# FACTORS INFLUENCING FARMER PARTICIPATION IN THE ADOPTION OF HORTICULTURAL INNOVATIONS IN KAKAMEGA AND MACHAKOS DISTRICTS OF KENYA

**M.A. RESEARCH DESSERTATION**

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**SIGNATURE PAGE**

I wish to present this dissertation in partial fulfilment for the requirements for a Masters degree in rural sociology and community development. I declare that this is my original work.

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# DEDICATION

I dedicate this work to my father [Nathan Fitzjoji Magomere] and my mother [Athibeta Mwenesi Magomere] for their strong belief in education as the root of life and the endless and tireless effort that they dedicate towards educating the youth.

## *EPIGRAPH*

*It appears that the act of extension, in whatever sector it takes place, means that those carrying it out need to go to 'another part of the world' to 'normalize it', according to their way of viewing reality: to make it resemble their world.*

*Paulo Freire, 1974: 95*

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**ABSTRACT**

A survey was undertaken in Kakamega and Machakos districts of Kenya with the aim of studying the factors influencing farmer participation in the adoption of horticultural innovations. The study examined the role of farmer participation in the adoption of better horticultural production practices, it investigated the influence of farmer personal characteristics on participation in horticultural programmes and examined the influence of market accessibility to farmer participation in horticultural improvement programmes in both districts. The two districts were compared to explain the difference in participation in horticultural extension. In the study each district was partitioned into five clusters based on the agro ecological zones. Ten farmers were randomly selected from each cluster to give a total sample of 100 farmers. A questionnaire was administered to each of the respondents and the results were statistically analysed. The study found out that farmers' participation in horticultural improvement programmes positively influenced their adoption of improved farm practices in both study districts, with farmers from Machakos showing higher participation scores thus scoring higher in adoption of improved farm practices. The research found that farmer personal characteristics (age, marriage status and educational status) influenced farmer participation in horticultural improvement programmes in both districts. The study also found that accessibility to horticultural markets encouraged farmers to participate in horticultural improvement programmes in both districts, with the effect more pronounced in Machakos. Policy should focus on setting up an agricultural extension service that encourages the participative approach. These extension services should not be general for all the districts in the country but rather they should be focused and specific for each district depending on the characteristics of the farmers in the district, the infrastructure, market accessibility, post harvest losses and type of the agricultural enterprise.

# CHAPTER ONE

## 1.0 INTRODUCTION

### 1.1 BACKGROUND

In the absence of farmer participation in agricultural extension the process of agricultural development fails to achieve its objectives in rural development. When farmers participate at all levels of extension adoption of agricultural innovations tend to increase (Chambers, 1989). For any initiative to benefit the local population the members of that population must be fully involved in the initiative. This assertion is based on a realization that the local population is knowledgeable and intelligent, and that they have much to contribute to most projects that are meant to improve their way of life (Chambers, 1983; Gran, 1983; Timberlake, 1985). Furthermore the only way to know what people need is by involving them in making decisions on meeting their needs. Otherwise efforts to help people do not materialise because what change agents assume is good does not necessarily turn out to be so (Altieri, 1987).

Farmer participation is influenced by strong forces that either push or pull the process. These forces are both internal and external. The internal forces consist of those that are intrinsic to the farmer. These include the farmers' educational level, level of awareness, and skills necessary for participation. The external factors are those that the farmer has very little influence. The most common in developing societies are those posed by existing

governments and formal institutions. These governments are normally rigid in their central administration and view farmers as ignorant and thus can't contribute in matters of their development. (Midgely, 1986; Lele, 1975).

The irony is that most of the landmark rural development policy documents, which guide governmental development planning, have given specific attention to farmer participation. For instance the sessional paper No. 10 of 1965: African Socialism and its Application to Planning in Kenya; the National Development Plan, 1984-88; District Focus for Rural Development (Blue book, March 1987); and the sessional paper No.1 of 1986 on Economic Management for Renewed Growth, all had as an important section of their activities the participation of farmers. These documents acknowledge people's capabilities, control, needs and aspirations. They outline the bottom up approach in such initiatives as the self-help, and participation at the district level. (Government printer, Nairobi, Kenya). The late 1960's special rural development programme had as its central concern the decentralisation of decision-making and implementation of the rural development agenda.

Beyond these, major plans that emphasise farmer participation have in the recent past been implemented so as to encourage the farmer to fully participate and therefore fully own the process of their development. A good example is the implementation of the training and visit extension methodology (T & V) in some central Kenyan districts. This model puts the

farmer first and all the necessary action at any stage of extension is seen as a result of the farmers' feedback. This model lets the farmer first decide what kind of agricultural education is necessary for his or her area. Albeit it's shortcomings the T & V system emphasized the participation of farmers.

On the other hand non-governmental organisations (NGOs) have in the past operated in these regions and to an extent have shown considerable success in the involvement of farmers in their development agenda. Farmers have been facilitated to participate in development at different levels. Farmers have been encouraged to assume various responsibilities depending on their level of decision-making. Some NGOs have given farmers full autonomy over their development initiatives while others have limited the farmers' involvement to the provision of labour for project implementation (passive participation). All in all some success has been seen in the activities of NGOs in encouraging farmer participation.

The main focus in most development initiatives is to improve methods by which the farmer will be encouraged to participate more in the process of their own development. Thus, its is extremely appealing to all stake holders in rural development especially in agricultural improvement programmes to be armed with information on factors that enhance participation in specific enterprises, and therefore the adoption of improved farming practises.

## 1.2 PROBLEM STATEMENT

The study inquired into the role of farmer participation in the adoption of improved horticultural practices in Machakos and Kakamega districts of Kenya. It also inquired into the factors that influence farmer participation in the two districts. Farmer personal characteristics and accessibility to horticultural markets were studied to find out how each influenced farmer participation. The results on the variables were used to compare the two districts. Prior to the study it was noted that though Machakos district was not endowed climatically for arable farming as Kakamega district was, there was higher horticultural produce output in Machakos than in Kakamega district. (Annual District Reports, Kakamega and Machakos, 1994).

To increase production of horticultural crops in the country it is important to initiate an appropriate strategy by which improved farming practices from research stations will be transmitted to the farmers. Uma Lele (1975) notes that such a strategy should not only be intensified but should impart a technological package that is sufficiently profitable at the farm level to provide an incentive for the farmer to adopt innovations. Second, the service should have trained staff to solve the specific but diverse farm level constraints faced by farmers. Third, it should have an incentive system to encourage the extension service to perform its task efficiently, meaning not only rapid growth in prediction but also broad participation in the adoption of

innovations. Fourthly and most important, it should enlist the active support and participation of the farmers at all levels.

The traditional extension methodology in Africa is dominated with flaws such as few, ill paid, ill trained and ill equipped extension agents, (Leonard 1972). This scenario reduces markedly the participation of local farmers in the strategies geared towards their adoption of improved practices. The condition can be attributed to the inability of the extension agents in promoting participatory approaches due to their inherent lack of training and reduced morale.

Farmer participation in adoption of improved horticultural practices is necessary for agricultural and rural development to succeed. Participation of farmers in horticultural extension may guarantee maximum utilization of the potential in horticultural production. Currently 300,000 hectares of land are under fruit and vegetable production in Kenya (HCDA 1997, Nairobi). Small-scale farmers contribute to 80% of the total horticultural produce used locally while the large-scale growers account for 20% of the horticultural produce. This shows that if the small-scale sector is developed appreciably by increasing its production, the horticultural industry in Kenya will be greatly enhanced. The importance of horticulture in the country cannot be over emphasized, since the produce from this industry is utilized both locally

and for export as food and ornamentals (table 1). 1n 1999 horticulture was the third largest foreign income earner after tourism.

***Table 1:*** **MAJOR HORTICULTURAL COMMODITIES IN KENYA**

| | | | |
|---|---|---|---|
| Vegetables: | Artichoke | Cauliflower | Lettuce |
| | Asparagus | Celery | Okra |
| | Baby marrow | Chillies | Onions |
| | Beet root | Cucumber | Potatoes |
| | Brinjal | Dudhi | Radish |
| | Brussels Sprout | Galka | Snake gourd |
| | Cabbages | Karela | Spinach |
| | Capsicums | Kohlrabi | Turia |
| | Carrot | Kale | Turnips |
| Fruits | Avocado | Mango | Strawberry |
| | Apple | Mulberry | Sweet corn |
| | Banana | Orange | Sweet melon |
| | Cap gooseberry | Papaya | Tangerine |
| | Fig | Passion Fruit | Tomatoes |
| | Grape | Pear | Water melon |
| | Guava | Pineapple | Lemon |
| | Plum | Lime | Pomelo |
| Cut flowers: | Agapanthus | Chrysanthemum | Orchids |
| | Alliums | Heliconia | Ornithogalum |
| | Alstroemeria | Iris | Roses |
| | Bells of Ireland | Liatris | Strelitzia |
| | Carnations | Moluccella | Tuberose |

(HCDA, 1983, Nairobi)

Machakos and Kakamega are two Kenyan districts that have shown much horticultural activity. Horticultural production is practised on both large and small scale. The products of which are marketed both internationally and locally.

The two districts are located in different climatic conditions Kakamega being in the climatically more favorable region for horticultural production. Despite this Machakos has continually out performed Kakamega district in horticultural production.

## .3 RESEARCH OBJECTIVES

GENERAL OBJECTIVE

To study the factors influencing farmer participation in the adoption of horticultural innovations in Kakamega and Machakos districts.

SPECIFIC OBJECTIVES

- To examine the role of farmer participation in the adoption of better horticultural production practices.
- To investigate the influence of farmer personal characteristics on participation in horticultural programmes.
- To examine the influence of market accessibility to farmer participation in horticultural improvement programmes.

## 1.4 JUSTIFICATION

The horticultural industry is currently the third highest foreign exchange earner in the country. Horticulture includes production of vegetables, fruits, flowers and ornaments for export and local use. This industry is labour intensive and has the potential of employing large numbers of people residing in the rural areas. Horticulture as compared to the production of other food and cash crops has higher returns per acre of land and needs relatively less land for production.

Therefore, it is important to examine ways that this industry can be promoted and established in most arable regions in Kenya. Substantial amounts of agronomic research have been done in the and currently the main concern is how farmers can be encouraged to adopt these practices for better production. Farmer participation remains the most important phenomenon for facilitation of adoption of these superior farming practices. Understanding the push and pull factors for participation will enhance farmer participation and thus better adoption of innovations. Different communities have different factors that affect their participation in horticultural or agricultural programmes. It is therefore important to study and document such factors. Such information is invaluable for any development worker in the study districts.

This study shall go a long way in evaluating the effect of farmer participation in horticultural improvement programmes and beyond that, it shall also identify the push and pull factors that influence participation in the two study districts. The research is also in line with the Kenya government's agricultural policy of promoting development through poverty alleviation among small-scale farmers in marginal areas.

# CHAPTER TWO

## 2.0 LITERATURE REVIEW

### 2.1. INTRODUCTION

This chapter provides a base for the research. The facets of the research are strategically positioned in context by reviewing the previous work done on the subject, and further, the gaps present in the available information are highlighted. The chapter ends by proposing hypotheses that the research attempts to test to fill the existing gap. In the literature review previous researchers in the fields of farmer participation in horticultural improvement programmes, adoption of improved farming practices, farmer personal characteristics and enhancement of agricultural production are extensively quoted.

### 2.2. FARMER PARTICIPATION

Farmer participation is a phenomenon that is viewed by many development workers and writers as a strong aspect for community development. The smallholder farmers sometimes referred to, as the "poorest of the poor" recently have become victims to decisions made by armchair bureaucrats. Many of these decisions are then imposed through varying top-down strategies. These decisions are neither adopted nor internalised. In effect these decisions never influence positive development but in fact, perpetuate poverty among the poor. This situation is a consequence of non-involvement of the local beneficiaries in making decisions for their own

development. Under involvement of the stakeholders in the development agenda also increases poverty.

Many development workers are prompted to incorporate the popular participation phenomenon in their development agenda for the noble goal of achieving development. For many, the term "farmer participation" has continued to be either an unclear or ambiguous terminology.

The United Nations Task Force on Rural Development, (1977) defined popular participation as, "An active process in which the participants take initiative and action that is stimulated by their own thinking and deliberation and over which they can exert effective control. The idea of passive participation which only involves the people in actions which have been thought out and designed by others is unacceptable" (cited in Muia, 1991).

This conception is problematic especially when mirrored against a background of poverty, illiteracy and ignorance that dominate some rural communities in the third world (Ontita, 1992). Therefore the conception challenges rural development workers to assume facilitating roles, so that communities may evolve their own ideas about development and shape their own programmes, which can be implemented on their terms.

This in effect restores the community's mandate to outline their own development plans, initiate these plans, implement them and monitor them to their eventual success. Poverty, illiteracy and ignorance can pull down farmers' participation in some communities while in others these three foster farmer participation. This is dependent on how the farmers' strengths are harnessed and weaknesses trivialised, in the process of participation (Chambers, et al., 1989).

The 1982 World Consultation Forum on "The Churches and Peoples of Participation," noted that people's participation is the people's initiatives to assert themselves as subjects of history. It is marked by the development of new knowledge by the people, including the appropriation and control of technology so that it serves the people (Mulwa, 1987: VII). Lack of knowledge in various communities has acted, as a push for more participation while it can also be a pull factor for participation. When a community deliberately invokes a process of developing, appropriation and control of new technology for the purpose of development, popular participation must be encouraged and utilised for the success of such an endeavour. On the other hand lack of knowledge can render the community members desperate and lead to the demise of participation.

Chitere (1994: 3 – 5) has argued that the need for participation of local people in development is underlined by various reasons. First, people often

tend to resist innovations or measures that are imposed on them. Their involvement therefore, makes them internalise the innovations. Secondly, local participation is needed because it permits mobilisation of local resources and their use in development. Third, participation permits growth of local capacity, which develops out of the establishment of a partnership between development agencies and the community. Fourth, participation helps reduce the growing sense of lack of community, which comes with the weakening of social relationships in society. Finally participation tends to reduce alienation, which prevents members from identifying with their communities. Peoples' participation in development therefore stabilises and ensures the sustainability of any development initiative.

