

Impacts of Interventions in Bee-keeping and Irrigation on Household Welfare in the Kerio Basin Development Zone, Kenya

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Organization for
Social Science
Research in
Eastern and
Southern Africa

Social Science Research Report Series - no. 17

OSSREA
Documentation Unit
P.O. Box 31971
Addis Ababa, Ethiopia

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ACKNOWLEDGEMENTS

I am grateful to the following persons and institutions who made it possible for this study to be undertaken.

- the Organization for Social Science Research in Eastern and Southern Africa (OSSREA) for providing the financial support for the research;
- Mr. and Mrs. James Cheruiyot, who provided immense logistical support during fieldwork, and Mr. Mike Indulaji, Mr. Lee Milgo and Mr. Chelgut, the research assistants;
- the staff of the Kerio Valley Development Authority, who provided useful information about their role in the development of the Kerio Region, and allowed me to read useful documents in their library in Eldoret;
- Mr. Robert Amianda, who assisted a lot with data processing and analysis;
- Mrs. Jane Khayesi, who also helped with the logistics of the study, data processing and analysis as well as typing and editing of the research report.

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IMPACTS OF INTERVENTIONS IN BEE-KEEPING AND IRRIGATION ON HOUSEHOLD WELFARE IN THE KERIO BASIN DEVELOPMENT ZONE, KENYA

ABSTRACT: The Primary purpose of this study was to examine the impact of interventions in bee-keeping and irrigation on household welfare in the Kerio Basin Development Zone. Specifically, the study has analysed four main areas of impacts: employment-creation, income-generation, production and consumption patterns.

Twenty seven modern bee-keepers and thirty-nine farmers in Chemron-Marigat-Perkerra irrigation area were interviewed. Information was also sought from institutions involved in these two activities.

The results of the study reveal the following:

- a. Households that have adopted the new methods of bee-keeping reported that this activity provides, in varying degrees, employment to members of households. Other major benefits include increased honey production, earnings from the sale of honey and increased honey for home consumption.
- b. The problems experienced by the households that have adopted new methods of bee-keeping are: the physical environment, pests, and prices and marketing of honey.
- c. Two main kinds of intervention are taking place in irrigation: i) rehabilitation of traditional irrigation furrows, and ii) development of new irrigation projects.
- d. The respondents indicated two main benefits from irrigation: increase in production and improvement of the general welfare of the households in health, shelter, education and food.
- e. Water shortage is a major problem for the majority of the respondents (37) or (94.9%). Other problems are diseases, blockage of furrows, lack of market, crop failure and lack of funds.
- f. The changes sought by the respondents include construction of more dams, improvement in marketing of crops, provision of title deeds and loans, introduction of well-researched programmes and control of diseases.

The study concludes that although interventions in bee-keeping and irrigation have led to some improvement in the employment, income, production and consumption patterns of households in the Kerio Basin Development Zone, there is a need to solve the problems related to appropriateness of the bee-keeping technology, water shortage, marketing of produce and diseases. With careful planning, it is possible to address these problems and increase the benefits of new methods in bee-keeping and irrigation.

1. INTRODUCTION

1.1 Background to the Study Problem

The Kerio River Basin in Kenya remained a "Closed Zone" for most of the colonial period. This area did not receive any significant investment in infrastructure, agriculture and industry as did, for instance, central Kenya (Soja 1968, 1979). Despite the limited colonial government development interventions (Kipkorir 1981), the inhabitants of the Basin continued to rely on their traditional livelihood systems. These systems had been developed on the basis of the local people's perception and knowledge of their fragile ecology. These systems include pastoralism, bee-keeping and cultivation. Due to limited rainfall, furrow irrigation has been developed by some of the communities to support cultivation. These traditional livelihood systems have been developed not only due to the perception and knowledge of the environment but also in relation to the existing level of technology.

Since the attainment of independence in 1963, the Government of Kenya and non-governmental organisations (NGOs) have made efforts to integrate the Kerio River Basin into the mainstream of development in Kenya. Efforts have been made to initiate development projects that can improve the welfare of the local people. Examples of these projects include mining, irrigation, bee-keeping, tourism, fishing and development of infrastructure.

These development projects form an extensive and integrated programme of investment in the Kerio Basin. In order to centralise the planning and management of development projects in the Kerio Basin, the Government of Kenya set up the Kerio Valley Development Authority (KVDA) in 1979 (Were 1981). The operations of the KVDA cover the administrative districts of Elgeyo, Marakwet, Baringo, Koibatel, West Pokot and Turkana. This is an extensive area that forms what is referred to in this study as the Kerio Basin Development Zone.

Two of the projects that have been initiated with the express aim of improving the welfare of the local population are bee-keeping and irrigation. These two broad projects are widespread in the Basin and are sponsored by both governmental and non-governmental agencies. There are both small and large-scale irrigation projects, for example, Weiwei, Moruny, Embobot, Arror, Kimwarer, Perkerra, Chemron and Losekem.

In 1984, the KVDA initiated an intervention programme in traditional bee-keeping activity in the Kerio Basin. This intervention, which is explained in detail in chapter four, took the form of training, extension or demonstration service, supply of modern bee-hives, collecting and processing honey, and marketing honey. The underlying objective in this intervention is to modernise and commercialise local traditional bee-keeping that is based on subsistence technology.

Though these interventions in bee-keeping and irrigation have been undertaken for over ten years now, their impacts on household welfare are not fully known. Existing studies have not analysed this aspect of these interventions. In fact, what mainly exists in the literature are broad studies on the arid and semi-arid lands in Kenya, anthropological

surveys, historical background of the inhabitants of the Kerio River Basin and pre-investment consultant reports and critiques. There is, therefore, a need from both an academic as well as a policy point of view for a research to investigate the impacts of interventions in bee-keeping and irrigation on household welfare in the Kerio Valley Development Basin. This is the context that led to the formulation of the study reported herein.

1.2 Statement of the Problem

The problems of poverty and low standards of living in the Kerio Basin Development Zone largely led to the initiation of interventions in bee-keeping and irrigation. These interventions are aimed at generating incomes, creating employment, providing a higher standard of rural life and increasing sedentary opportunities for the predominantly nomadic pastoralists (Were 1981, 13). In other words, these interventions are aimed at improving the economic condition of the local population.

Though these interventions have been implemented and are spreading to cover a number of households, limited systematic analysis has been undertaken to examine the impacts of these interventions on household welfare. Though a survey of the literature shows that bee-keeping and irrigation in the Kerio Basin Development Zone have the potential not only for development but also for employment-creation and income-generation (Kipkorir 1981; Ssenyonga 1981, 1985, Soper 1981, Adams 1992, Khayesi 1991, 1995), the theme of the impacts of exploiting these opportunities on household welfare does not appear to have drawn the attention of these researchers.

The primary purpose of this study is to examine the impacts of interventions in bee-keeping and irrigation on household welfare in the Kerio Basin Development Zone. Specifically, the study analyses four main areas of impacts: employment-creation, income-generation, production and consumption patterns. Further, the study examines the views of the respondents on what they think is the desired line for future development and improvement in bee-keeping and irrigation.

1.3 Research Questions

This study is guided by four research questions:

- a) What changes are taking place in the indigenous bee-keeping and irrigation systems in the Kerio Basin Development Zone?
- b) What are the impacts of the interventions in bee-keeping and irrigation on household employment, income, production and consumption patterns?
- c) What are the problems faced by households that have adopted interventions in bee-keeping and irrigation?
- d) What are the views of the respondents on the desired developmental changes and improvements in bee-keeping and irrigation?

1.4 Research Objectives

This study seeks to achieve the following objectives:

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This study seeks to achieve the following objectives:

- a) To analyse the impacts of these interventions on household employment, income, production and consumption patterns;
- b) To investigate problems experienced by the households that have adopted interventions in bee-keeping and irrigation;
- c) To examine the views of the respondents on what they see as the desired developmental changes and improvements in bee-keeping and irrigation.

1.5 Significance of the Study

The results of this study are significant in the following ways. The first significance is that the study contributes to knowledge on the impacts of interventions in bee-keeping and irrigation on household welfare. Though these interventions are taking place, not much is known from the available literature about their impacts on household welfare (Darkoh 1990; Darkoh and Finkel 1991; Walubengo et al. 1994; Odegi-Awuindo 1983, 1990; McCabe 1990). An important contribution of this study is not just in presenting quantitative data on these impacts but also in presenting stated impacts by the respondents. In other words, this study presents both quantitative and descriptive assessment of the impacts of interventions in bee-keeping and irrigation.

The second significance is that the study contributes to a further understanding and validation of the integrated rural development (IRD) model. Though other strategies and frameworks have been advanced for development intervention in rural areas, this study shows that the IRD strategy still has relevance in the design of rural development programmes, especially where a number of development objectives have to be addressed simultaneously in one or more projects. The study reveals that with a clear specification of development targets, the IRD model can be utilised to realise developmental goals in rural areas. The study does not necessarily nullify the shortcomings in the model; rather, it shows that the model can be specified to take into account prevailing conditions and developmental concerns within a given spatial setting.

The third significance is that the study provides relevant information to inform policy practice on interventions in bee-keeping and irrigation in the Kerio Basin Development Zone. For instance, the study presents views of the respondents on what they think are the desired developmental changes and improvements in bee-keeping and irrigation.

1.6 Scope and Limitations of the Study

This study covers only bee-keeping and irrigation. The study looks at impacts on welfare in a broader sense. These impacts include income-generation, employment-creation, increased agricultural production and consumption patterns (e.g., nutrition, health, educational participation, shelter provision). In other words, the study combines both direct and indirect impacts. The study limits itself to these impacts as these are considered to be important initial ingredients towards poverty-alleviation and environmental rehabilitation in the arid and semi-arid lands (Darkoh 1996). This study has left out other relevant aspects of impacts such as environmental conservation, as all these can not be handled in one study.

Though the study has concentrated on a sample of households that have adopted the interventions, it has taken into consideration the dynamism involved in household production systems. Those who have adopted the interventions have not completely abandoned the traditional livelihood systems. This is why there are respondents who are utilizing modern irrigation but at the same time keeping traditional bee-hives. There are those who have new bee-hives but still keep traditional ones and at the same time carry out traditional pastoralism and farming. What this points to is that rural households are involved in multiple livelihood activities. Hence, the need for the assessment of impacts partly based on the respondent's own experiences and views. This is necessary as the respondents are able to qualitatively state the benefits and problems associated with these interventions. To complete the picture, some of the farmers who have not adopted modern bee-keeping were identified and interviewed to understand why they have not adopted the new methods and also compare their situation with that of the ones who have adopted the new techniques.

1.7 Review of Literature

The literature in this section is reviewed under two main sub-topics: indigenous livelihood systems and impacts of development interventions.

1.7.1 Indigenous Livelihood System

Human history reveals that societies develop livelihood systems that are in tune with the prevailing potentials and constraints in their physical environment as well as their level of technology. The Egyptians developed a shadoof irrigation system to harness the waters of the Nile River and the fertile soils by the banks of the Nile (Rodney 1972). Nomadic pastoralism has developed in the arid and semi-arid lands of the world because of constraints brought about by scarcity and seasonal variations in water and grazing resources. Communities in these environments have a shifting pattern of living (transhumance) to take advantage of the available water and grazing resources at different seasons and locations (Johnson 1996).

With time, the inhabitants of the present day Kerio Basin Development Zone have developed livelihood systems based on their perception and knowledge of their fragile physical environment: low rainfall, scanty vegetation and friable soils. Pastorals, bee-keeping and grain cultivation are old established systems among these communities. Furrow irrigation has long existed among the Marakwet, Keiyo, Knemps and Pokot (kipkorir 1981; Soper 1981; Ssenyonga 1981; Odegi-Awuondo 1990; McCabe 1990; Adams 1992). In addition, through social and economic networks such as trade and marriage, these communities are able to get other products from amongst themselves and their neighbours (Tanaka 1981; Kurita 1981).

