

Chapter One

Introduction

Background information

Gender differentiated technology is not a new phenomenon. Indeed, most technologies are developed and tailored according to the stereotyped roles of men and women in society. According to Kramarae (1988), women's use of and associations with technology reflect their major occupations in life. Telephones are used by women operators and receptionists and men repair them. Women frequently use household appliances such as cookers, vacuum cleaners, washing machines, refrigerators, and so on, during their household chores and men purchase them, allocate them and make decisions about maintenance and disposal.

Men on the other hand, are associated with computers in office work; bicycles, cars, motorcycles and steamers in transportation and; combine harvesters and tractors for agricultural production. They repair things, make furniture, take technical courses such as engineering, while women are believed to concentrate on interpersonal relationships and emotional issues. Indeed, according to Benston (1988), women are more of users of technology and rarely creators, shapers and producers. Men, on the other hand, are the inventors and owners of technology.

This stereotyping of technological development and its use on the basis of gender, ignores the fact that the majority of scholars concentrate on male participation and achievements in technological developments. Women's role and the relevance of existing technologies to women are ignored. Kramarae's (1988) description of how nineteenth century western women were ridiculed when they rode on bicycles, serves to illustrate this point.

In Africa, technological development has been modelled on western pre-selected packages and implemented everywhere, irrespective of their appropriateness to the environmental, cultural and economic context. The perception of local communities about agricultural technology and their active involvement in technological development, is largely lacking. Despite their active and continuous interaction with the environment as food producers, concern regarding women's technological knowledge on seed selection practices, pest and weed control measures, and harvesting and food preservation technologies, has never been included in policy making and implementation. This omission of the knowledge systems of a significant proportion of agricultural producers, makes it difficult to develop relevant techniques for rural farmers in the continent. In those societies where agricultural production is the mainstay of economic production, it is an acknowledged fact that men and women do different things, have access to different resources and benefits, and play different roles in the production cycle.

While technological implications of the different spheres of operation exist, logically, one can assume from these gender differences that the adoption, adaptation, allocation and utilization of the various

technologies, are directly related to the different activities in the production cycle. It is expected that when men and women engage in the production of different crops such as cash crops and subsistence crops, they will require different technologies in terms of farm equipment and input, storage techniques and labour requirements.

The inter and intra-household decision making processes on the allocation and use of these technological resources is also made along gender lines. Indeed, studies from Staudt (1977), Pala (1980), Ventura Diaz (1985) and Njiro (1990), reveal that cash crop production which is dominated by men is characterized by the availability and utilization of improved farm equipment, such as tractors and combine harvesters, and farm inputs, such as fertilizers and pesticides. It is also associated with the cash economy, where substantial financial benefits are obtained from agriculture. Subsistence farming, on the other hand, which is usually dominated by women, is characterized by traditional farming techniques, rudimentary farm technology and inadequate farm inputs.

A daunting realization about agricultural technology in the third world, is that it is largely skewed to benefit males. Tasks performed by men, such as land preparation, harvesting and processing are the easiest to mechanize. The abundance of tractors, combine harvesters and processing factories in many countries attest to this fact. Women's task, on the other hand, remain labour intensive and time consuming. Furthermore, those female tasks which are mechanized often become male tasks. Whitehead (1980) gives examples of how rice milling employing male labour is replacing hand-pounding in Sri Lanka, South India, Bangladesh and Java, thus decreasing employment for landless women.

Whitehead, however, does not point out that women lose out on new technology, because they lack the skills and training which is required for the handling of these innovations. In Kenya, agricultural development planners deliberately target men for agricultural training, because they argue that men are the household heads and therefore the major decision makers for productive resources (Staudt, 1977). This view persists, despite the fact that women are the cornerstone of agricultural production in the rural areas and make major decisions while their husbands are away from home. This factor becomes particularly significant when one considers the fact that almost 30% of rural households in Kenya are women (Annual Report of Kitui District 1991). In certain Districts like Machakos the figure rises to almost 50%, because of the diverse ecological zones and proximity to urban areas (Machakos District Development Plan, 1994/1995).

Another point of consideration emanates from the fact that the introduction of new technology either improves the quality of work for the men or reduces their workloads, while increasing those of women. Palmer (1978) describes the increased transplanting, weeding, harvesting and processing work done by women, resulting from the increased hectareage created by tractorization during the Green Revolution. In Kenya, the mechanization of large scale farms has resulted in a high migration of men from smallholder agriculture to large scale farms, leaving women with an over-intensification of work-loads in the subsistence sector. This increased workload prevents women from effectively adopting new agricultural innovations, which according to Fortman (1978), is characterized by additional workloads and therefore requires more time.

Another dimension of agricultural technological adoption and its use may be discerned from the increased presence of female managed farms in the rural areas. These category of farmers include defacto and de jure household heads: widows, and divorced and single women. While they are believed to have full control of their resources, the poorer socio-economic circumstances of female headed

households are indicative of poverty and dependence other than authority and autonomy (United Nations, 1981). This directly affects not only their adoption of various agricultural innovations, but also the utilization of these technologies, since they lack adequate capital to purchase them. According to Mbiti and Mbale (1981), male headed households in Kenya own more land and equipment (bicycles, ploughs and wheel barrows) than female headed households. These findings compare favourably with those of the Ministry of Transport and Communications (1980), which noted that male headed households had 87% more ploughs per family than female headed households.

It is worth noting that in the Kenyan scenario, the patriarchal nature of the society deny many women full control of productive resources despite male absence in their lives. The ownership of resources such as land, and purchase and utilization of oxen ploughs depend on the inter- and intra-household dynamics, where the presence of a male relative play a dominant role in decision making processes. These cultural constraints prevent women from fully utilizing and making decisions about available resources.

In conclusion, the reviewed literature reveals the following research gaps which were addressed by this study:

- the dynamics that lead to the choice and utilization of technology in various categories of households such as female headed, married, and defacto and dejure households, for purposes of agricultural programme planning and implementation.
- the illumination and practical suggestions made for women's perception and knowledge of agricultural technology, which has previously been unrecognised and unacknowledged was for their inclusion in the development of appropriate technologies for men and women in Kenya.
- the highlighting of points of departure in gender differentiated technology, which may exist because of differences in environmental contexts, cultural and socio-economic value systems and ideologies.

The problem statement

Paucity of literature on gender differentiated technology and its implications for increased food production in rural communities is an acknowledged fact (Palmer, 1978; Whitehead, 1981). Considering the inter-causal relationships that exists between men and women in all spheres of farm operations, it is surprising that planners, policy makers, implementers and scholars have either focused on men's or women's roles in agricultural activities, without considering both simultaneously. In Kenya, agricultural programmes focus on men despite the predominant role played by women in the agricultural sphere.

The apparent failure of this approach has prompted scholars such as Palmer (1978), Whitehead (1981), Dias (1985), Oduol and Karugu (1993), to focus on technological innovations and women farmers. However, the focus on women farmers is as incomplete as those studies which focus on male participation in agricultural production. This is because these kinds of studies are insensitive to the fact that men's and women's roles and patterns of intra- and inter-household relations are embedded in farming systems. They will have an effect on and be affected by changes in these systems (Fieldstein et al 1989). Furthermore, these interrelationships are reinforced by cultural beliefs and practices, which determine decisions on ownership, allocation and disposal of resources and the benefits derived from them. The decisions on who may purchase and use particular farm equipment, fertilizer, pesticide, storage facilities or who may go to farm demonstrations, farmers training centres and receive extension services, may

already be predetermined in the social dynamics of the society. It is, therefore, obvious that any study which focuses on either male or female participation without consideration of both is incomplete.

Recent decades have seen a shifting of focus from either sex to the analysis of the gender variable as a determining factor in the adoption and utilization of agricultural technology. However, this literature has largely been general and theoretical, without providing case studies, which reveal the interactive mechanisms that result in the allocation and use of technology along gender lines (see Fieldstein et al 1989; Cloud, 1985, 1988). This has obscured the vital role played by the gender variable in determining the effective adoption and utilization of agricultural technology and its implications for increased food production in the rural areas.

We have chosen to study the rural farming community of Machakos District of Eastern Kenya. The District is ideal for this kind of study, because it is characterized by diverse ecological zones, which dictate the type of farming systems that prevail in the area. It is one area where allocation and utilization of resources along gender lines is determined by existing environmental factors and other external influences such as the active participation of government and donor agencies in agricultural activities in the area. From the high potential hill masses of Iveti, Maua and Kangundo, where cash crops predominate; the horticultural irrigated areas along Tana River and Yatta Canal and to the semi-arid regions of Masinga, farming systems differ according to the prevailing circumstances. Machakos District is also the area which was formerly occupied by white settlers whose farms were allocated to landless squatters.

Despite the complexities that prevail in relation to agricultural technologies, there is lack of literature to guide implementors in providing the right technologies for the diverse target groups. This in turn, not only illuminates the gender parity in the district, it also serves to depress overall crop production in the area. This rich diversity, therefore, provides an ideal setting for studying gender dynamics in the ownership, distribution and allocation of technological resources.

Research objectives

General objective

Our objective is to find out the mechanism which influences the choice and use of agricultural technology along gender lines and determine their implications for increased food production in the area of study. Such mechanisms would include ownership of various forms of knowledge as well as the hardware technology required for farm operations.

Specific objectives

Specifically, our objectives were to:

- document male and female preferences and use of agricultural technology in the area of study.
- determine who has knowledge of and uses indigenous agricultural technology and what implications this has for agricultural production in the area of study.
- determine who makes decisions about the technologies used in these spheres, purchases, distributes, has access to and derives benefits from them and why.
- examine the effects of modern technology on division of labour along gender lines and determine its implications for increased food production in the area of study.

- examine the processes underlying technological adoption and use in female and male headed households and determine their implications for increased agricultural production in the area of study.
- determine the policy implications of gender differentiated technology.

Research questions

To fully explore the importance of gender variable in influencing decisions relating to agricultural technology, the following questions became pertinent:

- What types of agricultural technology do men and women prefer and why?
- Who purchases the technology, uses it, repairs and disposes of it?
- In which spheres of operation are these technologies utilized and who controls their use and distribution?
- How does their adoption affect distribution of labour across gender lines and what are its implications for the increased adoption of agricultural technology?
- Who derives benefits such as access to extension services, credit, attendance in farmer training centres and why?
- Who retains knowledge of indigenous technology and what interactive processes occur as a result of the blending of traditional and new technology?

The research topics identified for exploration were as follows:

- Type of technologies used by men and women and why.
- Types of technologies used on the specific crop, by who and why.
- Who has access to and owns the knowledge on the types of technologies used.
- Channels of knowledge transmission on the basis of gender.
- Values placed on types of technology used between men and women and decisions relating to their ownership, preservation and maintenance.
- Households spending patterns in relation to who provides income for expenditure and on what items.
- Who benefits from the use of agricultural technology and why.

Hypotheses

Following the literature review, the stated objectives and research questions, the following hypotheses were tested in the area of study:

- The gender variable does not affect the farmer's decisions, preferences and use of agricultural technology in various spheres of farm operations.
- The adoption and use of various types of agricultural technology does not depend on whether the household head is a man or a woman.
- There is no relationship between division of labour and types of technologies used during farm operations in the area of study.
- The benefits derived from and access to and use of agricultural technology, is not influenced by gender.

1. *The gender variable does not affect the farmer's decisions, preferences and use of agricultural technology in various spheres of farm operations.*

This is a null hypothesis which postulates gender as the independent variable, and decision making, preferences and use of agricultural technology, as the dependent variables. The various spheres of agricultural operations include preparing land, planting/sowing, harvesting, milking, and post-harvest activities such as irrigating, weeding, thinning, and marketing and packaging. An alternative hypothesis is that gender does affect farmers decision-making, preferences and use of agricultural techniques in Machakos in the various spheres of farm operations. Men and women in Machakos show differences in decision-making, preferences and use of agricultural techniques in the various spheres of farm operations. The hypothesis was to prove:

- Whether or not women or men dominate decision-making associated with agricultural production, such as use of technology in farming.
- Do men and women have differing preferences of the various agricultural technologies (indigenous and modern) in Machakos?
- Whether women and men use agricultural technologies equally.
- If there are differential uses of agricultural technologies in Machakos among male and female farmers and what reason/factors account for such differences. Have they anything to do with gender?
- Are there similarities (or unity) among women and men farmers as a group in terms of decision-making, preferences and use of agricultural technologies (both indigenous and modern) in Machakos? i.e. Are women and men farmers having similar/general behaviour in terms of decision-making, preferences and use of agricultural technologies? If not, what other factors other than gender, account for the variations in decision-making, preferences and use of agriculture technology even among the same sex?

2. *The adoption and use of various types of agricultural technology does not depend on whether the household head is a man or a woman.*

This is another null hypothesis which postulates that male- and female-headed households in Machakos show no remarkable differences in terms of adoption and use of the various agricultural technologies. That they adopt and use agricultural technologies almost equally and the agricultural technologies adopted and used in male-headed households, are similar to those used in the households headed by females. The independent variable here is headship of household by gender and the adoption and use of agricultural technologies are dependent on it.

The alternative hypothesis is sex of the household head influences the type of adoption and use of agricultural technologies. An assumption is that male and female headed households do not use agricultural technologies equally and this is due mainly to the sex of the household head. The task is to prove:

- Whether male/female headed households adopt and use agricultural technologies equally. If so, then sex of household head influences adoption and use of agricultural technologies in Machakos.

- Do households headed by same sex (e.g. male headed households) show any remarkable differences in terms of adoption and use of agricultural technologies? If yes, then sex of the head of household is not a significant factor in determining adoption and use of agricultural technology in Machakos. Other factors might have greater influence on adoption and use of agricultural technology than the sex of the household head. The hypothesis required further tabulation to check the association between sex of the household head and adoption as well as use of agricultural technologies (Table 1.1a).

Table 1.1a: Gender and Use of Technology in Machakos Households

Sex of the household head	Adoption and use of indigenous technology	Adoption and use of modern technology
Female-headed households		
Male-headed households		

A cross tabulation of a few farm tasks and implements used by both the female and male headed households to perform the agricultural tasks. Table 1.1b shows what was observed:

Table 1.1b: Gender and Use of Technology in Machakos Households

Type of household head	% Households using			Total percentage
	modern implements in land preparation (plough/tractor)	mainly indigenous implements in land preparation (traditional hoes)	both modern and traditional implements	
Male headed	60 (24)	34 (14)	6 (2)	100
Female headed	20 (12)	79 (47)	1 (1)	100

In parenthesis are figures representing an actual no. of households selected for pretesting.

This table indicated that there is enough evidence that adoption and use of agricultural technology between female and male headed households is not the same. It is also revealed that male-headed households are the greater adopters and users of modern agricultural technologies (60%) and only 20% of female headed households ever used modern implements. About 79% of female headed households adopt and use more indigenous implements in land preparation compared to 34% of male headed households. The next task was to find out why this is the state of affairs.