On the other hand Pearse and Stiefel, (1980), record that the word 'participation' (sharing and joining in) defines a central element of all social life and unless some societal context is stipulated it does not point to any specific field of action, and therefore remains vague. Pearse and Stiefel goes ahead to identify one of the better UN definitions as "influence on the decision-making process of all levels of social activity and social institutions". (Geneletti C.,1975).

This view emphasises the need for the rural masses to be enlightened enough to know their roles and responsibilities in any given scenario. Thus the issue of empowerment of the people becomes very relevant.

Norman Uphoff, (1980) notes that empowerment is a key aspect of participation, but it is not the whole of participation. This has relevance since there can be participation with little power, which is still participation, though meagrely empowered or un-empowered participation. The challenge in such a case being how to increase the power associated with participation, the participants or stakeholders are moved from a lower level to a higher level of participation by increasing their power in decision making.

## 2.3. ADOPTION OF FARM INPUTS AND PRACTISES

Adoption of better farming practices or innovations has direct influence on the improvement of agriculture and specifically horticulture. According to Rodgers E. (1983), adoption is a consequence of an innovation – decision process. He defines adoption as "a decision to make full use of an innovation as the best course of action available". The opposite of which is rejection "a decision not to adopt an innovation" The adoption stage is very vital in all extension processes and it is the stage that determines the success or failure of an extension or diffusion strategy. In this research, the success of farmers' participation will be graded on the adoption pavilion.

It is expected that farmers on the higher level of participation may have higher chance of adoption of innovations than the farmers on the lower levels of participation.

Farmers find it rational to try out new innovative ideas on a partial basis before adopting the whole. "For most individuals, one means of coping with the inherent uncertainty about an innovation's consequence is to try out the new idea on a partial basis" (Rodgers E., 1983). This small-scale trial is often part of the decision to adopt, and is important as a means to decrease the perceived uncertainty of the innovation for the adopter. This can only hold truth in a situation where the adopter is not involved in the process of creation of the new innovation. In most top-down diffusion strategies where the adopter is not sufficiently consulted during the creation of the innovation, the adopters find it important to try an innovation on a probationary scale first since they do not believe in its success. On the other hand when a participatory approach is used, the adopters are involved in the production of the new knowledge or innovation and thus they tend to trust it more than when it is just imposed on them.

Adoption is often influenced by successful demonstrations. Thus, most change agents seek to speed up the adoption process by sponsoring demonstrations of a new idea in a social system, and there is evidence that this demonstrations strategy can be quite effective, especially if the

demonstrator is an opinion leader (Magill and Rodgers, 1981). These demonstrations rapidly increase awareness of the target group about the innovation but they do not guarantee the reduction of the time required for the innovation decision. This results in a situation where, "the rate of awareness (knowledge for an innovation) is more rapid than its rate of adoption" (Ryan and Gross, 1950).

Adoption of various farm practices is also influenced by the physical variations among farms, leading to farmers in the same locality having to use different methods to solve a similar problem. For instance Schmidt and Swoboda observed that in western Kenya, hoeing is common in Kisii district because of the physical structure of the area, which is mainly hilly slopes. On the other hand, the ox plough is popular in other non-hilly districts. Economic factors also tend to affect the rate of acceptability and response to innovations. For instance, the economic well being of a household head explains his attitude towards a given technology (Mellor, 1970).

**Adopter Categories**

Rodgers (1983) classifies adopters into five categories. Adopter categories are the classification of members of a social system on the basis of innovativeness.

Innovativeness has a direct impact on the rate of adoption. Innovators tend to exhibit a faster rate of adoption than laggards. The rate of adoption of an innovation will depend on it relative advantage over others, the ease with which it can be carried out on a small scale and the extent to which it can be compatible with the old ideas it is meant to replace.

Based on innovativeness members of a community have been categorised as innovators [who constitute an average of 2.3% of the members of a social system], early adopters [constituting 13.5%], early majorities [constituting 34%], late majorities [constituting another 34%], and lastly laggards [constituting 16%] (Rogers, 1983). At one extreme are the innovators who adopt first, they can afford to take risks and have resources to invest in new farm ventures; at the other extreme are the laggards who adopt last, they fear taking risks, they are usually sceptical of new ideas and they do not posses resources to invest in farming. This categorisation of farmers is based on the length of time it takes them to adopt a particular innovation and on the differences in their personal characteristics such as years of formal schooling and economic status (Chitere O. P., 1998).

As many other stereotypes, this categorisation of farmers lack in the very intricate of details that affect farmers to exhibit such characteristics. For instance Rodgers is silent on the role of farmer participation in the promotion of adoption. When the wrong methodology (e.g. diffusion) is

used to introduce an innovation to a social system, such adoption characteristics are expected. If farmers are involved in the creation and subsequent implementation of innovations such an adoption scale could be rendered fallacious.

## 2.4. ENHANCING AGRICULTURAL PRODUCTIVITY

Agricultural improvement is closely tied to the principles of green revolution. Highly productive agriculture is based on the use of improved seed, fertilizers and other farm chemicals for higher production. The 1960s saw a breakthrough in plant breeding, which promised vastly increased harvests of a number of crops such as maize, wheat, and rice. The technological improvements in these crops, in many developing countries, were so dramatic as to give rise to the term green revolution. (Baker and Winkelmann, 1974)

The term green revolution implies a well-marked improvement in agricultural production in a short period and the sustenance of higher level of agricultural production over a fairly long period of time (Tyagi B. P.,1987). This kind of revolution is experienced when people in a given community make directed effort to improve the production of their land even in a situation when there are other limiting forces. The effort to improve agriculture can be a product of the need for higher production of a certain agricultural or horticultural commodity. The increased production of

this commodity increases rewards proportionately. Rewards could be profits, food self-sufficiency or even honour and respect. One agricultural based industry that has largely exhibited increased production is the horticultural industry. This is due to the high prices or benefits that are fetched from the products.

The improvement in agricultural production over a short period and its sustenance on a long term basis can be directly linked or explained by the following factors: The application of a combination of improved practices; the farmers do not adopt an improved practice in isolation, but they adopt simultaneously all the elements needed for augmenting production. The constituents of this package of practices include utilisation of improved seed varieties, use of potent fertilisers, use of improved agricultural implements, plant protection measures, effective water use and management and use of agronomic cultural practice. It is only when a proper mix of these improved methodologies are put into practice that the farmer is able to achieve the goal of higher production.

Increased cropping intensity; Farmers implement new crop rotations and others methodologies that ensure the available land is used to its maximum potential. This can be done through use of early-maturing crops during the short rains and changing to the longer duration crops in the long rains. It ensures that the farm is utilised all year round.

The high yielding varieties have tremendously changed the course of agriculture to the better. (Sen,B.,1974). These are plant varieties that are improved through scientific procedures to ensure that the yield of a cultivated crop plant is increased. Various crops have been subject to this kind of manipulation. Good examples include wheat, rice, maize, beans etc. For a high yielding variety to continue exhibiting its better yields it has to be sown in fields, which have proper drainage facilities, proper sanitation and well aerated soils. Since these varieties are highly responsive to fertilisers the farmers who use fertilisers tend to see greater production. Fertiliser application makes these varieties to show exceptional vigour and thus tend to have fast growth. The varieties are sometimes found to be more susceptible to pests and diseases than other local varieties that have developed resistance overtime. This implies that these varieties need regular pest and disease management and control by use of pesticides and necessary mixtures that allow the plant to grow in good health from planting to production.

Plant protection measures are followed closely. This is an attempt to control the plant pathogens and insect pests that could destroy the plant's health or even destabilise its production. Plant protection includes, seed treatment, intensive spraying, weed control and rodent control (Tyagi, 1987). Fertiliser utilisation forms a central point in green revolution. This

is due to the narrow land to man ration in the most productive regions in Kenya. This implies that increased agricultural production must be carefully nurtured. The fertiliser is a balanced set of plant nourishment consisting of macro and micronutrients required for specific functions in plant life. "It has been noted that throughout the world increased agricultural production is related to increased consumption of fertilisers" (Corea, G. 1973)

Well-formulated agricultural research has also contributed much to the development of horticulture. Various institutions such as universities, government research stations and private researchers have continued to provide indispensable knowledge for improvement of agriculture. Many research methodologies are normally used but in recent times it has been found that research that fully involves the beneficiary normally has more potent results that can help them improve their production.

Improved implements and machinery have on the other hand made work in the farm less laborious and less time consuming. This widens the capacity of the farmer to utilise more land. With tractors, ploughs, sprayers and combined harvesters many farm practises have been made simple and more achievable.

The green revolution has recorded benefits in Asia and some countries in South America. As the term "revolution" suggests it has increased

agricultural production, there has been increased income for the rural farmers and the general environment ecology has been improved.

Despite all these successes, the new technology associated with the green revolution has increased personal inequalities. Though, in absolute terms, the gains from technological changes have been shared by all sections of the community through increased wages and increased employment, "technological changes have contributed to widening the disparities in income between different regions, between small and large farms and between landowners on the one hand and the landless or tenants on the other" (Hanumauth Rao, 1983). The revolution has benefited the well to do farmers who can afford to acquire the superior quality inputs and credit facilities to their own advantage. (Sen, B., 1974). This has continued to widen the gap between the rich and the poor and concentrated most wealth in the hands of a few 10% of the rural population.

The technology or innovation necessary to initiate and maintain the green revolution is more expensive than the more familiar traditional modes of agricultural production (Tyagi, B., 1984). The farmer has to purchase inputs such as chemical fertilisers, irrigation pipes and pumps, pesticides, high yielding variety of seeds and seedlings. The farmer incurs high farm operational costs related to electricity, fuel etc. Tyagi also notes that the farmer is presented with technology in a package form. The package

contains a number of inputs, which have to be bought. This means that the farmer has to either accept the whole package or reject it. Noting the economic conditions of the small farmers, one can state that the technology has not been readily available to them.

The technology associated with the green revolution has persisted to be inaccessible to the rural poor farmer since it requires knowledge about it and the proper application of the same (Corea, G., 1973). The small farmers have in the past not been the beneficiaries of such important knowledge. Thus, they have been alienated from the revolution.

Farmer participation in horticulture is seen as a means of improving the farmers' knowledge based on these elements of the green revolution. This makes the farmer be in a position to implement most of the better farming practices that are availed by various research and extension institutions. Out of the multitude of ways that these better farming practices are transmitted to the farmers, farmer participation has been deemed as a positive influence to the adoption of better farming practices. To understand better the adoption of these better practices by farmers the factors that influence participation need to be analysed and carefully studied.

## 2.5. MARKETING OF HORTICULTURAL PRODUCE

One major goal pursued by farmers involved in horticultural production is to obtain a monetary surplus. These farmers voluntarily use marketing channels since they produce in excess of domestic consumption or the products are not conveniently consumed domestically. These products are sent to the markets. A market can be aptly defined with relation to a place, a commodity or even the transactions that take place in the exchange of one commodity for another of relatively agreeable equity in value. Thus, a market may be defined as an institution for the exchange of goods and services (Whethan E. H., 1972). This extends the meaning of a market from a place to include a succession of exchange amongst various individuals.

In view of this marketing is the set of human activities directed at facilitating and consummating exchange (Kotler, 1972). This definition emphasises that marketing is located specifically in the realm of human activities, and that marketing deals in exchange of valuable things whether tangible or intangible. Kotler suggests three elements, which must be present in order to define a marketing situation. The first element is two or more parties potentially interested in exchange, second, each party possesses things of value to the others and last each party is capable of communication and delivery.

Agricultural marketing often has a certain associated mystique. Thus Baxter defines agricultural marketing as "any deliberate activity undertaken by the farmer with the purpose of aiming his output towards pre-selected market areas so as to maximise, or at least optimise profits" (Baxter, J. M., 1989). This definition fits horticultural marketing since it is usually a deliberate activity and as such is planned, the output is usually aimed towards pre-selected market areas and the aim is usually to maximise, or at least, optimise profits.

In agriculture, we have farmers with two marketing orientations. This is the way farmers view their enterprises, which is influenced by their personal aspirations and opinions. Some farmers are usually production-orientated; they regard the major part of their enterprises as being concerned with the goods they wish to produce. In contrast most horticultural farmers are market-orientated. They endeavour to produce goods, which can profitably be sold, giving due consideration to the likelihood of profit before production is undertaken (Abbot, J. C., 1970).

Horticultural marketing has it peculiarities as opposed to general marketing. Consumer demand for horticultural products is a derived demand; the utilities or satisfaction, provided by different farm products create the demand for them. Though the total demands in physical terms does not alter much, fundamentally the economic demand, in monetary value terms,

fluctuates widely from year to year and the demand for individual products varies a great deal over a number of years (Baxter, J. M., 1989).

The horticultural markets are also rather static since the individual usually has neither the scale nor the available capital to increase his share of the market through innovation. These markets also have a high degree of government involvement e.g. through price support, subsidies, and the introduction of marketing boards overseen by government officials (Whetham, E. H., 1972).

Designated institutions handle marketing of horticultural products and pricing policies in this sector. Such institutions include statutory authorities like marketing boards or their agents that have been granted official monopoly by government. Gray C.S., (1977) suggests extremes of statutory authorities in Kenyan agricultural marketing, which operate as monopolies or monopsonies. There are cooperatives involved in agricultural marketing; these are grouped into large scale and small-scale cooperatives. The most important in horticultural marketing in Kenya are the individual producers and the forces of demand and supply mostly determine pricing.

Transport is important in fruit and vegetable marketing not only as an integral link in the marketing chain but also because of its strategic implications for cost (Abbot, J. C., 1970). The importance of horticultural

transportation is highlighted due to the intrinsic nature of horticultural products; they are perishable in nature, therefore, conducive micro-environment should be created for the products if they have to be transported over long distances.