The discussion in this section will concentrate on two indigenous livelihood systems that are the concern of this study; bee-keeping and traditional irrigation. Bee-keeping and wild honey-collection have been a historical pre-occupation of the local communities in the Kerio Basin Development Zone, especially in the low lying areas of West Pokot, Elgeyo, Marakwet and Baringo Districts. The vegetation in these areas attracts bees that manufacture the honey that is harvested and used as food, medicine, in trade and for brewing a favourite local liquor known as "kipketin". This liquor is an essential

commodity in ritual ceremonies such as marriage and initiation (Kipkorir 1981, 4; Olenja 1981, 113).

Traditionally, these communities harvest wild honey though there are some people who keep traditional log beehives (Barrow 1981). Some of the beehives are set for wild honeybees in revering forests (Tanaka 1981). When honey has been formed, it is collected, boiled for refining and kept in the homes for the uses already identified above. This was essentially an activity of men that were responsible for the preparation of beehives and collection of the honey.

It has been observed that this traditional bee-keeping and honey-collection has potential for development into a commercial activity to produce quality honey for the local market and beyond (Barrow 1981; KVDA 1982). Attempts by the Kerio Valley Development Authority to harness this under-exploited and under-utilised economic potential, and the resultant impacts on household welfare are discussed in chapter three.

Lack of water is a major limiting factor to crop cultivation in the Kerio Basin, particularly on the valley floors and drier areas. In addition to using rainfall, the Marakwet, Keiyo and Pokot have developed small-scale indigenous irrigation systems. These systems are labour-intensive. An effort has already been made to document and describe these traditional irrigation systems (Ssenyonga 1981; Hogg 1984; Gibb and Partners 1987). Water is tapped from the rivers and streams and led into farms and villages by a system of furrows. There is an extensive and intensive system of furrows whose exact date of construction has not been easy to establish (Hogg 1984; Kipkorir 1981). Nevertheless, their presence shows that furrow irrigation has existed among these communities for some period of time. The technology and system of furrow or water management reveal the ingenuity in these communities to tackle the problem of water constraint in their environment.

Among the Marakwet and Keiyo, the furrows are owned by clans (Ssenyonga 1981), unlike among the Pokot where one furrow can serve more than one clan (Hogg 1984). The furrows traverse several kilometres over varying terrain (Gibb and Partners 1987). Some furrows cover short distances while others cover long distances. The number of furrows and amount of irrigated land vary from one river to another. According to Hogg (1984, 7), the exact number of furrows off a particular river or stream is related to the:

- a) distribution of farm plots
- b) distribution of people
- c) local topography and gradient
- d) availability of water.

These communities have devised a system of water distribution, furrow maintenance and settlement of water disputes that is well integrated within the local social and economic system. The clan elders have an important role to play in this arrangement (Soper 1981; Hogg 1984). Presently, some of the furrows have been abandoned; some destroyed by floods and gullies while others have been neglected, with no maintenance work going on. Despite these problems, it is important to note that irrigation potential exists in some

parts of the Kerio Basin Development Zone. As mentioned earlier, some of the local communities already have knowledge of furrow irrigation. It has been suggested that this knowledge can be exploited further for the economic development of the region. For instance, small-scale irrigation schemes incorporating the knowledge, technology and water management system of the local people can be developed where furrow irrigation already exists. There is also the possibility of enhancing the existing furrow irrigation system by building stronger embankments and/or rehabilitating the rundown furrows.

1.7.2 Impacts of Development Interventions

A development intervention is undertaken with a view to solving a problem so as to enhance productivity, boost the performance of an existing system and improve the quality of life of the community concerned. The intervention can be technological, organisational or marketing in nature. Human history attests to the fact that mankind has often made efforts to introduce innovations to improve agriculture, industry, health and even social organisations.

It should, however, be noted that an innovation can bring in its wake both positive and negative effects on the target population or system. These effects partly arise due to the complexity of the physical and human systems, whose functioning is yet to be fully comprehended and considered, especially when designing or formulating an intervention programme. There have been attempts by the Government of Kenya and development agencies to intervene in the traditional livelihood systems of the arid and semi-arid lands. For instance, there have been efforts to: sedentarise the pastoralists, commercialise the pastoral economy, conserve soil and rehabilitate the degraded ecology. There are mixed results from these efforts (Darkoh 1990).

Some studies tend to indicate that development interventions and modern changes in the arid and semi-arid lands of Kenya have not significantly benefited and addressed the prevailing human and ecological conditions. In Maasailand, modern interventions (e.g., group ranching, wheat farming, land sub-division and tourism) are shown to be having mixed blessings to the local population and environment (Ogutu 1991; Holland 1996). On one hand, social and economic benefits have accrued to a few immigrants and dominant local persons; on the other hand, there have resulted negative effects on the physical ecology and local communities such as land degradation, alienation of and loss of formerly communally-owned grazing land, and very limited spread of the economic benefits to the majority of the population. These negative effects have partly resulted from deficiencies in the planning and implementation of development interventions where there has been little involvement and consideration for the local ecology and communities (Ndirangu 1994; wa Njaga 1996).

Ogutu (1991) observes that land privatisation in the Narok District of Maasailand is undermining the traditional Maasai land ownership practices and uses which are in harmony with the limitations of the physical ecology, particularly scarcity of water and grazing resources. Holland (1996) found out that only a few Maasais are gainfully employed in the modern tourist sector in their area.

Odegi-Awuondo (1990) shows that despite governmental and non-governmental development initiatives among the Turkana of northern Kenya, this community has not

been effectively cushioned against vulnerability to drought and famine. Odegi-Awuondo highlights the social stress and economic hardships this community goes through in the event of drought or famine. For instance, in 1979, the Turkana were affected by drought. A survey of 65 families showed that before the drought, each family owned an average of 30 head of cattle, 80 sheep and goats, and 2 camels and donkey. After the drought, these families had an average of 0.3 head of cattle, 2.4 sheep and goats, and zero camels and donkeys. About 3631 families were affected, with a total of 24,550 drought and famine victims having to rely on famine relief in Lokitaung Division of Turkana District (Odegi- Awuondo 1990, 106).

Tiffen et al. (1994) have examined long-term trends in ecological and socio-economic situation in Machakos District, Kenya. They indicate that there has been an overall improvement in the environmental and human situation in this region. This improvement occurred despite an increase in human population and is attributed to the implementation of a wide range of interventions by the government of Kenya, development agencies and the local community. These interventions include, for instance, soil conservation measures and adoption of commercial agriculture. The improvements noted by Tiffen and associates may have to be interpreted with caution as their analysis concentrates on general long-term trends, with selected case studies. Findings in other studies tend to indicate that the ecological and human condition in Machakos District and the ASALS of Kenya in general has deteriorated and is under stress (Darkoh 1990; Walubengo et al. 1994; Wisner 1980 – 81; Wisner and Mbithi 1974; Matheka 1992; Musyoki 1986). What is probably necessary is further research to be done at a micro-level to examine, for instance, the experiences of particular groups and households with development interventions in Machakos District.

A study by Thompson (1991) on the impact of improved or enhanced accessibility to water for irrigation in Njoguini-Gitero-Kabati in Nyeri revealed that it enabled the farmers to cultivate a variety of food and cash crops on their irrigated plots. The farmers were able to supplement inadequate rainfall and extend the growing period to enable the women to have dry-season vegetable gardens. As a result, the farmers were able to increase cash income and reduce food shortages. This irrigation project, which was a self-help venture by the community, led to the establishment and strengthening of effective and village-cluster institutions capable of solving complex socio-technical problems. Other programmes that were undertaken by the local institutions and irrigation executive committee were improvement of rural access roads, building food storage and milk processing facilities, and establishing rural electrification committees. Though these benefits were realized, there were also negative impacts or challenges such as overwatering of fields by some farmers, overproduction of certain crops (cabbages, tomatoes) and competing claims for water from neighbouring communities. These results show that a development intervention can have both positive and negative impacts. For this reason, there is a need for an effective institutional framework to deal with such issues. More or less the same problems were found to exist in the small-scale, gravity-fed irrigation schemes in the Kimana Group Ranch and its environs in Kajiado District (Southgate and Hulme 1996a and b).

Results from other ASALS of Africa indicate that development interventions have not been effective in arresting the deteriorating ecological and human conditions (Darkoh 1994, 1996; Ornas 1992). The failure of these interventions is attributed partly to their attempts to radically transform and change the existing livelihood systems in these areas. For instance, rather than promote pastoralism, some cultivation and small-scale irrigation, some of the development interventions sought to sedentarize the pastoralists and introduce commercial agriculture.

Evaluations of the integrated development model and impacts of interventions on communities or regions reveal that varying results have been realised. For instance, Bolnick and Nelson (1990) evaluated the economic impacts of a special credit programme for small-scale enterprises in Indonesia and found out that incremental investment varied from zero for the construction sector to more than 100 percent of the credit for building material traders, agricultural produce wholesalers, livestock traders, taxis and merchandise transport operators. The incremental impact on employment varied also. For example, in manufacturing, between 1.2 and 1.5 jobs per firm were attributed to credit, while in other sectors such as fish pond farming, credit borrowers hired fewer new workers than non-borrowers. This study mainly looked at the impact of credit on sectors. Furthermore, the measure of credit impact was strictly defined to refer to changes in employment, output and incomes in businesses. Credit, even as acknowledged by the two authors, has multiple effects and a measure of its impacts should consider other aspects such as personal and household consumption and wealth.

Lall and Broadway (1994) examined the impact of an integrated rural development programme on income and standard of living in Allahabad District in India. This programme had four major activities. The first was agricultural, under which the following interventions were undertaken: distribution of implements, demonstration of crops, conservation of soil, supply of store bins and a pair of bullocks. The second was animal husbandry, which involved the following aspects: loan for purchase of milk animals, establishment of pigs, goat and poultry units, and loan for draft animals. The third included minor irrigation, digging and repair of wells, distribution of pump sets, Persian wheels and boring of tube wells. The fourth included industries and business in which the following were done: supply of improved tools for artisans, training of rural youth to prepare them for self-employment in bee-keeping and carpet-weaving. The study found out that as a result of the integrated rural development programme in Allahabad, there had been a substantial increase in the income of the beneficiaries. The percentage of persons in the lowest income group (below Rupees 250) was reduced from 78% to 17%. On the other hand, the percentage of persons in the income groups above Rs 250 had increased in percentages ranging from 0 to 16. The effect of the rise in income was reflected in the improvement of the living standard as seen in the increase in material possessions of the beneficiaries.

Cohen (1987) examined an integrated rural development programme in the Arssi region of Ethiopia. The objectives of the programme were to:

- (a) bring about economic and social development;

- (b) give the population an increased awareness of and responsibility for development processes;
- (c) verify methods of agricultural development;
- (d) train staff not only for the programme but for similar projects elsewhere.

The project had both positive and negative impacts. Among the positive impacts were increased agricultural productivity, rising incomes, improved accessibility, new structures such as hotels and houses, and increased marketing activities. The negative impacts were increased tenant eviction, rising land rents and prices, and expanded government and elite's capacity to profit from benefits intended for the target population. Following the 1974 socialist revolution in Ethiopia, the new regime was more interested in pursuing socialist objectives and paid little attention to agriculture. This led to a gradual decline in the performance of the integrated projects in Arssi region. Cohen observes that the experience of Arssi region revealed that integrated rural development strategy has relevance as an intervention strategy in designing and implementing programmes to improve the socio-economic condition of a population.

The Kerio Development Basin is no exception to efforts at integrated development interventions. During the colonial period, a number of innovations were slowly introduced such as the construction of a few roads, introduction of new crops (cassava, sweet potatoes, groundnuts, bananas) and construction of irrigation canals (Kipkorir 1981). By and large, these efforts did not significantly improve the socio-economic situation of the inhabitants. Part of the reason for this poor performance was the colonial perception of the indigenous livelihood systems as unproductive, hence the attempt to change or transform them. There was little involvement and participation by the local population. The colonial development efforts were also on a limited scale as this region is an arid area and did not attract a lot of the colonial interests as did the high potential areas of Kenya (Soja 1979).

Since the attainment of independence in 1963, both governmental and non-governmental agencies have shown an interest in the development of the Kerio Basin Development Zone. Wide-ranging development initiative, such as environmental rehabilitation, infrastructure improvement and agricultural development, have been undertaken. Despite the intervention, the overall welfare of the communities and the region has not improved much. Many of the development projects did not address fully the crucial issues of welfare improvement. As already noted, the outside intervention sought to radically change and move the communities away from their traditional livelihood systems (Darkoh 1990).