3. *There is no relationship between division of labour and types of technologies used during farm operations in the area of study.*

Alternative hypothesis is that there is a relationship between division of labour and types of technologies used during farm operations in Machakos. The questions asked are as follows:

- How are the farm activities allocated and shared within the households in Machakos?
- What contribution does each sex make in a given or specific task, eg who between women and men contributes most in land preparation?
- Which tasks are mainly performed by the men, women, children, young adults and older people?
- If there is a difference in tasks performed based on age and sex, what technologies do the specific groups utilize? For example, if men are the ones who dominate land preparation, do they rely more on indigenous or modern technologies.

4. *The benefits derived from, access to and use of agricultural technology is not influenced by gender.*

Another null hypothesis postulating the influence of gender on benefits from agricultural use of and, access to agricultural technologies. The questions asked are:

- Who are the main adopters of modern agricultural technology men or women? Female headed households or male headed households?
- In household where a certain agricultural technology exists, e.g. where ox-plough has been adopted, who has access to it among the men and women households in Machakos?
- In the areas of study, which households would one say have access to what it takes to adopt modern technology e.g credit facilities? What is the rate of adoption?
- Who between female/male headed households uses more modern agricultural technologies or indigenous ones.

Conceptual framework: definition of concepts, terms and their operation

Conceptualizing technology

Like all commonly used concepts with highly generalized characteristics, the definition of technology reveals a myriad of complexities which render the term both ambiguous and slippery. In general, technology means in a narrow sense, material artifacts — machines and other physical devices and products. In a broader sense, it means a particular kind of knowledge about how to produce desired and intended outcomes, not only “knowing about” but also “knowing how to do” (Layton, 1974). In this view, technology is not only material artifacts, but also social wisdom (Law and Bijiker, 1992). According to Mackenzie and Wacman (1985), technology is composed of material objects, and scientific knowledge and methodological processes utilized to transform them for individual and social needs. This definition is consistent with Otilienfield’s (1914) perception of technology as a refined totality of procedures and instruments within a defined specified area of human activity. Rapp’s (1981) summarizes technology as procedural knowledge and actual execution.

However, these definitions of technology do not encompass the interactive mechanisms that exist between technology, human beings and other environmental, socio-cultural and political factors. Humanistic proponents of technology perceive it as an integral part of human life shaping and being

shaped by human influence. It is culture specific, environmentally tailored and malleable to socio-economic and political circumstances. Indeed, according to Pfaffenberger (1988: 249), technology is defined as a totality of social and cultural phenomenon, which blends the material, social and symbolic in a complex web of associations. It is the social construction of nature around us and with us and therefore a form of life. It is a symbolic reflection of people's norms, values, beliefs, systems and cultural practices. It is also a reflection of human attempt to subdue and adapt to the environment.

McCloughlin (1970) views technology as a social process or a set of problem solving ideas, skills and devices. McDowell (1976) expanded this view further by pointing out that technology consists of skills, techniques and artifacts. In this view, technology of a society is the tools, skills and techniques utilized in that society for performing tasks such as storing food, raising crops, preparation of land for planting, threshing grain or carrying a load. Appleton and Scott (1994) are more systematic in their views on technology as consisting of four aspects, namely:

- Physical artifacts (for example tools and equipment) sometimes referred to as hardware.
- Skills and knowledge that enable artifacts to be used and production carried out.
- The forms of organization (social and directly production related) needed to make use of the hardware. These two (ii and iii) are referred to as "software."
- The product itself, which has direct relationship with the techniques and skills required to produce it (Wagner, 1989).

These views reiterate that technology is a systematic study of techniques of making and doing things. The activity by which humans seek to change and or manipulate their environment. In anthropological terms, it is the total system of means by which a given group interacts with its environment. That technology includes: the use of tools, patterns of work, information or knowledge employed and organization of resources for productive activity. In this view, technology is more than just material culture.

This study contextualized technology from two broad dimensions:

- Modern agricultural technology embodied in the green revolution model, which promotes hybridization, modern farm methods and the use of farm inputs and equipments.
- Indigenous agricultural technology, which encompasses traditional farming techniques accumulated over generations, based on local value systems, a wide experience and knowledge of the environment, rituals and belief systems.

This knowledge is not static, but consists of dynamic insights and techniques, which are adapted to environmental and socio-economic circumstances. The variable was measured by asking the respondents about the kind of technology they use, why and who makes the decisions about the purchase and adoption of these technologies.

Farming technology means the way agriculture is done. It includes methods by which land is cultivated and crops are harvested and also the way livestock is cared for. It includes the seeds, fertilizers, pesticides, medicines and the fodder for livestock. Tools and implements the farmers use, and their source of power are also included. Enterprise combinations by which farmers seek to make the best use of their labour and land, should also be considered (Mosher 1966). Agriculture technology is thus a combination

of all management practices for producing or storing crop mixture (also livestock; Either and Startz, 1984).

Indigenous technology

The term indigenous technology has been defined as that which originates, grows or lives naturally in a particular place (*The Longman Dictionary of Contemporary English 1987*). It is born or produced naturally in a land or region; pertaining to or intended for the natives. When applied to population, it refers to the original inhabitants of an area. It is sometimes synonymous with native (*The Oxford English Dictionary and Macmillian Dictionary of Anthropology*). MacDowell(1976) defines indigenous technology as locally generated/homegrown technology. This is to say, technologies developed within a society, were not necessarily brought out from outside and adopted. Thus, indigenous technology is home-based, grown from within a given society rather than imposed from without. These traditional technologies are in most cases appropriate and simple and represent the use of non-cost materials fashioned with simple tools or woven by methods handed down over the centuries. They have been tested in the laboratory of survival. Traditional or indigenous technology form the fabric of culture.

Indigenous technologies are therefore viewed as those which have evolved within the community and have been passed from one generation to another. Examples are the techniques and practices employed in utilizing and managing fields, such as cropping methods, patterns, calender, and intensity, and cultivation, and milking, milk storage and fermentation techniques. Table 1.2 shows a set of dichotomies about indigenous technology:

Table 1.2: A Set of Technology Dichotomies

Set One	Set Two
Indigenous	Modern
Traditional	Western
Local	Scientific
Culture specific	General
Particular	Worldly
Simple	Sophisticated
Old	New

Characteristics of indigenous agricultural technology is simple and primitive to the western eyes, but has been well-tried and proved reliable through the use by many generations. It is labour intensive, self-sufficient, and relies on outside suppliers of materials or services (Ghatak, 1984).

Technology as conceptualized within this study is quite broad and general. This necessitated the narrowing down of variables to obtain an in-depth analysis of the dynamic and interactive mechanisms, which determine the choice and use of agricultural technology on the basis of gender. The variables included seed selection practices, planting, weed management, pest control strategies, harvesting and farm equipment.

Furthermore, it will be altruism that the type of technology used depends on the type of crops grown, the availability of resources and the influence of the ecological zone. Since local farmers grow several

crops simultaneously, it was only practical to study technological use on all the crops grown. Technological choice on all crops grown and the livestock reared, were studied contrary to the earlier author's intention, only to select three crops for analysis. This way choice and use of agricultural techniques by both male and female farmers were explored according to the different agro-ecological zones. Also, the diversity that characterizes preferences, access and control of technology in the district were captured.

Farm household

Households are those individuals who farm a communal field under the jurisdiction of the household head and who eat from the same cooking pot (Koeing 1980; Hunger and Moris, 1973; Norman, Simons and Hays (1982). The individuals who eat and work together most of the time (Macmillian, 1983). Farm household, therefore, can be viewed as a farm unit which comprises of a person or a group of persons living together in the same house or in different houses in the same compound, are in one way or another related to and /or answerable to the same head of household and may be sharing the same source of food.

Agriculture

Agriculture concerns production based on the growth processes of plants and animals. Farmers manage and stimulate plant and animal growth on their farms. Therefore, the elements of agriculture can be viewed as: farmers, farm, production process and farm business. Farm production uses inputs to produce outputs. Farm inputs used in the production process include land, labour of the farmer's family and workers, and the mental effort of planning and managing the seeds, animal feeds, fertilizers, insecticides and implements. All these constitute the inputs and technologies of the farm. The outputs are crops and livestock products produced in the farm.

Division of labour

This is the extent and manner in which tasks are divided among men, women and children on a daily basis. The variable was measured by asking the respondents what tasks they perform, who allocates duties in the various spheres of operation and why. Attention was paid to household activities and off-farm enterprises in so far as they influence the time allocated to agricultural activities.

Benefits

This refers to the benefits associated with adoption of modern agricultural technology, such as income from farm production, free provision of farm inputs by extension staff and from other sources, attendance in farmer training centres, farm demonstrations and other agricultural training and access to credit facilities. The variable was measured by asking the respondents to identify those who benefit and why.

Expected results and impact

In recent years, there has been a growing recognition by planners, implementors and scholars that few development programmes can succeed without considering the gender variable. Indeed, attempts have been made by government ministries and non-governmental organizations to include the gender dimension in programme planning and implementation.

A study such as this will not only supplement the literature that already exists on this subject, it should also assist development planners in identifying the constraints that prevent the effective adoption and utilization of existing agricultural technologies. This will, in turn, help them to develop appropriate technologies for the relevant target groups.

The information obtained from this study should clearly reveal to planners and implementors, the inter-causal relationship between men and women that prevail in all decisions affecting farm operations. This information could be useful in the development of technologies that families can use to improve their welfare and reduce the gender parity that prevails in all spheres of development. Furthermore, it may lead to the development of technologies which will reduce women's workloads, save costs and time, improve farm yields and generally result in a sense of well-being for the farmers.

Finally, the information generated from this diverse environment could also be generalised to those areas with similar characteristics, with the hope that the right technology will be targeted to the right population during programme implementation.

Expected beneficiaries

- The study will benefit researchers and scientists who are involved in developing agricultural technologies for communities all over the country.
- The Ministry of Agriculture will benefit with emphasis on the extension service system.
- Farmers will benefit not only in the research area, but also in those areas in Kenya where similar problems exist.
- Institution and personnel: The sponsoring institution is the Institute of African Studies in the University of Nairobi. This institution emphasises the socio-economic and cultural aspects of production activities. It therefore complements the existing scientific and technological activities being undertaken in other campuses of the university of Nairobi, such as Kabete Campus, which specifically deals with agricultural activities. In addition, the Institute of African Studies is the only institution in the university which provides gender and development courses, both to undergraduate and graduate students. The findings generated from this research are of direct relevance to the institute as reference material. The project will be housed in the physical setting of the institution and will enjoy access to office space and library facilities, including departmental and main university libraries.

Problems encountered during the study

The area of this research is Machakos District at a time when prolonged famine had hit the people. They were therefore very reluctant to answer most of the research questions as they felt they were irrelevant to their famine situation. All visitors to the area were suspect unless they were bringing relief food. Respondents demanded to be paid for spending time discussing with us. This was not possible as there was no money for such unethical demands.

Questions about choice and use of agricultural technologies in a location such as Masinga were not taken kindly as the farmers have been very frustrated for the two years of no rain. They found our questions too long and many and they did not see how they could be of use to them. Participatory methods were also found to be time wasting and only the idle school leavers had time and energy to

participate in them. The elderly people with the information about the historical perspective in the use of agricultural technology were too busy travelling in search of food for their families.

Issues of politics of the area, particularly in Masinga, were rife during this study. They wanted us to tell them what the government is doing to stop the famine once and for all. They were bitter at the way the cabinet ministers in the area had piped the water from Masinga dam, which is the source of the water to their constituencies, leaving them to wallow in a dry famine stricken area. They have to buy water, fodder for their livestock, food for their families and all the other needs, such as fees and school uniform, when they had no money for any of these.

It was difficult to obtain answers to the questions about the choice and use of such technologies, such as application of fertilizers and pesticides. Many farmers did not receive any instructions as to how, where and when to apply them. The difference between indigenous and modern agricultural implements was another complex issue. It was difficult for the farmers to estimate their labour contribution for the last six months when all they have done is wait in frustration. Farming, whether done with modern or indigenous technology was not successful in any of the locations sampled in this study. Farmers did not take kindly to questions to evaluate the determinants for choice and use of technologies. These problems were resolved through dialogue which made the research take longer than was planned. Waiting for compromise by research communities meant staying longer than budgeted in the research area. Analysis of data collected through participatory methods was not easy and it took many hours making sense of the enormous information.

Transport within the research area was another problem as there are no vehicles in the area even when it is not raining. We devised a method of hitching rides from tractors and carts. Walking was the main mode of travel and this is slow and it delayed the research further.

Chapter Two

Literature review

The following are the selected topics which were found relevant to this study:

Kenya's food policy and strategies

According to Sessional paper No.2 (Republic of Kenya, 1994) on National Food Policy, the major objectives in Kenya's development policy are: food self-sufficiency, food security, employment creation, income generation, generation of foreign exchange earnings, rural urban balance and overall growth. In view of the rapid population growth and the increasing demand for food, food production and food security will remain key priorities in the agricultural sector. Other important objectives of the sector will continue to be the generation of raw materials for domestic industry and agricultural exports and contribution towards the national objectives.

The central objective of National Food Security Policy is to ensure an adequate supply of nutritionally balanced foods in all parts of the country at all times. Food security at the national level will be achieved through:

- Increasing food production in all areas of the country.
- Promoting drought-resistant crops such as sorghum and millet in the dryland areas.
- Rapid development of the country's irrigation and drainage potential.
- The establishment of a food commodity monitoring and reporting system.
- Continued monitoring and forecasting of weather conditions in the main agricultural zones, and wider dissemination of information on expected weather trends.
- Improvement in the marketing, processing and distribution of food.
- Adequate multi-commodity strategic reserves, including strategic reserves of milk powder, will be maintained at all times to see the country through difficult times, such as droughts and poor harvests.
- Liberalization of marketing, including importation of food, subject to variable import duties wherever appropriate.

Food security at the level of individuals and households will be improved through the following measures:

- Improvement of macro economic management for better economic performance.
- Providing incentives to farmers for improved agricultural production.
- Improved extension services on storage methods to reduce post-harvest losses.
- Providing traders and commodity dealers incentives for improved marketing, storage and distribution of food commodities.

- Improved health and nutrition education.
- Provision of emergency food relief programmes.
- Food-for-work programmes for the rural poor and other programmes targeting assistance to identified vulnerable groups.

In order to meet the earlier mentioned measures, Kenya's agricultural development strategy is aimed at the continued expansion of productive investment through growth in agricultural outputs and conservation of scarce natural resources to ensure their sustainable utilization. There is a clear need for the country to continue with the major policies spelt out in sessional paper no. 4 of 1981 on national food security, which sets guidelines for decision making on all major issues related to food production and distribution. The overall objectives of this policy were to:

- Maintain a position of broad self-sufficiency in the main foodstuffs, in order to enable the nation to be fed without using scarce foreign exchange on food imports.
- Achieve a calculated degree of security of food supply for each area of the country.
- Ensure that these foodstuffs are distributed in a manner that every member of the population has a nutritionally adequate diet.