"Marketing plays an important role in boosting farmer's morale to produce more and in a better way" (Wheatham, E. M. 1972). With good marketing the farmer gets good returns from sales of products. When the farmer has a high surplus or profit margin, the chances of repeating the previous year's enterprises and in a better way are higher. This aspect has significance in this research since by increasing production the farmer must get better ways of production. The farmer may then be necessitated to participate more in horticultural extension and promotion activities so as to gain higher knowledge in its production. In effect marketing may be a push factor for farmer participation in horticultural improvement programmes.

## 2.6. SUMMARY OF THEORETICAL FRAME WORK

In this chapter, previous work in the fields of farmer participation in horticultural improvement programmes, adoption of improved farming practices, farmer personal characteristics and enhancement of agricultural production are discussed to place the study in theoretical context.

The concept of farmer Participation was described as, "An active process in which the participants take initiative and action that is stimulated by their

own thinking and deliberation and over which they can exert effective control". (The United Nations, 1977), but the description was problematic especially when mirrored against a background of poverty, illiteracy and ignorance that dominate some rural communities in the third world. In the chapter the roles and limitations of participation are emphasized, and it is shown that there is a gap in information on the factors that influence farmer participation in the adoption of improved horticultural practices in Kakamega and Machakos.

Adoption of farm inputs and practises was defined as, "a decision to make full use of an innovation as the best course of action available". Rodgers E. (1983). It was shown that the final product of a good extension service was high level of adoption of improved farm inputs and practises. The review showed the necessity of finding out how adoption was influenced by farmer participation. Differences in farmer personal characteristics such as years of formal schooling and economic status influence their adoption of improved farming practises (Chitere O. P., 1998). Farmer personal characteristics also influence their participation in various rural development initiatives, but no study demonstrates how personal characteristics influence farmer participation in horticultural extension programmes in any district in Kenya. Marketing of perishable horticultural produce is discussed and studies on the effect of marketing to production are quoted. A gap exists on the effect of accessibility to markets on farmer participation.

## 2.7. HYPOTHESES

1. The extent of farmer participation in horticultural improvement programmes influences their adoption of modern agricultural practices.

2. Farmer personal characteristics influence farmer participation in horticultural improvement programmes.

3. Accessibility to horticultural markets encourages farmer participation in horticultural improvement programmes.

# CHAPTER THREE

## 3.0 RESEARCH METHODOLOGY

### 3.1 INTRODUCTION

This chapter describes in detail the systematic research methods that were used in obtaining the results that will be presented later. In this chapter the sites of the research are described, the sampling design is clarified and the methods of data collection are clearly stated. In addition data analysis and interpretation methods used in the research are stated. The variables of the research are elaborated at the end of the chapter. This chapter clearly shows how the scientific method of inquiry was adhered to, in this research.

### 3.2 SELECTION OF SITES AND DESCRIPTION

Machakos and Kakamega districts were selected for this study in lieu of the fact that many governmental and non-governmental organisations operate in these areas. These organisations utilise participatory approaches in extending agricultural innovations to the horticultural farmers. The two areas were best suited as the sites for analysing the factors that influence participation in adoption of horticultural innovations.

Both districts have peculiar climatic and social conditions, but have a similar problem of high poverty levels and high population. Machakos is situated in the semi-arid region while Kakamega is located in a high

potential area. The disparities in horticultural production in the two districts are huge where Machakos district distinctly performs better than Kakamega district. This presents a wonderful channel of inquiry, as the research attempts to question the factors that influence farmer participation and the effect of participation in the adoption of better farming practices which ultimately improve horticultural production.

### 3.2.1 MACHAKOS GEOGRAPHIC LOCATION

Machakos district covers an area of approximately 6,165 $km^2$, with a population of 844,204 persons (1993 projections). The district borders Kitui to the East, Makueni to the South, Kajiado and Nairobi to the West, Murang'a and Embu to the North and Mwingi to the Northeast.

### 3.2.2 MACHAKOS CLIMATE AND RAINFALL

The district has a bimodal rainfall regime (March to May – long rains and October to December – short rains). The short rains are more reliable and most horticultural tree crops are planted then. Total rainfall averages between 500 mm to 1,000 mm.

The mean annual temperature varies with Agro-Ecological Zones (AEZs), which range between AEZ2 and AEZ6. The altitude ranges from 880 m above sea level in the southern part and 2,144 m at Donyo Sabuk. The most important AEZs for horticulture in Machakos district are zone II,

III, IV and V. Zone II covers the upper slopes of the hill masses of Iveti, Mua and Kangundo; Zone III covers the lower slopes of Iveti, Mua and Kangundo hills, Matungulu and Mitamboni areas. Zone IV covers the largest part of the district including most parts of Mwala, Ndalani, Kinyatta, Yatta, Kangonde and Ndithini in Masinga, Matungulu and Donyo Sabuk in Kangundo. Zone V covers most parts of Masinga, parts of Mwala bordering the Yatta plateau, a small portion of Kangundo (in Komarock) and Mitaboni in Kathiani. In regions covered by zones IV and V, in Yatta and Matuu most of the horticultural activity is concentrated along the Yatta canal.

### 3.2.3 MACHAKOS LAND UTILISATION

Land utilisation is categorised as follows (Annual Report 1994). Arable land accounts for 22.9% (1,595.03 km²), rangeland covers 65.3% (4,544.14 km²), forest land covers 0.1% (6.83 km²), steep slopes 0.2% (15 km²), water is 0.03% (2 km²) while lands and homestead covers 794 km² (11.4%) of the land. Fruit crops are grown widely and they dominate the low lands. Some temperate fruit crops are grown in the hill-masses. The major fruit crops grown in the district are bananas, citrus, mangoes, pawpaws, avocados and passion fruits. Other fruits grown on small scale include guavas, loquarts, apples, plums and peaches. Most of the fruits grown on small scale are utilised locally.

Fruits crops are mainly rain-fed with an exception of those grown along the Yatta furrow and Athi River.

Vegetables are generally dominant in the hill masses, along the Yatta furrow and Athi-River where they are grown mainly under irrigation. Rain-fed vegetables are also grown but on a lesser scale. The major vegetable grown are tomatoes, onions, cabbages, kale, French beans and Asian vegetables i.e. brinjals, chillies, karella, dudhi, okra etc.

The annual fruits production (tonnes) in Machakos average as follows; Bananas-23,031, Citrus-37,744, Mangoes-12,643, Pawpaw-26,032, Passion fruit-3,049, Avocados-5,320 (Ministry of Agriculture Annual District Report, 1995).

### 3.2.4 KAKAMEGA GEOGRAPHIC LOCATION

Kakamega district is located in Western province. It has a total district area of 2,963 square kilometres of which 327 km² is forest, 2,481 km² being arable and cultivable land. The district population estimate is at 1.2 million people constituting 176,000 farm families with an average density of 405 persons per square kilometre. The average family size is 8 people per household.

### 3.2.5 KAKAMEGA CLIMATE AND RAINFALL

The district has a bimodal rainfall regime with an average annual rainfall of 1,968.8 mm. The average temperatures range at 22 – 28°C mean maximum and 14 – 18°C mean minimum. The district lies within the Agro-Ecological Zones of Umo – LM2. Zone Umo covers Shinyalu and Malava, forest covers massive parts of this zone. Zone UM1 (coffee and tea zones) coves Shinyalu and Ikolomani. Zone UM4 (maize/sunflower) covers Matere, Lugali and Likuyani, Zone LM1 (sugarcane zone) covers Mumias and Butere while Zone LM2 (marginal sugar cane zone) covers Navakholo, Kabras, Lurambi and Khwisero.

### 3.2.6 KAKAMEGA LAND UTILISATION

The land use pattern can be distinctly associated with the AEZ and the soil type of a given region. Towards the North, South and Central Kakamega we find dark brown sandy loam's, this region is characterised with the cultivation of maize, beans, horticultural crops, sunflower, pasture and forage. The South and East divisions have dark-red soils covered with Lumic. Crops grown in this region include maize, beans, millet, sorghum, tea, coffee, bananas, forest, pasture and forage. The West and North regions have yellow-read loamy sands typically used for the cultivation of maize, beans, millet, and sugarcane. In light of this characterisation it is important to note that, land in use in the majority areas of the district is associated with mixed farming practices.

Horticultural crops account for 16% of the total arable land in Kakamega District. The cultivation of these crops is mainly for local consumption and the local market. One horticultural crop that does relatively well on the international market is the French beans.

According to the 1995 Annual District Report fruits are grown on an area of 1,787.8 hectares of land. Bananas take the largest acreage (1,156) and yield a tonnage of 13,884. Citrus is planted on approximately 20 hectares of land and the total production is 140 tonnes. The citrus varieties commonly grown are Valencia and Washington Navel. Pineapples are grown on a region of 357.5 hectares with a tonnage of 5,005. Pawpaw is grown on 44.2 hectares of land with a tonnage of 486.2 while mangoes and avocados are grown on 84.4 hectares of land with a tonnage of 19.3 and 293.7 respectively. The Bukura farmers training center, rural youth and various other horticultural improvement institutions and programmes contribute immensely in the promotion of horticulture in Kakamega district.

## 3.3 POPULATION

The inhabitants of Machakos district belong to the Kamba tribe. The 1993 projections show that the district population stood at 844204 persons. The total district area covers around 6163 $KM^2$. This means that there are 136.98 people per square kilometre. Higher population is

evident in areas around the Yatta canal, which is a major source off livelihood in the district. On average there are six people per household.

Kakamega district is estimated to have a population of around 1.2 million people constituting 176,000 farm families with an average density of 405 persons per square kilometre. The average family size is eight people per household. The district is mainly inhabited by the Luhya community.

## 3.4 SAMPLING DESIGN.

A sample is a subset or portion of the entire population under study. It should be viewed as an approximation of the whole rather than as a whole in itself. In the study the population is the total number of horticultural farmers in Machakos and Kakamega districts. In this research a sampling frame was obtained form the Ministry of Agriculture offices. This was a list of all horticultural farmers in a sampled sub-location. From this list 10 farmers were randomly sampled from each sub location. Random sampling was used at this stage due to the similarity or homogeneity of members per sub location.

A sample is used in the study because of the expense in terms of time and money involved in studying an entire population it is also because of the unmanageability of studying the entire population. The assumption

in studying a sample is that its aggregate characteristics reflect the entire population from which it has been drawn.

This study was conducted in the form of a survey of farm families and the interviewing thereof, of household heads. Both probability and non-probability sampling techniques were used to secure the sample of heads of households for study.

Sampling is necessary in a research process due to reasons of cost and time limit and efficiency in information collection. The larger a population the more it is necessary to collect a sample or samples across the population that are representative. This fact has made all social research to fully depend on good unbiased samples.

### 3.4.1 SAMPLING OF SITES AND SUB SITES

The two districts Kakamega and Machakos were purposively sampled for this study due to the increased activity of organizations that utilize the participatory approach to influence change. Secondly, both districts are important horticultural areas in the country. Lastly, the districts record significant differences in their horticultural production in favour of Machakos district, while Kakamega district seems to be climatically and therefore agronomically better endowed for horticultural production.

In both districts a multi-stage sampling design was utilized to get the final sample of 50 household heads per district (table 2). In this design the population was broken down into groups called clusters and each cluster was defined by some characteristic (Singleton et al., 1993). The number of clusters in a district was related to the intensity of horticultural production and the diversity of horticultural commodities produced. The clusters were based on Agro-ecological zones (AEZs). There were 10 AEZs in Machakos district, of which LM5, LM4, LM3, LH3 & LH2 AEZs show most horticultural activity. In Kakamega there were five important AEZs i.e. UM0, UM1, UM4, LM1 & LM2. Differences in AEZs were due to climatic and agronomic conditions. In the first stage the five AEZs were purposively sampled due to their high horticultural activity. In the second stage one administrative sub-location was randomly sampled from each of the five AEZs from the first stage. In the third and final stage ten household heads were randomly sampled from each of the sub-locations in stage two. A total of fifty household heads were sampled and interviewed using a standard interview schedule in each district.

TABLE 2. TABULATED MULTI-STAGE SAMPLING DESIGN

| STAGE | SAMPLING UNIT | METHOD |
|---|---|---|
| | 2 districts | Purposive |
| Stage 1 | 5 AEZs/district | Purposive |
| Stage 2 | 1 sub-location /AEZ | Random |
| Stage 3 | 10 household heads/ sub-location | Random |
| Final sample | 50 household heads / district | |

A list of all the horticultural farmers in each sub-location sampled was obtained from the village headman and/ or the organizations operating in the districts to improve the horticultural industry. This was then used as the sampling frame for randomization at the household level. The research was carried out when the horticultural commodities were in the season of production. This made it easier to identify the households that were actively engaged in the horticultural enterprise.

## 3.5 DATA COLLECTION

There are a number of techniques for data collection available for social science research. These techniques and methods are normally determined by the nature of research. In addition, factors like time availability, cost limitations, and the researchers training determine the choice of methods used.

This study benefited from both primary and secondary sources of data. All research questions were complied into a single research tool (questionnaire) that was administered to the household heads in the two study areas. The use of observations and informal interviews were limited to situations where the formal interview schedule was not sufficient to capture or clarify important issues for the research. For instance the techniques accommodated farmers' opinions, expectations and interactions in the community.

**Questionnaire;** The most useful tool for data collection was a questionnaire that contained both open and close-ended questions. The open-ended questions gave the interviewees a chance to express themselves fully while the close-ended ones simplified the process of recording down the responses. The questionnaire was administered to the heads of households. In the absence of the household head the second in command was called upon to respond to the questionnaire. Face-to-face interviews were used and the responses were recorded in the spaces provided in case of the close-ended questions. The study allowed a limited number of open-ended questions due to the cost of analysis.

The questionnaire acquired information on adoption of improved horticultural farming practices and inputs. It measured whether farmers adopted certain improved seedlings, better fertilisers, pesticides, irrigation methods and better plant maintenance methods. The questionnaire also gathered information on how the farmer viewed marketing of his/her horticultural products. The tool was also used to measure the level of participation.

**Secondary data;** was obtained from the local administrative offices, offices of other non-governmental organisations operating in the area and churches. These included monthly reports, annual reports and

statistical records. These secondary data availed to the study information on horticultural production, number of farmers in horticultural production, size of farms, general incomes and other general information.

