted citrus (Washington navel). Indeed the 10 farmers who have been growing the local non grafted citrus varieties have the grafted citrus (Washington navel) too. The table below shows the frequency distribution and the reasons given by the 10 farmers who had the non grafted citrus.

Table 2 Reasons given by farmers who have local varieties of citrus

Reasons for growing the non-grafted citrus	Frequency(N=10)
Management practices to be carried out to citrus crop	2
Long duration the citrus takes before maturation	5
Drought problems (failure of plant to tolerate drought)	3
	10

Drought problems:

3 out of the 10 farmers maintained that they continue to grow the local citrus varieties given the sporadic nature of rainfall in the region. They said replacing the local varieties with Washington navel has to be done gradually. The farmers said that for it is problematic to maintain citrus plants especially in the initial stages when the plant is still small due to scarcity of water. The newly planted citrus will end up drying up therefore the farmers finds its more advantageous to still have the mature non grafted citrus plants which still produce.

Long duration of wait:

5 out of the 10 farmers who have the non-grafted citrus said that it takes a long duration for waiting before the farmer can realize positive returns from citrus. The five farmers said that it takes around 6 years for the citrus to reach maturity age and productivity increases in subsequent years. The farmers said that such a long wait prompts them not to do away with the already mature non grafted despite their low productivity. They opted to plant the new grafted citrus whilst they still have the non grafted citrus.

Management practices:

2 of the 10 respondents mentioned issues related to difficulties in the management practices of grafted citrus. They said that grafted citrus required more attention in aspects to do with-

The establishment of a nursery for the growth of rough lemon for rootstock purposes.

The best time for grafting has to be considered.

The duration the rough lemon takes before transplanting.

The technicalities involved in grafting.

Care and attention the farmer has to pay to the young seedlings after grafting process is done.

The farmers however commented that the grafted citrus fruits have the following advantages over the non grafted citrus:-

The grafted(Washington navel) citrus fruits tasted better than the non grafted citrus fruits .
The size of the grafted citrus fruits were much larger and attractive compared to the non grafted citrus fruits.

The non grafted citrus fruits had a large number of seeds compared to the grafted(Washington navel) which had none.

The acidity level. The non grafted citrus fruits had high acidity level compared to the grafted(Washington navel) citrus fruits.

The middle men preferred the grafted varieties which were in high demand in the cities.

It was however noted in the interviews that the farmers who had the both grafted and non-grafted citrus were over 50 years of age. It goes without say that the non grafted citrus were planted over 25 years ago.

On the aspect of non grafted citrus farming one extension staff said that all the upcoming farmers starting to grow citrus now, only go for the grafted varieties.

On the other hand the three extension workers attributed the productivity of citrus in the district to the following reasons:-

Climatic conditions:

All the interviewed extension workers said that the region was conducive for citrus farming. One male extension respondent said that the hot spells prevalent in the region was conducive for citrus ripening. They said climatic condition favored citrus farming in Makueni District. They also mentioned that citrus crop thrives well in sandy to loamy soil with low levels of acidity. This they said were the soil type found in Makueni district. 'The important motivation to the farmers to grow citrus crop is largely due to availability of a market for the citrus crop in the cities' commented a female extension worker. 'Once you have citrus that are ready for the market then you have a ready buyer at your doorstep' continued the female extension worker

They also said that the farmers opted to grow citrus owing to the fact that the district has few other cash crop that can thrive well compared to citrus . The citrus could act as a buffer in the event that other food crops failed due to the shortage of rainfall.

Labor availability:

However the extension workers said that the initial labor requirements are high and may be an impediment to the establishment of a citrus farm. Digging of the hole for planting the citrus calls for high labour investment and sacrifice from the farmers perspective. Irrigation and manuring activities which are activities carried out during the dry spell equally demand large amounts of labour input.

Rainfall patterns:

The establishment of a citrus orchard is difficult especially at the early stage of the plant growth due to the erratic patterns of rainfall in the Makueni district. This is evident when the farmer has to maintain the seedlings of citrus which have been recently grafted. 'The young citrus tree calls for frequent watering and mulching' one of the extension workers commented. The citrus tree will ultimately under produce when there is prolonged drought.

Land sizes:

This was named among the prime reasons why the farmers in the district are not expanding citrus farming. The citrus requires a larger spacing compared to food crops like maize, beans, and vegetables.

The spacing is necessary owing to the fact that citrus is a perennial crop and it keeps growing year after year.



Figure 6 Ripe citrus fruits ready for harvest

4.4 Frequency of farm visits by the extension staff.

Only 2 male farmers of the 20 farmers reported to have been visited by the extension personnel on regular basis. The other 18 farmers (9 male and 9 female farmers) said that they hardly see the extension staffs. The 2 farmers who reported to have been often visited by the extension staff own over 200 citrus trees. But it is interesting to note that there were other farmers who had over 200 trees but were never visited by the extension staff. There were 7 farmers who had over 200 citrus trees of which 2 respondents were female farmers.

On interviewing the extension worker on the subject of frequency of farm visits to the citrus farmers, it was recognized that there was a contradiction with the responses given by the citrus farmers.

Not all the three extension workers were in agreement on the number of times they visited the farmers per given time. Two extension workers however said they visited the farmers 3 times per week. The other extension staff said it depended on the farmers' urgency and/or request. 'Extension today is demand driven and we can only visit the farmer who requests for our services' commented one female extension officer.

4.5 Farmer to farmer knowledge exchange

Among the 20 interviewed respondents 18 citrus farmers (9 female respondents and 9 male respondents) said much of the knowledge and skills of citrus farming was learnt through farmer to farmer knowledge exchange. The farmers shared their knowledge in social gathering such as market places, churches, funeral gatherings, communal working arrangements and in weddings ceremonies. This was done by collaborating and networking among farmers engaged in citrus farming. In this kind of encounters the

farmers centre their discussions on how to control certain diseases, the chemical available in the market place, the cost of the industrial chemicals and availability of a buyer of their produce.

Three female respondents out of the 9 female respondents also reported the great motivation they received from the earliest farmers who grow the Washington navel in the district. The five out of eleven male respondents said that the desire to have an alternative means of income motivated them to grow citrus. The reason behind this is that the region lacks other high value cash crop compared to citrus. This left the farmers with little or no other option to get income. The other 12 respondents(6 male and 6 female) said that they were motivated to grow by the good price the citrus fetched in the markets. 'Citrus is fast turning into a cash crop in Makueni district' commented one male respondent. This motivated the young up coming farmers to set long term goals in citrus farming since for maximum productivity of citrus to be realized, it takes about 8-10 years. This obviously calls for a lot of patience, motivation, and close monitoring of the citrus farm.

Table 3 Motivation of farmers to grow citrus

Reasons why farmers started growing citrus	Male	Female	Total
Motivation from other citrus farmers	----	3	3
Desire to have an alternative source of income	5	----	5
Good market price for citrus	6	6	12
	11	9	20

The other type of learning reported were negotiations between the citrus farmers and the middle men. This involved discussions on the price of citrus per kilogram, the desirable sizes of citrus for the market, the transportation difficulties arising due to the dilapidated roads networks, and the market outlets in Makueni district .