The food policy will continue to be sufficiently flexible to adjust to policy decisions taken in other sectors of the economy and to changes in the domestic and international economic environment. During the next decade, expansion of food production will need to be based primarily on increases in yields. The aim is to set rolling a "green revolution". This may be achieved by:

- Increasing inter-cropping.
- Increased multiple cropping.
- Improved soil analysis, and increased and efficient use of fertilizers.
- Increased use of other inputs.
- The progressive introduction of improved seeds and livestock breeds.
- Other improvements in cultural practices.
- Use of organic manure.

In addition to yield increases, the supply of food actually available for consumption can be increased substantially through a reduction in storage and handling losses. These will be reduced by improved extension advice and investment in on-farm storage facilities and by increased participation by the private sector in marketing, storage and processing.

Agricultural input policy

The central objective of the government's agricultural and livestock inputs policy is to ensure that adequate and quality inputs are made available to farmers and that, to the greatest extent possible, they are used at the right time and in the correct quantities.

Fertilizer importation and distribution was liberalized in 1991 and in general, the market has performed reasonably well. However, fertilizer use has been on a declining trend over the last 5 years, primarily because of high relative prices. The government will ensure that importation of fertilizers and other agricultural and livestock inputs is given priority in utilization of foreign exchange. Measures will also

continue to be taken to ensure the adequate provision and optimum utilization of other agricultural chemicals (to keep prices of agricultural chemicals low, the government will allow their importation free of duty).

The main policy for seeds will be to ensure adequate supply of high quality seeds of improved varieties of a wide range of crops. The objective of food crop research will be to continue the search for more productive and affordable crop varieties.

The main aim of the agricultural machinery policy will be to support the private sector in the development and wider distribution and maintenance of more appropriate technology, to increase labour productivity and reduce the present emphasis on imported capital-intensive equipments.

The government will further seek to reduce their policies by waving VAT on those inputs, to encourage farmers to intensify agricultural production through the use of agricultural and livestock inputs (fertilizers, agro-chemicals, livestock drugs and farm machinery). The policy will also aim at increasing the availability and quality of concentrates, compound feed and minerals required for increased livestock and poultry production. To keep the prices of imported livestock drugs, semen and embryos low, the government will allow their importation free of duty.

The Ministry of Agriculture, Livestock Development and Marketing will liaise with relevant institutions to finalise the preparation of the National Agricultural Mechanization Strategy (NAMS). Through the implementation of NAMS, the government will support the development of effective farm machinery manufacturing, distribution and servicing system for the country's needs and even for export.

It is essential that farmers have access to adequate financial resources, to continue making effective use of improved supply of agricultural and livestock inputs. These resources will be provided by expanding seasonal and long term move towards a decentralized agricultural finance system and to support the expansion of informal credit.

Gender issues in agricultural technology

Kenya's National Development Plan 1994-1996 (see Republic of Kenya 1994), stressed the need for agricultural policy to be sensitive to the special needs of women and youth so that their contribution to agricultural development as well as their welfare can be enhanced. Required are policies that improve the access by women and youth to information, land, credit and other resources. Such views were earlier articulated by Appleton(1993) in her paper entitled "Women: Invisible women technologists", in which she made the following observations:

- Women and men use and adopt technologies in different ways and have different priorities.
- Women's knowledge of production is rational and is based on a logical framework of understanding.
- The space in which women live affects their patterns of production and their use of technology, as do external circumstances such as national disasters, conflicts, environmental changes and market demands.
- It must be understood that, technological use cannot be divorced from the rest of people's lives. Domestic violence in all parts of the world restricts women and limits their ability to adopt and innovate technologies.
- The innovations (and adoptions?) that women make, are based on their priorities in all aspects of their lives and particularly on their understanding of the risks which are involved.

- Women's perception, use and adaptation of agricultural technology is shaped by their evaluation of risk.
- That decisions by women to reject particular technologies are often dismissed by others as proof that women are "resistant to change" or conservative, but such decisions are actually based on women's knowledge of their own environments, available resources, priorities and the risks they can afford to take.
- It is generally accepted that women have knowledge and skills in food production, processing and marketing and that this plays a crucial role in household livelihoods and food security.
- The national policy environment affects the ways in which women use, adopt and adapt to technologies. This is to say that women do not use and adopt technologies in a vacuum, without influence from both local and external factors.
- Women are not high-profile users of technical hardware: machinery and equipment. The most important components of women's technology are the software elements: The expertise, skills, knowledge, techniques and organization of production processes, are based on years of experience.

The same author jointly with Andrew Scott highlight issues in gender agricultural technology (ITDG, 1994). The authors argue that women's priorities and expectations in relation to technology may be fundamentally different from those of men. Also, traditional models of technology development may fail women, simply because they do not address the differences between men's and women's technological needs, uses and contributions. The implicit undervaluing of the skills, knowledge and organization of technology use has had serious implications for the status of women as technology producers and users, and also for their involvement in technology development processes.

Gender and technology

People's experiences in relation to technology are formed by their gender. Women and men from birth absorb the norms and values of the society around them. They learn the roles and responsibilities, skills, behaviour and expectations which relate to each sex and which define for each, their position in society. The technology which they use, and the technical knowledge to which they have access to, are shaped through this process, and also the potential which they have, to extend their knowledge and skills in any direction.

Similarly, although men and women live in the same place, each will experience differently the economic, social, cultural, political and geographical environments around them. Different experiences impact differently on their respective capacities and priorities in relation to the use and also the innovation of technology whether within enterprises or other activities. These sets of experiences can be identified and conceptualized as separate frameworks of technology use. Relationships also exist between these two sets of uses, which support hierarchies of access, ownership and control. These also affect the ways in which technology is used and adopted, and how women and men perceive themselves in relation to that use and adoption.

Different sets of technical knowledge

Men and women do different things or similar things in different ways, have different ways of organizing or applying knowledge or different ways of preserving and transferring knowledge (Norem et al. 1989). All these factors contribute to each sex building up different sets of skills and therefore knowledge. In crop production, men and women may perform different tasks within a single crop system, or cultivate different crops. They may well use and need different tools. Evidence shows that the development of agricultural technology has focused on support for men's tasks whilst women's activities have received less attention.

Women farmers in general work primarily with rudimentary tools and implements, since few poor women have access to modern inputs, which would enhance productivity. Their incomes are primarily allocated to pressing consumption needs; also appropriate inputs and technologies are seldom available in rural areas. Rural women's activities in animal husbandry, food processing, crop storage and marketing similarly do not bereft from modern technology (IFAD, 1992). Women farmers are rarely reached by extension services and included in on-farm research programmes. Women's crops and livestock activities, especially crop processing and storage have received relatively little attention in agricultural research and technological development programmes.

Women's and men's work is valued differently by development workers. Many of the tasks done by women are not perceived to involve any form of technology or use of technical skills. They are undertaken in the private environment of the home or are of low status, because they are domestic.

Often, development programmes ignore the gender related nature of production. Sometimes this has meant the introduction of new crop varieties like sugar-cane to men, which have had the effect of increasing women's work (such as weeding), without giving them access to any of the benefits. In some cases, the introduction of new technology to men has brought about a loss of control for women over an area from which they once gained an income. An example is the introduction of palm oil processing machines and hybrid rice varieties in some countries in West Africa (Ashy, 1981; Doy, 1982).

Policies that hope to widen technology choice for agricultural production can only achieve this if they include a commitment to understanding the different technical capacities, needs and priorities of women and men. Ann Leonard (1992) gave further insights concerning this issue in an article in *The Seeds Magazine* with a story of women in agriculture in western province, Zambia. She reiterated that like almost all women in Zambia, the majority of women in Zambia's western province are farmers. Hence, they have the following obligations:

- It is their duty to produce food to feed themselves and their children and to meet their basic cash needs according to custom.
- Women head over one third of all households in Zambia, in law or in fact.
- Women as well as men find farming a worthwhile activity. In areas where soils are good, efficient agricultural services are available, and markets and inputs are accessible.

Allocation of work in the households is somehow skewed in that while some men help women to clear land for food cropping, they spend most of their time tending their animals, fishing, looking after their own food plots and on cash cropping. In the past, women did not plough. It was a man's skill and a woman's touch of the plough was thought to bring misfortune and sickness. However, today, with more women being sole providers, there is a growing recognition that women must also learn this skill.

In Zambia's western province, women are breaking through traditional barriers. They are doing a job that was taboo, such as ploughing. Women rarely herd cattle, but almost one third of all women in the province probably own cattle at some point in their lives through inheritance or as payment of bride price. It is a widely held belief among men that women have little to do with the care and management of cattle and that they are not interested in keeping them.

A survey of women's work in rice production carried out by the Dutch advisors (to women's extension programme, WEP), revealed that a number of women already owned an ox or even a team, or had access to one through relatives. However, they had no control over the oxen's use and lacked the skill to plough.

Women's roles in the food cycle technologies

Ilkkaracan and Appleton(1994) in a study in Machakos, concluded that the introduction of modern agricultural technologies has aggravated the consequences of lack of rainfall and here, local producers are trying to return to traditional methods of cultivation. Technology programmes that are designed and conducted in a "gender neutral" way, end up having gender-segregated results and even among women, there are different effects on different groups.

The technological invisibility of women has been supported by lack of acknowledgement, both at national and international levels of women's economic contribution. Similar views were propounded by Ester Boserup (1989) when she wrote that Africa is the region of female farming per excellence. In many African tribes, nearly all the tasks connected with food production continue to be left to women. Female farming systems seem most often to disappear when farming systems with ploughing of permanent fields are introduced in lieu of shifting cultivation. It is not an invariable rule that men operate the plough right from the moment it is introduced. Among some Bantu people in Southern Africa, women steer the plough. These women probably belong to tribes with female farming traditions, and such examples are no more than sporadic exceptions to the general rule that ploughs are operated by men.

Barriers to access of rural women to land, livestock, other productive assets, extension services and credit in selected African countries

In a study by United Nations Economic Commission for Africa (1991), the following were observed as the main barriers to women's agricultural roles:

- Women in rural areas of Africa carry the heaviest burden in terms of Agricultural production, especially food production for the increasing population of the continent. Traditional division of labour by gender in which women's primary responsibility is usually food production, and preparation and collection of fuel and water, has continued in the rural areas of the region.
- In spite of the huge responsibilities shouldered by the female half of the region's population, in most cases they do not enjoy equal status as men when it comes to access to the resources necessary for efficient agricultural production. Be it land, livestock, extension services, credit or any other productive asset, there is marked imbalance in their accessibility between sexes. Experience shows that improvements in agricultural inputs and services usually end-up in the hands of the rural men. Agricultural inputs and improvements tend to flow to the male-controlled cash crops rather than to the female-dominated food production.

- The fundamental problem of women's limited access to land, credit, labour, technology and other productive assets, is linked to security of land tenure. Food production and food security in the region has been hampered by the fact that women have not been able to fully participate in many aspects of managing farms.
- Women encounter barriers as far as access to new and improved technology and other productive assets is concerned. This is related to the fact that women do not have equal access to land, and thus also not to credit. It follows that technologies and other inputs are not equally accessible or distributed to them.
- Institutional constraints and regulations, some of which originate in the land tenure systems prevalent in many African countries, limit women's access to credit, productive assets, and extension services and training, which therefore tend to be provided to men.
- There is often a distinct division between men and women in rural Africa as to the types of tools and animals they are responsible for. For example a man is generally in charge of the larger animals which include cattle and oxen to pull the ploughs, while women take care of smaller animals such as chicken and goats, which produce eggs, and milk and meat, respectively.
- Men also tend to obtain the newer or more sophisticated technology and tools, leaving the older and less efficient types to the women. Women have been displaced from their traditional domains by the introduction of more sophisticated technologies, because these newer gadgets have usually been taken over by the males in the community. It is further more clear that the problem of obtaining new or improved productive assets by women is related to the barriers to access to credit and extension services and also has its roots in the fact that women have less collateral, such as land.
- Food production in the region is primarily the rural women's responsibility and technological change has not displaced women from this activity, nor has it provided significant relief from their burden. Women's work has increased due to the high rate of male out migration to the urban areas or in search of non-farm occupations. Women are often excluded from new productive assets and technologies, because they are not trained to utilize it, nor do they have the financial resources to obtain and maintain technologies.
- Male domination of large livestock, agricultural technologies and other inputs such as fertilizers, also extends to the access of information about these productive assets. That information regarding fertilizer, seeds, and mechanization, is largely limited to men, both in the formal education system as well as in the informal networks that revolve around teashops or market places.
- Women also do have limited access to agricultural technologies. Such access to technology implies the economic ability to pay for such inputs, and physical access to inputs. These are only available at a distance, meaning women will not be able to benefit from their use. Technical training programmes frequently discriminate against women by exclusion, since it is assumed or culturally defined, that mechanization and technology are a male domain.
- That if women are to not only gain equal access to productive assets to increase food productivity, but also to gain equal access to cash crops, the traditional gender-based division of labour between the two sectors (food crop Vs cash crop?), will have to be broken down. To

achieve this, the women would have to gain access to the inputs required, to succeed in this sector. These include credit, technology, fertilizers, extension services, institutional support and hired labour.

- When decisions are made by a rural community (in Africa) as to what technologies and other inputs to be obtained, there is often a bias in favour of the men. This often results in the purchase of or demand for goods which the men deem as necessary or prestigious. This is to the detriment of the women, because it leaves less resources for inputs which would increase the productivity of crops grown by women or help alleviate their workload.

In conclusion, it seems clear that agrarian reforms in African countries have reduced prospects for women. The provisions of the reforms have only recognized only men as the heads of rural farmer households and therefore as the sole recipient of agricultural inputs, such as deeds to land, credit, productive assets and extension services.

Situation analysis of women and children in Kenya

A focus on Kenya was done by UNICEF and Central Bureau for Statistics (CBS, 1984) in their Situation Analysis of Children and Women in Kenya. They confirmed that small holding households headed by women tend to be poorer than those headed by men. Women who are heads because they have no husbands (through death, divorce or separation), are more firmly trapped by the conditions of poverty than women who head the family and farm in their husband's absence. Slightly over a quarter of the rural small households are headed by women. Female-headed households can be fitted into two major categories: permanent and temporary — a female (wife) heading household during absence of the male head (husband).

The study revealed that the proportion of small holding households headed by women by Kenya's provinces as of 1984 was as follows: Coast (12.2%), Eastern (22.9%), Central (31.1%), Rift Valley (21.1%), Nyanza (32.6%), Western (32.8%) and North Eastern (27.3%). The study also found that there were economic differences within female-headed small holdings and they are not homogenous. The economic position of women who head rural households, because they currently do not have husbands tend to be more adverse than that of women who head households in their husbands' absence. Smallholdings headed by women whose husbands are absent are disadvantaged in comparison with those headed by resident males.