To carefully study farmer participation in the adoption of horticultural innovations, it was vital to obtain background information on the variables. This involved collecting data from unpublished and published sources. The main sources of such data were libraries from the ministry of agriculture and livestock development at the district level.

The disadvantages of the secondary data were that the findings obtained through this method represented an official view on the situation. This information was likely to be biased. Apart from this the records were not a representation of the whole district and there was no data on farm output in specific divisions and locations of the district.

### 3.5.1 METHODS OF DATA ANALYSIS AND THE STATISTICAL MODEL

The raw data obtained from the field may not be important to research if it is not presented and analysed in a scientifically justified manner. On this premise it's worthwhile to note that the raw data that was obtained from the field by use of questionnaires was first coded to enable the compilation of frequencies of the occurrences of key variables. The

coding scheme was prepared after the fieldwork on the basis of the categories that emerged from the information given.

Both descriptive and inferential statistics were used depending on the characteristics of variables and their levels of measurements.

**Descriptive statistics**. These are statistics used for the purpose of summarizing and condensing raw data in to forms that supply useful information efficiently. Descriptive statistics comprises ways of reducing large masses of data into forms that can be clearly appreciated. It tends to describe the data to make more sense to the reader. These are important in giving information on the totals of frequencies, percentages and the mean. The mean was used in this study to summarize frequencies. The mean is obtained by summing up the individual values (X) and dividing by their total number (N).

Mean $\overline{X} = \frac{\sum X}{N}$

Where: X- individual values
N- Total number.
$\sum$- summation

The mean is referred to as the measure of central tendency since it tells the researcher about the central characteristics of a distribution. It is used to describe a sample by the character of most of its members.

**Inferential Statistics;** this is a method of understanding whole populations on the basis of representative samples. These are the most important in any scientific venture since they assist the researcher to make inferences, conclusions and recommendations. The inferential statistics tools used in this study include: (1) cross tabulations, (11) chi-square and (111) measures of association.

**Cross tabulation;** this is a joint frequency distribution of cases according to two or more classificatory variables. The technique is to display the distribution of cases by their distribution of variables by use of contingency tables. These can then be used for chi-square analysis.

**Chi square ($X^2$) statistics;** this is a test of the overall fit of one set of data with another. The null hypothesis that states no difference between two populations from which the data is obtained from is tested on the alternate hypothesis that states presence of difference between two populations. The fit has to be perfect and be able to exclude the sampling errors encountered in collecting the data. The test is therefore used in testing for the association or lack of it between two variables (independent and dependent variables). Chi square was used to test the statistical significance, which helps to determine whether a systematic relationship exists between two variables. It was used in order to assess the significance of the relationship between the variables. This was

computed by simply establishing the difference between the calculated (expected) and the observed frequencies. The distribution of the differences between the observed values has been found to approximate the $X^2$ distribution as indicated by the formula below.

$$X^2 = \sum \left[ \frac{(O-E)^2}{E} \right]$$

Where: O= observed
E= expected

In this study the Chi-square was not used as a test for goodness of fit but as a test of independence. It was used to test the independence of two variables on which frequency data are available. The method entails that both variables in the table are at nominal level, a condition that was catered for in this study. A null or alternate hypothesis was accepted or rejected at or beyond the 95% level of confidence. The degree of freedom (R-1) (C-1), the $\alpha$ value and the $X^2$ values were compared.

**Measures of association or correlation;** this is a measure that indicates how two variables are related to each other. It indicates the extent of which two variables are correlated. This test was used in the study on all bivariate distributions that were paired in logical format. The test can either give a positive correlation, negative correlation or a zero correlation.

The Pearson product-moment correlation coefficient (r) was used in the study to express the degree of relationship that exists between two variables. This method was developed by Karl Pearson.

$$r = \frac{\sum (Zx\ Zy)}{N}$$

Where: R= Pearson's correlation coefficient.
Zx= Z score for variable X.
Zy= Z score for variable Y.
N= No. of pairs of X and Y values.

The formulae shows that if we have high scores of variable X and high scores of variable Y then the correlation is positive. The r-value always lies between −0.99 to +0.99. When r is more than +0.9 for two variables it means that high values of variable X will be accompanied by high values for variable Y.

## 3.6 OPERATIONALIZATION OF VARIABLES

For successful practical implementation of an inquiry it is important to define the hypothesis and the variables therein in terms of indicators that will be used to measure them. This clarifies the method of study to the investigator and all stakeholders. The value of a good hypothesis diminishes if the variables lack clear indicators that are conveniently measurable. The importance of this section cannot be overemphasized. In the sequel, variables in each of the four hypotheses proposed in this research are defined.

**Farmer participation in horticultural improvement programmes**

This variable was measured by use of the seven indicators below.

1. *Farmer's attendance to demonstrations in horticulture.* This variable had three categories; Farmers who attended >3 demonstrations in six months were placed high on the participation scale. Those who attended 1-2 demonstrations were medium participators and those who did not attend to any of the demonstration in the six months were considered low on the participation scale.
2. *Farmer's attendance to agricultural shows.* Farmers who attended 2 agricultural shows in the past two years were placed high on the participation scale. Those who attended 1 agricultural show were medium participators while those who did not attend to any of the agricultural shows were considered low on the participation scale.
3. *Farmer's Community leadership roles.* Farmers who were engaged in community leadership were placed high on the participation scale while those who did not have leadership roles were considered low on the participation scale.
4. *Farmer's attempts to solve own farm problems.* Farmers who seek to get advice from friends and extension agents were placed high on the participation scale. Those who waited for extension agents to visit were medium participators while those who took no step to solve their farm problems were considered low participators.

5. *Farmer's initiative to consult horticultural extension agents.* Farmers who consulted extension agents on weekly basis were high on the participation scale. Those who consulted monthly and quarterly were considered medium participators while those who never approached extension agents were considered low on the participation scale.
6. *Farmer's attendance to public barazas.* Farmers who attended more than 3 barazas in one year were placed high on the participation scale. Those who attended 1 to 2 barazas were considered medium participators while those who did not attend barazas were considered low on the participation scale.
7. *Farmer's membership in community based organizations.* Farmers who were members of community based organizations were placed high on the participation scale, while those who were not members of community based organizations were considered low participators.

**Adoption of Improved Farming Practises**

This is a dependent variable and in this study it is defined and measured by use of the seven indicators below.

a) *Use of tissue culture seedlings.*
b) *Use of knapsack sprayers.*
c) *Use of chemical herbicides.*
d) *Use of economic drip irrigation.*
e) *Use of leguminous cover crops.*

f) *Use of agroforestry.*

g) *Use of contour ploughing.*

The farmers who adopted these techniques and practises and used them in every cropping season were classified as high adopters. Those farmers who adopted these techniques partially, and did not use them in every cropping season were termed medium adopters, while those farmers who never adopted any of the practises and techniques were placed low on the adoption scale.

**Farmer personal characteristics**

This is a dependent variable in this study and it is defined by three factors:

a) *Age.* This is measured in years lived up to time of data collection and it is categorized in to four clusters for the purpose of this research. The first is the farmers who have less than 30 years of age. The second is farmers with 30-45 years of age, the third is 45-60 years of age and the last category is greater than 60 years of age.

b) *Formal education.* This was measured by the number of years of formal school education undertaken by farmers. Four categories were identified and utilized in the study; farmers who had never undertaken formal education, those who had 1-4 , those who had 5-8 and those who had more than 8 years of formal education.

c) *Marriage status.* This factor was measured by whether a farmer (respondent) was married or not. It had four categories; Single, married, divorced and widowed.

**Accessibility to Horticultural Markets**

This is a dependent variable in this study and it is defined by two factors:

a) *Distance from the market to the farm*

This factor categorized farmers based on the distance that the farmer had to travel to the closest horticultural market. Farmers were categorized as being near, average or far from the market. Those who were near included those who sold their commodities at the farm gate and to their neighbors. Average farmers included all those who had to sell their commodities 4-6 km away from their farm while farmers in the far category included all those who had to sell their commodities more than seven kilometers away from their farm.

b) *Post-harvest losses of products*

This factor was measured by the amount of post harvest losses that a farmer suffered between harvesting his products to sale. The losses were in form of rots, insect attacks, abrasion blemishes due to transportation, dehydration of fresh produce and even theft. Based on the losses the farmers were categorised in to three; Farmers who

endured >50%, farmers who endured 25%-50%, and farmers who endured <25% post harvest losses.

## 3.7 CONCLUSION

The validity of all scientific data rests squarely on the methods of sampling, data collection, data analysis and interpretation. This chapter focused on integrating all this aspects in the research. The chapter described the two study sites Kakamega and Machakos and provided the rationale of their selection. The sampling design was described and a multistage design was used in which a total of 50 household heads were sampled from each of the study districts. Ways of incorporating both Primary and secondary data in the research are clearly described. In addition the chapter describes how both descriptive and inferential statistics were used to analyse the data. Finally all the variables in the study are concisely operationalized.

# CHAPTER FOUR

## 4.0 DATA PRESENTATION

### 4.1 INTRODUCTION

The data collected from the two districts is presented in this section. This data includes all aspects of farmers' participation in horticultural extension, farmers' adoption of improved horticultural practises, farmers' personal characteristics, and farmers' accessibility to horticultural markets. These data have been presented in tables and graphs showing the comparison of the two study districts. In the two dependent variables (farmers' participation in horticultural extension and farmers' adoption of improved horticultural practises) the individual respondent's data was scored based on the indicators and added up to summarize the variables performance in every district. According to Gutman, indicators showing similar characteristics can be aggregated to describe a variable. Data from the independent variables (farmers' personal characteristics, and farmers' accessibility to horticultural markets) was not aggregated since the indicators chosen to study the variables were not similar. These results are presented in tabular and graphical form.

### 4.2 FARMER PARTICIPATION IN HORTICULTURAL IMPROVEMENT PROGRAMMES

In this study Farmer participation in horticultural improvement programmes was seen as the drive for adoption of better horticultural

farming practices that leads to reduction of agronomic, cultural, economic or infrastructural constraints to horticultural production. It was proposed that those farmers who participated in horticultural improvement programmes were more likely to make a wide range of adoptions. Data on participation of farmers in agricultural extension is presented in the sequel with the guidance of the variables below:

a) Farmer's attendance to demonstrations in horticulture.
b) Farmer's attendance to agricultural shows.
c) Farmer's Community leadership roles.
d) Farmer's attempts to solve own farm problems.
e) Farmer's initiative to consult agricultural extension agents.
f) Farmer's membership in community based organizations.
g) Farmer's attendance to public barazas.

a) Farmer's attendance to demonstrations in horticulture. This indicator was used to measure participation in this study. The ability of a farmer to attend to horticultural demonstrations is seen as an effort by the farmer to participate in issues that would benefit his /her horticultural activities. Respondents were asked how many demonstrations they had attended to in the past six months.

Table 3: Data on farmer's attendance to horticultural demonstrations

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| No. of demonstrations attended | Frequency | Percent | Frequency | Percent |
| >3 | 14 | 28 | 29 | 58 |
| 1-2 | 15 | 30 | 17 | 34 |
| none | 21 | 42 | 4 | 8 |
| TOTAL | 50 | 100 | 50 | 100 |

The data in Table 3 shows that in Machakos district, there was higher participation in attendance to horticultural demonstrations than was the case in Kakamega district. Out of the total sampled in Machakos 58% attended to more than three demonstrations, 34% attended 1-2 demonstrations while only 8% did not attend. On the other hand 28% of the Kakamega farmers attended to 3 demonstrations, 30% attended 1-2 demonstrations while 42% did not attend to a single demonstration. This clearly shows that the farmers from Machakos district were exposed to more horticultural information through demonstrations than their counterparts from Kakamega district.

b) Farmer's attendance to agricultural shows. The ability of a farmer to adopt new practices for better production in the horticultural industry is also determined by attendance to well organised provincial agricultural shows. Farmers who attend such shows on a regular basis show greater participation and thus may be able to adopt more practises for improved horticulture. Respondents were asked how many agricultural shows they had attended in the past two years.

Table 4: Data on farmer's attendance to agricultural shows

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| No. of agric. shows attended | Frequency | Percent | Frequency | Percent |
| 2 | 30 | 60 | 40 | 80 |
| 1 | 12 | 24 | 9 | 18 |
| none | 8 | 16 | 1 | 2 |
| TOTAL | 50 | 100 | 50 | 100 |

The results in Table 4 show that 60% of the respondents from Kakamega and 80% of the respondents in Machakos attended two agricultural shows in the past two years. From the results 24% of the respondents from Kakamega and 18% of the respondents in Machakos attended one agricultural show in the past two years. More farmers in Kakamega (16%) did not attend to any agricultural show as opposed to the case in Machakos where only 2% did not attend to any district agricultural shows in the past two years.

c) Farmer's Community leadership roles. Farmers engaged in some form of community leadership have the potential to be more participative in the community initiatives. From the field work its was noted that leaders were mainly chosen due to the active role they play in the various community gatherings or due to the success that is seen on their farms. Individual's leadrship roles were used to measure the level of participation of the individual farmers. The respondents were asked whether they were engaged in community leadership.

Table 5: Data on farmer's leadership roles

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Have leadership roles | Frequency | Percent | Frequency | Percent |
| Yes | 37 | 74 | 32 | 64 |
| No | 13 | 26 | 18 | 36 |
| TOTAL | 50 | 100 | 50 | 100 |

The results, as presented in Table 5 show that 74% of the respondents in Kakamega and 64% of Machakos respondents were engaged in community leadership, while only 26% of the respondents in Kakamega and 36% of Machakos respondents were not engaged in community leadership roles.

In this indicator of participation, it is worthwhile to note that the respondents in Kakamega seemed to out weigh their counterparts in Machakos by exhibiting higher leadership scores. The research had postulated that the horticultural farmers engaged in community leadership activities participated more in horticultural extension activities than those who did not have any leadership roles.

d) Farmers' attempts to solve own farm problems. In an attempt to measure participation the study required the respondents to provide information on how they attempt to solve farms problems. It was contended that if farmers make an effort to solve their own problems then their participation index was high. This meant that they would get more access to horticultural production information and diminish farm problems by adopting these novel technologies and practices. Farmers were asked whether they tried to solve their problems and if they did

what actions they took towards this goal. They responded as presented below in Table 6.