Participation in weekly meetings:

Four women interviewed out of the twenty indicated that they participated in weekly meeting organized by non-governmental bodies. The weekly meetings provided the women an opportunity to learn from both the non-governmental body and also from amongst themselves. The women acknowledged that a lot of learning about many farming practices emanated from their weekly encounters with the staff from the non-governmental body.

The non-governmental bodies shared with the women groups' information concerning both agricultural practices and information about home economics. The learning focused on:

- Control of diseases and pest in citrus.
- Importance of pruning to control diseases in citrus.
- Encouraging the farmers to plant drought resistant crop varieties e.g. millet, sorghum. This could ultimately contribute to food security for the families in since the district often experiences inadequate rainfall.
- The importance of cleaning their stores to curb storage losses resulting storage pests like weevils.
- They also commented learning about the importance of proper drying of their farm produce to curb the spread of aflatoxin (a fungal that attacks maize that is not properly dried and stored- the maize becomes lethal to human life if consumed).
- Post-harvest technologies in farm produce to ensure reduced produce loses.
- Proper handling of industrial chemicals to ensure reduced incidences of contamination.
- Preparation and cooking certain traditional meals.

It was however commented that women were still quite busy with other household chores and at times did not attend to the weekly meetings. This was especially noted among women who were de facto household heads.

Networking and collaboration:

Of the 20 farmers interviewed the four women said that the non-governmental bodies encouraged them to form women groups. This could encourage them to form association that could boost their living standards. The typical ones are the merry-go-rounds. Merry-go-rounds are social groups that meet at regular intervals bringing agreed savings to each meeting and allocated them to individual (Kothet-Argwings, 2004). The women were also said that most of the financial institutions target groups. Therefore women who were in groups could benefit through getting loans to improve their agricultural productivity. Networking was also reported to be central in issues to do with knowledge circulation and learning among the women farmers.

The women interviewed talked of the sharing culture they developed as they continued to attend to the weekly meetings. A spirit of promoting trust, care and a teamwork spirit develop over time amongst the diverse range of women. It thus becomes evident that the non-governmental bodies involved the women groups in maintenance of processes and governance structures that encourage participation and sharing of leadership tasks.

The respondents interviewed indicated that the extension staffs were hardly seen in their farms. One woman lamented 'to see an extension worker one has to book an appointment and travel to the divisional headquarters!' Therefore at the village level the operations of the extension department are hardly available and learning is only achieved through this social networks.

The men interviewed did not report this kind of encounters with the non-governmental bodies nor was there any indication that men were encouraged to form groups.

'Why should I attend to this meetings which teach women how to cook' exclaimed one of the male respondent.

Therefore the learning among male does not take place in this weekly meetings organized by the non-governmental bodies.

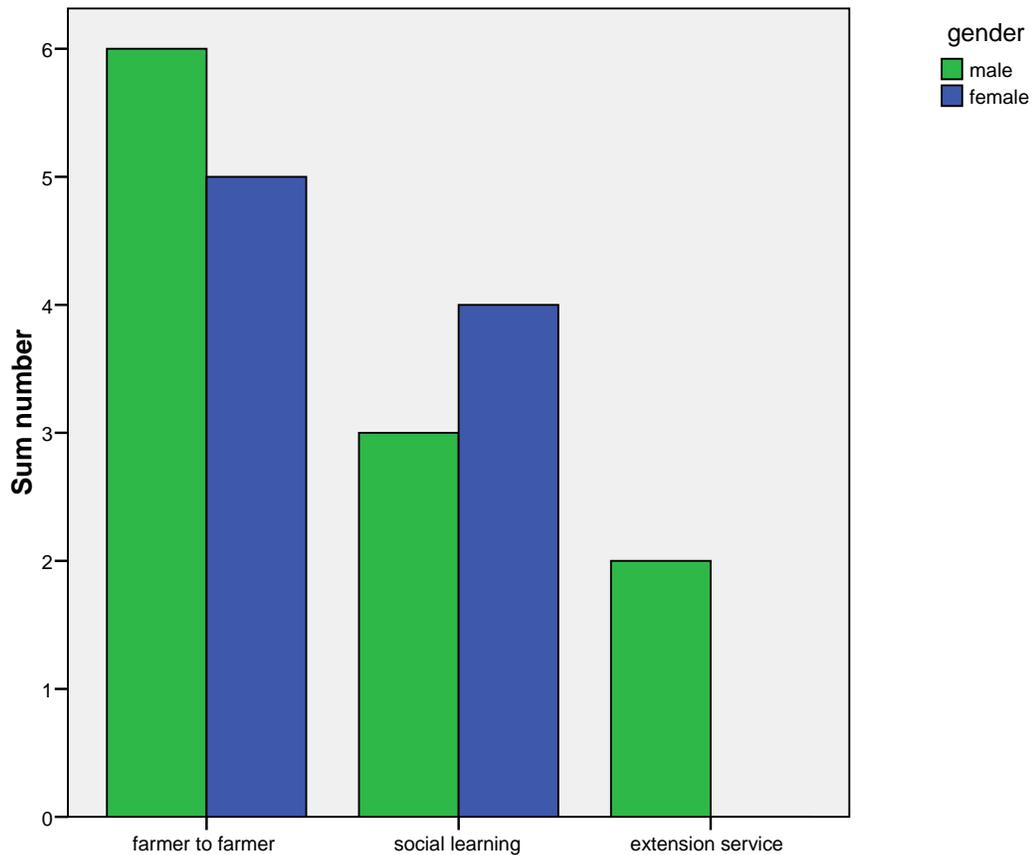


Figure 7 Learning styles among the farmers in Makueni district

4.6 Sharing information and learning:

Eleven farmers (6 men and 5 women) indicated that they often met with their neighbors informally to share their experiences about citrus farming practices. Their discussions centered on issues about effective chemicals to control pests and diseases in their citrus trees. Other discussions were about how to plant the rough lemon that would be used as the rootstock upon where grafting could be done. The farmers also explained how they shared the seedlings from a farmer who had a nursery planted with rough lemon. The farmers shared the seedlings from the farmer who had a nursery since some varieties of rough lemon planted took a long time before germination besides the concern that some farmers lacked nearby water sources for irrigating their nurseries. There were however two male farmers out of the 20 farmers who said the extension personnel visited them regularly, at least once in a week.

4.7 Skills and knowledge of extension workers:

The extension workers form the vital link between the research station and the farming communities. It is basically assumed that innovations originate from scientists, are transferred by communication workers and other intermediaries, and are applied by the agricultural practitioners (leeuwis, 2004). The communication workers have the challenging role of ensuring that information and knowledge concerning modern farming practices are transferred to the farming communities. The three extension workers interviewed shared the following types of information with the farmers.

Type of information delivered to the farming communities:

- The best time for pruning citrus to ensure maximum productivity.
- Manure and water requirements in citrus.
- The proper time for grafting citrus.
- Proper use of industrial chemicals.
- Management and control of pests and diseases in the farms.
- The control of weeds by use of chemicals as well as proper weeding techniques.
- Training of farmers in book keeping that is keeping record of expenditure and output.
- Post harvest technologies in cereal crops to curb cases of aflatoxin contamination in food.
- They were also trained on the importance of cleaning their stores.
- Encouraging the farmers to plant drought resistant varieties given that the region is semi-arid.
- Utilization of scarce farm resources.
- Livestock improvement by use of artificial insemination.