In order to co-ordinate, harmonise and enhance the development of the Kerio Basin, the Government of Kenya established the Kerio Valley Development Authority (KVDA) in 1979. The overall purpose of KVDA was to try to focus interest on and investment in the Kerio Basin, which, as has already been shown, lagged behind other parts of Kenya in general socio-economic development due to historical, geographical and other reasons (Were 1981). The KVDA was specifically charged with the following functions:

- a) To initiate, identify, plan and implement feasible development projects and programmes in consultation and collaboration with the specialised government sectoral departments, local leaders and administrative officers;
- b) To develop and keep an up-to-date record of short, medium and long range development plans for the area;
- c) To initiate and undertake reconnaissance studies, special surveys and any other pertinent exercises which may be deemed as necessary prerequisites for more detailed feasibility or pre-investment studies and engineering designs;
- d) To play a co-ordinated role through provision of linkages between the various sectoral projects and programmes in the different administrative districts falling within its areas of operation.

In addition to the KVDA, there are other change agents and programmes in the Kerio Basin such as the Integrated Agricultural Development Project, the Arid and Semi-Arid Pre-investment Survey, Fluorspar Mining Company, the development plans drawn up by the various districts in the region, non-governmental groups and individuals from within and without the Basin (Ssenyonga 1979; Khayesi 1995). There is, therefore, an array of participants in a number of development projects among the different communities in the Basin. The KVDA has undertaken a number of feasibility studies and also formulated a master development plan for the Basin (Wenge International Associates Limited and Geodetic Associates Limited 1986).

Whether in collaboration with other agencies or on its own, the KVDA has initiated a number of development projects in the Kerio Basin, the major ones being Turkwel Gorge Power Project, Fluorspar mining, irrigation, infrastructure improvement, cotton growing, tourism promotion, bee-keeping and catchments rehabilitation (Khayesi 1991, 1995). These projects should not be seen as isolated but rather as various components of a broad-based and integrated development strategy, addressing the challenging ecological and human condition in the Kerio Basin. A comprehensive evaluation of the progress and achievements of the Kerio Basin projects is currently lacking in literature. This study contributes in a small way toward filling this gap in literature with respect to bee-keeping and irrigation.

1.8 Theoretical Framework

The Kerio River Basin has a multiplicity of development projects aimed at environmental rehabilitation and socio-economic development of the region and its inhabitants. These projects form a broad programme of interventions undertaken by a number of agencies, but co-ordinated by the Kerio Valley Development Authority. Given the multiplicity of development projects and an effort at co-ordination in the River Basin, the integrated rural development framework is deemed as appropriate to guide the present study.

Integrated rural development strategy was an important development intervention applied in the Third World in the 1970s. This strategy had its origin in increasing concern with the problem of rural poverty by the governments of Third World countries and international development agencies, which introduced projects and programmes

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dealing simultaneously with a number of different aspects of rural wellbeing. This concern partly arose from the failure of the economic growth models of the 1960s, which had not resulted in the alleviation of poverty. These growth models tended to emphasise large-scale projects; industrial, urban, and outward-oriented development; high cost and capital-intensive enterprises that led to marginalisation and stagnation of rural areas. These were some of the reasons for increased emphasis on rural development in the 1970s and the growing importance of the integrated rural development strategy.

Among the notable proposals and identification of the need for integrated rural development were recommendations by Ford Foundation specialists who, in response to the 1966 Indian Famine, argued that intensive integrated efforts were needed to stimulate India's agricultural sector. These specialists suggested a ten-point programme for achieving this goal. The ten points revolved around accessibility to inputs and markets, education, viable village institutions and co-ordination (Cohen 1987, 13). Underlying this proposal was the notion that a package of reinforcing activities applied to a particular area was the key to improving the productivity of small-scale farmers and promoting more effective government support for agricultural development.

The integrated rural development model looked promising and provided the operational framework for intervention. This partly explains why a number of integrated development projects were initiated, among the well known in the 1960s being the Puebla Project in Mexico (1967), the Chilalo Project in Ethiopia (1968), the Lilongwe Project in Malawi (1968) and the Vihiga Project in Kenya (1970).

Agricultural development was seen as a key mover in rural development. A number of interacting activities were identified as playing an important role if the objectives of inducing growth or improving quality of life were to be achieved. Examples of the activities and components of an integrated rural development strategy aimed at increasing agricultural productivity are:

- a) markets for farm products
- b) technology
- c) local availability of supplies and equipment
- d) improving and expanding agricultural land
- e) national planning for agricultural development.

In addition to agricultural activities, other activities that have been identified include rural public works, education, health family planning, energy and industry. Thus, from an initial emphasis on agricultural development (small-scale agriculture), the development activities of rural areas were expanded to include also non-agricultural activities such as industry. The underlying concern in the selection of these activities is to enhance their interrelationship and focus on addressing the diverse rural development problems.

Though differing perspectives have been noted in defining and articulating the concept of integrated rural development (Cohen 1987; Lele 1975), the following can be summarised as the key issues.

- a) Rural development problems and issues are diverse and have multiple causes.
- b) A number of development projects and activities need to be implemented to address the diverse issues of rural well-being. This can be achieved through special single programmes that meet the needs of specific groups of areas, or a total package of activities.
- c) Integrated rural development projects should emphasise the goal of simultaneity and relatedness.
- d) The projects should bring about permanent change, and they should be implemented in a long-term framework.
- e) The projects should have forward and backward links with the rest of the space economy in which they are located.
- f) A number of institutions are involved: national line ministries, sub-national government bodies (e.g., local authorities), project management units and private voluntary organisations or non-governmental organisations.
- g) The projects should aim at promoting popular participation, access to resources, increased production and fair income distribution, i.e., promote both and equity objectives.
- h) The projects should be area-specific and aim at spatial integration, i.e., they should be focused on the developmental needs and problems in a given area.

In brief, the integrated rural development strategy attempts to consider the totality of a region's development and advocates for comprehensive and co-ordinated development programmes if far-reaching and long-lasting benefits are to be achieved (Cohen 1987). An integrated development approach is, therefore, based on the assumption that mass poverty is a result of multi-causal and interdependent factors. This implies that long-lasting development impacts cannot be achieved by mono-sectoral interventions or by sectoral development agencies. In order to achieve long-lasting development, intervention strategies should consist of well-selected and well-co-ordinated efforts from different sectors. The integrating factors in such an approach are both the problems of people or communities in a specific area and their potential for solutions.

The integrated rural development model is, therefore, based on a holistic problem and potential analysis at community level. This model aims at combining sectoral activities in such a way that synergetic effects are achieved. Through integrated planning, sectoral development agencies are able to co-ordinate their development activities at different institutional and regional levels. An integrated development approach is a dynamic process in which all partners have to continually check their roles, activities and common goals. It can be seen from this description that an integrated rural development model is community-focused or at least area-focused (Schubert et al. 1994; Sunday Nation,

1997). The participation of the intended recipients is deemed necessary in the design and implementation of development projects as a way of ensuring acceptance and success of the projects (McGregor 1997).

According to Chambers (1983), unless the intricate rural development issues are attended to, especially the problem of poverty, conditions will be created for perpetuation of the deprivation gap that is characterised by poverty, isolation, powerlessness, vulnerability and physical weakness. Chambers (1983) argues that due to the interaction of these factors, the conditions of the rural poor have degenerated and to him, the end product is integrated rural poverty. On the other hand, there is a view that under the right conditions appropriately designed, integrated rural development projects can play an important role in bringing development to small-scale farmers and their regions (Cohen 1987, 9). It can be seen from these two views that an integrated rural development approach has promise for improving a region's wellbeing if the underlying theoretical and practical issues are carefully attended to. This underscores the need for careful consideration of the development goals and design of projects or programmes in a given spatial setting to achieve these goals in the short-term as well as long-term.

This study postulates the position that if the development of the Kerio Basin is to benefit the people in the region and Kenya as a whole, it must take into consideration an approach that links the various projects to the specific felt ecological and socio-economic conditions of the people and region. Further, the projects should be well co-ordinated and where they have any common elements, these should be enhanced. Any new project should be related to existing ones so as to utilise already existing knowledge and technology to forge an interlinked network.

In order to examine the impacts on household welfare of the bee-keeping and irrigation projects, this study has put together ideas of relevance in the framework shown in Fig. 1. Box A refers to the broad framework or programme of development projects that are aimed at environmental rehabilitation and socio-economic development. The impacts of all these projects can be assessed but given the focus of this study, only bee-keeping and irrigation projects are selected for analysis. Mediating between boxes A and B are the agents of change, the institutional framework and policy framework.

The inception of the projects shown in box B is expected to lead to adoption of new technology, innovations and new changes by the recipient communities (Households). This adoption should ideally lead to observable changes in household employment, income and consumption patterns. Details of the impacts are shown in box C. Linking the three boxes is the feedback loop that sends messages and from the homes that can lead to modifications in the total development intervention process or its components. For instance, if negative effects are resulting, the necessary measures should be taken on project design and implementation to correct such situations. If, on the other hand, positive effects are resulting, then this should be enhanced and sustained.

The framework shown in Fig. 1 reveals that a development project can have both direct and indirect impacts. Directly, a project can lead to changes in employment, income and production, Indirectly, a project can lead to changes in quality of life which can be considered as indicators of well-being. Quality of life can be measured in relation to

changing patterns of consumption and expenditure of income generated. The income can be spent on food, education, health, clothing, housing and energy. The underlying assumption is that any changes in household improvement and income are reflected in the household consumption patterns.

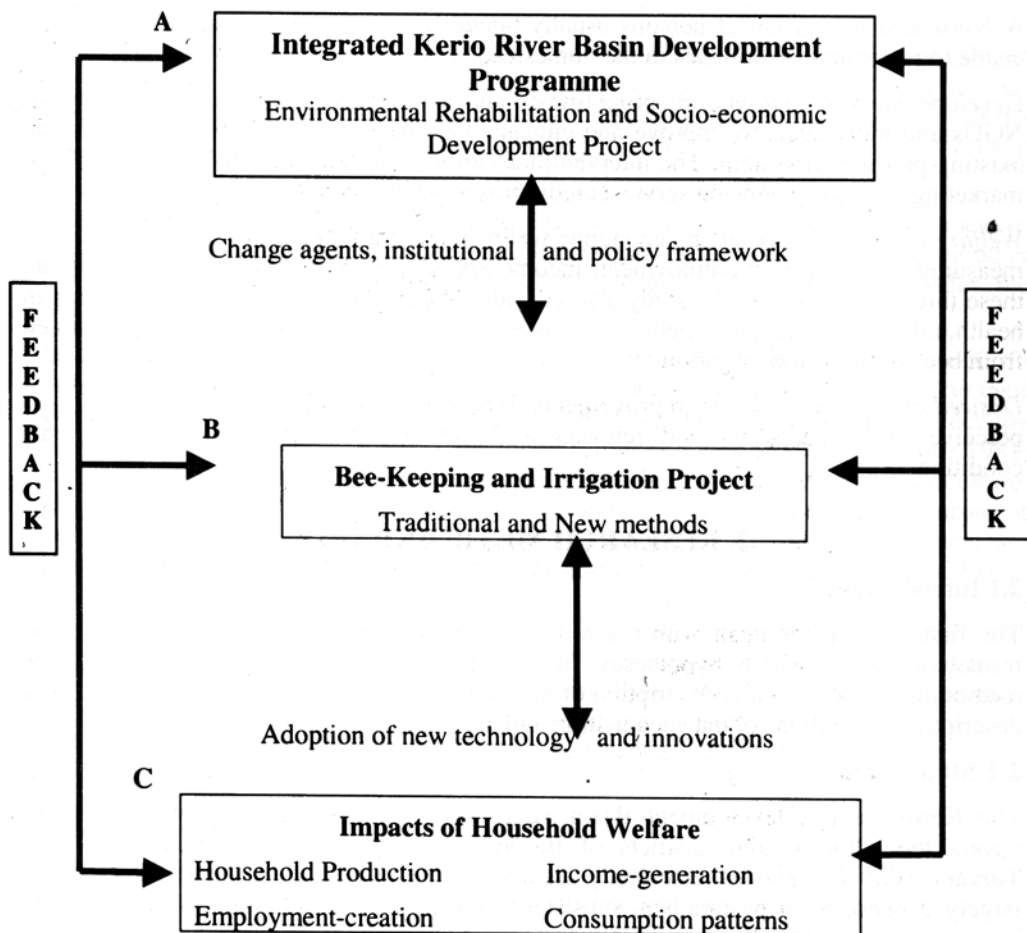


Fig. 1: A framework for analysing the impacts of bee-keeping and irrigation development projects on household welfare in the Kerio Basin Development Zone.