Table 6: Data on farmer's attempts to solve own problems.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Actions taken to solve problems | Frequency | Percent | Frequency | Percent |
| Seeks advice from friends and extension agents | 21 | 42 | 39 | 78 |
| Consults text books agricultural | 5 | 10 | 1 | 2 |
| Waits for extension agents farm visits | 24 | 48 | 10 | 20 |
| Takes no step | 0 | 0 | 0 | 0 |
| TOTAL | 50 | 100 | 50 | 100 |

Table 6 shows that 42% of the respondents from Kakamega and 78% of the respondents in Machakos approached friends and extension agents to seek for ways of remedying farm problems. Few farmers (10% in Kakamega and 2 % in Machakos) took time to consult agricultural textbooks. More farmers in Kakamega (48%) tended to wait for extension agents than was the case in Machakos (20%). No farmer responded by saying that they took no steps in solving their own problems both in Machakos and Kakamega.

e) Farmers' initiative to consult horticultural extension agents. The study asserted that, farmers own initiative to consult the horticultural extension officers was an indicator to the level of farmer participation. The respondents were asked to state how frequently they had approached

horticultural extension agents for advice in the previous year. The results were as presented in Table 7.

Table 7: Data on farmer's frequency of consulting horticultural extension agents.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Consultation period | Frequency | Percent | Frequency | Percent |
| Weekly | 4 | 8 | 5 | 10 |
| Monthly | 7 | 14 | 7 | 14 |
| Quarterly | 20 | 40 | 31 | 62 |
| Never approached | 19 | 38 | 7 | 14 |
| TOTAL | 50 | 100 | 50 | 100 |

The results, as presented in Table 7 shows that 8% of the respondents in Kakamega and 10% of Machakos respondents took the initiative to consult the horticultural extension officers weekly. The results also show that 14% of farmers in both Kakamega and Machakos consulted the horticultural extension officers on a monthly basis. More farmers consulted the horticultural extension officers on quarterly basis in both districts. Kakamega showed 40% while Machakos had 62%. Beyond this 38% of the farmers in Kakamega and 14% of the farmers in Machakos never approached horticultural extension officers.

f) Farmers' attendance to public barazas. The study postulated that, farmers who attended public functions such as public barazas, would have a chance to participate in the agricultural extension process better than those who otherwise did not attend the functions. Respondents were

asked how many barazas they had attended to in the past one year. The results are presented in Table 8.

Table 8: Data on farmer's attendance to public barazas

| Kakamega | | | Machakos | | |
|---|---|---|---|---|---|
| No. of barazas attended | Frequency | Percent | No. of barazas attended | Frequency | Percent |
| >3 | 19 | 38 | >3 | 33 | 66 |
| 1-2 | 20 | 40 | 1-2 | 12 | 24 |
| none | 11 | 22 | none | 5 | 10 |
| TOTAL | 50 | 100 | TOTAL | 50 | 100 |

The table shows that 38% of the respondents in Kakamega and 66% of the respondents in Machakos attended more than three barazas in the past one year. In Kakamega 40% of the respondents attended 1-2 barazas while in Machakos there were only 24%. Apart from this 22% of the farmers in Kakamega and only 10 % of Machakos farmers did not attend the barazas within the past one year.

g) Farmers' membership in community based organizations. This study contended that membership of farmers in community based organization promoted the participation of farmers in horticultural extension activities. Members were expected to be organized in such a way as to enhance the chances of extension. The respondents were asked whether or not they were members of community-based organizations and their responses are shown in Table 9.

Table 9: Data on membership in community based organizations.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Membership to CBOs | Frequency | Percent | Frequency | Percent |
| Yes | 29 | 58 | 43 | 86 |
| No | 21 | 42 | 7 | 14 |
| TOTAL | 50 | 100 | 50 | 100 |

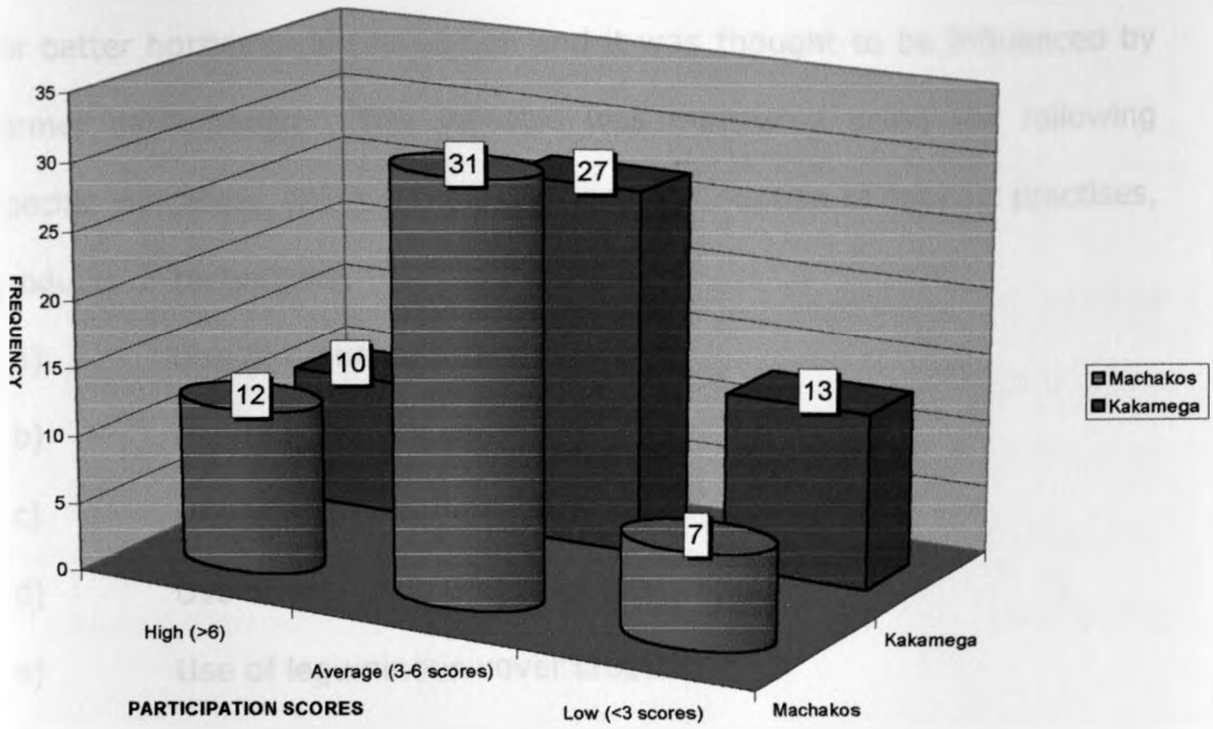
The results show that 58% of the respondents from Kakamega and 86% of the respondents from Machakos were members of community based organizations, while 42% of farmers from Kakamega and only 14% of farmers from Machakos participated in community based organizations and were therefore potentially highly participative in the agricultural extension process. This showed that the farmers from Machakos were more participative in community based organizations than those in Kakamega.

h) Respondents' participation in the horticultural extension process.

The scores obtained by each of the respondents on all of the seven indicators of the variable participation listed earlier, were added up and the distribution was as shown in and chart 1 below.

Chart 1 shows that the level of participation was high among 20% of the farmers from Kakamega and 24% of the farmers in Machakos. Participation was average among 54% of the farmers from Kakamega and 62% of the farmers in Machakos. Participation was low among 26% of the farmers from Kakamega and 14% of the farmers in Machakos.

CHART 1. RESPONDENTS LEVELS OF PARTICIPATION




The results shows that the majority of the farmers in both of the study districts participated averagely in the extension process, but Machakos results show that more respondents had above average participation in the process of horticultural extension.

## 4.3 ADOPTION OF BETTER HORTICULTURAL PRACTICES

The horticultural enterprise is one of the most lucrative in agriculture. Therefore produce standards are maintained on the higher side, so as to ensure good marketable quality. Horticultural farmers are therefore

required to possess and practice the most recent production and quality standards. Thus adoption is supposed to be a continuous process for these farmers. Thus in this study adoption was considered a prerequisite for better horticultural production and it was thought to be influenced by farmer participation. This variable was measured using the following specific indicators, which were based on the adoption of specific practises, products or techniques.

a) Use of tissue culture seedlings.

b) Use of knapsack sprayers.

c) Use of chemical herbicides.

d) Use of economic drip irrigation.

e) Use of leguminous cover crops.

f) Use of agroforestry.

g) Use of contour ploughing.

a) Use of tissue culture seedlings. Disease prevalence and lack of true to type seedlings have been common problems in horticultural production in the country. One way of remedying these problems in farmers' fields is by the use of tissue culture seedlings, which are being extensively promoted in the two districts. In this study a farmer who uses these seedlings was considered as an adopter of the better horticultural production practises. Respondents were asked whether they used tissue-cultured seedlings

(bananas or citrus) in their farms. The response received is as shown below in Table 10.

Table 10: Data on adoption of tissue culture seedlings

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Adopted tissue culture seedlings | Frequency | Percent | Frequency | Percent |
| Yes | 27 | 54 | 35 | 70 |
| No | 23 | 46 | 15 | 30 |
| TOTAL | 50 | 100 | 50 | 100 |

As shown in Table 10, 54% of the respondents in Kakamega had adopted the use of tissue culture seedlings while 46% had not adopted these superior planting materials. In Machakos district 70% of the respondents had used tissue culture seedlings in their farms, while only 30% had not. This shows high adoption rate in both study areas but Machakos giving higher frequencies.

b) Use of knapsack sprayers. These sprayers are absolutely critical for effective and safe spraying of chemicals on horticultural plants and on the plants environment. The knapsack is also used to determine the exact amounts of chemical that can be sprayed on the harvestable portion of the plant. This is absolutely vital for export based horticultural produce due to the necessity to maintain the maximum residue levels of a certain recalcitrant compounds below a given level. Respondents were asked whether or not they used Knapsack sprayers and their responses are Shown in Table 11 below.

Table 11: Data on use of knapsack sprayers.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Knapsack sprayers used | Frequency | Percent | Frequency | Percent |
| Yes | 20 | 40 | 26 | 52 |
| No | 30 | 60 | 24 | 48 |
| TOTAL | 50 | 100 | 50 | 100 |

The respondents in Kakamega district showed that they had adopted less of the use of the knapsack sprayers. Only 40% had accepted the sprayers while 60% did not use the sprayers. In Machakos 52% had accepted the sprayers as compared to the 48% who had not accepted to use the sprayers. This implied that 60% of respondents in Kakamega and 48% of the respondents in Machakos either used hand sprayers or never bothered spraying their crops. These farmers who did not use sprayers adduced lack of money to their non-adoption of the sprayers.

c) Use of chemical herbicides. Uncontrolled proliferation of weeds along side horticultural crops causes low yield and poor quality produce. The study noted that the use of hand to weed within horticultural gardens or orchards is uneconomical and slow. Thus it's vital to use chemical herbicides that are accepted internationally due to their easy degradability in the soil. Respondents were asked to state whether or not they applied chemical herbicides in their farming activities. Their responses are shown in Table 12 below.

Table 12: Data on use of chemical herbicides.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Herbicides used | Frequency | Percent | Frequency | Percent |
| Yes | 19 | 40 | 27 | 52 |
| No | 31 | 60 | 23 | 48 |
| TOTAL | 50 | 100 | 50 | 100 |

The results show that 40% of the respondents from Kakamega and 52% of the respondents from Machakos applied chemical herbicides in their horticultural farming activities, while 60% of farmers from Kakamega and 48% of farmers from Machakos did not apply chemical herbicides in their farming activities. This practise was averagely adopted in both districts but Machakos showed higher rates of adoption.

d) Use of economic drip irrigation. The persistent use of rain fed agriculture is a major limiting factor to agricultural production in the country. This is due to the uncertainty and the current unpredictability of long-term weather condition due to the depletion of the ozone layer and various other effects brought about due to the high levels of deforestation and desertification. Thus, the use of economic irrigation techniques such as drip irrigation has been extensively publicized in most districts that experience a drought season within its annual climatic calendar. On this premise the research contended that any farmer who used such economic irrigation techniques was an adopter. Respondents were asked whether they had adopted economic irrigation techniques or not. The results are as presented in Table 13.

Table 13: Data on use of economic and drip irrigation.

| Kakamega | | | Machakos | | |
|---|---|---|---|---|---|
| Drip irrigation used | Frequency | Percent | Drip irrigation used | Frequency | Percent |
| Yes | 1 | 2 | Yes | 23 | 46 |
| No | 49 | 98 | No | 27 | 54 |
| TOTAL | 50 | 100 | TOTAL | 50 | 100 |

The results in Table 13 show that only 2% of the respondents from Kakamega and 46% of the respondents from Machakos applied economic and drip irrigation techniques during their horticultural production, while 98% of farmers from Kakamega and 54% of farmers from Machakos did not apply economic and drip irrigation techniques during their horticultural production. The big variation between the two districts could be due to the shorter drought period in Kakamega as opposed to an extensive dry period in Machakos.

e) Use of leguminous cover crops. Leguminous cover crops are important in horticulture since they prevent soil erosion, serve as alternative hosts for pests and diseases, stifle weed growth due to their wide leaves and provide environment for rhizobial activity and thus nitrogen fixation in to the soil. Farmers are normally encouraged to use these crops as intercrops between their horticultural crops. Farmers who have accepted this practise are considered as adopters. Respondents were asked whether they use leguminous cover crops or not. The responses were as shown in Table 14.