Barnes and Werner (1982) of US Agency for International Development (USAID) study of Kenya found that almost all women who headed households (95%) classified farming as their main occupation and that households studied tended to have more resident women than men. Three types of households were studied namely: those headed by married men, married women and unmarried women.

A study showing percentage of distribution of improved cattle, revealed that improved cattle, were present more in the households headed by married men than in those headed by married women. Unimproved cattle were found more in households headed by married women than in those headed by married men. The conclusion is that there appears to be a relationship between type of cattle (improved or unimproved) and type of household.

On percentage distribution of expenditure on fertilizer by the same types of households, the same study found that although a higher percentage of married women than unmarried women reported

buying fertilizer, the percentage of married men purchasing fertilizer is higher than married women. About 78% of households however, reported no expenditure on fertilizer. The conclusion is that, households headed by married men use fertilizer (modern agricultural technology), more than households headed by married women. Also there is a relationship between the use of modern agricultural technologies (fertilizer) and type of households depending on who heads the farm household.

Social and economic constraints for women in farm household economy

A study by Mathangani (IDRC, 1989) disclosed some anthropological studies which identify a distinctive traditional division of labour among most African societies. Such arrangement charged men with basic responsibility of providing security and defence and the clearing of virgin land. As providers of subsistence, women performed all the related tasks of planting, weeding and harvesting. Women have been established as prime movers in the activity of food production. Thus, any effort seeking solutions to the food crisis in Africa, would have to take into consideration the primacy of women in this activity, while giving recognition to their total contribution to development.

Boserup (1970) had clearly demonstrated the way traditional division of labour between sexes in African societies have had (and continue to have) influence upon women's roles in agriculture and on food production in particular. She discussed the division of labour in African agriculture and noted that virtually all rural women in Africa take part in farm work, and the agricultural labour force is predominantly female as shown in Table 2.1.

Table 2.1: Division of Rural Labour by Task and Sex in Africa, Percentages of Total Labour in Hours

Task	% Total Labour	
	Men	Women
Cuts down forest, stakes out fields	95	5
Turns the soil	70	30
Plants the seeds	50	50
Weeds	30	70
Harvest	40	60
Transports crops from fields	20	80
Stores the crops	10	90
Markets the excess	40	60

Source: Women in Developing Agriculture, FAO 1984. (Also see Boserup 1970).

According to this report, introduction of cash crops took men further away from the area of food crop. The present situation is that women specialize/predominate in food production and men in cashcrop production. Hanger (1973) also found similar constraints in her studies in Embu, Kenya and Mukono, Uganda. She had the following major findings:

- In a household with the husband working full time on the farm, the husband was the one running the farm and the woman was not unduly pressed with farm work. That the wife normally had rights over the allocation of certain resources and power to dispose of certain crops.

- In a household consisting of more than the simple nuclear family, the control patterns constantly changed as the family matured. The stage of each farm in the development cycle determined to what extent control over the land and farming practice was shared between different members of the family.
- Work in the fields was largely dominated by women so that innovations in agriculture can only be successfully introduced if women become acquainted with new methods and convinced of their expediency (Molnos, 1968).
- The making of farm decisions or the acceptance of innovations, can be influenced by very many factors. Some factors affect a farm family's decision-making as a whole and others affect more specific decisions.
- There are various ways of grouping decisions when describing the patterns of control in a farm household as follows:
 - (i) Long term decisions such as allocation of land or cultivation of permanent crops. These are likely to fall within the area of responsibility of the head of the household (farm unit).
 - (ii) Mid-term decisions eg. those taken each season concerned with product mix, i.e. what to produce, how much of each, factor proportions (how to produce, when and by what methods), the distribution of the product (for whom to produce and where to dispose of product).
 - (iii) Day to day or short-term decisions. Minor decisions which have less effect on the whole farming system.
 - (iv) Decisions made once as opposed to those which are of a more routine nature.
 - (v) Decision, concerning an individual crop as opposed to others made for the whole farm.
 - (vi) Other classifications of farm decisions.

Often farm decisions are the responsibility of several different people, and in many cases, it is difficult to define exactly where responsibilities lie. Decision-making responsibilities may be categorized as follows:

- Husband in complete control.
- Husband in control, but wife having some say.
- Husband and wife jointly responsible.
- Wife mainly in control, but husband sometimes influencing decision.
- Wife entirely responsible for decisions, usually as a result of death or absence of husband for long periods.

Generally, it was found that in many cases, all the land that a wife controlled was planted with food crops and the rest of the farm, if under the husband's control, to cash crops. In all the households in Embu, the woman said she decided for herself what she would do. However, in 62% of the households, the husband decided on all the things of operations concerning cash crop and the women predominated on food crop operations. It appeared (for both Embu and Mukono) that female control in the farm

household did follow some recognizable patterns and was affected to a larger extent by both the presence or absence of husband on the farm, and the availability of employed labour.

A woman's decision-making is governed to a certain extent by what she herself or her children will receive from each of the alternative choices. Where a family functions as a unit and the wife knows that the money she makes from the cash crops will be spent on the children's education, clothing or her own needs, she will more readily allocate time to the task. The women's actions were not governed first and foremost by economic considerations. Farmers in Mukono knew more about better methods of production, but very few of the women were putting their knowledge into practice. It seemed the teaching they had received (from agricultural extension services) had not been sufficiently related to what they did on their own farms. Thus, although they could recite what they learned (including rather large errors in some cases), they did not see the relevance to their own situation.

In a situation where the women were already under pressure of work sometimes in the year, adopting a new method might put further pressure of work on them. They might not even have the time to think it worth trying the new method. The sample size in the studied areas, however, were too low, n=20 households in Buganda and Embu.

Barnes in a paper edited by Achola-Pala (1978) agreed that it is in the smallholder agricultural areas where women predominate. The 1969 census shows that about one third of rural households are headed by women. Land ownership among women (also property) is not extensive.

Management and decision-making of farm and farm issues is as follows:

- (i) Male managed farms
- (ii) Female-managed farms.
- (iii) Jointly managed farms where both wife and husband perform decision-making roles over certain agricultural activities. The husband may or may not be living on the farm.
- (iv) Corporately managed farms where two generations i.e. mother/father and son/daughter-in-law have a role in the management of the farm, which they jointly share.

There is evidence to indicate that when a cash crop under male control competes for labour with food crops under female control, the cash crop tends to be neglected until work on the food crop is completed. Moreover, women may refuse to work on a crop or do so inefficiently when the income will go to the male household head.

The responsibilities of women tend to increase with the introduction of labour-intensive crops, education of children and off-farm employment for men. Women are dependent on their spouses for access to land, and social sanctions operate to prevent them from interfering with this right. However, customary law and customs are eroding and this right is jeopardised.

Gender and farming in the future

An introduction to low external input and sustainable agriculture (ILLEIA, 1992), has highlighted the socio-economic, cultural and political characteristics, which form the human setting of a farm household apart from its biophysical setting. Each household is a unique combination of men, women, adults and children, who provide management, knowledge, labour, capital and land for farming, and who consume at least part of the produce. Thus, the farm household is a centre of resource allocation, production and consumption.

The decision-making process in the farm household is influenced by the culture of the community to which the household belongs. In patriarchal societies, decisions are taken by the household head, a man. In matriarchal societies, this may be true only to a lesser extent and only with respect to certain distinct responsibilities. However, the personalities of the different household members will also affect decision-making. The man may be the formal decision maker, but in reality it may be the woman in the household who determines what is done.

Feldman and Welsh(1995) describe the farm as the site of production and the place from which ideas are produced. Kloppenburg(1991:528) argues:

it is the locality of such knowledge production, which most completely intimate the many dimensions of its character. Such knowledge is local in the sense that it is derived from the direct experience of a labour process, which is itself shaped and delimited by the distinctive characteristics of a particular place, with a unique social and physical environment.

Division of labour on-farm in the future

Adding gender variable to dominant research perspectives has led to recognizing that Agricultural production on small family farms cannot be realized by activities of the farmer alone, but requires the contribution of many farm household members (Rosenfield, 1986; Jones, 1986). Women are relevant and active agents in constituting meaning and activities of social life. In an analysis of agricultural modernization in Greece, Shatagaki (1988) observed that women remain in the house and perform reproductive activities after they have been replaced by labour-saving machinery.

Relation of gender, generation, power and authority within the farm household, conditions the kinds of claims and challenges households take against strategies to industrialize production or generate and implement alternative agricultural practices. Household relations affect farm characteristics. Meara (1992) has argued that farm households reflect different patterns of negotiation and resolution about who should participate in the farm operation. This diversity of intra-household relations, conditions specific characteristics, such as age and education, and affects decision about (on and off-farm) employment.

Thus, gender relations are part of a process of negotiation and reconstitution that frame household relations and household based activity (Dwyer & Bruce, 1988; Sen, 1990). Industrializing of agricultural production contributes to a shift in familial relations (Fink, 1986) as the adoption of scientific management and technologies, and increasing specialization, restructures farm relations and re-organizes productive activities. According to Jones and Rosenfeld (1984) and Poole (1981), there is a correlation between the centrality of women's role in the production and decision-making. Women's desire to retain control may explain why some farmers choose not to adopt many of the new technologies and techniques of modern farming. Knowledge, decision-making authority and control of the production process, varies according to the farm task, and life cycle, and the differing situations of farm household members.

Gender and technology choice is, therefore, determined to some extent by division of labour along gender lines. Household members make decisions about whether to accept, reject, or seek alternative to the conventional or normative model of agricultural production. McLoughlin (1970) outlines factors influencing farmers' decisions to adopt new technology (constraints on the adoption of new technology) as:

- The farmer: Technology may not be known or understood, by the farmer who may also lack managerial competence. The innovation may not be socially, culturally or psychologically acceptable.
- The innovation may not be economically feasible, technically viable and/or adequately adaptable. All elements in the new package may not be available. (inadequacy of supply or services).

The process of adoption of new ideas and practices was outlined by Lion Berger (1960) as constituting:

- Awareness stage — learning
- Interest stage — developing interest
- Evaluation stage — evaluating information and the technology
- Trial stage — trying the technology
- Adoption — adopting

In planning technologies appropriate to farmers, CIMMYT (1980) gave some concepts and procedures as follows:

- That many factors affect the choice of a technology for the target crop, because of interactions in the farming system. This is to say that various circumstances affects farmers' choice of a crop technology. Farming system as the totality of production and consumption decisions of the farm household, include the choice of crop, livestock, off-farm enterprises, and food consumed by the household.
- It can be said, therefore, that a farmer's decision to choose or use an innovation is influenced by a myriad of factors, such as the following:
 - (i) Farmer's decisions and management practices are determined by natural and economic factors/circumstances. Very little is said of the cultural factors.
 - (ii) Natural circumstances influence farmers' decisions by imposing particular biological constraints on the crop (e.g. pattern of rainfall affects decisions on time of planting). The circumstances of most farmers are such that they adopt technologies in piecemeal, because of:
 - (a) scarcity of capital,
 - (b) inability to withstand large risks, and
 - (c) a learning-by-doing approach.

Conclusions from the reviewed literature

A future can only be built on the past and present, and to plan for the future without facts is to build a house without a foundation. Assembling and collecting data on the participation of women and men in society is therefore a must, if the whole is to provide a complete picture of their contributions to the national development and therefore, bestow on everyone (especially her) that great honour she always deserved (Barnes in Achola Pala et al. (eds), 1978).

Most farmers and their families live on the farm or in a nearby village. Therefore, any new practice/technology must also be acceptable to the farm families social situation, personal beliefs, customs, attitudes, religion, culture and overall way of life.

Different people know different things in different places and learn new things in different ways. Knowledge is not a stock, but a process. The issue is not just whose knowledge counts? but who knows, has access to and can generate what knowledge and how? Knowledge is bound to action. What people do, is not necessarily what people consciously know (Scoones and Thompson, 1994).

Most societies have a complex division of labour and women work in separate spheres, in an almost segregated manner from men. This separation permits the development of what can be termed a woman's subculture. In a woman's subculture, separate group activity, status systems, and support networks operate. Such sex segregation system poses many constraints to access, use and benefits to women in agriculture (Staudt, 1976).

Household gender division of labour contributes to the choices household members make about whether to accept, reject or seek alternatives to the conventional or normative model of agricultural production (Rural Sociology Journal, Spring 1995).

Most outstanding features of agricultural policies in Africa is their attention to gender issues in agriculture, namely lack of emphasis in policy documents of recognition of women's contributions in agriculture, needs and prospects. Most often, women only receive only paragraphic attention in development plans and policy documents. Hence, it is not a surprise that agricultural development programmes have tended to ignore them.

Gender bias and blindness are evident throughout the agricultural and food systems and farmer is usually perceived as either genderless or male (Scoones and Thompson 1994). Women are both farm workers and decision-makers, at least to some extent. If this is true, it is doubly important that they know, understand and accept the new ideas, which improve farm family welfare (Hanger, 1973).

Knowledge is held, controlled and generated by different people in a society and is not evenly distributed. Different individuals are recognized as specialists in particular fields and are key in the transmission and interpretation of knowledge within a community or family (Swift, 1979).

Farm families' social, personal beliefs, customs, attitudes, religion, culture and overall way of life, affect farm practices that would be found in a given farm household. Besides these, government plans, policies and agricultural programmes affect adoption of farm technology. To understand and influence patterns (and the various aspects of production, consumption and investment, including purchases of farm inputs), we must move beyond the single dwelling unit or household. We must look inside the "node", i.e. investigating intra-household relations and the place of gender in farming systems (Moock, 1989).

Farmers' attitudes towards taking risk will also determine farmers' decision whether or not to take new technology. Also, adoption of agricultural technologies is dependent on government plans, policies and agricultural programmes.

Chapter Three

Methodology

The research site

This study was carried out among farmers in Machakos District of the Eastern Province of Kenya. The District is in the semi-arid zone of Eastern Kenya, bordered by Kajiado District to the West, Taita-Taveta District to the East, Embu and Mbeere Districts to the North-East, Muranga to the North, Kiambu District and Nairobi Province to the North-west (Figure 3.1).

Its total area is approximately 5,818 sq km ranging from 125 km wide in the north and less than 20 km wide in the south (Machakos District Development Plan, 1994/1996). The population projections by the Machakos District Development Plan of 1994 estimates the population to have risen from 876,242 in 1993 to 903,378 people in 1994.

The District is divided into three physical regions. The high potential zone roughly covers 54% of the agricultural area. The medium potential zone covers 38.2%, and the low potential zone covers 56.4% of the total land mass. The land productivity varies from zone to zone with those areas in zone II having a high degree of crop expectancy, because they have higher and more reliable rainfall. Their soils are also better suited for agricultural production. The medium potential zone is suited for growing a variety of crops including sorghum and animal husbandry. In low potential zones the rainfall is erratic and unreliable, so they concentrate on drought resistant crops such as sorghum, millet, pigeon peas and katumani maize variety.