1.9 Research Premises

The following premises guide this research study:

- a) There is no variation in observed and reported impacts on household welfare resulting from bee-keeping and irrigation among the different households.

- b) There is no variation in the views of respondents on desired changes and improvements in bee-keeping and irrigation.

1.10 Operationalisation of Research Variables

This study has used the following key terms, which are operationally defined below:

A *household* is a group of persons usually bound by ties of kinship and that normally reside together and share meals in the homestead.

Development interventions are programmes and activities undertaken by government, NGOs and individuals to improve and enhance the productivity and performance of an existing production system. The interventions can include new information, technology, marketing strategy, extension service, credit provision and manufacturing.

Welfare refers to the social and economic wellbeing of households, which in this study is measured by changes in employment, income and output. Since the impacts go beyond these three main aspects, the study also considers other aspects such as improvement in health, education, nutrition, shelter and possession – acquisition that could have resulted from bee-keeping and irrigation.

Desired change refers to the improvements or new ways, which members of households perceive to be necessary and relevant to improving their present socio-economic condition.

2. RESEARCH METHODOLOGY

2.1 Introduction

The first chapter has dealt with the research problem, review of literature, theoretical framework and research hypotheses. In this chapter, an explanation is given of the methodology used. First, a description of the study area is given and this is followed by a description of methods of data acquisition and analysis.

2.2 Study Area

The Kerio Valley Development Basin Zone, under the management of the KVDA, covers the administrative districts of Baringo, Elgeyo, Marakwet, West Pokot and Turkana (Fig. 2). This is essentially an arid and semi-arid zone whose economy is largely dependent on pastoralism, subsistence farming based on irrigation and rainfall, bee-keeping and limited commercial-industrial activities.

The Kerio Basin, though an arid and semi-arid zone, has variations in its ecological characteristics. The Basin receives low natural precipitation, less than 625 mm of rainfall per year. There are, however, a few high altitude areas that receive about 750 – 1000 mm of rainfall per annum or even more. Due to this low natural precipitation, the Basin is characterised by low and unreliable seasonal streams. The major surface water resources are rivers Kerio, Perkerra, Molo, Subukia, Turkwel, Tarach and Suguta. The notable lakes include Baringo, Gogoria, Kamnarok and Turkana. Other sources of water are dams, water pumps and boreholes.

Due to the limited water supply from rainfall and ground sources, cultivation is also limited. Hence, the need for irrigation water to sustain crop cultivation. The Basin further experiences generally high temperatures, with the mean annual temperatures ranging from 16 degrees centigrade in the high altitude areas to about 30 degrees centigrade in the lowlands. The high temperatures increase loss of surface moisture through evaporation.

Vegetation is varied depending on altitude, rainfall regime and availability of surface water. Pockets of forests are found on the highlands, plateaus and along river valleys. Otherwise, bush land, shrubs, acacia, and desert and semi-arid flora cover much of the land. The vegetation in the Basin is favourable to the bee-keeping activity by the local population.

It can be noted that the physical environment presents a constraint to the development of the area. In addition to low unreliable precipitation and scanty vegetation, there are other physical constraints such as friable soils and steep rocky gorges that hinder the construction of roads or increase the costs of construction.

Despite the limitation imposed by the physical environment, the inhabitants of the Kerio Basin Development Zone have over the years developed land use systems based on their perception and knowledge of the fragile ecological base. The local communities occupy a three-tier ecological zone in which livelihood activities are undertaken (Kipkorir 1981; Ssenyonga 1981). First is the valley ecology where the main activities are agriculture, grazing, fuelwood gathering, bee-keeping and hunting. Second is the lower escarpment that is used for human settlement. Third are the mountaintops and highlands that are covered by the forest. Pastoralism, bee-keeping and grain cultivation are long established land use systems in the Kerio Basin. Furrow irrigation has long existed among the Marakwet, Keiyo and Njemps (Kipkorir 1981; Odegi-Awuondo 1990; McCabe 1990). In addition, these communities engage in trade and other livelihood activities such as wage employment to sustain themselves. The current Kerio region development projects represent some of the recent efforts by the government of Kenya and donor agencies to intervene in the development of an otherwise fragile, lagging and marginalized region in the country (Kipkorir et al. 1981).

2.3 Data Types and Methods of Acquisition

In order to meet the objectives, answer the research questions and test the hypothesised relationships, archival and field-based research techniques were used to generate the data required. The procedures followed in data acquisition are explained below.

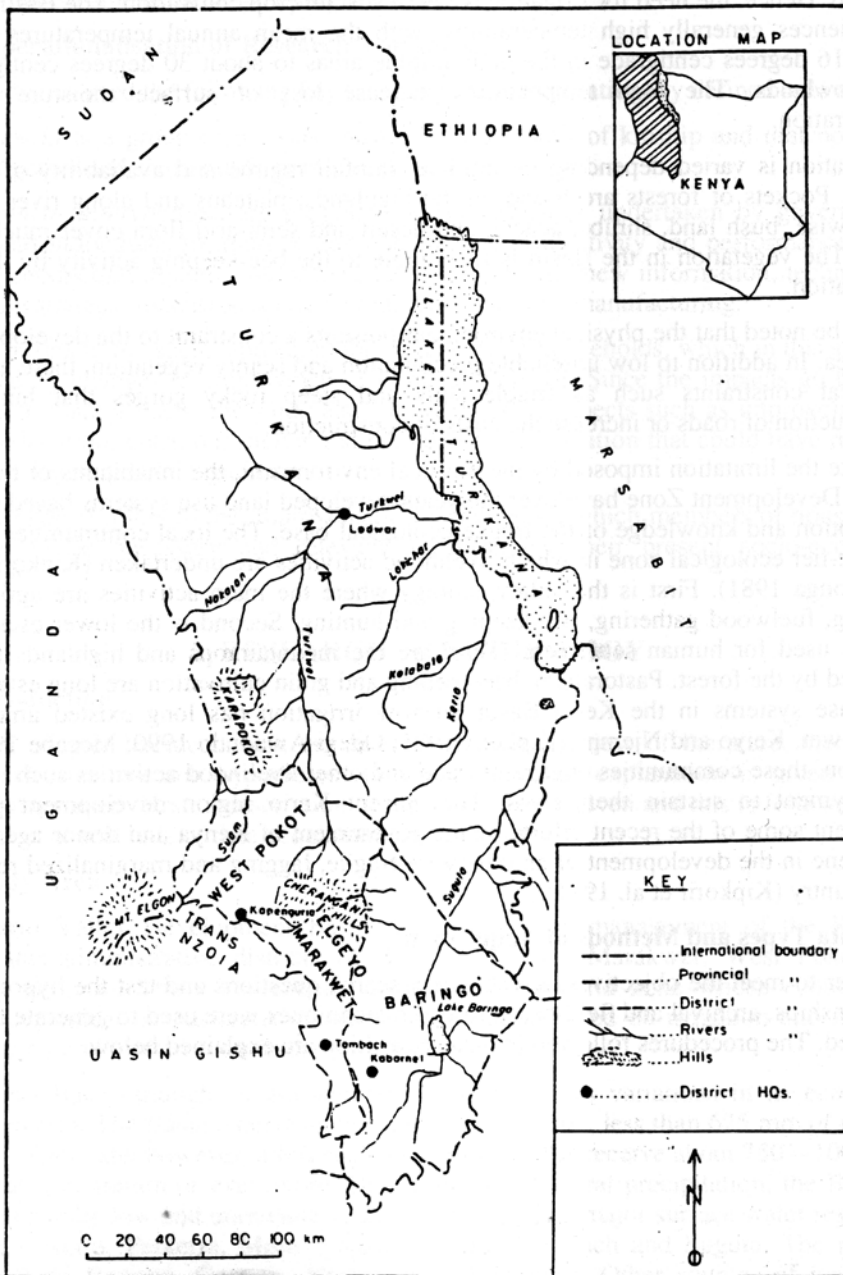


Fig. 2: The Kerio Basin Development Zone.

2.3.1 Secondary Data

In order to build and gain insight into the socio-economic situation of the region in general and the development activities in the region, data and information were sought on population, traditional livelihood systems, modern livelihood systems, history of development of intervention and current socio-economic indicators of development (health, education, infrastructure e.t.c.). Special attention was paid to gathering secondary information on bee-keeping and irrigation in the Kerio Basin.

Kenya's Development Plans, Statistical Abstracts and Economic Surveys were consulted to gather information on the general socio-economic situation of the Kerio Basin. In addition, socio-economic profiles undertaken by the government of Kenya and other groups were consulted to gather information on the region's traditional livelihood and modern development activities (especially on bee-keeping and irrigation, a number of research reports and studies were consulted. Important sources of this information were the KVDA offices in Eldoret town, Kenya National Archives, Jomo Kenyatta Memorial Library at the University of Nairobi, Moi library at Kenyatta University and Central Bureau of Statistics Library in Nairobi.

The data gathered are utilised in the appropriate sections of this research report. The interpretation given of the data reflects, to a large extent, the interpretation of this researcher and not necessarily the sources cited.

2.3.2 Primary data

The following stages were followed in collecting primary data: development of research instruments, preliminary survey, revising the research instruments, selecting the sample and fieldwork. A questionnaire was developed before hand. This questionnaire was designed to reflect the issues raised in the research questions. During the preliminary survey (February 1966), discussions were held with the representatives of the Kerio Valley Development Authority to gather basic information on the development of the Kerio region, in general, and bee-keeping and irrigation projects, in particular. These representatives allowed this researcher to consult documents at the KVDA library in Eldoret that have useful background information on the Kerio region. More informal discussions were held with the residents of the region, especially people who have knowledge on the development of the region and on the two selected intervention projects of bee-keeping and irrigation.

During the preliminary survey, samples of ten respondents were interviewed to determine the kind of responses that may be anticipated in the final survey. In addition, two enumerators living in the study area were identified to assist in the data collection process. One enumerator assisted with the bee-keeping project and the other assisted in the irrigation project. Following the preliminary survey, the questionnaires were revised to reflect the anticipated situation in the field.

Fieldwork was preceded by selection of the sample. The Kerio Valley Development Authority Bee Project office in Kabarnet was approached to help identify farmers to whom they had introduced the new bee-keeping technology. It was not easy to know which farmer was still practising or had abandoned the new methods. This required a

follow-up in the field. The enumerator assisted in following them up and it was possible to identify 27 farmers who had adopted and were still practising new bee-keeping methods. These were the farmers who constituted the sample for bee-keeping.

The Chemron-Marigat-Perkerra irrigation area in Baringo district was selected to provide a sample of farmers who had adopted the new methods of irrigation. This area was selected, as it was one among the first to benefit from intervention in irrigation. It, therefore, has a reasonable duration to enable an assessment of its impacts on household welfare to be undertaken. A visit was made to the selected irrigation area. With the help of the officers in-charge of the irrigation project and field enumerator, it was possible to select 39 respondents to answer the questionnaire. Fieldwork began in March 1996. The bee-keepers were interviewed in March and April 1996. The interviews for irrigation farmers were done in February – March 1997. The reason for this break in the fieldwork was that the principal investigator left Kenya for an academic visit to Germany from May – October 1996. It was necessary to stop the interviews so it could be conducted under the direction of the principal investigator.