Table 14: Data on use of Leguminous cover crops.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Cover crops used | Frequency | Percent | Frequency | Percent |
| Yes | 20 | 40 | 26 | 52 |
| No | 30 | 60 | 24 | 48 |
| TOTAL | 50 | 100 | 50 | 100 |

As shown in Table 14, 40% of the respondents in Kakamega had adopted the use of leguminous cover crops while 60% had not adopted this technique. In Machakos district 52% of the respondents had adopted leguminous cover crops in their farms, while 48% had not. This shows high adoption rate in both study areas but Machakos giving higher frequencies.

f) Use of agroforestry. Agroforestry is now widely recommended in rural areas, for it is a practice that attempts a solution to many rural problems including soil erosion along riverbanks, ecological balance, and shortage of fuel wood and desertification. This study considered its adoption as a step in the direction of horticultural improvement. Respondents were asked to state whether or not they practiced agroforestry and their responses are shown in Table 15 below.

Table 15:Data on use of agroforestry.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Agroforestry used | Frequency | Percent | Frequency | Percent |
| Yes | 39 | 78 | 21 | 42 |
| No | 11 | 22 | 29 | 58 |
| TOTAL | 50 | 100 | 50 | 100 |

Table 15 shows that majority of the respondents in Kakamega (78%) had in the course of their farming activities practised agroforestry, while the minority (22%) had not practised agroforestry. In Machakos 42% of the respondents had practised agroforestry while 58% had not. Farmers in Kakamega seemed to practise agroforestry more than those in Machakos and this was attributed to farmers in Kakamega having more land at their disposal than those in Machakos.

g) Use of contour ploughing. This is a technique that improves soil conservation by avoiding soil erosion along steep land. The technique increases available land for horticulture and enhances growing of foliage and fodder along the contours. This technique has been publicised in both districts by various extension agents. Respondents were asked whether they had adopted this technique. The results are presented below.

Table 16:Data on use of contour ploughing.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Contour ploughing | Frequency | Percent | Frequency | Percent |
| Yes | 22 | 44 | 34 | 68 |
| No | 28 | 56 | 16 | 32 |
| TOTAL | 50 | 100 | 50 | 100 |

From Table 16, 22% of the respondents in Kakamega had adopted the use of contour ploughing while 56% had not adopted this technique. In Machakos district 68% of the respondents had adopted contour ploughing in their farms, while 32% had not. Farmers from Machakos district

adopted more of this technique than their counterparts in Kakamega due to disposal to less arable land which was also hilly.

n) Respondents Adoption of Improved Horticultural Practices

The scores obtained by each of the respondents on all of the seven indicators of the variable adoption listed earlier, were added up and the distribution was as shown in Chart 2.

**CHART 2: LEVELS OF ADOPTION**

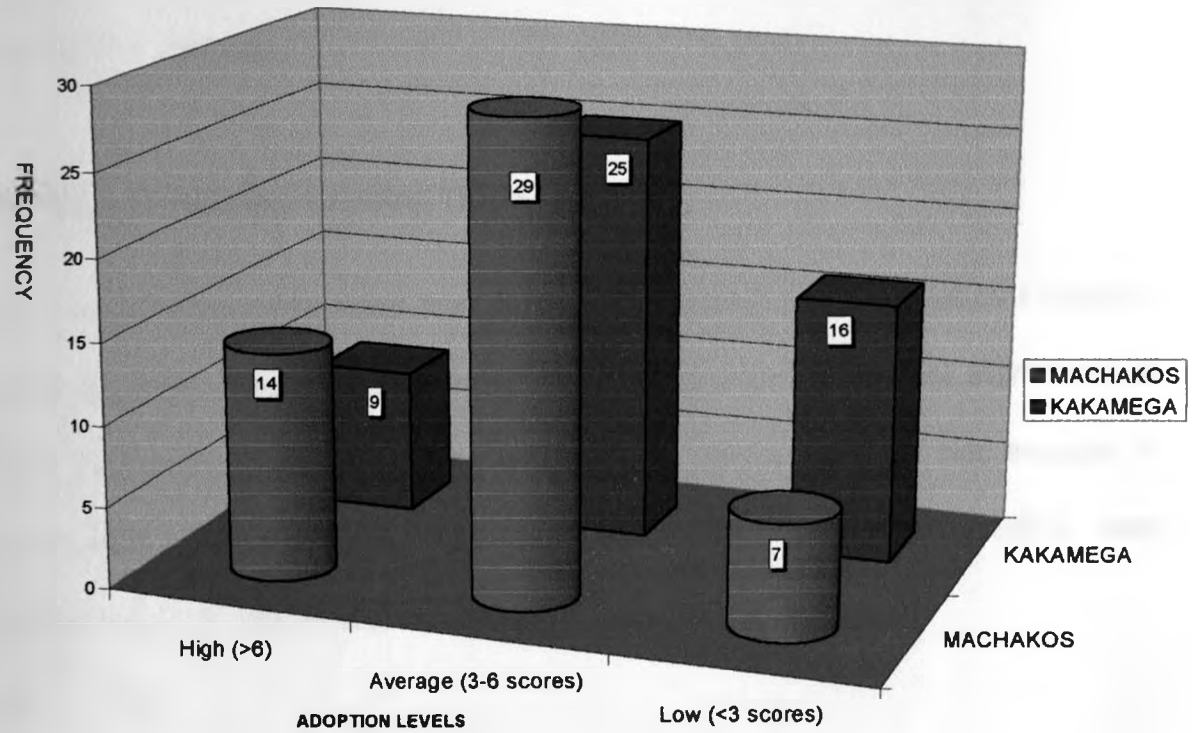



Chart 2, indicates that adoption was higher in Machakos than in Kakamega. Further to this adoption was high among 18%and 28% of

farmers in Kakamega and Machakos respectively. Adoption was average among 50% and 58% of farmers in Kakamega and Machakos respectively and low among 32% and 14% of farmers in Kakamega and Machakos respectively. This implies that Machakos farmers were better adopters of the various horticultural production techniques and this was also confirmed by their field yields and production.

These disparities in adoption may be a result of various factors noting the fact that the two districts are geographically separated. For the purposes of this study we will find out whether these disparities were due to their levels of participation in horticultural extension, in the next chapter during the analysis.

## 4.4 FARMER PERSONAL CHARACTERISTICS

The research hypothesized that farmer's personal characteristics influence participation in horticultural improvement activities. Different attributes of each farmer tend to determine whether he can engage or not engage in participatory activities at the community level. The variable was measured with the indicators below;

a) Age.

b) Formal education.

c) Marriage status.

a) *Age.* The research proposed that the age of a respondent determined his/her ability to participate in horticultural extension. This influenced the respondent's adoption of improved horticultural practises and technologies. Respondents were required to give their age during the formal interview.

Table 17: Data on farmer's age.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| AGE | Frequency | Percent | Frequency | Percent |
| < 30 | 7 | 14 | 6 | 12 |
| 30-45 | 20 | 40 | 19 | 38 |
| 45-60 | 16 | 32 | 15 | 30 |
| > 60 | 7 | 14 | 10 | 20 |
| TOTAL | 50 | 100 | 50 | 100 |

Table 17 outlines the results obtained on the variation of farmers' ages within the two study districts. In Kakamega 14% of the respondents were less than 30 years old, 40% had 30-45 years, 32% had 45-60 years while only 14 % had more than 60years.

This is almost similar to the case in Machakos where 12% of the respondents were less than 30 years old, 38% had 30-45 years, 30% had 45-60 years while only 20 % had more than 60years.

b) *Formal education.* The research proposed that the respondent's educational standard determined his/her ability to participate in horticultural extension. This influenced the respondent's adoption of

improved horticultural practises and technologies. Respondents were required to outline their educational status during the formal interview.

Table 18:Data on farmer's education.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Yrs of education | Frequency | Percent | Frequency | Percent |
| none | 17 | 34 | 14 | 28 |
| 1-4 | 14 | 28 | 18 | 36 |
| 5-8 | 12 | 24 | 11 | 22 |
| >8 | 7 | 14 | 7 | 14 |
| TOTAL | 50 | 100 | 50 | 100 |

Table 18 shows the results obtained on the education status of farmers within the two study districts. In Kakamega 34% of the respondents had not attended any form of formal education, 28% had undergone formal education for 1-4 years, 24% had undergone formal education for 5-8 years while only 14 % had undergone formal education for more than eight years. This is contrary to the case in Machakos where 28% of the respondents had not attended any form of formal education, 36% had undergone formal education for 1-4 years, 22% had undergone formal education for 5-8 years while only 14 % had undergone formal education for more than eight years.

c) *Marriage status.* The research proposed that the marital status of a respondent determined his/her ability to participate in horticultural extension. This influenced the respondent's adoption of improved

horticultural practises and technologies. Respondents were required to outline their marital status during the formal interview.

Table 19: Data on farmer's marriage status.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Marriage status | Frequency | Percent | Frequency | Percent |
| Single | 4 | 8 | 2 | 4 |
| Married | 35 | 70 | 39 | 74 |
| Divorced | 2 | 4 | 3 | 6 |
| Widowed | 9 | 18 | 6 | 12 |
| TOTAL | 50 | 100 | 50 | 100 |

Table 19 shows the results obtained on the marriage status of farmers within the two study districts. In Kakamega 8% of the respondents had never married before, 70% were married, 4% were divorced while 18 % of the respondents were widowed. This is comparable to the case in Machakos where 4% of the respondents had never married before, 74% were married, 6% were divorced while 12% of the respondents were widowed.

## 4.5 ACCESSIBILITY TO HORTICULTURAL MARKETS

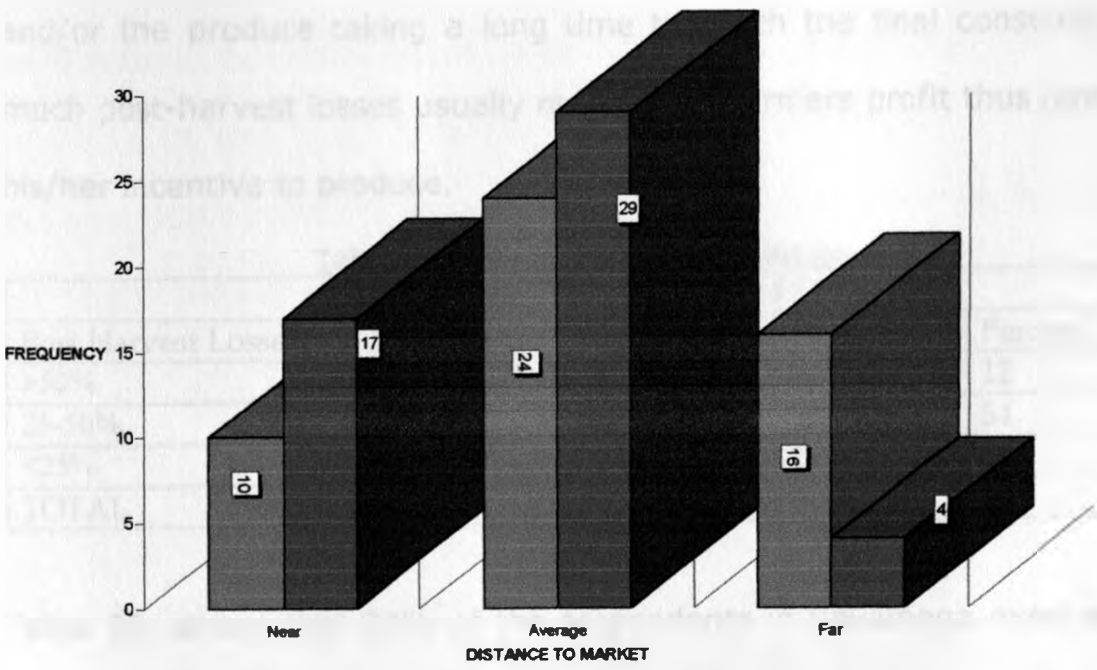
In this hypothesis the research attempted to establish how closeness to markets tended to encourage the farmers to participate in the communal horticultural activities. Accessibility to horticultural markets was the independent variable while participation in horticultural improvement programmes was the dependent variable. The independent variable was measured on the basis of the following indicators;

a) Distance from the market to the farm

b) Post-harvest losses of products

a) *Distance from the market.* The nature of horticultural products is such that they are perishable. They require quick marketing so as to be able to sustain profits. The quality of these products diminishes exponentially immediately after harvest, thereby affecting the prices and potential of sale and marketing. Thus the distance from a market can determine the profits of any horticultural enterprise. The farmers were asked to respond to the question whether the market was near, average or far. Results are presented in Chart 3.

CHART 3 DATA ON DISTANCE TO MARKET



As shown in Chart 3, 20% of the respondents in Kakamega felt they were near to a market, 48% felt they were neither far nor near the markets, while 32% felt that they were quite far from the market place. In Machakos district 34% of the respondents felt they were near to a market, 58% felt they were neither far nor near the markets, while 8% felt that they were quite far from the market place. The difference on this indicator between the two districts was very elaborate since in Machakos there are some business people who collect horticultural products from the farm-gate, though at relatively low prices.

b) *Post-harvest losses of products.* These are losses incurred on most agricultural produce after being harvested from the farm. These losses might be incurred due to poor storage, diseases, poor transportation and/or the produce taking a long time to reach the final consumer. To much post-harvest losses usually reduces the farmers profit thus reducing his/her incentive to produce.

Table 20:Data on post harvest losses.

| | Kakamega | | Machakos | |
|---|---|---|---|---|
| Post Harvest Losses | Frequency | Percent | Frequency | Percent |
| >50% | 15 | 30 | 6 | 12 |
| 25-50% | 23 | 46 | 27 | 54 |
| <25% | 12 | 24 | 17 | 34 |
| TOTAL | 50 | 100 | 50 | 100 |

Table 20, shows that 30% of the respondents in Kakamega experienced more than 50% post harvest losses before getting to the market, 46%

had 25%-50% post harvest losses, while 24% had less than 25% post harvest losses. In Machakos district 12% of the respondents experienced more than 50% post harvest losses before getting to the market, 54% had 25%-50% post harvest losses, while 34% had less than 25% post harvest losses. This difference can also be attributed to the situation where in Machakos there are some business people who collect horticultural products from the farm-gate, as opposed to their counterparts in Kakamega. This reduces the post harvest losses.