4.8 Ways of passing information and knowledge to the farming communities:

The extensionists mentioned the following ways of passing to the farming communities:-

- Field days:
- Demonstrations.
- Home visits-individual farm visits.
- During Seminars (*barazas*).
- Group farm visits.
- Tours.

These are avenues for publicizing information and knowledge to the farming communities

The extension workers pointed out that the above methods of passing information and knowledge were important because:-

- They increased the awareness level of the farming communities in issues pertinent to agricultural development. e.g. group formation among farmers.
- The methods facilitated effective methods of farming practices demonstrations.
- They facilitated sub-location, location, division, district and regional cross visits between farmers groups and community representatives to share knowledge and exchange experiences among farmers

Table 4 Farmers-staff activities

Activity	Target	Achieved	Participants		Source fund
			Male	Female	
Demonstrations.	1020	808	8491	15941	GOK, KARI COTTON IFAD
Courses/Seminars <i>/ Barazas.</i>	425	255	8320	7567	GOK, COTTON IFAD DASS
Field days	136	118	3110	5777	GOK, COTTON IFAD
Tours	12	9	174	120	GOK, IFAD
Individual farm visits.	13248	5051	2625	2426	GOK, COTTON IFAD
Group farm visits	2484	1326	4034	4388	GOK, COTTON IFAD DASS HCDA ICRISAT
4-K Club visits	400	375	4886	4600	
Farmer field schools	50	47	382	866	GOK, IFAD

Source; Ministry of agriculture, Makueni district annual report 2006

4.9 Documentation of the field experiences:

The 3 extension staffs said that they had to present regular monthly reports providing recent and past experiences with the farmer groups. The reports included demonstrations, seminars, field days, individual farm visits and group farm visits conducted in the particular division under the jurisdiction of the divisional extension officer. The extension pointed out that for them to make correct decisions, they must have good information about the actual field situation.

Data and information concerning the following variables was documented by the extension workers:-

- Types of farmer groups available in the division.
- The number of the farmer groups in the division.
- The frequency of demonstrations, farm visits, field days, and seminars conducted.
- Physical resources needed for organizing farmers training programme.
- The farmer group needs assessments.
- The training needs of the farmers.
- The impacts of previous trainings.
- constraints and barriers to proper functionality of group processes.
- Possible ways of averting constraints to group processes.

The extension staffs said that this information was organized, updated, and easily accessible for the extension department to be able to project trainings/group demonstrations plans for the coming days. The information and data well organized and stored was to show trends and progresses made by the extension department in their endeavor's to be catalysts of change in knowledge circulation and learning to the farming communities.

The extension staff said that information and data concerning their field activities should be available in various forms so that it can be used to serve different extension management issues. The extension

department prioritizes program depending on how field reports have been documented pertaining to issues of planning, reporting, budgetary allocations, and the evaluation systems in place. The proportion of time allocated to the extension staffs for the coordination of groups has direct implications on the learning needs of the farmers.

4.10 Organizations for farmers:

The interview with citrus farmers revealed that they lacked an organization. 'Citrus farmers have never be able to formalize their activities' commented one citrus farmer. However the extension pointed out that that they are encouraging the farmers to form citrus farmers organization to due to the reason outlined below:-

Group approaches enables farmers to easily access information from the research stations, extension, non-governmental bodies, community based organizations (CBOs), seed companies and other services providers. It forms an appropriate platform for access to credit and inputs. The approach also helps to empower and strengthen farmers in decision making, enabling them to efficiently and effectively implement collaborative research and other development activities.

4.11 Organization of the extension department in Makueni district;

Extension is one of the important support systems to mainstream the large chunk of the Kenyan farmers in processes pertaining to socio-economic development.

The objective of the Extension department in Makueni is-;

- To bring about desirable behavioral changes in rural people.
- To enhance knowledge circulation and learning for need based information.
- To enhance transfer of technical innovations to ensure increased production and productivity of rural enterprises including farming.
- To foster peoples participation in processes that enhance learning and knowledge circulation across the farming communities.
- To empower the rural people and peasants in terms of decision making processes.

The discussions with the DAO revealed to the researcher that there is one divisional head and between one to four extension frontline extension staff who are in contact with the farming communities. The numbers of locations per division vary, with the kathonzweni having the highest number of locations. Kathonzweni has sixteen location having only six frontline extension workers (four males and two female staff). The staff capacity to manage extension services in the division is minimal due to insufficient numbers of staff deployed there. 'We have an acute shortage of agriculture field staff' commented Mr. Kibe the district agricultural officer.

4.12 Extension approaches in the district

The extension mechanism the district has adopted to enhance learning and knowledge circulation is the group approach. The farmers have to be organized in groups then the extension organizes forums for the farmers concerning pertinent issues in the farming communities. The district agricultural head noted that it is much easier to deal with groups, given that large numbers of farmers will be trained in one forum. Groups of between twenty to thirty farmers are trained on specific issues such as safe use of chemicals or post harvest technologies in cereals.

The DAO explained that Individual farmer visits are rare. These kinds of farm visits are in most cases are demand-driven. Farmers who require a certain service from the extension service has to arrange in advance and in that case he/she will be visited by the extension staff. The farmers will share with the extensionist his/her concerns and solutions will be sought in a collaborative manner.

Seminar and trainings are other approaches the district head mentioned that have been adopted by the extension department. These are organized depending on the work schedule of the division and also facilitated by the extension staff.

4.13 Institutions collaborating with government extension services

The discussions with the district agricultural head revealed that there are a number of institutions that collaborate with the extension department to enhance learning and knowledge circulation in Makueni district.

Other ministries for instance ministry of social services is in charged with registration of farmer groups and issuance of certificates. The extension staff have the responsibility of mobilizing farmers to form groups and have these groups registered. This essentially provides farmers with a common voice in their different undertakings. The farmers groups form the so called common interest groups (CIGs). This can be for farmers engaged for example in citrus farming. These common interest groups enables the farmers to market their produce as a block and chances of exploitation by middle men are greatly reduced.

Table 5 Stakeholders supporting sectors

	Name	Area of Operation	Activities	Remarks
1	World Vision	Kathonzweni Nguu	Seed bulking Seed and grain store Irrigation	
2	Inades formation	Kathonzweni, Kalawa	-Farmers capacity building Food preservation	
3	ARIDSAK	Kathonzweni Kibwezi	❖ Seek bulking ❖ Crop demonstrations ❖ Mango production	
4	Arid Land Resource Management Project II (A L R M P II)	District wide	❖ Drought monitoring ❖ Seed bulking ❖ Environmental conservation	
5	ICRISAT	Kathonzweni, Mbitini, Matiliku, wote, Kasikeu	❖ Bulking of pigeon peas ❖ Linking of buyers of foodstuff	
6	Kenya Agricultural productivity Project (KAPP)	District wide	❖ Formation of CIG's ❖ Promotion of Private service providers	
7	Njaa Marufuku Kenya (NMK)	District wide	❖ Mobilization of groups ❖ Supervision of Implementation of proposed projects for the groups	
8	I F A D (Eastern Province Horticultural & Traditional Foods Programme)	Kisau, Kibwezi, Mbitini, Kasikeu, Kee, Mbooni, Wote	❖ Provision of clean planting materials ❖ Product promotion ❖ Promotion of horticulture Dev.	In its winding up phase
9	Chemical companies	District wide	❖ Chemical promotion	
10	Makueni Gineries	Lowland divisions	❖ Cotton production & marketing	
11	Christian children fund (CCF)	Mbitini	❖ Seed bulking ❖ Fruit tree promotion ❖ Farmers training	
12	SCODP	District wide	❖ Promotion of cotton and fruit trees production	
13	Kenya Rural enterprise programme K-REP	District wide	❖ Agribusiness Financial services & marketing promotion	
14	Kenya women finance trust	District wide	❖ Give small loans to farmers to promote agribusiness	
15	Micro-enterprise development programme (MEDP)	District wide	❖ Agribusiness, marketing, production	
16	Farmers	District wide	❖ Own initiative	