Two kinds of research instruments were used. The first was a questionnaire and the second was an observational schedule. Two types of questionnaires were administered. The first was to households and the second was to institutions involved in the intervention in bee-keeping and irrigation. The household questionnaire sought to gather data on four main aspects: socio-economic information about the respondents and the households, adoption of new methods in bee-keeping and irrigation, benefits that have resulted from the new methods, and problems that have resulted from the use of the new methods. A number of open-ended questions were asked so as to get the desired information without necessarily restricting the respondents to specified categories of responses. The institutional questionnaire sought the following information: history of the institution and intervention (i.e., objectives, date of inception), activities undertaken, benefits that have accrued to the community and problems experienced in the process of implementing the intervention. The observational schedule was used to record relevant information noted on households and institutions during the fieldwork such as the households' assets, and activities seen being done in bee-keeping and irrigation.

2.4 Data Processing and Analysis

The first stage in data processing and analysis was to edit the questionnaires to find out if the responses had been entered well. This was followed by the designing of code books for systematic extraction of the data. The questionnaires were then scrutinised, one by one, to extract the data. Summary tables were then prepared. The data were further analysed using statistics such as cross tabulation, frequencies and percentages.

3. IMPACTS OF INTERVENTIONS IN BEE-KEEPING ON HOUSEHOLD WELFARE

3.1 Introduction

In pursuit of the goal of initiating, planning and implementing development projects in the Kerio region, the KVDA has attempted to improve traditional bee-keeping. The

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KVDA bee-keeping project was aimed at integrating the production and marketing of honey and beeswax from smallholders and bee-keepers in the Kerio Valley and to improve all sectors of bee-keeping activities. In other words, the overall aim was to set bee-keeping on a sound and profitable footing with subsequent benefits to the local economy. (Republic of Kenya, n.d.). The KVDA has a bee-keeping co-ordinating office or field station at Kabarnet Town in Baringo District. This office is charged with the responsibility of promoting the new methods in bee-keeping. It encourages farmers to adopt the new methods of bee-keeping (apiculture).

Working with the local farmers, women groups and co-operative societies, the KVDA bee-keeping programme undertakes the following activities.

- a) Introduction of modern beehives that have metallic covers and are rectangular in shape, shape unlike the traditional log-beehives. These beehives are produced at a workshop at the Kabarnet Bee Station. The new beehive is called Kenya Top Bar Hive (KTBH).
- b) Introduction of new methods of collecting honey using protective clothing.
- c) Assisting the local honey producers by buying their honey that is processed and marketed. The authority has, in addition, its own beehives, which are kept on local farms for demonstration.
- d) Providing extension service to the local bee-keepers.

This chapter examines the impacts of the new methods of bee-keeping on household welfare. The chapter is guided by the following specific research questions:

- a) What are the effects of new methods in bee-keeping on household welfare as indicated by employment, production income and consumption?
- b) What problems are experienced by modern bee-keepers?
- c) What are the views of the respondents on desired developmental changes in bee-keeping?

3.2 Adoption of New Methods in Bee-keeping

Twenty-seven respondents who had adopted the new methods of bee-keeping were interviewed. They had adopted these methods at different dates. As shown in table 1, adoption of the new methods is a continuous process. However, majority of the respondents (29.6%) adopted the new methods in 1994 and 1995. The new methods include the use of a new beehive made of wood and covered on top with a metal (iron sheet). The farmers also use materials to cover their arms when harvesting honey. In addition, the farmers can sell their honey to KVDA who acts as middleman.

Table 1. Date of respondents' adopting new methods of bee-keeping

Year	Number of respondents	Percentage
Before 1987	3	11.1
1987	2	7.4
1988	0	0
1989	1	3.7
1990	2	7.4
1991	1	3.7
1992	4	14.8
1993	3	11.1
1994	4	14.8
1995	4	14.8
1996	1	3.7
No response	2	7.4

N= 27

As shown in table 2, the new methods were introduced by more than one agent. The main agent cited by majority of the respondents (11 or 40.7%) was KVDA. There were others such as Rachemo, Mission Station and Ministry of Livestock Development. Apart from the agents, there were farmers who were self-motivated, partly by learning or seeing the new methods from their neighbours.

Table 2. Agent introducing new methods of bee-keeping

Agent	Number of respondents	Percentage
Rachemo	2	7.4
Mission Station	3	11.1
KVDA	11	40.7
Ministry of Livestock Development	2	7.4
Self motivated	9	33.3
Total	27	99.9

Though the respondents had adopted modern methods of bee-keeping, they still kept traditional bee-hives. As shown in table 3, the respondents practise both modern and traditional methods of bee-keeping. In fact, they still have a big number of traditional beehives. What comes out is that the traditional beehives have not been completely replaced by the adoption of modern beehives. This co-existence has the potential of integrating these two methods and coming up with a method that has borrowed the best from both the traditional and the modern.

Table 3. Number of Beehives kept by the households

Number of bee-hives	None	1-3	4-6	7-10	11-13	14-16	17-20	21+
No. of households with modern bee-hives	0 (0%)	17 (63%)	6 (22.2%)	2 (7.4%)	1 (3.7%)	0 (0%)	1 (3.7%)	0 (0%)
Additional traditional beehives	7 (24.9)	5 (18.5%)	7 (25.9%)	3 (11.1%)	1 (3.7%)	0 (0%)	3 (11.1%)	1 (3.7%)

N = 27

3.3 Benefits of Adopting New Methods in Bee-keeping

This section uses both quantitative and qualitative data to assess the impacts of adopting new methods of bee-keeping on the welfare of sample households in the Kerio valley Development Region. Both direct and indirect impacts are assessed in relation to household employment, production, income and consumption patterns.

3.3.1 Household Employment

Bee-keeping provides employment, in varying degrees, to members of households. The respondents stated various activities that are done by parents and children in bee-keeping (table 4). These activities include cleaning beehives, watering the bees and harvesting honey.

Table 4. Activities done by household members in bee-keeping

Members	No response	Farm Manager	Clean beehives	Water bees	Harvest honey
Father	4	18	10	9	14
Mother	9	2	1	3	0
Children	12	1	15	6	13

It should be noted that bee-keeping is not a full-time activity. The tasks done in bee-keeping come at certain periods of the year. This means that bee-keeping supplements or helps to diversify the employment structure of households. As shown in table 5, members of households from whom the responses were solicited are involved in a number of employment activities ranging from farming to butchery, and bee-keeping contributes towards these activities.

Table 5. Employment structure of members of households

	Father	Mother	Children	Total	Percentage
No response	2	0	19	12	5.7
Toddler	0	0	13	13	6.4
Farmer	20	2	4	26	12.9
Housewife	0	17	2	19	9.4
Business	5	1	3	8	4.5
Civil servant	1	2	11	14	6.9
Unemployed	1	0	12	13	6.4
Student	0	0	52	52	25.7
Farm labour	13	0	9	22	10.9
Herdsmen	11	0	1	12	5.9
Butcher	1	0	3	4	2
Others	2	0	33	6	3
Total	56	26	120	202	99.7
Percentage	27.7	12.9	59.4		

Rural households are involved in a number of livelihood activities. Introduction of new methods or activities are adopted in the households to expand their economic opportunities. As shown in table 6, bee-keeping households have other economic activities such as livestock keeping (cattle, goats, sheep, donkeys) and crop production (e.g., coffee, millet, vegetables, bananas and fruits).

As far as modern methods of bee-keeping are concerned, it can be stated that their effect on household employment has been to increase the employment opportunities available to members of the households that have adopted these methods. Given the multiple livelihood activities in the households, it is important to see the new methods of bee-keeping as part and parcel of the total employment setting available to households.

3.3.2 Household Production and Income

The respondents were asked to indicate the amount of honey production in the period 1990 – 1995. The results summarised in table 7 reveal that the majority (47.6%) of the households produced less than 25 kilograms of honey. Only a few produced more than 25 kilograms. There were also a few households (19.6%) that did not harvest any honey during some of these years.

Table 6. Other economic assets and activities of bee-keeping households

a) Size of land (acres)	Less than 2	2.1-2.4	4.1-6.0	6.1-8.0	8.1-10.0	10.1-12.0	12.1+	Total
b) No. of households	2	4	3	1	4	1	12	27
c) Crops grown	No. of Households	%						
Vegetables	5	18.5						
Coffee	1	3.7						
Maize	20	74.1						
Beans	15	55.6						
Groundnuts	5	18.5						
Bananas	3	11.1						
Millet	12	44.4						
Nappier	1	3.7						
Fruit trees	4	14.8						
Cassava	2	7.4						
Sorghum	1	3.7						
Cotton	1	3.7						
d) Number of livestock	None	1-5	6-10	11-15	16-20	21-25	26+	Total
i. Cattle	1	10	10	1	0	0	3	25
ii. Goats	4	2	4	5	3	0	8	26
iii. Sheep	13	10	2	0	0	0	0	25
iv. Donkeys	14	5	0	0	0	0	0	19
v. Poultry	9	7	5	2	2	2	2	29
vi. Fish Ponds	26	1	0	0	0	0	0	27

N = 27

Table 7. Amount of honey harvested by households in the period 1990 -1995

Year	No. response	None	Below 25 (kg)	25.1-50 (kg)	50.1-75 (kg)	75.1-100 (kg)	101-125 (kg)	Total
1995	3	4	16	2	2	0	0	27
1994	2	3	18	2	2	0	0	27
1993	3	5	15	2	2	0	0	27
1992	5	8	7	3	4	0	0	27
1991	8	7	9	1	2	0	0	27
1990	9	7	8	1	1	0	1	27

Note: Cell entries represent the number of households that harvested the amount of honey specified in the first row.

The respondents were further asked to state how much they earned from the sale of honey in the period 1990 - 1995. Though some of the households did not sell the honey,

the results in table 8 reveal that the sale of honey contributes towards household income. There is variation in the amount of money earned. The results also reveal that the amount of money earned per year is generally low or too little to sustain the needs of the households.

Table 8. Earnings from the sale of honey by households in the period 1990-1995

Year	Not sold	No response	Below 500 Ksh*	5001-1000 Ksh*	1001-1500 Ksh*	1501-2000 Ksh*	2001-3500 Ksh*	3501-4000 Ksh*	4001-6000 Ksh*	6001+ Ksh*	Total
1995	7	6	1	2	1	1	2	3	1	3	27
1994	6	4	5	1	2	0	3	3	1	2	27
1993	6	6	3	3	4	0	3	1	0	1	27
1992	1	12	3	0	3	1	2	0	3	2	27
1991	2	15	2	2	0	2	2	0	0	2	27
1990	2	16	2	2	1	1	0	0	1	2	27

* Ksh = Kenya Shillings.

3.3.3 Household Consumption Pattern

The respondents were asked to state the benefits they got from adopting new methods of bee-keeping. Three main kinds of responses were given as shown in Table 9: increased honey production (15 respondents or 55.6%), increased earnings from the sale of honey (17 respondents or 63%) and increased honey for home consumption (18 respondents or 66.7%). Representatives of the KVDA bee-keeping office in Kabarnet Mogoswork Bee-keeping co-operative indicated that the main benefits of the new approach in bee-keeping to the local community are: access to marketing through KVDA, availability of relevant extension service and income from the sale of honey.

Table 9. Stated benefits following the adoption of new methods in bee-keeping

Benefits	Number of Respondents	Percentage
Increased overall amount of honey produced	15	55.6
Increased earnings from sale of honey	17	63.0
Increased amount of honey for home consumption	18	66.7

N = 27

To examine further the impacts of adopting new methods in bee-keeping, the respondents were asked to state what they had used the money from the sale of honey in 1995 for. The results shown in table 10 show that this money had been spent largely to satisfy the basic needs of the households such as food, clothing, education, health and furniture. They also used the money for farm work such as buying seeds, buying fertiliser, hiring farm labour and buying items for bee-keeping.

All the respondents indicated that they used part of the money to assist friends and the community in such matters as funerals and harambees (donations towards community

development projects.) Only 2 and 6 respondents used part of the money towards paying dowry and building houses, respectively. Further, 4 respondents reported that part of the money was used for entertainment. Three respondents reported that they had not harvested any honey in 1995 and thus had not earned any income from bee-keeping that year.

Given the age and composition of the sample households (table 11), the respondents were asked whether the money they earn from the sale of honey is enough to meet their household financial needs.