## 4.5 CONCLUSION

Data obtained was presented in this chapter to demonstrate the similarities and differences inherent in the two districts in respect to the four variables and their indicators. The first variable (farmers' participation in horticultural extension) was measured by seven indicators. It was found that more farmers exhibited high and average levels of participation in Machakos than Kakamega. More farmers from Kakamega showed low levels of participation than from Machakos. In lieu of this it is worthwhile to conclude that Machakos farmers were more participative in horticultural extension than Kakamega farmers.

The second variable (farmers' adoption of improved horticultural practises) was also measured by use of seven indicators. From the results

86% of respondents from Machakos exhibited high to average adoption of improved horticultural practises while only 68% of Kakamega farmers had high to average adoption. This shows that Machakos farmers had a higher adoption index than their Kakamega counterparts. This concurs with the hypothesis that farmer participation boosts adoption of better practises.

The independent variable (farmers' personal characteristics) was measured using three variables. The results show that 54% of the farmers from Kakamega and 50% of the farmers from Machakos were aged below 45 years of age. The results also show that 14% of Kakamega farmers and 20% of Machakos farmers were aged above 60years of age. This shows differences in the age structures in the two districts. From the results 38% of the respondents from Kakamega and 36% of the respondents from Machakos had attended more than 5 years of formal education. The results also show that 70% of Kakamega farmers and 74% of Machakos farmers were in engaged in marriage relationships. The results also show disparities in farmer personal characteristics from the two districts.

The next independent variable accessibility to horticultural markets was measured and the results showed that 68% of the Kakamega farmers and 82% of the farmers from Machakos felt that the horticultural markets

were near or average. The results show that 76% of Kakamega farmers and 66% of Machakos farmers recorded more than 25% post-harvest losses. Wide differences were recorded in this variable across the two districts.

# CHAPTER V

## 5.0 RELATIONSHIP BETWEEN FACTORS OF STUDY

### 5.1 INTRODUCTION

The data presented previously is analysed in this chapter to decipher the relationships between the various variables of the study. The hypotheses proposed for this study are tested and either accepted or rejected based on statistical significance. In this chapter Chi square ($X^2$) statistics and the Pearson product-moment correlation coefficient (r) were used to infer from the representative sample the characteristics of the whole population. It is important to note that while the chi-square test brings out the strength of the relationship between the independent and dependent variables, the Pearson's product-moment co-efficient of correlation shows the strength and whether that relationship is positive or negative. Thus both techniques were used to test the hypotheses proposed for the study.

1. Farmer participation in horticultural improvement programmes positively influences their adoption of modern agricultural practices.

2. Farmer personal characteristics influence farmer participation in horticultural improvement programs.

3. Accessibility to horticultural markets encourages farmer participation in horticultural improvement programmes.

## 5.2 Farmers' participation in the horticultural improvement programmes and their adoption of improved farming practices.

This study hypothesized that farmer participation in horticultural improvement programmes positively influences their adoption of modern agricultural practices. The study postulated that farmers who participated in horticultural demonstrations, agricultural shows, public barazas and community leadership were better placed in adopting better agricultural practices. Farmers who had developed ways to solve their own farm problems and who frequently consulted with horticultural officers in their districts were thought to be better adopters of improved horticultural practices. With these assumptions, results on participation were cross-tabulated with adoption results in both districts and the results were as shown in Table 21 and 22 below.

Table 21 Kakamega farmers' adoption levels according to their levels of participation in horticultural improvement.

| | | ADOPTION LEVELS | | |
|---|---|---|---|---|
| | | HIGH | LOW | TOTAL |
| FARMERS PARTICIPATION IN HORTICULTURAL PROGRAMMES | HIGH | 12 | 9 | 21 |
| | LOW | 8 | 21 | 29 |
| | TOTAL | 20 | 30 | 50 |

$X^2 = 4.4334$ df = 1 Significant at 0.05 (95%). R = 0.443

Table 21 show the levels of adoption and the farmer participation levels. The Chi-square analysis gives un-reliable values when the observed or expected values are less than 5. Due to this the average column and row were collapsed to give a 2x2 matrix indicated in the

table in bold. The Chi-square value was calculated on a 2x2 matrix with 1 degree of freedom.

Table 21 shows that 8% of the respondents in Kakamega demonstrated high participation and high adoption levels. The majority of the respondents (34%) had average adoption and participation levels. The table also shows that 16% of the respondents exhibited both low participation and adoption. The cross-tabulation shows a chi-square value of 4.4334 at df = 1 and which is significant at 0.05 (95%) level of confidence. This shows a strong relationship between participation in horticultural extension and adoption of better farm practices.

**Hypotheses testing;**

This section marks the culmination of the statistical analysis by accepting or rejecting (using statistical evidence) either of the two hypotheses stated below:

- Null hypothesis ($H_0$) there is no relationship between participation in horticultural extension and adoption of better farm practices.
- Alternative hypothesis ($H_1$) farmers' participation in horticultural extension positively influences their adoption of better horticultural practices.

The independent variable is participation and the dependent variable is adoption. A chi-square test revealed a strong relationship ($X^2$= 4.4334 significant at 0.05 confidence level), between farmers' participation in the agricultural extension process and their adoption of improved

horticultural practices. The coefficient of correlation (r) of 0.443 shows a positive relationship between the two variables.

Table 22 Machakos farmers' adoption levels according to their levels of participation in horticultural improvement.

| MACHAKOS ADOPTION LEVELS | | | | |
|---|---|---|---|---|
| FARMERS PARTICIPATION IN HORTICULTURAL PROGRAMMES | | HIGH | LOW | TOTAL |
| | HIGH | 20 | 6 | 26 |
| | LOW | 9 | 15 | 24 |
| | TOTAL | 29 | 21 | 50 |

$X^2 = 7.9622$ df = 1 Significant at 0.05 (95%) R = 0.597

Table 22 shows the levels of adoption and the farmer participation levels. The Chi-square analysis gives un-reliable values when the observed or expected values are less than 5. Due to this the average column and row were collapsed to give a 2x2 matrix indicated in table 22 he Chi-square value was calculated on a 2x2 matrix with 1 degree of freedom.

Table 22 shows that 16% of the respondents in Machakos district demonstrated high participation and high adoption levels this was higher than that of the farmers in Kakamega. The majority of the respondents (40%) had average adoption and participation levels. The table also shows that 10% of the respondents exhibited both low participation and adoption. The cross-tabulation shows a chi-square value of 7.96 at df=1 and which is significant at 0.05 (95%) level of confidence. This shows a

strong relationship between participation in horticultural extension and adoption of better farm practices in Machakos.

***Hypotheses Testing;***

- Null hypothesis ($H_0$) there is no relationship between participation in horticultural extension and adoption of better farm practices.
- Alternative hypothesis ($H_I$) farmers' participation in horticultural extension positively influences their adoption of better horticultural practices.

The independent variable is participation and the dependent variable is adoption. A chi-square test revealed a strong relationship ($X^2$ = 7.9622 significant at 0.05 confidence level), between farmers' participation in the agricultural extension process and their adoption of improved horticultural practices (Table 22). The coefficient of correlation (r) of 0.597 shows a positive relationship between the two variables. This shows that the relationship between participation and adoption was stronger in Machakos than it was in Kakamega. This implies that more farmers participate in horticultural extension activities in Machakos thereby exhibiting higher levels of adoption.

## 5.3 Farmer personal characteristics influence farmer participation in horticultural improvement programs.

This study hypothesized that Farmer personal characteristics influence farmer participation in horticultural improvement programs. The study postulated that, farmer personal characteristics such as levels of education of an individual farmer, their age and marriage status influences their participation in horticultural extension programmes and thus their adoption of better or improved horticultural innovations. The results obtained on participation were cross tabulated with farmers age, educational status and marital status, and the results were as shown in Table 23, 24 and 25 respectively.

Table 23 Farmers' participation levels according to their age

| | | PARTICIPATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | KAKAMEGA | | | | MACHAKOS | | | |
| | | HIGH | AVER | LOW | TOTAL | HIGH | AVER | LOW | TOTAL |
| FARMERS AGE | < 30 | 1 | 4 | 2 | 7 | 1 | 4 | 1 | 6 |
| | 30-45 | 6 | 11 | 3 | 20 | 9 | 9 | 1 | 19 |
| | 45-60 | 2 | 8 | 6 | 16 | 1 | 11 | 3 | 15 |
| | >60 | 1 | 4 | 2 | 7 | 1 | 7 | 2 | 10 |
| | | 10 | 27 | 13 | 50 | 12 | 31 | 7 | 50 |

Table 23 shows the cross tabulation of results on farmers participation in horticultural programmes and farmers age in Kakamega and Machakos districts of Kenya. From the results, it is evident that Machakos farmers had higher participation index than those in Kakamega. A total of 43 farmers in Machakos and 37 farmers in

Kakamega had high to average participation. Farmers between the ages of 30-45 years had the highest participation index in both districts, followed by farmers between 45-60 years of age. From these results the study concludes that the farmers ages influence their participation in horticultural extension activities in both districts but at varying degrees. In Machakos district the age of farmers has a more distinct effect on farmers participation than in Kakamega.

Table 24 Farmers' participation levels according to their years of formal education

| | | PARTICIPATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | KAKAMEGA | | | | MACHAKOS | | | |
| YEARS OF FORMAL EDUCATION | | HIGH | AVER | LOW | TOTAL | HIGH | AVER | LOW | TOTAL |
| | None | 1 | 10 | 6 | 17 | 2 | 11 | 1 | 14 |
| | 1-4 | 2 | 8 | 4 | 14 | 5 | 10 | 3 | 18 |
| | 5-8 | 4 | 7 | 1 | 12 | 3 | 5 | 3 | 11 |
| | >8 | 3 | 2 | 2 | 7 | 2 | 5 | 0 | 7 |
| | | 10 | 27 | 13 | 50 | 12 | 31 | 7 | 50 |

Table 24 shows the cross tabulation of results on farmers participation in horticultural programmes and farmers years of formal education in Kakamega and Machakos districts of Kenya. The results show that farmers who had more than four years of formal education had higher participation index in both Kakamega and Machakos districts. Similarly, farmers who had less than four years of formal education seemed to participate less in the process of horticultural extension. These results show that the education status of a farmer in the two study districts

influences their participation. This could be due to the fact that education makes farmers realize that making an effort to participate in extension improves their adoption of improved farming practises. Though education status seems to influence participation in both districts, its effect is more pronounced in Machakos than it is in Kakamega.

Table 25 Farmers' participation levels according to their marriage status

| | | PARTICIPATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | KAKAMEGA | | | | MACHAKOS | | | |
| FARMRES MARRIAGE STATUS | | HIGH | AVER | LOW | TOTAL | HIGH | AVER | LOW | TOTAL |
| | Single | 2 | 1 | 0 | 4 | 1 | 1 | 0 | 2 |
| | Married | 6 | 23 | 6 | 35 | 5 | 29 | 5 | 39 |
| | Divorced | 1 | 1 | 0 | 2 | 2 | 1 | 0 | 3 |
| | Widowed | 1 | 2 | 6 | 9 | 4 | 0 | 2 | 6 |
| | | 10 | 27 | 13 | 50 | 12 | 31 | 7 | 50 |

Table 25 shows the cross tabulation of results on farmers participation in horticultural programmes and farmers marriage status in Kakamega and Machakos districts of Kenya. Farmers were single, married, divorced or widowed. More than 60% of the farmers in both districts were married and had average levels of participation. In addition some married farmers exhibited high levels of participation in both districts. None of the single and divorced farmers showed low levels of participation. These results show that the marriage status of a farmer in the two study districts influences their participation in extension.

## 5.4 Accessibility to horticultural markets encourages farmer participation in horticultural improvement programmes.

This study hypothesized that accessibility to horticultural markets encourages farmer participation in horticultural improvement programmes, thereby improving the adoption of modern agricultural practices. Farmers who grew their horticultural products close to a market or farmers who had good roads to their farms were hypothesized to be more participative in the process of horticultural extension. The study classified these farmers as those who had less post harvest losses and had more profitable production. With these assumptions, results on participation were cross-tabulated with results on farmers distance to markets and farmers post harvest losses results in both districts and the results were as shown in Table 26 and 27 below.

Table 26 Farmers' participation levels according to their distance to markets

| | | PARTICIPATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | KAKAMEGA | | | | MACHAKOS | | | |
| | | HIGH | AVER | LOW | TOTAL | HIGH | AVER | LOW | TOTAL |
| DISTANCE TO MARKET | Near | 5 | 3 | 2 | 10 | 9 | 5 | 3 | 17 |
| | Average | 4 | 16 | 4 | 24 | 2 | 25 | 2 | 29 |
| | Far | 1 | 8 | 7 | 16 | 1 | 1 | 2 | 4 |
| | | 10 | 27 | 13 | 50 | 12 | 31 | 7 | 50 |

Table 26 shows the farmers' participation levels distributed according to their distance to markets, in both districts. From the results 9 farmers

from Machakos and 5 farmers from Kakamega exhibit high levels of participation with high proximity to horticultural markets. In addition 25 farmers from Machakos and 16 farmers from Kakamega demonstrate average participation with average proximity to horticultural markets. Two farmers show low participation and low proximity to markets in Machakos while 7 farmers from Kakamega have low participation with low proximity to markets. The results show that farmer participation in horticultural improvement programmes is significantly influenced by the proximity of farmers to horticultural markets. The farmers who are closer to the markets participate more in extension than those who are further away. This may be due to the income obtained from the sale of horticultural produce and secondly due to the increased horticultural activities around such markets. Some farmers who were far from the markets but had good roads also recorded high participation indexes.

Proximity to horticultural markets differed within the two study districts, with farmers from Machakos recording higher proximity than those from Kakamega. This was partly due to the presence of farm gate buyers in Machakos as opposed to Kakamega. Higher market proximity in Machakos district therefore influenced the higher participation indexes that were recorded in the same district.