Source; Ministry of agriculture annual report 2006

Table 6 Field staff distribution in makueni district

Division	Division head		Front line extension	
	male	female	Male	female
Makindu	1		2	-
Kaiti	1		1	1
Wote		1	1	4
Kathonzweni	1		4	2
Kilome		1	1	2
Mbitini	1		2	-
Mtito andei	1		-	1
Mbooni	1		2	-
Kasikeu	1		1	-
Kibwezi	1		4	2
Kalawa	1		1	-
Tulimani	1		1	-
Kisau	1		1	1
Matiliku	1		2	1
Kilungu	1		1	2
Nguu		1	1	1
Kee	1		1	1

Source: Makueni district annual reports (2006)

4.14 Extension research linkages:

The district has linkages with the Kenya Agricultural Research Institute(KARI, Katumani) that channels agricultural findings and breakthroughs to the extension department in the district. There are two officers involved in the coordination of these extension-research linkages. We have the extension farmer liaison regional coordinator based at the district headquarters. The other officer is based at KARI. The officer in collaboration with farmers conducts diagnostic surveys on contentious issues that are then forwarded to KARI for further analysis by the scientists. This is conducted through an approach known as district farmer systems trials (DFST). The results of whatever was send to the research stations are channeled to the farmers through the extension department

4.15 Organizational changes and their effect on extension:

The district agricultural officer revealed to the researcher that the (DFST) were recently revived in an effort to integrate farmers in the research work. This according to the district head could guard against researchers mentality of conducting research without having the priorities of the farmers in mind. In the past researchers were known to conduct research works without collaboration with the farmers. Therefore many of the research were merely shelved due to its inapplicability in the farming setup.

There has been an over haul of the entire ministry and major reforms that have been effected within the department of extension to enhance learning and knowledge circulation among the farming communities. These reforms include the appointment of the deputy permanent secretary (titled

Agriculture Secretary) under this officer there four directorates in charge of implementation of the following services:-

- Extension and training of the field staff.
- Crops and land developments.
- Agri-business practices for farming communities.
- Policy issues-reforms effected to remove the bottlenecks in land issues. Previously the land policy was not in place.
- Policy issues related to support knowledge circulation and learning in farming communities.
- Better facilitation of the extension field staff.

Appropriate capacity building in place at the ministry of agriculture. There is the provision of staff trainings for at least five days of training per year per every staff member involved in extension service delivery. The district agricultural officer said that knowledge, new working modes, and organizational skills are acquired through training.

The district head of agriculture lauded the involvement of the field extension staff in planning and execution extension service delivery to the farming communities. The heads of departments always involve the field staff in the negotiations to ensure that the services are tailor-made to match the farmers' knowledge requirements.

4.16 Constraints in delivery of extension service

The interview with the district agricultural head revealed some significant constraints facing the extension department.

Lack of proper framework for coordination of the development partners at the district level. There are a number of development partners working in the district. There are engaged in different activities such supporting farmers in citrus seedling management, proper use of industrial chemicals, seed bulking etc. The development actors liaise with the extension staffs to be able to implement their development project. This puts the extension staff off their regular activities of meeting the farmers' groups. This causes tension between the extension staff and the farmers groups if meetings have to be delayed or postponed for some other day. The lack of proper coordination also causes duplication of development projects in the district at times. In cases where chemical companies are marketing their products to the farming communities, conflicting reports send by different companies concerning the efficacy of a certain chemicals cause farmers to lose for choices.

Lack of extension staff. This has been said to be the major constraint in knowledge circulation and learning in the district. In a number of locations they farmer said they had never seen an extension personnel conducting any form of training to the farmers. According to the district agricultural head each location should have at least two.

Poverty level in the district. Majority of the people in the district live in abject poverty conditions, and organizing the people for a training forum is quite difficulty. The vast majorities are engaged in livellhoods activities outside farming and may not be within the locality. As rainfall becomes erratic many farmers are opting to engage in other livelihood activities outside agriculture. This is a major drawback to learning and trainings processes conducted by the extension staff.

4.17 Reforms at the organizational and institutional level:

In the agricultural sector, extension service plays a vital role in knowledge sharing, technology, agricultural information and also linking the farmers to other actors in the economy. The extension

service is therefore one of the critical change agents required for transformation of subsistence farming to modern commercial farming.

According to the district agricultural head a number of reforms have to take place to ensure effective and efficient extension service delivery. The establishment of national agriculture sector extension policy (NASEP) paves way for more efficient and effective provision of extension services. This has been done by embracing pluralism in extension provision and better coordination and regulation of service providers, thus contributing to the aims of knowledge circulation and learning of the farmers. The district agricultural officer said that government will continue to provide extension services to subsistence producers and to groups of smallholder, and public goods services.

The face of extension is changing due to economic liberalization, reduced government funding, and the expectations of the clientele.

The national (NASEP) is a framework that provides a point of reference for service providers and other stakeholders on matters of standards, ethics, and approaches, and guides all players on how to strengthen coordination, partnerships and collaborations.

The new policy(NASEP 2007 which has not yet to be implemented) also stipulates that all stakeholders involved in agricultural extension should harmonize their approaches in the implementation, monitoring and evaluation processes.

According to the DAO successful implementation of the policy will contribute towards improved transfer of technology and management for higher agricultural sector productivity, a key prerequisite to poverty and enhanced nutrition and food security.

The framework elaborates/articulates the expected roles of key stakeholders in a pluralistic system and an increasingly liberalized market economy.

The importance of creating an enabling environment for private sector role in the extension service delivery is outlined.

Empowering extension clientele to effectively demand services and hold service providers accountable is a clause to be considered in the new system.

NASEP will ensure acceptable quality standards of services offered through a regulatory body. NASEP also hope to ensure access to resources by creating a multi-stakeholder driven trust fund. The implementation frame work will also spell out desirable characteristic of extension approaches and methods through:-

- Enhancing access to technological packages through improved research-extension managements.
- Management of agricultural knowledge and information systems.
- Streamlining of cross-cutting issues in extension.

However the key challenge in implementing the policy lie in the ability of stakeholders to provide support and collaboration required in building the necessary institutional and legal frameworks for implementing the key policy recommendations(of NASEP)

Private extension and privatization does not necessarily mean that clients have to pay for the extension service. For example, non-governmental bodies, faith based organizations and other private organization provides extension services for free.