The District usually has two rainy seasons, one between March and April and another between November and December. Rainfall in the District varies with altitude. The average annual rainfall ranges from 1000 mm in some of the highlands to slightly below 500 mm in the low-lying south and south-east parts of the District (Machakos District Development Plan, 1989/1993).

The district has six divisions, namely, Central, Kangundo, Kathiani, Mwala, Yatta and Masinga. The divisions are divided into 28 locations and the locations, in turn, are sub-divided into 130 sub-locations. Kangundo, Yatta and Masinga are the divisions where this study took place.

Sampling procedure

The three divisions that were selected for this study have diverse agro-ecological zones, which allowed a focus on different agricultural activities and technologies. Furthermore, during the research activity, emphasis was placed on capturing the diversity that exists in the community, based on age, gender and status. Stratified sampling will be used to collect data from various categories of community members. They include married couples where men live with their wives and family, defacto and de jure female

headed households, men, women, people of different economic status, extension agents, and non-governmental organization and church representatives.

This desegregated data illuminated the differences in people's access to and allocation of resources, and their influence on technological adoption and use.

Research protocol and data collection techniques

The major research methodology to be used is the participatory approach. The philosophical basis for this approach is derived from the fact that the respondent participation must be at the centre of every development effort. Authentic development originates from collective imagination, thoughts, ideas, convictions, visions, experiences, decisions and practical actions of people. These experiences and actions not only reveal people's perception of the issues at hand, but they are culture specific, relevant to the environmental and economic circumstances, and provide the link between people's needs, indigenous value systems and biophysical resources.

The participatory approach necessitates the involvement of local community, selected development planners and implementors, and those who participate in production activities, such as extension agents, agricultural research station staff and non-governmental agencies.

In Machakos, these organizations include:

- Dryland farming research station in Katumani (DFRS), in central division, Machakos town.
- National horticulture research station in Machakos town.
- Ruiru coffee research station
- Churches
- Food Relief Agencies

Informal research methods, such as informal interviews, focused group discussions, key informant techniques and direct observation were applied. Where appropriate, selected Participatory Rural Appraisal (PRA) tools were utilized, such tools as, preference ranking, transect walks, participatory modelling and mapping, seasonality calendars, daily routines and activity profiles, were practised. These PRA tools, not only facilitated the process of rapport building between the actors in the research process, it empowered the community to shape the research process by providing their perception of the issues at hand and developing action plans for implementation purposes.

The survey method was also used to obtain generalized data on household composition, family size, marital status, and activity profiles. The method has the major advantage of facilitating the computation of summary statistics on a more representative basis. To more effectively tap gender specific information without regressing into generalities, the questionnaire included the Gender Analysis Framework. The tool which was designed by Fieldstein et al. (1985, 1989); Cloud (1985, 1988) and Poats (1989), facilitates the collection of gender specific information on division of labour in farming operations, household chores, off-farm enterprises and choice and use of different technologies. The strength of the tool lies in highlighting the diversity and differences that exists amongst categories of farmers, such as single women, divorcees and de jure household heads. An illustrative sample of the activity profile is shown in Table 3.1.

Table 3.1: Activity Profile

Crop Production Crop	Gender								
	F A	M A	BOTH	FC	MC	BOTH	EQUI	TIM	LOCU
Task 1									
Task 2									
Task 3									
Household									
Chores									
Task 1									
Task 2									
Task 3									
Off-farm									
Enterprise									
Task 1									
Task 2									
Task 3									

Source: Adopted from Overhault et al. (1985) A paper prepared for Harvard Institute for International Development Case Study and Training Project, USAID.

Key: FA-Female Adult, MA-Male Adult, FC- Female Child, MC- Male Child

Data analysis techniques

Both qualitative and quantitative data analysis techniques were utilized. Qualitative techniques included detailed description of people's attitudes and feelings towards resource allocation, and its use and benefits derived from it on the basis of gender. Content analysis helped to make sense of the massive information gathered through participatory approach. Quantitative analysis was used to measure the extent to which the different sexes have adopted agricultural technology and the characteristics of the adopters. This analysis required intensive use of frequency distributions, cross tabulations, means and averages. Illustrative methods such as bar graphs, pie charts, maps and line graphs were applied when appropriate.

Chapter Four

Findings

Characteristics of the study sample

Sample size $n = 96$ (general sample). Sample n is individual items varied with the maximum being 96. Proportions used are therefore those applying to individual items out of the total actual responses.

Sex of respondents

Majority of study respondents were men. The distribution is shown in Table 4.1.

Table 4.1: Sex of Respondents

Sex	Number	% Total
Male	51	54.3
Female	43	45.7
Total	94	100

$n=94$ as sex for two cases was not indicated.

Age of respondents

The range of those interviewed was from 15-64 years. The distribution of the study respondents by age is shown in Table 4.2.

Table 4.2: Respondents by Age

Age Group	Number	% Total
15-24	5	5.2
25-34	16	16.7
35-44	17	17.7
45-54	22	22.9
55-64	18	18.8
64 and over	18	18.8
Total	96	100

Marital status

The distribution of study respondents by marital status is shown on Table 4.3.

Table 4.3: Distribution of Respondents by Marital Status

Marital status	Number	% Total
Single	9	9.4
Married	81	84.4
Divorced	1	1.0
Widow/Widower	5	5.2
Total	96	100

It is evident that the majority of the study respondents were married people. Many were therefore mothers and fathers. Respondents who were interviewed were few, about 9.4% of the sample. Only 1 % were divorced, while 5.2% were either widows or widowers

Status of respondents in households

Majority of the respondents were heads of households. The distribution of respondents in relation to the status held within the households is in Table 4.4.

Table 4.4: Status Held in Households

Status	Number	% Total
Household head	61	64.2
Other (eg. wife/son)	34	35.8
Total	95	100

The status for one case was not entered.

Household size

All the study respondents came from households with more than two members. The smallest household interviewed had three members and the largest had 20 members. Majority of households interviewed had between seven to nine members. This represented 37.2% of total households interviewed. About 62.8% of total households interviewed had between three to nine members.

Ethnic group/background

Almost all the study respondents were Akamba. The distribution of the respondents by ethnic group is in Table 4.5.

Table 4.5: Ethnic Background

Ethnic Group	Number	% Total
Akamba	93.0	96.9
Other	0.3	3.1
Total	96	100

n=96

Religious affiliation

Majority of respondents were Christians. The distribution is in Table 4.6.

Table 4.6: Religious Affiliation

Religion	Number	% Total
Christian	94	97.9
Other	02	2.1
Total	96	100

Residence

Those interviewed ranged from those who had been in their present site for only one year to some who had been living in their present site for 99 years. Respondents, therefore, were composed of both recent immigrants and those who had been in the specific study sites for many years. (n=83). About 47.9% of the respondents have had previous residence in other parts of Ukambani, meaning they were actually migrants who had settled in these specific study sites.

Education background of respondents

- (a) About 83.7% of the respondents had received some form of formal education, 16% had informal education. (n=92) and four respondents did not indicate the type of education received.
- (b) A large portion of those respondents who had some form of formal education had received primary education. A good number had also received secondary education. The distribution of respondents by level of formal education is shown in Table 4.7.

Table 4.7: Education status of the Respondents

Level of Formal Education	Number	% Total
University	2	22
College	7	7.8
Secondary	34	37.8
Primary	34	37.8
Other	1	1.1
None	12	13.3
Total	90	100

n=90. level of education for 6 cases(respondents) not indicated

Main occupation (economic activity)

Majority of the respondents did farming as their major economic activity. They were mainly engaged in crop production. Other respondents were involved in paid up employment and others in business. The distribution of the respondents by main economic activity performed is shown in Table 4.8.

Table 4.8: Economic Activities

Economic Activity	Number	% Total
Agricultural		
Crop Cultivation	83	94.4
Livestock farming including poultry	02	
Paid employment	01	1.1
Business	02	2.2
Others	02	2.2
Total	90	100

n= 90. The main activity of 6 cases (respondents) was not indicated.

General information on agricultural production (economic activity)

About 94.4% of the respondents(excluding those whose main economic activity was not indicated) were involved in agricultural production. Some households earned Kshs 1,500 per year from agricultural production and others as much as Kshs 400,000 per year. This indicates, therefore, that there is a wide disparity among farmers in the study area on the amount of money they earned per year from involvement in agricultural production. Households (41.6%) interviewed earned between Kshs 1,500 to Kshs 30,000 per year.

Land size

Respondents mentioned possession of land on which their households were established. The smallest were 0.3 and the largest 137 acres; only one household owned 137 acres. About 78% of the studied households owned land between 0.3 and 10 acres and 54% of total households owned land between 0.3 and 5 acres (Table 4.9).

Table 4.9: Acreage

Size of land	Number	% Total
Less than 1	1	1.1
1-2	25	27.5
3-5	15	26.3
6-10	21	23.1
11-15	8	8.8
16-20	3	3.3
Over 20	9	9.9
Total	91	100

n=91. The size of land owned by households represented by 5 respondents is not indicated.

Main agricultural activities carried out

The main agricultural activities carried out by the respondents were listed in order of importance as:

- Food production (subsistence farming)
- Cash crop production
- Poultry keeping
- Horticulture
- Beekeeping

Generally, farmers whose main agricultural activity was crop production had maize and beans as the main crops grown. The overall distribution of responses regarding the main crops is in Table 4.10.

Table 4.10: Percentage of Food Crops Grown

Main Crop	Number	% Respondents
Maize	58	63.7
Beans	8	8.8
Maize and beans	13	14.3
Bananas	5	5.5
Sugar-cane	1	3.3
Others	4	4.4
Total	91	100

Utilization of land by type of crop including land under grazing

The number of acres under food, cash crop and grazing land is varied. The largest portion of land mentioned to be under food crop was 30 acres and the smallest was 0.3 acres. The largest piece of land under cashcrops was 20 acres and the smallest 0.2 acres. On the other hand, some respondents mentioned having grazing land measuring 92 acres and the smallest was 0.2 acres (Table 4.11a).

Table 4.11a: Farming Activity and Land Size

Activity	Smallest Pieces	Largest Piece of Land
Food Cropping	0.3 acres	30 acres
Cash cropping	0.2 acres	20 acres
Grazing	0.2 acres	92 acres

Distribution of acreage under food crops, cash crop and grazing land by households is in Table 4.11b.

Table 4.11b: Distribution of Food Crops

Food Crop	% Total Households
Less than 1 acre	21.0
1-3 acres	40.6
4-6 acres	20.0
7-9 acres	6.5
10 acres	12.0

n=91. Majority of the households (61.6%) had between 0.3-3 acres under food crops.

Cash Crop	% Households
Less than 1 acre	20
1-3 acres	31.0
4-6 acres	29.6
7-9	3.7
10 and above	15.7

n=81

Grazing Land	% Households
Less than 1 acre	40
1-3 acres	37.0
4-6 acres	7.4
7-9 acres	-
10 acres and above	14.9

n=54

Differential tending of crops

The study reveals that there is no marked differential in tending of crops by sex. However, 51.3 % of respondents felt that there were crops which were tended by more male/female members of the households. Those who said that male/female members tended certain crops, also mentioned the crops in order of importance as: sweet potatoes, arrowroots (23%), food crops (8.6)% and cash crops (5.7) .

Differential tending of animals by sex

Respondents (73.9%) felt that there were no animals kept on their farms, which were tended exclusively by female /male members of their households. Only 20.4 of the respondents felt that such animals existed and mentioned cattle as one type of such animals, mainly tended by men.

Ownership and land acquisition on agriculture

Generally, the majority of respondents owned the land on which they carried out the agricultural activities. they mentioned participating in food and cash crop and livestock (including poultry) production. Majority of farming respondents acquired their land through inheritance. (Table 4.12).

Table 4.12.: Percentage of Ownership and Acquisition of Land

Mode of Acquisition of Land	% Total Respondents
Inherited	52.4
bought	26.0
Allocated(eg by government)	18.1
Other	3.5

About 58.7% of respondents (n=92) mentioned having more than one piece of land, ranging from 0.3 to 888 acres.

Very few of the interviewed respondents, 9.6% mentioned using land as security to acquire a loan.

Trends in gender variables in agricultural technology

Preference and use of indigenous agricultural technology

- (a) Data demonstrates that women have greater preference and use of indigenous agricultural technologies than men. About 79.2% respondents mentioned women as users of indigenous agricultural technologies. Only 8.3% of respondents mentioned men as having greater preference and use of these types of technologies, compared to women. Respondents (31.1%) felt that both sexes prefer and use indigenous agricultural technologies. It is therefore clear that women tend to use indigenous packages. This point is further supported by the fact that 40% of respondents (as opposed to 10% who mentioned female adults) felt that male adults do not generally use indigenous methods of agricultural technologies.
- (b) A number of factors or reasons have been advanced to account for the differential preference and use of indigenous agricultural technologies proposed by percentage respondents as follows:
- Some tools are more appropriate for women, while others suit men (32%)
 - The amount of energy to be expended on using a particular technology (implement) (12%)
 - The level of access to a technology e.g. women have greater access to indigenous technology than modern ones (17%)
 - The level of technological knowhow determines use (4.0%)
 - The level of men/women's involvement in agricultural production (activities) eg. men are often busy on non-farm activities (40%)
 - The kind of posture that the use of a given agricultural technology (implement) demands of the user eg. men do not like bending. Hence, would have less use of tools (implements) that require them to bend (most of these would be traditional tools) (4.0%).
 - Tradition i.e. people having inclinations to prefer/favour and subsequently use that which has always been there (19.0%).
 - Availability i.e. indigenous agricultural technologies are much more available than modern ones (14.3%).

- Level of access to the technology in question (among women and men), depending on costs involved.
 - Physical make up of the technology.
 - Culture of the people (users of technology).
- (c) In general, farmers (men and women) show preference for a wide range of indigenous methods and implements. These include the following (in order of importance):
- The jembe (23.8%), panga (23.8%) and mixed cropping (23.8%).
 - Digging sticks, fencing stick, strip grazing, and broadcasting.
 - Indigenous breeds in livestock production. The main reasons being that: they are cheaper to acquire and maintain, and withstand the environment better.

The first two methods are preferred because they are relatively cheaper, farmers have experience in their use, are easier to use, have not been supplemented and the land is scarce for use of modern technology.

Knowledge and use of indigenous agricultural technologies

Who has knowledge of technology?

The study revealed that there is gender differential in the knowledge of agricultural technology. Women in the study area use indigenous agricultural technologies more than men. Therefore, they can be perceived to have knowledge of various aspects of indigenous agricultural technologies. They know how to use and produce them, knowledge on the origin of the technology, and the merits and demerits of the technology.

All farmers interviewed have knowledge on the use of the following implements which they have identified as indigenous: the jembe (hoe), digging stick, panga, fencing stick, beating stick, herding stick, cutlass, axes, mattocks. Panga and jembe are generally viewed by farmers as indigenous while others see them as foreign.