Table 27 Farmers' participation levels according to their post harvest losses

| | | PARTICIPATION | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | KAKAMEGA | | | | MACHAKOS | | | |
| POST HARVEST LOSSES | | HIGH | AVER | LOW | TOTAL | HIGH | AVER | LOW | TOTAL |
| | >50% | 1 | 5 | 9 | 15 | 1 | 2 | 3 | 6 |
| | 25-50 | 4 | 15 | 4 | 23 | 2 | 22 | 3 | 27 |
| | <25% | 5 | 7 | 0 | 12 | 9 | 7 | 1 | 17 |
| | | 10 | 27 | 13 | 50 | 12 | 31 | 7 | 50 |

Table 27 shows the farmers' participation levels distributed according to their post harvest losses in both districts. From the results 18% of Kakamega farmers recorded low participation with more than 50% post harvest losses. Their Machakos counterparts had only 6% of farmers showing low participation with more than 50% post harvest losses. On the other hand more farmers (10% and 18% in Kakamega and Machakos respectively) had high participation accompanied with lower than 25% post harvest losses. This shows that farmer participation in horticultural improvement programmes is significantly influenced by the post harvest losses incurred by horticultural farmers. Farmers who have high post harvest losses tend to exhibit lower participation than those with less. The income lost due to post harvest losses may cause farmers to loose interest in the horticultural enterprise.

This factor differed among Machakos and Kakamega farmers. More farmers in Machakos experienced lower post harvest losses and thus exhibited higher participation indexes in horticultural extension.

## 5.5 Conclusions

This chapter analysed the relationships that existed between the factors in the study with the aim of accepting or rejecting the hypothesis postulated for the study. All the three hypotheses were declared true with the application of descriptive and inferential statistics.

The first hypothesis (farmer participation in horticultural improvement programmes positively influences their adoption of modern agricultural practices) was tested and it was accepted for both study districts. Further it was found that higher farmer participation and higher adoption of farming practise was exhibited in Machakos.

The hypothesis; farmer personal characteristics influence their participation in horticultural improvement programs, was tested and accepted. In addition it was shown that farmer personal characteristics (age, marriage status and educational status) influenced their participation in horticultural improvement programmes.

The hypothesis; accessibility to horticultural markets encourages farmer participation in horticultural improvement programmes, was also tested, accepted and found to be true for both study districts. Farmers in Machakos district were more accessible to horticultural markets and thus participated more in the process of horticultural extension.

# CHAPTER VI

## 6.1 CONCLUSION AND RECOMMENDATIONS

The study found out that farmers' participation in horticultural improvement programmes positively influenced their adoption of improved farm practices in both study districts. This meant that increasing the participation of farmers in the process of agricultural extension improved their chances of adopting better horticultural practices.

The results showed farmers in Machakos district were more participative in horticultural extension than their counterparts in Kakamega district and thus, they tended to adopt more of the improved farming practises than the farmers from Kakamega district. Machakos farmers exhibited an initiative to reduce agronomic, cultural, economic or infrastructural constraints to horticultural production. The farmers attended to more demonstrations in the field of horticulture, they also attended to agricultural shows and attend chief's barazas more than their Kakamega counterparts. Farmers from Machakos were more frequent in approaching extension agents either from governmental or non-governmental organizations and also they were more involved in-groups that enhance horticultural production.

The research found that farmer personal characteristics were important in influencing farmer participation in horticultural improvement programs in Kakamega and Machakos district. In the findings farmers' age and education status influenced their participation in Kakamega and Machakos districts but at varying degrees. It was evident that the middle age and more educated individuals had more interest in participating in horticultural extension. This could be due to their realization that increased participation exposed them to better horticultural production technologies. The marriage status of the respondents also influenced participation in both districts.

From these findings, it is prudent to state that the lower participation in horticultural extension in Kakamega as compared to Machakos is partly due to the ages and educational and marriage statuses of the farmers.

The study also found that accessibility to horticultural markets influenced farmers' participation in horticultural improvement programmes in both districts. The proximity of farmers to the horticultural markets increased their level of participation in horticultural extension. Shorter distance to the market increased the farmers' income from and interest in horticulture and therefore their participation in horticultural extension. Post-harvest losses experienced by farmers

contributed significantly to their participation in horticultural extension in both study districts. This could probably be due to post harvest losses having a direct effect on the farmers' income.

In summary the research found that farmer personal characteristics (farmers age, marriage status and educational status) and accessibility to horticultural markets (proximity to markets and post harvest losses) are two factors that tend to affect participation in the two districts. The two factors explained why participation seemed to be higher in Machakos than it was in Kakamega; therefore it explained why higher adoption rates were recorded in Machakos than in Kakamega. This explained (in part) why there was higher productivity in horticulture in Machakos than Kakamega district that was climatically better endowed for horticultural production.

From these findings it is appropriate to recommend the following for policy considerations. Policy should focus on setting up an agricultural extension service that encourages the participative approach at all levels. In such an approach farmers should be seen and treated as being knowledgeable of their most important and most felt problems. In such a service the farmers and the extension agents should use creative ways to capture these needs and to introduce an intervention that is

mutually accepted. The extension agents should play the role of facilitators who encourage the farmers to own the process of their own development. This is in line with the findings that higher adoption rates were recorded in situations where there were higher farmer participation indexes.

The extension service should not be general. It should have special focus that can accommodate the inherent differences in horticultural crops, horticultural enterprises, the infrastructure, characteristics of farmers in different districts and different social systems. With these considerations policy should strive towards designing specific extension packages, with the help of the farmers and extension officers at the grassroots level.

The government should focus on improving the educational status of the rural small-scale and large-scale farmers. The research noted that farmers who had more than four years of formal education exhibited higher participation levels and thus adopted more of the improved horticultural farming practises. Therefore a critical mass of rural horticultural farmers with an equivalent of more than four years of formal education is necessary for enhancement of agricultural productivity.

The government should improve the marketing of horticultural products by improving the infrastructure in the rural areas. Better roads, and communication networks makes horticultural markets to be more accessible. The research noted that proximity to horticultural markets improved farmers' participation and it improved horticultural productivity.

## CHAPTER V11

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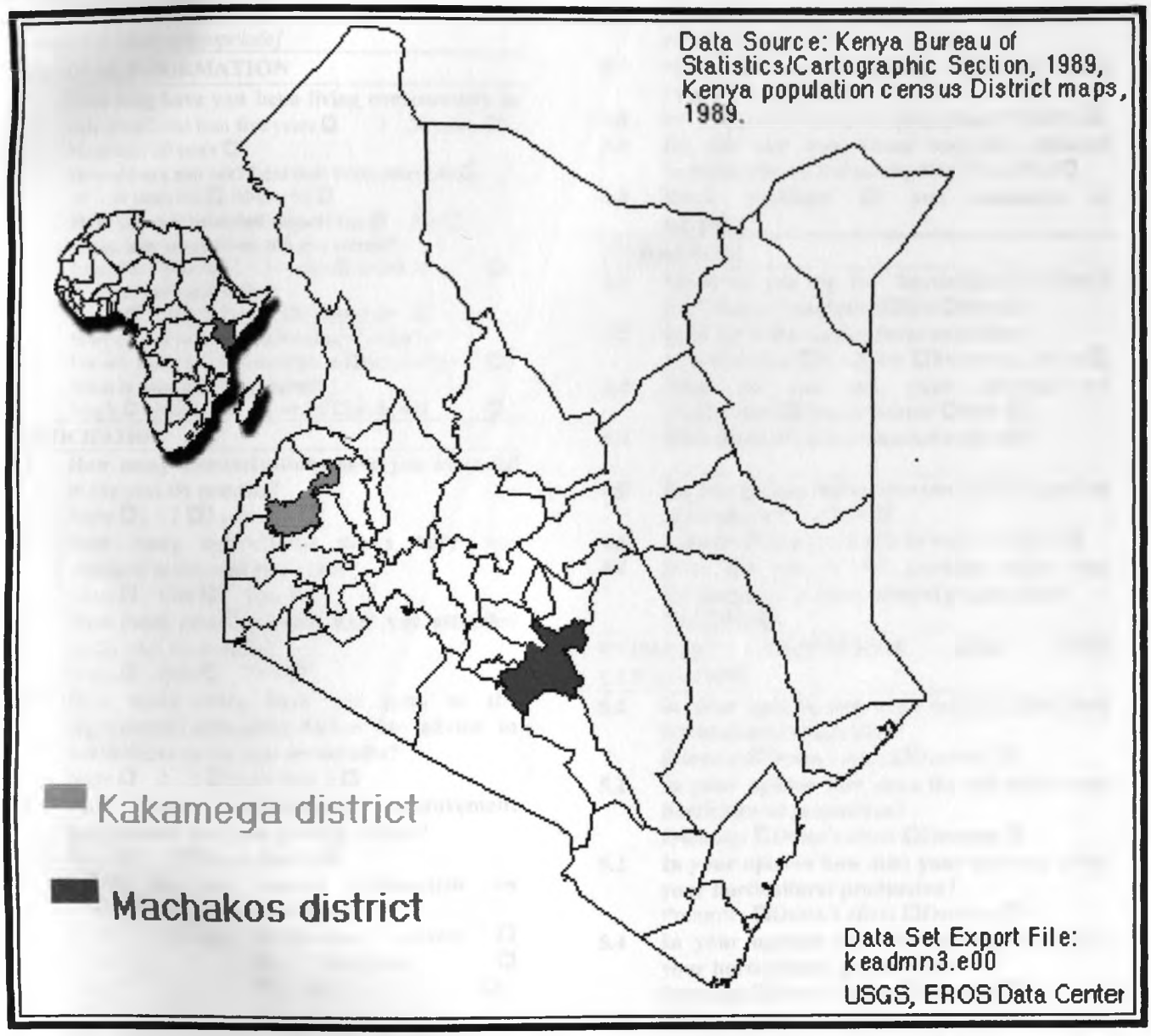
## APPENDIX 1

KAKAMEGA AND MACHAKOS DISTRICT GEOGRAPHICAL POSITION



## QUESTIONNAIRE

District: _____
Location: _____
Division: _____
Sub-location: _____
Date: _____
Household Owner: _____
Respondent: _____
Gender: Male ☐ Female ☐
*[Please tick where appropriate]*

### PERSONAL INFORMATION

1. **How long have you been living continuously in this area?** Less than five years ☐ 3 – 20 years ☐ More than 20 years ☐
2. **How old are you are?** Less than thirty years old ☐ 30 – 50 years old ☐ Above 50 ☐
3. **Have you ever attended school?** Yes ☐ No ☐
4. **If yes, how many years did you attend?** Less than 7 years ☐ 7 – 11 years ☐ Above 11 ☐
5. **Can you read and write?** Easily ☐ With difficulty ☐ Not at all ☐
6. **Why do you cultivate horticultural crops?** For sale ☐ For home consumption ☐ As a hobby ☐
7. **What is your marriage status?** Single ☐ Married ☐ Divorced ☐ Widowed ☐

### PARTICIPATION

2.1 **How many demonstrations have you attended in the past six months?** None ☐ 1 – 2 ☐ 3 or more ☐

2.2 **How many agricultural shows have you attended in the past two years?** None ☐ One ☐ Two ☐

2.3 **How many chiefs' barazas have you attended in the past six months?** None ☐ One ☐ Two ☐

2.4 **How many times have you gone to the Agricultural Extension Office for advice in horticulture in the past six months?** None ☐ 1 – 2 ☐ More than 3 ☐

2.5 **How many horticultural improvement programmes have you participated in?** None ☐ 1 – 2 ☐ More than 3 ☐

2.6 **Whom do you receive information on horticultural production from?** Chiefs' barazas ☐ Extension workers ☐ Villageleader ☐ Neighbour ☐ Women's group ☐ NGO ☐ Others (specify) _____

2.7 **What kind of information do you receive?** Input utilisation ☐ Practices appropriate for horticulture ☐ Others (specify) _____

2.8 **Are you involved in the following groups in your community?** Farmer group Yes ☐ No ☐ Co-operatives Yes ☐ No ☐ NGOs Yes ☐ No ☐ Others(specify) _____

### ADOPTION

3.1 **Do you utilise better performing seedlings?** Yes ☐ No ☐

3.2 **Do you utilise farm implements e.g. tractors and sprayers in your farms?** Yes ☐ No ☐

3.3 **Do you utilise fertilisers in your farm (DAP, C.A.N., N. P. K.)?** Yes ☐ No ☐

3.4 **Do you utilise pesticides, insecticides and herbicides in your farm?** Yes ☐ No ☐

3.5 **Do you use economic irrigation methods e.g. drip irrigation?** Yes ☐ No ☐

3.6 **Do you use leguminous cover crops in your farm?** Yes ☐ No ☐

3.7 **Have you planted guard rows and wind breaks?** Yes ☐ No ☐

3.8 **Do you practise contour ploughing?** Yes ☐ No ☐

3.9 **Do the new innovations acquired influence better horticultural production?** Yes ☐ No ☐

4.0 **What problems do you encounter in adoption?** _____

### MARKETING

4.1 **What do you use the horticultural products for?** Home consumption ☐ Sale ☐ Both ☐

4.2 **How far is the market from your farm?** Less than 5km ☐ 5 – 20 km ☐ More than 20 km ☐

4.3 **Who do you sell your produce to?** Middle-men ☐ Final consumer ☐ Both ☐

4.4 **How much of each produce do you sell?** _____

4.5 **Do you get any losses between harvest and sale of products?** Yes ☐ No ☐

4.6 **Is horticulture profitable to you?** Yes ☐ No ☐

4.7 **Does the sale of the produce affect your participation in horticultural programmes?** Yes ☐ No ☐

### CLIMATIC CONDITIONS AND LAND UTILISATION

5.1 **In your opinion how does rainfall affect your horticultural production?** Promotes ☐ Doesn't affect ☐ Demotes ☐

5.2 **In your opinion how does the soil affect your horticultural production?** Promotes ☐ Doesn't affect ☐ Demotes ☐

5.3 **In your opinion how does your land size affect your horticultural production?** Promotes ☐ Doesn't affect ☐ Demotes ☐

5.4 **In your opinion how do temperatures affect your horticultural production?** Promotes ☐ Doesn't affect ☐ Demotes ☐

5.5 **What other enterprises apart form horticultural are you engaged in?** _____

5.6 **Are these other enterprises more profitable?** yes ☐ No ☐

5.7 **Do the climatic conditions and the available options for land utilisation influence your participation in horticultural improvement programmes?** Yes ☐ No ☐