Only four respondents answered "yes", indicating that the money was enough. The rest of the respondents (23) answered "no", indicating that the money was not enough. This indicates that the adoption of new methods in bee-keeping has only increased, in a small way, the economic opportunities available to these households.

Table 10. Use of money earned from the sale of honey in 1995

Use	No. of respondents	Percentage
Pay school fees	10	37
Buy maize meal	17	63
Buy paraffin	14	51.9
Hire labour for farm work	4	14.8
Buy seeds	12	44.4
Buy livestock	8	29.6
Buy sugar	15	55.6
Pay medicine/health care	12	44.4
Buy items for bee-keeping	4	14.8
Pay dowry	2	7.4
Buy Soap	15	55.6
Buy beverages (coffee, tea)	15	55.6
Pay co-op services	2	7.4
Buy cloths	12	44.4
Build a house	6	22.2
Buy fertiliser	8	29.6
Entertainment	4	14.8
Help friends and community	27	100
Buy cooking utensils	12	44.4
Buy farm seeds	10	37
Buy chairs	9	33.3
Tables	9	33.3
Buy shoes	10	37
Buy cooking oil	13	48.1
Others	1	3.7
No harvest, thus no earning	3	11.1
No response	3	11.1

Table 11. Age and composition of households

Age group/ HH members	Father	Mother	Children	Total	Percentage
0.5	0	0	16	16	6.6
6.9	0	0	11	11	4.5
10.14	0	0	16	16	6.6
15.19	0	0	20	20	8.2
20.24	1	2	19	22	9.1
25.29	1	2	11	14	5.8
30.34	2	8	6	16	6.6
35.39	5	3	3	11	4.5
40.44	6	2	1	9	3.7
45.49	3	2	0	5	2.1
50.54	4	2	0	6	2.5
55.59	1	2	0	3	1.2
60+	3	2	0	5	2.1
Can't tell	1	2	86	89	36.6
Total	27	27	189	243	

Since the majority of the respondents answered "no", they were asked another question to find out what they do to get extra money to support their families. As shown in table 13, eighteen respondents indicated that they sell livestock, 11 stated that they borrow from friends and relatives and 8 indicated that they do casual work. These three were the responses with high frequencies. There were other responses, which are also important, such as borrowing from the co-operative, earning from formal employment, government aid and sale of household goods. These responses should be interpreted as reflecting some of the options available to these households to ensure the welfare of their members.

Table 12. Response to the question: "Is the money from the sale of honey enough to meet your household financial needs?"

Response	Number of respondents	Percentage
Yes	4	14.8
No	23	85.2
Total	27	100.00

It can be seen that the above options reflects the nature of rural household economic activities (table 6), employment structure (table 5) and existing social networks. Musyoki (1986) also found that households in Machakos District relied on borrowing and government aid to supplement their low earnings from the sale of staple foodstuffs.

Table 13. Source of extra money or support of the households

Source	Number of respondents	Percentage
Borrow from friends and relatives	11	40.7
Borrow from co-operative	3	11.1
From formal employment	6	22.2
Government aid	2	7.4
Sell livestock	18	66.7
Sell household goods	1	3.7
Casual work	8	29.6
Other	6	22.2

N = 27

3.4 Problems Experienced by Modern Bee-keepers and Desired Improvements

The respondents were asked to state the problems they have experienced since they adopted new methods of bee-keeping. The problems identified in table 14 should be understood to reflect the challenges that these bee-keepers face and which need to be attended to by the intervention agencies that were identified in Table 3.2. These problems relate to four major issues: The suitability of the new methods, the physical environment, pests, and prices and marketing of honey.

Table 14. Problems experienced since the start of using new methods of bee-keeping

Problem	Number of respondents	Percentage
Loss of honey due to theft	7	25.9
Drought, too much heat	15	55.6
Scarcity of flowers	5	18.5
Honey pest (badger)	12	44.4
Faulty equipment/facilities, hives not suited to the environment	17	63
Inadequate local market and promotion	2	7.4
Fluctuating price, hence unstable income	1	3.7
Lack of good sites to place bee-hives	24	88.9
Expensive project	5	18.5
Bees migrate frequently	17	63
Yield below expectation	3	11.1
No response	4	14.8

N = 27

With respect to the suitability of the new methods, the respondents pointed out that the new beehives are not appropriate because the top is covered with a metal. This increases the heat in the beehive, making it too hot for the bees to stay in. They also complained about lack of good sites to place the modern beehive. This beehive has to be hanged from

a tree or supported by posts. The respondents pointed out that it is not always easy to get such favourable site or location.

With respect to the physical environment, the problems identified were drought, too much heat, scarcity of flowers and frequent migration of bees. These problems affect the presence of bees and eventually, the viability or sustainability of honey production. Drought and high temperature affect the availability of vegetation. This partly explains the scarcity of flowers from which the bees get nectar for production of honey. These are some of the environmental constraints that affect bee-keeping in the Kerio Valley Development Zone.

The respondents identified the existence of a pest called honey badger that feeds on honey when it is being formed. This brings a great loss to the farmers. There is also another loss that results from theft of honey from the beehives.

Another problem that was of great concern to the respondents was related to the production, pricing and marketing of honey. The respondents noted that the amount of honey harvested tends to fall below their expectations. They also observed that bee-keeping is an expensive project that requires a good financial base, which they often lack. They went on to observe that the prices offered for their honey are low. Coupled with the low local demand for honey, the respondents noted that the income from honey production is unsteady.

Representatives of five institutions that are involved in bee-keeping activities in the Kerio Basin Development Zone identified more or less the same problems as facing bee-keepers. They particularly singled out the following problems: lack of funds for further improvement, drought, low production of honey, inappropriateness of the modern beehive that is covered on top by an iron sheet and theft of honey and beehives.

These problems partly explain why some of the farmers who had adopted modern methods of bee-keeping have abandoned them or are not keen on them any more. The respondents were asked to state some of the reasons that had made some of the adopters they know of, to abandon the new methods and why some people may not be willing to adopt the new methods. The responses revealed that the main reasons had to do with the viability of the activity, other competing commitments or activities, lack of money, pests and lack of information or knowledge about the activity. These responses imply that traditional methods of bee-keeping could still be offering better alternatives in the eyes of the farmers in the Kerio Valley Development Basin. There is need to re-examine critically the interventions that are being introduced in traditional bee-keeping. It may be appropriate to find out how the traditional bee-keeping methods can be enhanced rather than replaced with equipment (the metal-covered beehive) that has been found to be counterproductive.

The respondents were asked to state the improvements they desire to see in the bee-keeping industry in the region. The responses summarised in table 15 reveal issues related to the bee-keeping technology, physical environment, awareness campaigns, provision of loans and improvement of marketing strategies.

It is illustrative that the new bee-keeping technology was frequently cited as one of the areas that needed improvement. The respondents had specific suggestions that related to the provision of research-based cheaper beehives, replacement of the iron sheet from the top of beehives and improvement of harvesting equipment. The suggestions given in table 15 and the problems identified earlier in table 14 point to issues that require the attention of the agencies who introduced the new methods of bee-keeping in the Kerio Development Zone. These agencies need to work closely with the local communities through sharing information and developing the bee-keeping technology together.

Table 15. Desired improvements in the bee-keeping industry

Desired improvements	Number of respondents	Percentage
Provide loans to farmers	7	26.9
Increase bee-keeping awareness campaign	18	66.7
Improve breed of bees	7	25.9
Provide cheaper researched beehives	20	74.1
Frequent beehive inspections (maintenance) by extension workers	19	70.4
Improve harvesting equipment	15	55.6
Replace top iron sheet of the beehive	13	48.1
Improve marketing strategies	13	48.1
Form more bee-keepers co-operatives	9	33.1
Avail water during drought	12	44.4
Plant more trees for flowers to attract bees	2	7.4

N = 27

3.5 Summary and Conclusion

This chapter has examined the impacts of the new methods in bee-keeping on household welfare. In particular, the chapter has looked at the impact on household employment, production, income and consumption. The 27 respondents interviewed adopted the new methods of bee-keeping at different dates. More than an agent introduced the new methods. The main agent cited was KVDA, though there were others such as Rachemo, Mission Station and Ministry of Livestock Development. Apart from the agents, there were farmers who were self-motivated, partly by learning or seeing the new methods from their neighbours. Though the respondents had adopted modern methods of bee-keeping, they still kept traditional beehives, which shows that the traditional beehives have not been completely replaced by the adoption of modern beehives. This co-existence has the potential of integrating these two methods and coming up with a technology that has borrowed the best from both the traditional and modern methods.

Bee-keeping was reported to provide, in varying degrees, employment to members of households. The respondents stated various activities that are done by parents and children in bee-keeping. These activities include cleaning beehives, watering the bees and harvesting honey. It should be noted that bee-keeping is not a full-time activity. The

tasks done in bee-keeping come at certain periods of the year. This means that bee-keeping supplements or helps to diversify the employment structure of households. Members of households are involved in a number of employment activities such as keeping livestock and crop production, and bee-keeping contributes towards extending the range of these activities. Rural households are, in fact, involved in a number of livelihood activities and the introduction of new methods or activities are adopted in the households to expand their economic opportunities.

As far as modern methods of bee-keeping are concerned, it can be stated that their effect on household employment has been to increase the employment opportunities available to members of the households that have adopted these methods. Given the multiple livelihood activities in the households, it is important to see the new methods of bee-keeping as part and parcel of the total employment setting available to households.

During the period 1990-1995, majority of the households produced less than 25 kilograms of honey. Only a few produced more than 25 kilograms. There were also a few households that did not harvest any honey during some of these years.

With regard to how much households earned from the sale of honey in 1995, though some of the households did not sell honey, the responses given revealed that the sale of honey contributed towards household income. There was variation in the amount of money earned. The results also revealed that the amount of money earned per year was generally low or too little to sustain the needs of the households.

The respondents were asked to state the benefits they got from adopting new methods of bee-keeping. Three main kinds of responses were given as shown in: increased honey production (15 respondents or 55.6%), increased earnings from the sale of honey (17 respondents or 63%) and increased honey for home consumption (18 respondents or 66.7%).

To examine further the impacts of adopting new methods in bee-keeping, the respondents were asked to state what they had used the money from the sale of honey in 1995 for. The results revealed that this money was largely used to satisfy the basic needs of the households such as food, clothing, education, health and furniture. They also used the money for farm work such as buying seeds, buying fertiliser, hiring farm labour and buying items for bee-keeping. All the respondents indicated that they used part of the money to assist friends and the community in such matters as funerals and harambees (donations towards community development projects). Others used part of the money towards paying dowry, building household and for entertainment. Three respondents reported that they had not harvested any honey in 1995 and thus had not earned any income from bee-keeping that year.

Given the age and composition of the sample households, the respondents were asked whether the money they earn from the sale of honey is enough to meet their household requirements: Only four respondents answered "yes", indicating they the money was enough, Majority (23) answered "no", indicating that the money was not enough. This indicates that the adoption of new methods in bee-keeping has only increased, in a small way, the economic opportunities available to these households.

Since the majority of the respondents answered "no", they were asked another question to find out what they do to get extra money to support their families. Eighteen respondents indicated that they sell livestock, 11 stated that they borrow from friends and relatives and 8 indicated that they do casual work. These three were the responses with high frequencies. There were other responses, which are also important such as borrowing from the co-operative, earning from formal employment, government aid and sale of household goods. These responses should be interpreted as reflecting some of the options available to these households to ensure the welfare of their members. These options reflect the nature of rural household economic activities, employment structure and existing social networks. Musyoki (1986) also found that households in Machakos District relied on borrowing and government aid to supplement their low earnings from the sale of staple foodstuffs.