Indigenous agricultural activities which farmers have knowledge of include: use of manure, tethering (of animals), strip grazing, rearing of indigenous breeds, dehorning, tilling land, mixed cropping, broadcasting, open grazing, burning of land (in readiness for planting), application of ash as pesticide and shift cultivation.

Farmers identified the following to be implements and methods which have a foreign origin: tractors, disc-plough, mono cropping, fertilizers, ox-plough, sprayers, use of pesticides, pesticides, spade, growing of cash crops (e.g. coffee), pangas, wheelbarrow, irrigation, mulching, zero grazing, milking machines, mattock, crop rotation, drenching, dipping, exotic breeds, knapsack sprayers and use of HYV seeds.

Use of indigenous agricultural technology

It has already been identified that women use indigenous agricultural technologies. However, a fuller confirmation of this need to be made by looking at the various farm operations (tasks), eg. who performs the tasks, and what are the implements and methods they use? Use of indigenous agricultural technologies is not confined only to farmers practising crop production but also on the side of livestock production. It is confirmed by 82.8% of respondents that they kept indigenous breeds.

In the various farm operations, trends in respect to the use of indigenous agricultural technologies have been observed as follows:

Land preparation

This activity is performed predominantly by men. Responses revealed that male hired labour makes 27.6%, male adults 24.1% and female adults 10.3%. Major implements in order of importance in land preparation are: Jembes and pangas (17.2%), cutlass and jembes (17.2%), slashes cutlass and jembe (17.2%), and jembes and mattock (13.8%). Most of these implements have been identified as being foreign i.e. not indigenous among the Kamba. Both modern and indigenous agricultural technologies are used in performing this task.

Basically, the top ranking reason why farmers prefer and use the implements mentioned earlier in land preparation, is their availability (8%). The other reasons are that the implements are appropriate (39.3%) and affordable (10.7%).

Planting

This activity is mainly performed by female adults (39.3%) and male hired labour (17.9%), followed by female hired labour and female adults (10.7%). It therefore means that planting is mainly a woman's job, though men also perform it.

The ox-plough (51.7%), jembe (17.2%), panga (13.8%) and tractor (10.3%) are the major implements used in planting. Interestingly, most of these implements have been identified by majority of farmers as being foreign, i.e. not indigenous. Row planting (53.6%) and ox-ploughing (21.4%) are the major methods of planting as reported by farmers. Again, foreign use of agricultural technology (methods) is evident.

Major reasons for preference and greater use of these implements (most of them foreign) in planting is the availability of implements (37.0%), their appropriateness (29.6%) and convenience (25.9%).

Weeding

This is mainly performed by female adults (17.9%) and male hired labour (17.9%). Farmers also felt that combinations of female hired labour and female adults (10.7%) and male adults and male hired labour (10.7%) are also important in weeding. This activity appears to be performed equally by both men and women. (no clear cut allocation of this task along gender lines).

Weeding is mainly done traditionally eg. cultivating (61.5%), tilling (15.4%) and mechanical weeding (15.4%) is also practised. Implements used in weeding are mainly modern, jembes (42.9%), panga and jembe (32.1%) and jembes and ox-ploughs (17.9%).

Both indigenous and modern implements are used in weeding because of the convenience (57.7%), availability (26.9%) and affordability (15.6%).

Spraying

Spraying is mainly done by males, eg. male hired labour (41.4%), male hired labour and male adults (31.0%) and male adults (10.3%). Spraying of crops is a widespread practice among farmers in the study area. Respondents (69%) mentioned its use.

Most of the implements used in spraying are modern (foreign to Kamba). The major ones are knapsack sprayer (48.3%); spray pump (13.8%); bucket and twigs (3.4%) and sprinkler (3.4%). The main reasons for preference (and use) of these implements (technologies) are: safety in use (19.2%); availability (19.2%) and convenience in use (11.5%).

Spraying which is dominated by men, is mainly effected by utilizing modern technologies. Moreover, spraying by itself is not an indigenous agricultural activity among the Kamba.

Manuring

This is performed by male hired labour (31.0%). Female adults (17.2%) and male adults are also involved in manuring of crops.

Most of the implements (technologies) used in manuring, are modern. The main ones being: wheelbarrow and cart (33.3%); wheelbarrow (22.2%); wheelbarrow and bucket (22.2%). Others are tractors and shovels. These implements are modern. Main reasons for preference (and use) of the implements used in manuring are: convenience (44.0%); availability (28%); and efficiency (28%). Row manuring (41.7%); spreading (33.3%); broadcasting (16.7%); ridge manuring (4.2%) and mechanical manuring (4.2%) are the major manuring methods used.

Irrigation

It is not a widespread practice among the farmers, with only 34.5% of the respondents representing households mentioning practising it. Male hired labour dominantes (20.7%).

Gravitational irrigation (20.7%) is the most popular method of irrigation, followed by overhead irrigation (6.9%). Farrow irrigation is also done. Most of the implements used in irrigation are modern ones: sprinklers, water pump machines and channels. They are preferred due to their availability (3.7%) and ease of use (3.7%).

Harvesting

Female adults (13.8%) and hired male and female labour (13.8%) perform harvesting. Other groups are male hired labour and female adults (20.7%), and male hired labour (10.3%).

Both indigenous and modern methods and implements are utilized in performing this task: pangas, jembes, sacks, wheelbarrows and carts. The methods of harvesting commonly used (in order of importance) are: gathering, plucking and mechanical harvesting. Preference is due to affordability (37.5%), efficiency (29.2%), availability (20.8%) and ease of use (12.5%).

Post harvesting activities

The single most important group/category mentioned as the main performer of post-harvesting activities are the female adults (14.8%), and male hired labour and female adults (14.8%)

The activities include; threshing, packaging, plucking, and the major implements mentioned in performing these tasks include: beating sticks, sacks and carts. These implements are preferred mainly because: they are the only methods known (47.6%), convenient to use (28.6%) and available (14.3%).

Tending animals

Tending of animals in the area of study is carried out by men (29.6%) as male hired labour. However, 14.8% felt that it was male adults (general) and 11.1% felt all the household is involved. Women are involved in tending animals to a less extent, compared to men.

Animals are mainly tethered (37.0%). Open grazing (33.3%), zero grazing and strip grazing are also practised. Ropes are commonly used in the tethering of animals (66.7%). Also used are feeds, pastures and trough. Preference for these implements (inputs) are mainly because they are affordable (40%) and appropriate (24.0%).

Milking

Mainly performed by female adults (85.2%) However, male hired labour, female hired labour, and female children have also been mentioned by 14.8% of respondents as being involved in milking. Milking is mainly done manually (96.3%). Major implements used in milking include the bucket (34.6%), jug (26.9%), cups and kettle (19.2%).

Preference for use of these apparatus by farmers is mainly due to affordability (65.4%); availability (15.4%) and convenience use (11.5%).

Treating of animals

Mainly performed by male adults as mentioned by 37.0% of farmers interviewed and 33.3 mentioned male hired labour. Women, eg. female adults (3.7%), are also involved in the treating of animals. Injection (48.1%) and drenching (40.7%), are the main methods used in the treatment of animals. Drenching gun (40.7%) and the syringe (18.5%) are the main instruments used in the treatment of animals. Preference for these instruments is mainly due to their availability (20.0%), affordability (16.0%) and convenience (8.0%).

Dipping

Mainly performed by male hired labour (29.6%). Female adults (3.7%) are not important performers of this task. However, the dipping of animals is not a common practice among farmers, 48.1% of respondents keeping animals mentioned non-use of dipping. Dips (50.0%) and spraying with knapsack sprayer (34.6%) are the main instruments used. Dipping as opposed to spraying is the dominant method used. Availability of implements (26.9) is the dominant factor determining farmers preference of implements.

Dehorning

It is not a common practice among the farmers (70.4%). The activity has been identified as indigenous. Male hired labour (22.2%) is the single most dominant group performing the task.

Dehorning is mainly done by cutting horns (29.6%) with the hack-saw (29.6%). Farmers prefer the hacksaw mainly due to: its appropriateness (14.8%), convenience (9.4%), availability (8.7%) and affordability (3.7%).

Selling of animals

Mainly performed by male adults (55.6%). Female adults as well as other household members are, however, also involved at a lesser degree when compared with men. Animals are mainly taken to the market whereby open air bargaining is the dominant mode of selling.

Who makes decisions on the use of indigenous and modern technologies

The study demonstrates that decisions regarding agricultural production are made in collaboration with both women and men (57.1%). However, 42.9% of the respondents stated that decisions on agricultural production are made by one person. The areas of food production in which decisions are made by one person include: deciding on the planting time, selling, weeding, harvesting and tending of animals.

Majority of the respondents (57.7%) felt that decisions about planting and tending of animals are taken by one person. According to the respondents, men and women are the main regular decision makers in the activities shown in Table 4.13.

Table 4.13: Percentage of Decision-making in Households

Activity	Men(%)	Women
Clearing	55	15
Breaking the land	62	8.3
Planting	33.3	55.6
Weeding	6.3	12.5
Manuring	37	25.9
Harvesting	34.6	42.3
Packing	41.7	33.3
Marketing	15.6	3.1
Land preparation	26	4.2
Time to plant	64.3	21.4
Land preparation	25	75

These data indicate that men are regular decision makers on land clearing, breaking the land, manuring, packing, marketing, and land preparation. Conversely, women are regular decision makers in issues to do with planting, weeding and harvesting. However, the women are consulted more by men regarding land preparation.

The study also revealed some gender differences in the decisions about the timing of agricultural activities (Table 4.14).

Table 4.14: Percentage of Timing of Agricultural Activities

Activity timing	Men % responses	Women % responses
Land preparation	86.2	13.8
Planting	55.2	37.9
Manuring	64.3	35.7
Weed control	51.7	41.4
Spraying	66.7	7.4
Harvesting	42.1	57.9
Processing	60.0	33.3
Purchase and repair	73.3	20.0
Sale of produce	79.3	10.3

According to this study, hired male are also regularly involved in decision making in the following activities as reported by the respondents: clearing (25%), breaking the land (4.3%), planting (7.4%), weeding (17.2%), manuring (11.1%), spraying (23.3%) and harvesting (7.7%).

Purchases, access and benefits of agricultural technologies used

The respondents reported the gender associated purchase of implements as given in Table 4.15.

Table 4.15: Gender Associated Purchase of Farm Implements

Implements	Response % purchase by men	Response % purchase by women
Cutlass	78.6	10.7
Stick	14.3	28.6
Ox-plough	7.4	
Tractor	22.2	-

Most farm implements except for the digging stick are purchased by men. These implements are generally purchased from the sale of agricultural products. The respondents stated that the source of the income to purchase the implements is shown in Table 4.16.

Table 4.16: Percentage Source of Salary to Purchase Technology

Implements	Income source from sale of agricultural products % responses	Salary % responses	Spouse	Loan
Cutlass	64.2	25	7.1	-
Stick	21.4	21.4	-	-
Ox-plough	67.8	28.6	-	-
Tractor	17.9	7.1	-	75

There is likely to be an association between men's dominance in relation to their decision over major issues such as marketing, timing of harvesting, processing and sale of produce and their purchases of farm implements. Perhaps the stick is the cheapest, hence it can be bought directly by more women from either salary or sale of agricultural products. On the other hand, the stick is the simplest technology and can easily be made as reported by 25% of the respondents. Agricultural implements are either bought or hired. Thus, more men have access to most of the implements due to their access to financial resources either from agricultural sales and/or salary. The data indicates that adult men are the main owners of farm implements (Table 4.17).

Table 4.17: Gender-based Ownership of Farm Implements

Implement	Owner	
	Men	Women
Cutlass	82%	7.1%
Stick	22.2%	25.9%
Ox-plough	53.6%	7.9%
Tractor	-	-

Women own only crude indigenous technology such as the digging stick. Additionally, the data shows that women are the users of the digging stick as reported by 29.6% of the respondents compared to 25.9% of them who said men are the users of the stick. It can, therefore, be argued that men have more access to advanced technology and they derive more benefits from it than women.

The sale of agricultural products is usually decided upon by men. Since they make most of the important decisions on the farms which require finances, it is more likely that they keep most of the returns from their farms. Hence, they benefit more from the farm technologies than women.

Effects of modern technology on division of labour

The study reveals that some of the farmers adopt new agricultural technology through observation of and interaction with other farmers in this area. About 17.2% of the respondents knew about new methods from other farmers in this area. On the other hand, farmers from other divisions influenced 14.3% of the respondents. Extension workers (58.6%) and other agricultural officers (17.9%) have played a bigger role in teaching the people new methods. The respondents also indicate that seminars (35.7%) and agricultural shows (18.5%) have been important channels of communicating the use of new methods.

A majority of the farmers adopted the trials through consultation with the other farmers. This approach was mentioned by 70% of the respondents. Out of 27 respondents, other channels of new methods included immigrants (3.7%), inter-farmers views (11.1%) and agricultural shows (18.5%). Most of these respondents (70.4%) could recall some of the new methods they had learnt and tried in the recent past. A majority of them (30.8%) had learnt of the Mexican marigold popes and tried it. The respondents gave various reasons to explain the perceived differences in adoption of technology between female and male household heads. The majority (53.6%) argued that both women and men adopt new methods equally. Conversely, 21.4% of the respondents felt that men acquire and adopt new/modern methods faster than women and 14.3% of them stated that women lack time and economic power to adopt/acquire new methods of agricultural production. Some of the respondents (3.6%) observed that men travel more than women. Hence, are more exposed to new technology. On the other hand, 3.6% of the respondents felt that women have a negative attitude towards agriculture, hence, they could not acquire new technology easily. Only 3.6% of the respondents said that women have access to new methods through women's groups.

The people of Machakos are educated about new methods through home visits by agricultural officers. A majority of the respondents (69%) confirmed this. The approach of disseminating new methods which were mentioned by the respondents (n = 29), include: the encouragement to use modern technology (6.9%), plant exhibitions (10.3%), demonstrations (3.4%), and follow ups and guidance

(37.9%). About 10.3% of the respondents observed that indigenous methods of farming are usually despised by the agricultural education officers. A majority of these respondents (55.2%) confirmed that they also attended farming seminars, where the main topics included the advantages of using modern farm inputs (mentioned by 14.3% of the respondents) and the use of pesticides. Respondents (3.6%) attended a seminar on agroforestry while another 3.6% indicated that they learnt about soil conservation.

The study revealed that the perception of appropriate tools was associated with gender. Nearly all the respondents (96.4%) stated that some tools are suitable for men and others for women. There was a tendency to associate the tools with the perceived physical abilities of either gender as shown in Table 4.18.

Table 4.18: Percentage of Perceived Physical Abilities by Gender

Response	% Frequency
Some tools need strong people	40.7
Long duration of particular tools	18.5
Men use heavy tools	7.4
Difference in physique	11.1
Difference in tasks	7.4
Women bend more than men	14.8

The data further indicates that over half of the respondents (55.2%) consider purchasing what is perceived as suitable for their spouses. This consideration is basically based on the perceived efficiency of using appropriate tools by either gender. About 21.7% of the respondents indicated that it was necessary to go for tools that make the work faster and less tiring. To 12.9% of the respondents, the purchase of suitable tools was based on their goodness, perceived high productivity in using such tools and the ability to use the tools. Respondents (34.8%) viewed the various tools as suitable for either gender due to traditions. They found the tools appropriate, because their male spouses bought them. However, most of the respondents (85.7%) indicated that they were constrained economically to buy suitable tools for their spouses.