To ensure seamlessness in agricultural research, extension, education, and training institutions linkages will be enhanced by agricultural research extension education and research council (AREEC).

The government will have an extension regulatory body that will register and license extension service providers. A code of practice will be developed, which include principles governing choice of extension

methods approaches and context. A participatory monitoring and evaluation framework will also be put in place.

Stakeholders' meeting at location, division, district, province and national level will coordinated the planning and the delivery of the extension services.

The government will empower clientele through capacity building in order to improve their access to information and micro-finance facilities. Stakeholders will also set information resource centers in villages, location, division, district and province levels in order to improve access to information and knowledge relevant to clientele enterprises.

In the new policy research institutions will establish technology dissemination units to improve access to research-based information and knowledge.

Training and capacity building for extension service providers will improve knowledge and skills in value addition and marketing. This will enable producers increasingly to recognize farming as a business and improve enterprise management.

The DAO said that an institutional framework will be put in place to ensure that farmers' demands are met. This framework will ensure that extension service providers are accountable to the farmers for the quality if services they provide.

Agricultural sector development funds will provide funds for provision of extension services, research, education, training and agricultural development facilitating to factors that respond to farmers demands. The funds will be operated at district level. It should also be noted that proposal for funding will be made by the extension service provider in collaboration with groups of extension clients. The government may contract private sectors extension service providers to deliver on cross-cutting issues.

The NASEP implementation framework will be widely publicized so that all stakeholders understand the changes that are taking place and appreciate that new arrangements will improve the contribution of extension towards a dynamic agricultural sector.

CHAPTER FIVE - ANALYSIS AND DISCUSSIONS

5.1 Introduction:

The analyses of findings of the field research with the farmers, extension workers and individual interview with district agricultural officer are presented in this chapter. The findings are also compared with findings of studies done by other researchers and organizations.

5.2 The importance of land in citrus farming:

The findings have revealed that land is an important consideration for the farmers engaged in citrus production. Owing to the spacing recommendations for growing citrus of 4*4 meters then, clearly for a farmer to grow a large number of trees in the farm, then a larger acreage of land is needed. This is evident from the findings since those farmers with more than 100 citrus trees have land sizes of more than 20 acres. The other reason is that citrus is a perennial plant, to reach full production capacity it takes over 8 years depending of course on the management practices. Therefore between planting and the growth phase the farmer has to intercrop the citrus with food crops such as maize, beans, pea or pigeon peas provided there is sufficient rainfall. The farmers keeps on producing this food crops as he/she waits for the citrus to reach peak citrus productivity. In that case if the land is too small the farmer will have no option other to grow just a few trees.

The farmers who have the non-grafted citrus have to replace these with the grafted gradually due to the same reason mentioned above. They said they do not want to lose the current citrus given the long wait it takes for newly planted citrus to reach fruition age.

Drought effects. The farmers cited drought to be a threat to the survival of the citrus plants. They said that many of the plants are lost at the seedling stage due to adverse effects of drought and diseases. Water stress, which is caused by insufficient soil moisture, is among the chief causes of poor growth or poor health in plants. It is responsible for slow growth and, in severe cases, dieback of stems. It also makes plants more susceptible to disease and less tolerant of insect feeding (Wilson, R 2007)

5.3 Inputs considerations in citrus farming:

Labour requirements:

The findings revealed that labour is an important consideration in citrus production. Given that citrus is a perennial crop the farmer has to make difficult choices on the availability of labour on consecutive seasons for a long time before citrus productivity turns to positive returns. The full maturity can only be realized at between 6-8 years time when production peaks, depending on the management of the citrus farm. There are labour requirements for digging the holes for planting the citrus, putting manure, and irrigation. The region where the study was conducted is semi-arid and in the event of inadequate rainfall, the farmer has to look for water to irrigate the young citrus plants. The management of early citrus growth phase is the most important since it determines whether citrus will wither and die out or grow to reach maturity phase.

Pest and disease control in citrus:

There are a number of diseases and pest that attack citrus. These includes citrus rust, citrus cankers, citrus greening disease, aphids, termites, thrips etc. The presence of disease and pest in citrus is a bad indication to the citrus farmers. There is the possibility of the farmer to get total lose if urgent measures

are not taken to contain the disease/pest infestation. The cost of the industrial chemicals is very high therefore farm management practices that avert use of chemical are highly recommended. The stage at which the disease is controlled will also determine the quality of the fruit to be harvested. Early disease detection and control is crucial for the realization of a superb fruit harvest.

5.4 The role of farmer to farmer knowledge exchange:

The findings have revealed that farmer to farmer knowledge exchange is crucial in spurring agricultural productivity to new heights especially in the context of citrus production. The types of knowledge farmers share include:-

- Availability of good market for their produce.
- The best methods to control certain type of troublesome pests and diseases.
- Traditional methods of controlling pests.
- Availability of farm inputs at a reasonable price.
- The best time to prune the citrus crop.
- The water requirements of the citrus crops at different stages of the growth.
- The proper time to perform grafting.

Administrative capacity of the extension department in Makueni district is thin. There are 96,775 farming families which occupy an area of 7965.8 km square according to district annual report (2006). The extension to farmer ratio is 1: 1681. In the three divisions where the research was conducted there were one or two extension personnel. This presents a dilemma on how the extension service is being organized given the critical shortage of staffs. This ultimately has a negative impact on the processes of knowledge circulation and learning to the farming communities. The available staff are based at the divisional headquarters, with one or no staff at the field level. This obviously stands out as an impediment to processes knowledge circulation and learning among farming communities.

The other impediment to the processes of knowledge circulation is that the staffs in the division co-ordinate the activities of the non-governmental bodies in the region. This calls for an increased labour demand on the already overstretched capabilities of the extension staffs. The non-governmental bodies have their project to implement which may be in line with the district agricultural programmes or not. The extension staff have to work on their reports, prepare work plans and co-ordinate whatever else that is deemed necessary by the non-governmental body. This according to chambers (2007) the non-governmental bodies should check the consistency between demands on administration, including the effects of demands on staff in drawing them away from their activities. Chambers (2007) continues to say that weighing indirect administrative costs, including the costs of coordination and costs of taking staff away from the organization has implication on the capacity to deliver efficient services.

The costs of fuel and means of transportation were outlined to be a hindrance in the processes of service delivery to the farming communities. There are 16 motorcycles in the district and three of them are grounded. The motorcycles are not able to meet the demands for the entire district in terms of delivering appropriate extension services to farming communities. The resources allocated to the district could not equally be able to cater for the daily fuelling requirements for the motorcycles.

The understanding of a single farmer comprises a "knowledge system," or stores of information an individual uses to understand and act in the world (Nerbonne and Lentz, 2003). Individual farmers usually have much expertise based on experience, on farm experimentation and/or training which could be relevant to other farmers (pretty, 2007). Farmers are aware of this and as a result there are often informal means of farmer to farmer (i.e. horizontal) exchange of knowledge and information. According to pretty(2007) markets, work parties, funeral gatherings, bars, celebrations, community meetings and

church services provide opportunities for farmers to talk about agriculture. Therefore observations of other farmers' practices are an important mechanism for horizontal knowledge exchange.