The respondents were asked to state the problems they have experienced since they adopted new methods of bee-keeping. The problems identified relate to four major issues: the suitability of the new methods, the physical environment, pests, and prices and marketing of honey. These problems partly explain why some of the farmers who had adopted modern methods of bee-keeping have abandoned them or are not keen on them any more. The respondents were asked to state some of the reasons that had made some of the adopters they know of to abandon the new methods and why some people may not be willing to adopt the new methods. The responses revealed that main reasons had to do with the viability of the activity, other competing commitments or activities, lack of money, pests and lack of information or knowledge about the activity. These responses imply that traditional methods of bee-keeping could still be offering better alternatives in the eyes of the farmers in the Kerio Development Basin. There is need to re-examine critically the approaches that the interventions in traditional used. It may be appropriate to find out how the traditional bee-keeping methods can be enhanced rather than replaced with equipment (the iron sheet-covered bee-hive that has been found to be counterproductive).

The respondents were asked to state the improvements they desire to see done in the bee-keeping industry in the region. The responses given revealed issues related to the bee-keeping technology, physical environment, awareness campaigns, provision of loans and improvement of marketing strategies. The respondents had specific suggestions about desired improvements in the bee-keeping industry. The suggestions focused on the provision of cheaper researched bee-hives, replacement of the iron sheet from the top of bee-hives and improvement of harvesting equipment. The suggestions given in table 15 and the problems identified earlier in table 14 point to issues that require the attention of the agencies of introducing new methods of bee-keeping in the Kerio Development Zone. These agencies need to work closely with the local communities through sharing information and developing the bee-keeping technology together.

In conclusion, it can be stated that new methods of bee-keeping have expanded the livelihood options available to the households that have adopted these methods. In some respect, the new methods have had some impacts on household employment, production, income and consumption. This impact should be seen as part of the overall impact or cumulative effect resulting from other employment activities among rural households.

This verifies the premise that innovations in bee-keeping have had an impact on household welfare in the Kerio Basin.

Modern bee-keeping is, however, faced with a number of problems related to four major issues: the suitability of the new methods, the physical environment, pests, and prices and marketing of honey. The respondents also identified their desired improvements in bee-keeping with respect to the bee-keeping technology, physical environment, awareness campaigns, provision of loans and improvement of marketing strategies. Finding solutions to these problems. By implementing the suggested improvements, is one of the ways that can be used by the intervening agencies to increase the possible impacts of modern bee-keeping on household welfare. A reasonable starting point would be for these agencies to work with the local communities through sharing knowledge and developing the bee-keeping technology together.

4. IMPACTS OF INTERVENTIONS IN IRRIGATION ON HOUSEHOLD WELFARE

4.1 Introduction

Like in bee-keeping, attempts have also been made by the KVDA and other agencies to intervene in irrigation in the Kerio Basin. This chapter examines this intervention and its effects on household welfare. An overview of the intervention in irrigation is given, followed by a discussion of results from a survey of Chemron-Marigat-Perkerra irrigation area.

This chapter is guided by the following specific research questions:

- a) What are the new methods introduced in irrigation in the Kerio Basin?
- b) What are the effects of these new methods on household welfare?
- c) What are the problems experienced by farmers who use these new methods?
- d) What are the views of the respondents on desired developmental changes in irrigation?

4.2 Overview of Intervention in Irrigation

Some of the communities (e.g., Keiyo, Marakwet and Pokot) in the Kerio Basin already practise indigenous irrigation, which dates back to several years (Kipkorir 1981). Irrigation potential and knowledge, therefore, already exist in some parts of the Kerio Basin.

Two main kinds of intervention are taking place in irrigation:

- a) Rehabilitation of traditional irrigation furrows.
- d) Development of new irrigation projects, some on large scale and others on small-scale basis.

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- a) Rehabilitation of traditional irrigation furrows.
- d) Development of new irrigation projects, some on large scale and others on small-scale basis.

4.2.1 Rehabilitation of Traditional Irrigation Furrows

Some of the traditional irrigation furrows have fallen into disuse due to lack of maintenance and destruction by floods. The traditional irrigation furrows are concentrated in Elgeyo, Marakwet and West Pokot Districts. The traditional irrigation system or furrows have the following advantages: low cost, integration into the social and economic fabric, and simple technology. However, they are generally inefficient (KVDA 1982). An inventory of traditional furrows in Elgeyo and Marakwet Districts was done by Soper (1981) and Gibb and Partners (1987).

Many organisations and individuals have, over the years, invested money and labour into furrow rehabilitation and improvement (Gibb and Partners 1987). Furrow rehabilitation is aimed at improving their efficiency and effectiveness, and institution of improved technology and management as well as choice of "appropriate" crops, modern crop husbandry, adequate public education and reconciliation of the various usages. Gibb and Partners (1987) observe that most of the inputs in furrow rehabilitation and improvement have been for short periods only and have had little long-term benefits. An evaluation by Gibb and Partners (1987) reveals that many of the furrows listed down for improvement and rehabilitation since 1980 remained largely on paper with very little tangible results. Thus, many of these attempts have been unsuccessful and part of this failure is due to failure to secure the full co-operation and support of the owners and users of the furrows before any project is started. Even up to now, there are still some attempts to rehabilitate the furrows but the continuity and sustainability of these attempts are issues, which are yet to be fully addressed.

4.2.2 Development of New Irrigation Project

Along with the rehabilitation of traditional irrigation furrows, the Government of Kenya and development agencies have sought to establish new irrigation projects in the Kerio Basin. This has been done both on small-and large-scale basis.

The new irrigation projects attempt to sedentarise the pastoralists and provide water on a regular basis to enable cultivation to be undertaken. Sprinkler irrigation is used in some of these irrigation projects. The settled families are provided with extension services and other social amenities. New crops, for instance, bananas, maize, sorghum, castor oil, vegetables and fruits are introduced and grown on the new irrigation projects. The development of new irrigation projects is meant to help improve the economic situation of the settled households and the region as a whole.

There are a number of operational irrigation projects in the Kerio Basin. The Turkwel Gorge Project is the major multi-purpose irrigation scheme in the region. However, there are other small ones such as Weiwei, Sigor, Perkerra, Katilu, Lomut, Lakuna, Aror, Kacheliba, Losekem and Chemron. To analyse the effects of the new irrigation projects on household welfare a case study of Chemron-Marigat-Perkerra Irrigation Project area in Baringo District was undertaken. Results of this case study are reported in this chapter.

4.3 Chemron-Marigat-Perkerra Irrigation Project Area

This project is located in Baringo District, near Marigat. There are some farmers who live or cultivate in the main irrigation schemes and others who live along the canals and utilise the available water for crop production. Persons taking part in the irrigation activity were interviewed to gather information on the impacts of this irrigation project on household welfare.

4.3.1 Date of Settlement and Type of Irrigation of Respondents

The respondents were asked to state when they started living in the Chemron-Marigat-Perkerra irrigation area. As shown in table 16, the majority (18 or 46.2%) stated that they were born in the area. The rest of the respondents settled in the area at different dates, right from the 1960s up to the 1990s.

Table 16. Date of settling in the irrigation area

Year	Frequency	Percentage
Born here	18	46.2
Before 1960	5	12.8
1961 – 1965	2	5.1
1966 – 1970	1	2.6
1971 – 1975	1	2.6
1976 – 1980	3	7.7
1981 – 1985	6	15.4
1986 – 1990	3	7.7
Total	39	100.1

The households participating in irrigation use both traditional and modern methods of irrigation. As shown in table 17, the majority of the respondents use either dam/sprinkler (18 or 42.9%) or rehabilitated traditional/new furrow (18 or 42.9%). Only six respondents (14.3%) reported that they used a traditional furrow.

Table 17. Types of irrigation used by households

Type	Frequency	Percentage
Traditional furrow	6	14.28
Dam /Sprinkler	18	42.86
Rehabilitated traditional/new furrow	18	42.86
Total	42	100.00

Note: The total exceeds 39 because of double scoring in some cases.

4.3.2 Crops Grown under Irrigation and Other Economic Activities of Households

A variety of crops are grown on the irrigated farms. The dominant crops are maize, beans, cotton and vegetables. These crops, as shown in table 18, cover varying amounts of land. In addition to irrigation, these households have other economic assets and are involved in other economic activities. These assets and activities are seen in the amount of land owned, livestock kept and employment structure of household members (tables 19 and 20).

Table 18. Acreage of crops grown on irrigated farms

Crop/acres	Mixed	0.5 and less	0.6-1.0	1.1-2.0	2.1-3.0	Total
Maize		2	19	3	2	26
Beans		3	4	1	0	8
Onions		1	19	2	0	22
Water melon		2	8	0	0	10
Pepper		0	19	0	0	19
Pawpaw		0	2	0	0	2
Vegetable		3	1	0	0	4
Tomatoes		1	1	0	0	2
Cotton		0	12	0	0	12
Millet		3	1	1	0	5
Sorghum		0	0	0	0	
Fruit		0	0	0	0	
Total	17	15	86	8	2	110

Table 19 and 20 show that these households, like the bee-keepers, are involved in a variety of activities to enhance their livelihood.

Table 19. Other economic assets and activities of households involved in irrigation

a) Size of land (acres)	Less than 2	2.1-4.0	4.1-6.0	6.1-8.0	8.1-10.0	10.1-12.0	12.1 & above	Total	
b) Number of households	10	7	5	0	5	0	12	39	
c) Type and number of livestock	None	1-5	6-10	11-15	16-20	21-25	26+	No response	Total
i. Cattle	7	12	13	1	2	0	1	3	39
ii. Goats	0	2	6	3	11	1	0	16	39
iii. Sheep	13	15	4	0	4	0	1	2	39
iv. Donkeys	23	9	0	0	0	0	0	7	39
v. Others	6	1	5	1	2	2	1	21	39
vi. Fish ponds	26	1	0	0	0	0	0	12	39

Table 20. Employment structure of households involved in irrigation

HH Members	Toddler	Farmer	House wife	Business	Civil Servant	Student	Other
Father	0	39	0	5	4	0	2
Mother	0	6	32	0	1	1	0
Children	45	3	2	1	2	76	5
Total	45	48	34	6	7	77	7

4.4 Impact of Irrigation on Household Welfare

The impact of irrigation on household welfare is assessed using quantitative and qualitative data with respect to employment, income, production and consumption.

4.4.1 Employment

As shown in table 21, members of households are variously involved in irrigation activities such as ploughing, planting, weeding, harvesting and watering.

Table 21. Division of labour on irrigation farms among household members

Member	Ploughing	Planting	Weeding	Harvesting	Supervisor	Watering	Other	Total
Father	15	17	14	13	10	13	1	83
Mother	9	10	15	10	8	5	0	57
Children	15	17	31	28	7	4	9	111
Total	39	44	60	51	25	22	10	251

In addition to working on the irrigation fields, members of households have other activities such as herding, bee-keeping and formal employment.

4.4.2 Production, Income and Consumption

The respondents were asked to indicate the amount of their agricultural production for the period 1989 – 1995. As shown in Table 22, there is a general increase in the total amount of crops produced among the households.

The availability of water has also had an impact on livestock production. The farmers are able to water their livestock easily, unlike in the past when they had to trek long distances looking for water.

Table 22. Annual agricultural production from irrigation

Product	1995	1994	1993	1992	1991	1990	1989	Total
Maize	428	367.5	356.5	331	302.5	246.5	258	2290
Beans	95	43.75	42	38.5	39	31.5	29.5	319.25
Bananas	20	16	20	20	7	11	8	102
Vegetables	139.5	162	246	132	126	99	93	997.5
Millet	2	0	0	0	0	0	0	2
Head of cattle	212	182	158	128	142	38	34	894
Goats	662	592	707	543	721	457	365	4047
Sheep	140	236	201	178	128	121	106	1110
Poultry	85	73	43	44	49	46	21	361

Note: The grains are measured in bags and the bananas in bunch.

The respondents were asked to indicate how much they had earned from the sale of their irrigated crops in 1995 and 1996. As shown in table 23, the majority of the respondents earned up to 40,000 shillings in the two years. In 1995, twenty-six farmers earned between 1,000 and 40,000 shillings from the sale of their agricultural produce. This number increased marginally to twenty-seven in 1996, but in the same year there were two farmers who reported earnings of 61,000 and above. This level of earning was not reported in 1995.