A majority of these respondents (59.3%) had never had access to credit. Only 11.1% of the respondents agreed that credit was accessible to them, 18.5% did not have title deeds as security to acquire credit, and 3.7% of them avoid the strenuous repaying of loans.

The research finding indicates that the issuance of title deeds and provision of loans would assist the people in improving their agricultural production. About 24% of the respondents suggested that the government should provide them with loans and 17.2% recommended that training and financing should be done by the government. To 10.3% of the respondents, water, title deeds and credit were the major issues to be dealt with by the government.

This study indicate that men could adopt modern farming technology faster than women. Most respondents indicated that male household heads were the users of modern agricultural technology; 32.1% of the respondents stated that men have economic power. In fact, 14.3% of the respondents affirmed that the use of modern technology depended on economic status. Other respondents mentioned that men use modern technology because they:

- participate more in agricultural production (67.1% of the respondents)
- concentrate more on agriculture (3.6%)
- are flexible (7.1%)
- are more exposed (3.6%)

However, 32.1% of these respondents argued that men and women use modern agricultural technology equally.

There are cultural beliefs that would hinder increased food production in the area as 51.7% of the respondents confirmed and 17.2% support the fact that culture hinders the adoption of new methods. On the other hand, 17.2% of these respondents were of the view that time is wasted on traditional ceremonies. The belief that life is shorter as confirmed by 3.4% of the respondents would discourage people's efforts to increase production.

Culturally based gender differentiation would also affect agricultural productivity. In this regard, the division of labour along gender lines would hinder increased agricultural activities according to 3.4% of the respondents. Respondents (44.8%) also claimed that the suppression of women would have a negative impact on agricultural production. Some 48.3% of the respondents did not give any suggestions on how to eliminate the cultural hindrance; majority suggest that it can be eliminated by:

- Educating people to discard the cultural hindrance (41.3%).
- Encouraging the use of modern tools (3.4%).
- Encouraging the full participation of the whole household in food production (6.9%).

Processes underlying technological adoption

The use of modern technology has generally changed the modes of production and division of labour in the study area. Majority of the respondents (93.1%) confirmed that there no longer exists separate land portions for men and women. On the other hand, the use of farm implements is based on the demands of different tasks rather than gender. Most of the respondents (66%) indicated that men rarely participated in agricultural production during the last six months, but there is evidence that their overall participation in agriculture has increased. It could, therefore, be argued that there are changes in farming activities, which have been facilitated by adopting modern technologies as confirmed by 89.7% of the respondents.

The data indicate that men are now more involved in tasks that were previously done by women. About 40.7% of the respondents stated that men's task is land preparation, 25.9% observed that men are involved in planting, and 14.8% mentioned that they are involved in cultivating. The tasks of tilling, poultry farming and milking were stated as men's tasks by 3.7% of the respondents for each, 33.3% viewed the tasks as culturally for females, 44.4% believe that men are stronger to perform them and 5.6% stated that they are culturally for men. The tasks were previously performed by women as confirmed by 51.9% of the respondents.

The major female tasks are planting, land preparation, herding, erecting farm structures, ploughing and weeding. While 44.4% of the respondents observed that these tasks were previously performed by women, 29.9% of the respondents claimed that these were male duties. Culturally they are perceived as both male and female jobs as indicated by the observation of 19% of the respondents for each. Negligible proportions of the respondents indicated that these tasks may be culturally prohibited for

women, for reasons that climbing is an abomination for women, they should not bend for long hours and are not strong enough for the tasks.

The data indicate that the use of HYV seeds, fertilizers and exotic animal breeds are most likely to have led to an equal distribution of labour along gender lines. Conversely, the use of tractors, pesticides, the plough and other technologies have been confined to men. To 66.7% of respondents, both men and women participate in the use of HYV seeds and 33.3% of the respondents (n = 18) observed that only women participate in the application of the seeds. Both men and women participate in the use of fertilizers according to 77.8% of the respondents. The rest of the respondents indicated the involvement in the application of the technology as follows: children (5.6%), men (5.6%) and women (11.1%). The data indicates that men alone are more involved in the application of pesticides as stated by 78.9% of the respondents. On the other hand, 86.7% of the respondents indicated that both men and women are involved in the raising of exotic animal breeds. The participation of men in food production is most likely to be motivated by the fact that fathers are culturally held responsible for food production according to 69% of the respondents and 55.2% indicated that it was for mothers. Only 20.7% of the respondents supported that elder children are responsible for food production.

The use of modern methods have improved food production positively (Table 4.19.). All the respondents (n = 28) argued that the use of these methods have led to a decrease in the workload; majority of the respondents (61.5%), however, observed that the workload for women has decreased due to the use of modern technology, 19.2% observed that the workload for both men and women has been reduced, and 19.2% held the view that modern technology has reduced men's workload.

Table 4.19: Effects of Modern Technology on Agriculture

Effects	% Response
Soil depletion	3.7
More food produced	85.2
Less food produced	3.7
Maintain soil fertility	3.7
Efficiency in production (more produce, less workload)	3.7

n = 27

Another proportion of the respondents (3.7%) observed that modern technology has increased the acreage of land under cultivation.

Despite the fact that the local people perceived the advantages of modern technology, a majority of the respondents (62.1%) observed that there are some indigenous farming methods that could be improved to increase productivity. The main suggested improvements were the merging of indigenous and new technology; shifting cultivation and using of natural manure as shown on Table 4.20.

Table 4.20: Indigenous Methods to be Improved

Indigenous methods to be improved	% Response
Using of natural manure	17.9
Awareness on dangers of modern farming	3.6
Shifting cultivation	3.6
Merging indigenous and new technology	35.7
N/A	39.3

n = 28

Policy implications of gender differentiated technology

Most farmers desire more accessibility to credit facilities. This was expressed in the respondents suggestions that the government should issue them with title deeds, provide loans and reduce the price of farm tools. There is also a need to intensify training activities through an increased number of agricultural extension officers. The respondents also indicated that they would be motivated if the government assisted in marketing their produce as well as easing their transportation problem (Table 4.21).

Table 4.21: Policy Issues

Suggested government assistance	% Responses
Increase agricultural officers and reduce farm tool prices	3.4
Provide water, title deeds and seminars	13.8
Water, title deeds and credit	17.2
Transport improvement and titled deed provision	3.4
Loans and training	17.2
Provide seeds	10.3
Water, training and marketing	6.9
Loans and marketing	10.3
Reduce tool prices, improve transport and provide prompt payment to farmers	10.3
Bring agricultural officers close to farmers and increase coffee prices	3.4
Transport, water, title deeds, credit	3.4

n = 29

Majority of the respondents (24%) suggested that the productivity of female headed households would be improved if the government and/or NGOs provide loan facilities. Respondents (17.2%) recommended that training and finance be availed to the households and 17.2% suggested a farmer's cooperative union be formed to cater for the female headed households. A combination of the provision of water, title deeds and credit was given by 10.3% of the respondents as a way through which the government/NGOs should improve agricultural production for female headed households. Interestingly,

improvement of transport did not feature prominently as a way of helping female heads of households augment their production.

There should be deliberate action to educate the people about the cultural practices and beliefs, which hinder increased agricultural/food production. In fact, 51.7% of the respondents confirmed that there are cultural beliefs that would retard food production. Most of these respondents felt that culture hinders adoption of new methods and that the suppression of women would negatively affect food production. Other cultural beliefs and practices which would hinder food production according to the respondents include; the division of labour on gender basis, time wasting ceremonies and the belief that life is short. These cultural hindrances can be eliminated by sensitizing the people to discard them, as 24.1% of the respondents argued. To 17.2% of the respondents, elimination of the cultural hinderances could only be done through education. However, the majority (48.3%) of the respondents did not give any suggestion on how to do away with cultural hinderances to production. This implies that the government and/or NGOs need to devise ways of educating the people about the negative aspects of culture, which interfere with agricultural productivity.

Chapter Five

Conclusions and summary

General overview on gender variable in agriculture technology

There seems to be an existence of differential use of agricultural technologies between men and women (non-equal use). Women appear to dominate in the use of indigenous agricultural technologies and men are the least users of these technologies. The major factors accounting for such differential use of technology are:

- Perceived appropriateness of tools/implements for men and women, eg. some tools are more appropriate for women and others are perceived to be good for men.
- The amount of energy the use of a given agricultural technology requires of the user.
- The level of access to a technology, eg. women have greater access to indigenous technology, hence, their greater relative use of indigenous technology than the use of modern technology.
- Other factors such as:
 - (i) the technical knowhow the user has of the technology.
 - (ii) the level of involvement in agricultural activities e.g. men are often busy elsewhere are mainly involved in off-farm activities.
 - (iii) the posture a given tool demands of the user eg. men do not like bending, hence, avoid implements that require them to bend.
- Experience eg. indigenous methods are basically used by women.
- Land considerations e.g. scarcity of land under one's possession determines the technology to be used.
- The need for change eg. men feeling that indigenous implements/methods have been in use for a long time, hence, the need for change to newer methods/technologies.

In majority of the tasks (farm operations) where men predominate, there is a preponderate use of modern agricultural technologies. This suggests some association between type of task, type of performer and the technology used. Tasks along the gender of the performer appear to influence the type of technologies used. Evidence from research shows that preference and use of technology is a function of the type of task and the person who normally performs that task. The allocation of farm tasks along gender lines is what determines the differential use of technology between women and men. This implies, there is a connection between the perceived technology, gender of the user, level of use of that technology and the type of agricultural task performed.

Gender, the socially and culturally construed roles for women and men, has a significant influence on the preferences and general use of any agricultural technology. Gender influences the farmer's choice and the level of use of a given technology.

Division of labour

In Machakos, like in most of rural Africa where farming is carried out, farm household members have distinctive farm tasks to perform. Division of labour on the farm is based on sex and age of the household members. It is not an invariable rule, however, that women and men have distinctive farm tasks to perform, which the other sex cannot be engaged in as follows:

- Men do land preparation tasks such as clearing the bush, breaking the ground (using ox-plough at times), and construction of farm and storage facilities. On the other hand, women appear to put more farm labour than men in weeding, sowing/planting, harvesting, and post-harvest tasks.
- Cultural prescriptions on what women or men have to do is eroding slowly and in some instances, women are involved in land preparation using ploughs, which was previously regarded as a taboo and a man's domain.
- Division of labour among rural communities in Africa is culture specific and is also affected by individual farm household characteristics.

Some associations between agricultural technological use and sex of farmer is evident. However, the preference and eventual use of a specific agricultural technology appear to be influenced by intermediate factors as follows:

- Economic considerations eg. cost of the technology and ability of farmers to buy the technology.
- Appropriateness of the specific technology.
- The availability of technology in question (or availability of possible alternatives implied).
- Convenience of the technology to the user.

Access to agricultural technologies, credit and extension services

The introduction of modern agricultural technologies has followed cash crop farming, which has already been identified as a man's domain. A relationship therefore appears to exist between the application of modern agricultural technology and cash cropping on one hand and men farmers and modern agricultural technologies on the other. Women and food production appear to have a close relationship with the use of indigenous agricultural technologies. This is evidenced by this study's findings and literature. The dominance of women using traditional technologies for food production is itself catastrophic for food security in African societies. .

The use of various agricultural technologies along gender lines closely relates to access to these technologies. Women farmers have relatively limited access to modern agricultural technologies and have to use more of indigenous technologies in farming. The study has confirmed that women farmers have both physical as well as economic inaccessibility to modern techniques of farming.

Cultural prescriptions and restrictions denies them access to use of farm technologies such as the ox-plough, like the Zambian women farmers have revealed that "ploughing" was a taboo, so only men could use the plough. Economic access has to do with monetary constraints faced by women farmers

in their attempt to purchase technologies deemed by women as essential in raising farm productivity. This economic constraint is more acute amongst female-headed households shown by the study and literature to be critically disadvantaged in many areas of farming enterprise.

Culture limits women's ownership of land, therefore, denying them access to title deeds which could serve as collateral for taking loans to improve their farms. Among the studied Akamba community, women do not own land, and access to credit by rural men and women farmers in Machakos is limited. This has been identified as one of the constraints to agricultural development in Machakos District (see 1994-1996 development plans). Relative to men, women have limited access to farm credits and hence, limited capabilities to purchase and use modern technologies in their farms. Female-headed households are more vulnerable to this constraint.

Agricultural extension and training to women farmers is also limited, resulting in low level or lack of technical skills and knowledge about the various technologies. Women farmers are ignored by agricultural extension services and women farmers receive minimal agricultural training and hence, their prospects to acquire technical skills and knowledge about use of various agricultural technologies is reduced. It is also said that men rather than women, who dominate rural agriculture in Kenya and in Machakos, form the bulk of extension workers. They have tended to be biased against women farmers, often viewing them as less innovative, uninterested in agricultural training, and less enterprising on the farm and so forth.

Farm households in rural areas of Kenya are both female- and male-headed. In Machakos district, it was found that female-headed households are more in urban centres, such as Machakos town, Matuu, and Athi River other than in the rural areas. With increasing out-migration of rural populations (especially men of ages 15-59) from one rural area to towns, female-headed households are on an increasing trend. It was also found that in comparative terms, female-headed households are disadvantaged than male-headed ones in terms of access to, use of and benefits derived from modern agricultural technologies found in the area.

They also have lower adoption rates, and knowledge of modern agricultural technologies. However, it is noted that female-headed households cannot be taken to be a homogenous group registering similar production patterns. This is because household behaviour is more dependent on household characteristics and that of its members.

Decision-making in farm management and ownership of farm inputs/technologies

In the farm enterprise in the study area, both men and women are involved in decision making regarding the various farm issues, like on-farm purchases, marketing, and planting techniques. It is further revealed that certain decisions are made by men and others by women in the household. However, men are generally the key decision makers on the farm. When both man (husband) and woman (wife) are present, the overall running of the farm is the man's responsibility. However, both men and women may have distinctive responsibilities on the farm and hence, are to be considered as the key decision makers in the various spheres of production that they control.

It is also revealed that, while some decisions may be made by a man or woman alone, others may be arrived at after consultations with other member(s) of the farm household. However, the study points to a general agreement regarding the various farm operations and issues affecting the farm enterprise.

The household head who could be a man or woman is considered as the sole decision maker for the whole farm, although decisions for individual tasks/issues on the farm may be made by others.

It is also revealed that farm decisions (including those to do with choice of a technology), though influenced by gender, are also affected by a myriad of other factors, including directives from cooperatives, government policies, agricultural programmes in the area, and household's level of income, social, cultural and political setting.