The findings in this study have been supported by works of Fadeeva (2007). According to Fadeeva(2007) many members of the communities active in regional processes acquire expertise not by virtue of academic or other degrees but through the experience of dealing with a particular locally significant problem-be it in the rights of indigenous people, environmental or poverty. In other words they become 'experienced –based' experts. It has to be noted that farmers are familiar with intricate details of their farming situation and secondly, knowledge creation or learning for sustainable development is generally understood as requiring a different approach from learning governed by centralized and expert systems.

As leeuw (2004) points out farmers communication workers tend to speak the same language literally, and culturally, as their colleagues and are faced with similar constrains and problems as fellow farmers which may enhance the relevance and credibility of their advice and views. Moreover there are technicalities of the farmers having to go around looking for an extension worker which are tedious processes. On the other hand the few extension staffs are located at the district and divisional headquarters.

Learning from farmers experience is far more effective if placed in a theoretical framework. Farmers learn from both scientific theories and experience-combing the two ways of learning. Combining knowledge is especially important for developing technologies in locations with great variations (Van den ban, 1997)

The men's and women's different linkages indicate a potential for sharing within and between villages. The women in the farming communities have linkages with other women farmers, uncles, nephews etc and this provides an avenue for sharing and learning from one another the different constraints and problems in the farm setting.

5.5 Role of development partners in knowledge circulation

The findings show that farmers are learning and collaborating with many developmental agents in Makueni district. The farmers are collaborating with the non-governmental bodies, inputs suppliers, governmental agencies and community based organizations(CBOs) to enhance learning and knowledge build up. The complexity of the farming situation calls for the engagement of experienced-based experts and for the support of the general farmer population.

As has been noted in this research project, informal or deliberately arranged interaction among groups help people to get to know each other, and develop social networks. The interaction also increases people's confidence to act for the benefit of the society and its members, and to build a commitment t its members and the community as a whole.

Members of a group get to know each other before they could regard each other as credible sources of advice and support that is before they use each other skills and knowledge. Getting to know each other in a group is building knowledge resources. As people get to know each other they develop a sense of belonging and a sense that all group members could make valuable contributions. Participation in community activities provides opportunities for interactions, these being opportunities for using social capital to enhance economic and social outcomes according to Kilpatrick and Falk (1999).

In agriculture, different types of knowledge are needed for developing solution to different problems. Each type of knowledge may be developed by different group of persons or institutions or can be developed jointly by different actors through a process of social learning (van den ban, 1997)

5.6 Citrus farmers organization

As outlined in the findings in the previous chapter the citrus farmers lack an organization. A citrus fruit organization has various benefits to the citrus farmers. These include:-

Learning together:

Learning from one another and visualizing the other farmer as a colleague and not as a competitor. As leeuw(2004) suggests, social learning is a move from multiple to collective cognition. In this case 'collective cognition', coherence is forged primarily through shared perceptions of the 'learning fronts'.

Bargaining power:

This is very evident when farmers group together to market their produce, the processes of negotiation with the given buyer are always inclined to benefit the farmers. The current arrangements whereby farmers sell their products individually leave the farmers disadvantaged as they fall under the mercy of the scrupulous middlemen.

Apart from representing farmers' interests the situation is largely unique but makes good sense in that both the farmers' organizations as such and the agricultural cooperatives are organized and controlled by farmers to promote their interests.

Credit arrangements:

Many of the financial institutions target farmer groups since there is trust and commitments in groups than in individual farmers. The citrus farmers cannot benefit from such financial arrangements consequently getting loans for farm improvements become elusive.

Risk management:

Farmers often are able to spread risk across a large number of people in the advent of a farm disaster and therefore the farming activities are not likely to grind to an halt.

The following reasons reveals why the citrus farmers have not be able to form an organization:-

a) The harvesting time varies:

The citrus crop matures at different stages spread over a period of over four months and an individual farmer sells his/her crop as it ripens. The farmer who has his/her fruits ripe and ready for the market just goes ahead to sell his/her fruit. This means that cooperation between that farmer who has sold out the fruits and the other farmer who hasn't becomes weak. The dilemma always causes their efforts to organize into a group fail and this too has an important implication in terms of learning and knowledge managements among the citrus farmers.

b) Lack of a common buyer for the citrus:

There are many middlemen who mushroom in the beginning of harvesting season in the district. The different middlemen lure unsuspecting farmers into giving out their produce at a throw away price. This will equally depend on the farmer's urgency for cash.

c) Farmer variations:

Farmers have planted varied numbers of citrus trees and as such grouping together becomes difficult. The aspirations of a farmer who has planted 10 citrus trees are different from the farmer who has planted over 200 citrus trees. For this different types of farmers to share visions and aspirations towards achieving a common goal turns out to be a far fetch dream.

d) lack of a fruit processing plant in the district.

The district has no fruit processing plant and this means that the only way to market the citrus crop is through the middlemen. They have to transport the produce to the capital city or other towns which is located over 200 km away. The farmers are just obliged to sell to the middlemen to avert a total loss of the citrus crop.

Availability of fruit processing plant equipped with cold storage facilities could prove beneficial to citrus farmer by providing an organized common marketing channel.

e) Fear of corrupt officials.

This has been pointed to be a major barrier in the formation of a citrus farmer organization by the farmers. This has been a fear since the officials of many farmers organizations are said to manage the funds in the organization as their funds. The officials of the organization tend to be based in the district headquarters a phenomenon that does not sink well with the members of the organization. According to Leeuwis (2004) process facilitators need to work at the field level (rather than in a district office). Moreover they need to co-ordinate their activities with regular communication workers.

f) Funds to run the citrus farmers organizations.

Another constraint has been the lack of financial means. The funds generated from the membership fees is only enough for the Union's day-to-day management, not for any additional activities. The citrus organization has to be run by member fund which may not be available. Most organizations need a steady flow of cash to maintain them.

5.7 Individual farmers visits by extension staffs:

The finding shows that there were two large farmers who were often visited by the extension staff. This was because the farmers were large and progressive. The farmers had over two hundreds citrus trees. The extension workers also used the particular farms to demonstrate to other farmers how specific practices are carried out. The extension workers frequented these farmers often either to show the farmers how to control certain diseases or conduct the grafting in the citrus plants. According to Leeuwis (2004) extension workers have been frequently criticized for paying attention to those who need it least. More precisely, we would argue that communication workers have tended to focus on those farmers and opinion leaders who fitted best with their model of farm development.

It may be that these farmers had other networks with people working at the district headquarters. The particular farmers are also notable since they have other employment outside agriculture.

Diversity among citrus farmers. In a group meeting the extension often meets with diverse group of farmers and not everyone will speak up. The larger and the more heterogeneous the group, the less likely is it that all members will regularly participate in group discussions. Therefore for the extension staff to get some independent thought about certain ideas then individual farm visit provide an avenue for this.

5.8 Skills and knowledge of extension staff:

In general, extension workers in Kenya have been trained to do the following:
Assist men and women farmers to get knowledge and skills to improve their agricultural productivity. The extension workers form a link between the research station and the farming communities providing a framework in which information and knowledge flow to the farmers. They also share technical advice and information with men and women farmers that will contribute to the improvement of their farm management skills which is a crucial aspect in farming to ensure sustainable agricultural productivity. The extension workers support women and men farmers to form groups in order to increase their access to information, knowledge, markets, credit organization, etc

Encourage men and women farmers to work together so that they can be self reliant.
The extension staffs have also the mandate to work with farmers in the communities so that they can understand what services already exist and how to access the same.

5.9 The relevance of documentation to the extension department:

It has been noted that documentation by extension staff had a direct bearing on the learning needs of the farmer groups. Good information helps to avoid unnecessary duplication of project in a given farming community. New project plans implemented by the extension staff proceed with maximum advantage from what has been accomplished in the preceding years.
Decision making is normally based on what information is available for the extension staff. The presence of incomplete and scanty information at the disposal of the extension department may contribute to poor and inaccurate implementation of farmers' project which may lead to disastrous results.

5.10 Group approaches to enhance knowledge circulation:

The previous chapter outlined that the district has insufficient numbers of frontline extension workers. This in turn calls for a different approach to be adopted by the extension department. These old approaches of individual farm visits are no longer viable due to the acute shortage of field staff. The group approaches to enhance knowledge circulation have been cited as cost effective in terms of farmers to be trained in a single session and the low numbers of staff required to effect the farmer trainings.
The inability of the public extension service to reach all farmers, all the time essentially due to the wide ratio of extension staff farmer ratio(1:1668) is attributing to group approaches in service delivery(Akumar et al., 2007)
The government extension service established two farmer field schools in 2005 school which train farmers on participatory technology transfer on horticultural crops(tomatoes and cabbage farming).

a) Improved efficiency of extension resources.

A continuing issue for farming systems practitioners is the need to economize resources in terms of time and logistical costs. The group format provides a way to economize on the use of time since trial designs can be proposed and discussed in groups meeting. Moreover as chambers(1989) notes, group

meetings allow farmers to consult with each other about trial objectives and implementation procedures, thereby increasing implementation rates and reducing implementation errors.

b) Structural adjustment programmes(SAPS).

Kenya had SAPS and there was a decline in donor support to fund large scale public sector recurrent expenditures, which led to further under funding and consequent staff cuts. This led the extension department to adopt group approach system in service delivery.

c) Scattered clients in rural areas

On the other hand it has to been noted that smallholder farming poses particular problems, affecting both public service extension and private service providers. The characteristics often include:- A scattered clientele living in remote areas. This presents logistical problems for the extension workers of having to move from one farm to another. Makueni district is both arid and diverse and this presents particular challenges to the extension department in their role as information and knowledge brokers to the farming communities.

d) Pronounced resource constraints of individual farmers.

The intermittent nature of rainfall and the high dependency levels among families exacerbates the poverty levels in the region. This quite often contributes to the farmer to find for other livelihood strategies mostly likely outside agriculture. Therefore the farm visit approach is losing ground among small-scale farmers as an avenue of learning. The extension will hardly get the farmers in their farms due to the poverty levels among farmers.

e) The highly seasonal and risky nature of much of agriculture.

The seasonality of agriculture and risks involved means that farmers have to diversify their livelihood strategies. As such for the extension to organize routine farm visits to individual farmers becomes almost impractical and complicated.

f) Low reliability of many official services.

Its much easier for the extension department to organize group meeting whereby farmers will converge at a certain place for a training or demonstration purposes than to have the daily routine of individual farm visits.

The small number of citrus trees planted per farmer and transport economies make it unlikely that individual farmers will constitute an attractive prospect for extension service providers. All this factors have inclined the public service extension system to make significant changes in extension service delivery system in Kenya. The public extension department is now in favour of group learning approaches as opposed to individual farm visits.

g) Improving dialogue and networks.

The group format provides a forum for improving dialogue with and among farmers. Unlike the common approach where an extension worker talks to one farmer, here there is a large number of farmers in relation to the extension staffs. This completely changes the dynamics of interactions. Regular group meeting help provide solidarity for the group, create familiarity between the group members and extension and provides unique insights about farmers priorities and perceptions(chambers 1989, p.142).

h) Facilitates farmer field days. The farmer groups and associated trials provide an admirable format for farmer field day. In the field day group members are encouraged to explain what they did in trials and why and what results they observed. This way the farmers are able to learn from one another.

i) Potential for improving linkages. To bring about agricultural development there is need to be good linkages among farmers, extension, researchers, input suppliers, private organizations, etc. The group format provides an excellent opportunity for bringing together different actors in one forum for learning and information exchange as well as provide opportunities for networking.

One of the main advantages of the group approach to extension is that researchers and extension staffs outside the farming systems group, who are faced with limited amounts of time and resources, can address a number of farmers simultaneously.

5.11 The role played by other service providers

The government extension services do not have the monopoly in service delivery in Kenya therefore other actors come into play. These are non-governmental bodies, private service providers, input supplies and other farmer led initiatives. According to the findings the government is ill equipped to provide extension services due to the acute shortage of field staff as outlined in the previous chapter. Some locations in the divisions in Makueni district lack frontline extension staffs. According to the district agricultural head the government is playing a leading role to encourage other service providers help out in service delivery to the farming communities. The government service has a prime role of coordinating all the other actors in their pursuits to enhance learning and knowledge circulation in the farming communities.

Firstly it is only in the last two decades or so we started realizing that any one extension service provider be it private, public or any other, cannot cater for the changing and complex needs of the farmers and the rural people (Akumar et al., 2007). This is because agriculture and rural enterprises themselves have undergone so many changes in the recent years as a consequence of rapid changes in science and technology.

The public extension service does not cater for all development needs of the farmers and rural poor e.g. inputs supply, market support. The non-governmental bodies provide for example extension and information support in crisis situations (Akumar et al., 2007)

Also noted the educational background and the professional expertise of the village level extension staff to deal with complex issues in agricultural extension is deficient. The frontline extension staffs are mostly diploma holders in Makueni district.

The other reason why we have other service providers in the district is that, conventional extension provides advice and support only on technology propelled production concerns according to Akumar (2007)

5.12 Reforms in extension service delivery system:

The government of Kenya came up with National agricultural sector extension policy(NASEP) framework in 2007 which has not yet been implemented. Plans are underway to have it implemented to improve agricultural extension service in the country.

There has been declining human, capital and financial resources for public extension without a corresponding private sector input. Since the structural adjustment programmes(SAPS) of the 1980s funding in the public extension service has declined and the hiring of new extension staff have been frozen by the Kenya government.

The emergency of uncoordinated pluralistic extension delivery service has also contributed to the reforms in the extension service delivery. This often leads to duplication of projects and wastage of resources if proper coordination is not effected.

Poor linkages with extension facilitating factor. The coordination of the extension service providers is done at the provincial or district level and as such there lacks a proper framework for this coordination to be carried out.

The government is encouraging pluralistic extension system to cater for the diverse needs of the farmers. For the given policy reforms(NASEP-framework) to be effected then a number of things have to be done;-

- That the agenda for the technology be demand driven.
- Should be well formulated and funded.
- Extension agents are well trained and facilitated to carry out their duties.
- That there should be conducive environment for extension clientele to understand and apply acquired knowledge and skills.