Women and men own different things in the household. In most cases, ownership of land, cattle, ploughs and farm implements and inputs viewed as important to the farm enterprise, is based on cultural ownership laws or customs and deposits the right of ownership to the man. Men own large animals and women own the smaller ones such as chicken. Women in Machakos, according to Kamba tradition, do not own land. Such ownership patterns, influence women's and men's attitudes, perceptions, access to, uses and preferences for the various technologies found among the Akamba (as well as in other part of rural Kenya).

Socialization process for men and women in the community also influences to a great extent (and especially among the illiterate and poor), the attitudes, perceptions, preferences and use of technologies and this therefore determines their choices.

Households appeared to utilize hired labour (of both men and women) in the performance of agricultural tasks. There is a general trend in the use of a combination of both indigenous and modern technologies. This is suggestive that rapid adoption of new technology and rapid phasing out of indigenous technologies is not the norm among the Machakos farmers. There is therefore coexistence of various agricultural technologies.

Effects of modern technology

Modern technologies have been said to affect farm family household relations and may also affect women's control of farms. Some authors have argued that the introduction of modern agricultural technologies appears to replace female farming systems with male ones. The introduction of modern technologies affects the existing labour divisions and often necessitates adjustments and re-allocation of labour. They therefore appear to affect the traditional division of labour which as in most Kenyan societies goes along gender lines. To cope with changing situations, modern technologies often have required women to participate in operations previously restricted to men, for example, ox-ploughing as in Zambia (also in rural Kenya).

Modern agricultural technologies affect women's labour contributions in the farm, sometimes shifting them to new tasks, while in some other instances, it makes demand on their labour even more critical. Introduction of a tractor, for instance, increases acreage of cultivated land, meaning a larger area for women (who dominate in performing this task) to plant, weed, tend, harvest and process for the market. Market-oriented farming and introduction to modern technology gives men more rights and less work in the farms.

References

- Annabel, R. (1992). *Women and the Environment*. London. Zed Books.
- Appleton, H. (1993). Gender, Technology and Innovation. In *Appropriate Technology Journal* vol. 20 (2). pp. 6-8. London. Intermediate Technology (IT) publications.
- Appleton, H. (1993). Women: Invisible Technologists. In *Appropriate Technology Journal* vol. 20 (2). London. I.T. Publications.
- Appleton, H. and A. Scott (1994). *Gender Issues in Agricultural Technological Development*. London. Intermediate Technology Development Group (ITDG).
- Barnes, C. (1978). Women in Kenya's Rural Economy. In Pala, A. et al. (eds), *The Participation of Women in Kenya Society*. Nairobi. Kenya Literature Bureau.
- Barnes, C. and L. Werner (1982). *Kenyan Small Holders and the Division of Labour*. Nairobi. Central Bureau of Statistics and USAID.
- Batic, S.S. and J.P. Marshall (1986). *Agricultural Research Policy: Selected Issues*. Blacksburg. Virginia Polytechnic Institute and State University.
- Beneria, L. (ed) (1985). *Women and Development*. New York. Praeger.
- Benston, M. (1988). Women's Voices/Men's Voices: Technology is Language. In Kramarae C. (ed), *Technology and Women's Voices*. New York. Routledge and Kegan Paul.
- Boserup, E. (1989). *Women's Role in Economic Development*. London. Earthscan Publications Ltd.
- Brown, L.H. and J. Cochene (1973). *A Study of the Agroclimatology of The Highlands of Eastern Africa*. World Meteorological Organization.
- Burton, I.; R.W. Kates and G.F. White (1978). *The Environment as Hazard*. New York. Oxford University Press.
- Buttel, F.H and W.G. Gilbert (1984). The Sexual Division of Farm Household Labour Allocation Among Farm Men and Women. In *Rural Sociology Journal* 49:183-209.
- Carr, M. (Ed.) (1978). *Appropriate Technology for African Women*. Addis Ababa. UN Publications.
- (1991). *Women and Food Security: The Experience of SADCC Countries*. London. Intermediate Technology Publications.
- Celis, R. et. al. (Eds) (1991). *Adopting Improved Farm Technology: A study of Small Holder Farmers in Eastern Province of Zambia*. Washington, DC. International Food Policy Research Institute.
- Chege, E. (Ed) (1995). *Gender News. Issue Number 1*. Nairobi. Winrock International.
- Cloud, K. (1985). Women's Productivity in Agricultural Systems: Considerations for Project Design. In Overholt, C. et. al. (Eds), *Gender Roles in Development Projects: A Case Book*. West Hartford, Connecticut. Kumarian Press.

- (1988). A Teaching Module on Women and Agriculture: Household Level Analysis. *Draft Prepared for the International Workshop on Women, Households and Development: Building Data Base*. Urbana Champaign University of Illinois.
- Coen, R. (1992). *Farming for the Future: An Introduction to Low - External - Input and Sustainable Agriculture*. (LEIA) London: Macmillian.
- Colman, Gould and S. Elbert (1984). "Farming Families: The Farm Needs Everyone". *Research in Rural Sociology and Development* 1:61-78.
- Cowan, A.B. (Ed) (1978). The Role of women in meeting basic food and water needs in developing countries: *Proceedings of the international conference on women and food* held in Tucson, Arizona.
- Daily Nation (DNA) (1992). Impact of SAPS on Women. An article featured in the *Daily Nation* Newspaper of 6/9/1992 pp:12. Nation Media Group, Nairobi.
- Edgerton, R.B. (1971). *The Individual in Cultural Adoption*. Los Angeles. University of California Press.
- Elson, D. (1989). *How is Structural Adjustments Affecting Women in Development?* Lavoro Society for International Development. Paper No. 1.
- Feldstein, Sims, H.; C.B. Flora and S.V. Poats (1989). *The Gender Variable in Agricultural Research*. Ottawa: IDRC.
- Feldstein, Sims, H. and S.V. Poats (Eds) (1989). *Working Together: Gender Analysis in Agriculture*. West Hartford, Connecticut. Kumarian Press.
- Feldman, S.H. and R. Welsh (1995) Feminist Knowledge Claims Local Knowledge and Gender Divisions of Agricultural Labour: Constructing a Successor Science. In *Rural Sociology Journal* vol. 60 (1): pp 23-43.
- Flora, C.B. (1990). "Reconstructing Agriculture: The Case for Local Knowledge". In *Rural Sociology Journal*. 57: 92-97.
- Food and Agricultural Organization (F.A.O.) (1983). *Women in Agriculture*. Rome.: F.A.O.
- Flora, C.B. (1985). *Women in Developing Agriculture* Rome.: F.A.O.
- Gladwin, C.H. and K.A. Staudt (1987). Providing Africa's Women Access: One Solution to the Food Crisis. In *Journal of African Studies*. vol 13 (4).
- Goody, J.R. (1971). *Technology, Tradition and the State in Africa*. London Oxford University Press.
- Hanger, J. (1973). Social and Economic Constraints Aspects of the Contribution of Women to the Farm Household Economy: Two East African Studies. *Unpublished Thesis*, University of East Africa.
- Ilkkaracan, I. and H. Appleton (1994). *Women's Roles in the Innovation of Food Cycle Technologies* London. Intermediate Technology Development Group (ITDG).
- Jaetzold, R. and H. Schimdt (1983). *Farm Management Handbook of Kenya. vol II: Natural Conditions and Farm Management Information Part C: Eastern and Coast Provinces*. Nairobi. Ministry of Agriculture.
- Jones, C.W. (1986). Intra-Household Bargaining in Response to Introduction of New Crops: A Case Study from North Cameroon. In Mook, J.L. (Ed). *Understanding Africa's Rural Household and Farming Systems*: pp 105-123. Boulder. Westview Press.
- Kabeberi Macharia, J. (1995). Inequality: A Legal Analysis. In *Gender Review* 2 (4): 23-24.
- Kabira, W.M. (1992). Story-tellers and Environment. In Khasiani, S. (Ed). *Groundwork*. Nairobi. Acts Press. pp 7-18.

- Kirjavainen, L.M. (1995). Rural Women, Food and Agriculture: Looking Beyond Beijing. *Paper Presented to the Beijing Women's Conference* on 7 September 1995.
- Kraemare, C. (Eds) (1988). *Technology and Women's Voices*. New York. Routledge and Kegan Paul.
- Kumbler, V. (Ed) (1987). Farming Systems Research: *Proceedings of the Workshop* held on 17-21 Feb 1986. Panctancheru. I.A.R.C
- Lele, U. (1975). *The Design of Rural Development: Lessons From Africa*. Baltimore, The John Hopkins University Press.
- Leonard, A. (Ed) (1992). *Seeds Magazine*. Number 14. New York.
- Lewis, B.C. (1981). *Invisible Farmers: Women and the Crisis in Agriculture*. Washington D.C: Agency for International Development (A.I.D.)
- Lion Berger, H.F. (1960). *The Adoption of New Ideas and Practices*. Ames. Iowa State University Press.
- MacDowell, J.M. (Ed.) (1976). Village Technology in Easter Africa: *A Report of a UNICEF Sponsored Regional Seminar on Appropriate Technology for the Rural Farmer* held in Nairobi on 14-19 June 1976.
- Mathangani, S.W. (1989). *Information for Women in Food Production*. Nairobi. I.D.R.C.
- Mburugu, E.K. (1986). The African Household in Socio-Economic Change: A Conceptual Problem in Research. In Bashir, O.M. et al (eds) *Research Methods in the Social Sciences*. pp 70-79. Addis Ababa. Khartoum University Press.
- McCarthy, F.D. and W.M. Mwangi (1982). *Kenyan Agriculture: Towards 2000*. Luxemburg. International Institute for Applied Systems Analysis.
- McLoughlin, P.M. (Ed) (1970). *African Food Production Systems: Cases and Theory*. Baltimore. The John Hopkins University Press.
- Mooch, J.L. (Ed) (1986). *Understanding Africa's Rural Households and Farming Systems*. Boulder. West view Press.
- Mosher, A.T. (1966). *Getting Agriculture Moving: Essentials for Development and Modernization*. New York. Praeger.
- Munro, F.J (1975). *Colonial Rule and the Akamba Social Change in the Kenya Highlands. 1889-1939*. Oxford. Clarendon Press.
- Njiru, E.I. (1990). Effects of Tea Production on Women's Work and Labour Allocations: The Case of Small-scale Tea Growers in Embu Eastern Kenya. *M.A. Thesis*: University of Nairobi, Institute of African Studies.
- (1994). Food Culture and Environment. The Case of the Atharaka of Eastern Kenya. *Ph. D. Thesis* University of Nairobi Institute of African Studies.
- (1995). *Gender and Farming Communities Among the Akamba of Makeni District*. Rugby: ITDG.
- Olorunnipa, Z. (1993). African Women and Agricultural Technologies. In *African Technology Forum*, Vol 6 (1) Cambridge. A.T.F.
- Pala, A.D. (Eds) (1978). The Participation of Women in Kenya Society: *Proceedings of a Conference held in Nairobi* on 11-15 August 1975. Nairobi. Kenya Literature Bureau.
- Pala, A.D. (1980). Daughters of the Lakes and Rivers: Colonization and the Land Rights of Luo Women. In Etienne, M and Leacock, E. (Eds). *Women and Colonization: Ethnological Perspectives*. New York. Praeger.

- Palmer, I. (1978). *Women and the Green Revolution. A Paper Presented to the Conference on the Continuing Subordination of Women and Development Process*. Sussex Institute of Development Studies.
- Palmer, I. (1985). *The Impact of Agrarian Reform on Women*. West Hartford. Kumaran Press.
- Poats, S.V. (1988). *Gender Issues in Farming Systems Research and Extension*.
- Raikes, P. (1988). *Modernizing Hunger: Famine, Food Supplies and Farm Policy in the E.E.C. and Africa*. Ports Mouth (N.H): Heinmann.
- Relf, C. (1984). *Appropriate Rural Technology in Zimbabwe*. Geneva.: I.L.O.
- Reijntjes, C. et. al. (1992). *Farming for Future: An Introduction to Low-external Input and Sustainable Agriculture*. London. Macmillian.
- Republic of Kenya (1991). *Annual Report of Kitui District*. Nairobi: Government Printer.
- Republic of Kenya (1994). *Machakos District Development Plan for the Period 1994-1996*. Nairobi. Government printer.
- Republic of Kenya (1994). *National Development Plan for the Period 1994-1996*. Nairobi. Government Printer.
- Republic of Kenya (1994). *Sessional Paper No. 2 of 1994 on National Food Policy*. Nairobi. Government Printer.
- Republic of Kenya (1993). *Department of Agriculture Annual Report for Machakos District*. Ministry of Agriculture, Livestock Development and Marketing.
- Republic of Kenya (1987). *Socio-cultural Profile for Machakos District*. Nairobi. Government Printer.
- Rocheleau, D; F. Weber and A. Field-Juma (1988). *Agroforestry in Dryland Africa*. Nairobi. International Council for Research in Agroforestry. (ICRAF).
- Russo, S. (1989). *Gender Issues in Agriculture and Natural Resource Management*. Washington DC : USAID.
- Scoones, I. and J. Thompson (Eds)(1994). *Beyond the Farmer First: Rural People's Knowledge, Agricultural Research and Extension Practice*. London. IT Publications Ltd.
- Stamp, P. (1989). *Technology, Gender and Power in Africa*. Ottawa IDRC.
- Staudt, K.A.1. (1976). *Agricultural Policy, Political Power and Women Farmers in Western Kenya. PhD Dissertation*, University of Wisconsin - Madison.
- Staudt, K.A.1. (1977). *Inequalities in the Delivery of Services to a Female Clientele: Some Implications for Policy*. *Discussion Paper No. 247*, Institute for Development Studies, University of Nairobi.
- Stewart, F. (1977). *Technology and Underdevelopment*. London. West view Press.
- Sostheimer, S. (Ed.)(1991). *Women and the Environment: A Reader: Crisis and Development in the Third World*. London. Earthscan Publications.
- Timmer, C.P. et. al. (1983). *Food Policy Analysis*. Baltimore. The John Hopkins University Press.
- Titmus, R.M. (1976). *Commitment to Welfare*. London. Allen and Unwin.
- United Nations Economic Commission for Africa (UNECA) (1991). *Barriers to Access of Rural Women to Land, Livestock, Other Productive Assets, Extension Services and Credit in Selected African Countries*. Addis Ababa. UNECA.
- Ventura-Dias, V. (1985). *Modernization, Production, Organization and Rural Women in Kenya*. In Ahmed, I. (Ed.) *Technology and Rural Women: Conceptual and Empirical Issues*. London. Allen and Unwin.

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- Weller, S.C. and A.K. Romney (1988). *Systematic Data Collection*. London. Sage Publications.
- Whitehead, A. (1981). Effects of Technological Change on Rural Women: A review of Analysis and Concepts. In Ahmed, I. (Ed.) *Technology and Rural Women: Conceptual and Empirical Issues*. London. Allen and Unwin.