5.13 Measures to strengthen extension service provision:

Once the NASEP framework policy is implemented then the government put the following measures to strengthen extension service:-

- Restructure and reform public extension systems to facilitate multi-stakeholder participation in extension service provision.
- Facilitate capacity building in extension service providers.
- Developing and executing performance standards and a monitoring and evaluation framework for extension services.
- Create a favorable environment for agriculture by for example having appropriate policy, legal and regulatory framework.
- Improving access to agricultural information.
- Developing agricultural markets.
- Increasing agricultural productivity and output and market outreach, for example through improved research and extension services and improved agricultural support services.

CHAPTER SIX - CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The extension personnel needs to repackage their services taking into consideration the learning process across communities, the different forums that can enhance knowledge circulation in farming communities, the impediments to learning both at the organizational level and at personnel level, the diversity of the farmers involved in the learning processes, the participation on the people either as groups or as individuals, and also understand the effects of other services providers in collaboration and negotiations processes. They should strive to understand whether the collaborations with other service providers will enhance or are an impediment to processes of learning and knowledge circulation across farming communities.

The extension personnel need to understand there are important considerations among the farming communities besides the technological aspects and economical aspects. These includes social relations among farmers and how they learn from one another, how the different farmer to farmer networks contribute to the learning and knowledge circulation processes.

In other words the learning processes across the farming communities are shaped in a series of social interactions between different groups at various points in time and in different locations, within the context of the wider social system.

The extension personnel should equally understand the learning among farmers is a process of iterative reflection that occurs when farmers share their experiences, ideas and their environment with other farmers. There is the importance of reflecting on the value of what they know, how they know it which in turns leads to new understanding and consequently the learning processes among the farmers. The extension department needs to understand that learning takes place in different forums for both male and female farmers. Therefore when organizing forums for learning the extension should use different approaches for both male and female farmers.

6.2 Recommendations

In chapter four it was found that a lot of learning and knowledge circulation occurs at the level of farmer to farmer interactions and also through collaborations among farmers with different development partners in rural settings. However as mentioned earlier in this report the extension workers should properly coordinate the different development actors to enhance learning and knowledge circulation in the district.

The extension staff can stimulate or help to improve farmer to farmer knowledge exchange in various ways:-

- Organize meetings or festivals that are conducive to this kind of knowledge exchange(farmer to farmer knowledge exchange)
- The non-governmental bodies should encourage the formation of citrus farmers organization. Likewise induce formation of farmers study groups. This is especially important to the citrus farmers who lack a farmer organization.
- Support existing groups and networks with training and logistics.

- Correct uneven exchange of knowledge among farmers diverse farmers especially between large citrus farmers and small citrus farmers. This might form a reference point for future partnerships and associations.
- Communicate experiences of other farming communities.
- Organize excursions for the benefit of the farmers to ensure that they learn more given the exposure they get.
- The extension department in the district to facilitate more often the farmers' weekly meetings in collaboration with the non-governmental bodies to increase knowledge circulation and learning among the farmers.
- The extension department proper frame work for organization of all the rural development actors to enhance learning and knowledge circulation. Proper planning and coordination avoid duplication of projects in the rural areas.
- The Government extension service and non-governmental bodies should strive to form in partnerships and associations by engaging in negotiations as well as collaborating with the diverse citrus farmers to improve service delivery.
- The diverse rural development actors should follow up and document all their interactions with citrus farmers to stimulate knowledge circulation and learning in the community.
- This government should create an enabling environment for all development actors to be able to participate actively in learning collectively with farmers groups. Development actors may be involved in processes of critical reflection to find ways of improving citrus farming in the district.

In this case the role of an extension worker is not that of a consultant or an expert but rather a facilitator. That is, of someone who brings farmers together (networking) and acts as a catalyst for, and directs learning and exchange processes either in general or around a specific problem.

As already mentioned in this report that the linkages between farmers, extension and research should be strengthened. Improvement in collaboration between research, extension, farmers and other stakeholders is a precondition for effective service delivery at the village level that will lead to greater productivity and better livelihoods.

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Annex 1 Checklist for citrus farmers

Name:

Sex

- 1) How many citrus trees do you own?
- 2) How long do the citrus take before fruition?
- 3) What are the labour requirement for citrus farming?
- 4) What pest and diseases affect citrus?
- 5) How do you control them?
- 6) What are the initial cost of establishing an citrus orchrd?
- 7) How do you perfume grafting in citrus?
- 8) How is the marketing of citrus done?
- 9) How did you learn of grafting citrus innovation?
- 10) How often do the farmers visit you?
- 11) What kind of information does he/she bring to you?
- 12) How else do you get information on citrus farming?
- 13) How is the marketing of the fruits done?
- 14) What kind of organization do you have for citrus farmers?
- 15) How often do you meet and why?
- 16) What factors determines whether a farmer will grow conventional citrus or grafted citrus?
- 17) In what ways do you relate with other farmers to achieve you goal?
- 18) What motivated you to grow citrus plants?
- 19) How do you share information with other farmers?

Annex 2 Checklist for extension personnel

Name of respondent:

Division

Education level

- 1) How often do you visit citrus farmers?
- 2) What factors make this region suitable for growing citrus?
- 3) What inputs are required for citrus farmers?
- 4) What difficulties do farmers face in obtaining required farm inputs?
- 5) Which methods are available for grafting?
- 6) How do you pass information concerning citrus to farmers?
- 7) Why do you consider this methods effective?
- 8) How do you obtain information from research station?
- 9) In your view what could be done to improve citrus production in the district?
- 10) Or what information could you provide and why?
- 11) What organization collaborate with you in service delivery to the farmers?
- 12) What services do they offer and why?
- 13) What factors contribute to slow citrus innovation rates in the district?

Annex 3 Checklist for district agricultural officer:

Name of respondent

Education level

- 1) How do you organize the extension staff for service delivery to the farmers?
- 2) What other institutions collaborate with you in service delivery to the farmers?
- 3) What specific service do they provide and why?
- 4) How do you as an institution (agriculture extension) link up with the research station?
- 5) What organizational changes have you effected in the department in the last five or so years that have affected the performance of the extension service delivery?
- 6) In what way has the changes affected delivery of extension services?
- 7) What external changes have occurred in the last five or so years that have affected the delivery of extension service?
- 8) How are you coping with these changes?
- 9) In what ways do you involve the extension workers in organization of the extension?
- 10) What rigidities/limitation exist in your organization that hamper the performance of the extension service?

- 11) How are you addressing these limitations?

Annex 4 list of citrus farmers interviewed

s/no	Name	sex		Number of citrus Trees planted
		M	F	
1	Joshua musyoki	*		>250
2	Mrs. Nziza kamathi		*	30
3	Mrs muthoka		*	38
4	Florence muema		*	110
5	Mrs mbuvi		*	400
6	Rafael ngengwa	*		10
7	Domila muthoka		*	130
8	Dorcas		*	84
9	Jackline koki		*	65
10	Julius mutuku	*		200
11	Thomas muoka	*		>300
12	Sebina mbula	*		120
13	Boniface muthama	*		400
14	Mrs kavete kivuva		*	300
15	Robert Linda	*		68
16	Nzipora mutua		*	95
17	Munyao makau	*		>500
18	Nguta ngavu	*		170
19	Mutuota muli	*		40
20	Kisavi ndolo	*		35