Table 23. Amount of money in Kenya Shillings (kshs) earned from the sale of irrigated crops

Year	None	No Response	1000-10000	11000-20000	21000-30000	31000-40000	41000-50000	51000-60000	61000-70000	71000-80000	Total
1995	5	3	8	5	6	7	2	3	0	0	39
1996	4	3	6	7	8	6	2	1	1	1	39

The respondents were further asked to state what they had used the money earned from the sale of their agricultural produce on. It is clear from table 24 that the money was used to satisfy basic domestic needs of the households as well as attend to some needs of the community. Unlike the bee-keeping households, a high number of the households (22 or 56.4%) practising irrigation used part of the money to build houses.

Table 24. Use of money earned from the sale of agricultural produce under irrigation

Use	Frequency	Percentage
Pay school fees	29	74.4
Buy Maize meal	23	59
Buy paraffin	31	79.5
Hire Labour for farm work	32	82.1
Buy seeds	31	79.5
Buy livestock	15	38.5
Buy sugar	33	84.6
Buy medicine/health care	30	76.9
Buy items for bee-keeping	9	23.1
Pay dowry	10	25.6
Buy soap	33	84.6
Buy beverages (coffee and tea)	26	66.7
Pay co-op services	20	51.3
Buy cloths	33	84.6
Build a house	22	56.4
Buy fertiliser	20	51.3
Entertainment	11	28.2
Help friends and community	24	61.5
Buy cooking utensils	27	69.2
Buy farm seeds	30	76.9
Buy chairs	31	79.5
Buy tables	31	79.5
Buy shoes	30	76.9
Buy cooking oil	32	82.1
Others	10	25.6
No response	5	12.8

N = 39

It can be seen that earnings from irrigated crops are used to improve the household's welfare in such aspects as education, shelter, health and food.

In addition to the quantified impacts such as amount of money earned, the respondents were asked to give a qualitative assessment of the benefits they have got from the irrigation project. As shown in table 25, the responses given indicate that the benefits relate to two main aspects: increase in production and improvement of the general welfare of the households in health, shelter, education and food.

Table 25. Benefits of the irrigation project

Benefit	Frequency	Percentage
Increased land under cultivation	7	17.9
Increased food production for my family	30	76.9
Cultivation throughout the year	22	56.4
Increase in income or earning from farming	28	71.8
Increased access to water	19	48.7
Increased access to health facility or care	25	64.1
Improved health care for my livestock	22	56.4
Access to agricultural extension education	28	71.8
I have been able to build a better house for my family	22	56.4
I have been able to purchase more household goods for my family	28	71.8
I have been able to buy a car	28	71.8

N = 39

Though these households earn from the sale of irrigated crops, they were asked whether the money they earn is enough to meet their financial needs. As shown in table 26, only one respondent answered in the affirmative. Thirty-five answered in the negative and three did not respond.

Table 26. Response to the question: "Is the money adequate to meet your financial needs"?

Response	Frequency	Percentage
Yes	1	2.6
No	35	89.7
No response	3	7.7

N = 39

The respondents who answered in the negative were asked to state how they get extra money to meet their financial needs. As shown in table 27, the two most cited sources are borrowing from friends/relatives (27 or 77.1%) and co-operative (10 or 28.6%) and sale of livestock (29 or 82.9%). There is also dependence on employment elsewhere and government aid.

Table 27. Sources of extra money

Source	Frequency	Percentage
Borrow from friends and relatives	27	77.1
Borrow from co-operative	10	28.6
Other employment	7	20
Government aid	3	8.6
Sell livestock	29	82.9
Other	18	51.4

N = 35

4.5 Problems Experienced and Desired Improvements by Irrigation Farmers

The respondents were asked to state the problems they experience as they practise irrigation. The problems identified in table 28 relate mainly to the production process. Water shortage was identified as a problem by majority of the respondents (37 or 94.9%). Other problems relate to important issues such as diseases, blockage of furrows, lack of market, crop failure and lack of funds.

In addition to identifying problems, the respondents were asked to state what improvements they would like to see done in the irrigation project. Majority of the respondents (36 or 92.3%) desired that more dams be constructed (table 29). This points to the fact that water scarcity is a major limitation in the utilisation of the agricultural potential in the area. The respondents identified other areas that need improvement such as marketing, provision of title deeds and loans, introduction of well-researched programmes and control of diseases.

Table 28: Problems experienced by irrigation farmers

Problem	Frequency	Percentage
Water shortage	37	94.9
Blockage of furrows	5	12.8
Crop diseases	13	33.3
Livestock diseases	8	20.5
Lack of market	11	28.2
Harvesting Delay	2	5.1
Diseases	9	23.1
Limited grazing space	3	7.7
Loans and recoveries	3	7.7
Crop failure	9	23.1
Lack of funds	6	15.4
Fence destruction	2	5.1

N = 39

These are relevant suggestions that can be used by the development agencies working in this area.

Table 29. Desired improvements in the irrigation project

Improvement	Frequency	Percentage
Construct more dams	36	92.3
Encourage crop rotation	5	12.8
Improve pest and disease control services	6	15.4
Create awareness on hygienic requirements	7	17.9
Establish markets	10	25.6
Introduce well researched programmes	10	25.6
Provide title deeds and loans	9	23.1
Use well suited irrigation system	6	15.4
Furrow maintenance	3	7.7
Fence repair and construction	3	7.7
Provide more land for cultivation	1	2.6

N = 39

4.6 Summary and Conclusion

This chapter has examined the impacts of intervention in irrigation on household welfare. Two main kinds of intervention are taking place in irrigation: a) rehabilitation of traditional irrigation furrows and b) development of new irrigation projects, some on large-scale and others on small-scale basis.

The results reveal that the households participating in irrigation use both traditional and modern methods of irrigation. A variety of crops are grown on the irrigated farms, the dominant ones being maize, beans, cotton and vegetables.

The impact of irrigation on household welfare was assessed using quantitative and qualitative data with respect to employment, income, production and consumption. The results reveal that members of households are variously involved in irrigation activities such as ploughing, planting, weeding, harvesting and watering.

The responses given showed that during the 1989 – 1995 period, there was a general increase in the amount of agricultural production under irrigation. The households also earned income from the sale of their irrigated crops. Majority of the respondents earned up to Ksh. 40,000 in 1995 and 1996. The money earned was used essentially to satisfy the basic and domestic needs of the households as well as attend to some needs of the community,

In their qualitative statements on the benefits received from irrigation, the respondents indicated two main benefits: increase in production and improvement of the general welfare of the households in health, shelter, education and food.

The irrigation farmers identified the problems they face. The problems relate to their agricultural production activities. Water shortage was identified as a major problem by majority of the respondents (37 or 94%). Other problems relate to important issues such as diseases, blockage of furrows, lack of market, crop failure and lack of funds.

The respondents also identified improvements they would like to see done in this irrigation project. Majority of the respondents (36 or 92.3%) desired that more dams be constructed. Other desired improvements are in marketing, provision of title deeds and loans, introduction of well - researched programmes and control of diseases.

It is clear from the analysis in this chapter that the farmers interviewed have experienced benefits from irrigation in relation to employment, production, income and household consumption. These farmers are also experiencing problems related to water shortage, diseases, and marketing of produce . With careful planning, it is possible to address these problems and increase the benefits of irrigation.

The results in this chapter confirm that intervention in irrigation impacts on household employment, production, income and consumption.

5. SUMMARY OF CONCLUSIONS

5.1 Introduction

The primary purpose of this study was to examine the impacts of interventions in bee-keeping and irrigation on household welfare in the Kerio Basin Development Zone. Specifically, the study has analysed four main areas of impacts: employment-creation, income-generation, production and consumption patterns. Further, the study has examined the views of the respondents on what they think is the desired line for future development and improvement in bee-keeping and irrigation.

This study was guided by four main research questions:

- a) What interventions are being introduced in traditional bee-keeping and irrigation systems in the Kerio Basin Development Zone?
- b) What are the impacts of these interventions on household employment, income, production and consumption patterns?
- c) What are the problems faced by the households that have adopted interventions in bee-keeping and irrigation?
- d) What are the views of the respondents on the desired developmental changes and improvements in bee-keeping and irrigation?

5.2 Summary of Findings

The main findings of the study are summarised below. First, is a summary of the impacts of intervention in bee-keeping. This is followed by a summary of the impacts in irrigation.

The irrigation farmers identified the problems they face. The problems relate to their agricultural production activities. Water shortage was identified as a major problem by majority of the respondents (37 or 94%). Other problems relate to important issues such as diseases, blockage of furrows, lack of market, crop failure and lack of funds.

The respondents also identified improvements they would like to see done in this irrigation project. Majority of the respondents (36 or 92.3%) desired that more dams be constructed. Other desired improvements are in marketing, provision of title deeds and loans, introduction of well - researched programmes and control of diseases.

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5.2 Summary of Findings

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5.2.1 Impacts of Intervention in Bee-Keeping

Households from whom information was sought adopted the new methods of bee-keeping at different dates. More than one agent introduced these new methods. The main agent cited was KVDA, though there were others such as Rachemo, Mission Station and Ministry of Livestock Development. Apart from these agents, there were farmers who were self-motivated, partly by learning or seeing the new methods from their neighbours. Though the respondents had adopted modern methods of bee-keeping, they still kept traditional beehives.

Bee-keeping was reported to provide, in varying degrees, employment to members of households. The respondents stated various activities such as cleaning beehives, watering the bees and harvesting honey that is done by parents and children.

During the period 1990-1995, majority of the households produced less than 25 kilograms of honey, while a few produced more than 25 kilograms and a few did not harvest any honey during some of these years.

With regard to money earned from the sale of honey in 1995, though some of the households did not sell the honey, the responses given revealed that the sale of honey contributed towards household income. There was variation in the amount of money earned. The results also revealed that the amount of money earned per year was generally low or too little to sustain the needs of the households.

With respect to the benefits got from adopting new methods of bee-keeping, three main kinds of responses were given: increased honey production (15 respondents or 55.6%), increased earnings from the sale of honey (17 respondents or 63%) and increased honey for home consumption (18 respondents or 66.7%).

The impacts of adopting new methods in bee-keeping could be seen from the use of money earned from the sale of honey in 1995. The results revealed that this money was largely used to satisfy the basic needs of the households such as food, clothing, education, health and furniture. Other uses included buying seeds, buying fertiliser, hiring farm labour, buying items for bee-keeping and assisting friends and the community.

As to whether the money earned from the sale of honey is enough to meet the household requirements, only four respondents answered "yes", indicating that the money was enough while majority (23) answered "no", indicating that the money was not enough. This indicates that the adoption of new methods in bee-keeping has only increased in a small way the economic opportunities available to these households.

For the majority of the respondents who answered "no", there was indication that they got extra money from the following activities: sale of livestock; borrowing from friends, relatives, co-operatives; doing casual work; formal employment; sale of household items and government aid. These responses should be interpreted as reflecting some of the options available to these households to ensure the welfare of their members. These options reflect the nature of rural household economic activities, employment structure and existing social networks. Musyoki (1986) also found that households in Machakos

District relied on borrowing and government aid to supplement their low earnings from the sale of staple foodstuffs.

The problems they have experienced by the households that have adopted new methods of bee-keeping relate to four main issues: the physical environment, pests, and prices and marketing of honey.

These problems partly explain why some of the farmers who had adopted modern methods of bee-keeping have abandoned them or are not keen on them any more. The respondents were asked to state some of the reasons that had made some of the adopters they know of to abandon the new methods and why some people may not be willing to adopt the new methods. The responses revealed that the main reasons had to do with the viability of the activity, other competing commitments or activities, lack of money, pests and lack of information or knowledge about the activity. These responses imply that traditional methods of bee-keeping could still be offering better alternatives in the eyes of the farmers in the Kerio Development Basin. There is need to re-examine critically the interventions being introduced in traditional bee-keeping in the Kerio Basin Development Zone. It will be appropriate to find out how the traditional bee-keeping methods can be enhanced rather than replacing them completely with new equipment (e.g., the iron sheet-covered beehive) that has been found to be counterproductive.

With regard to desired improvements in the bee-keeping industry in the region, the responses given revealed issues related to the bee-keeping technology, physical environment, awareness campaigns, provision of loans and improvement of marketing strategies.

It can, therefore, be noted that the new methods of bee-keeping have expanded the livelihood options available to the households that have adopted these methods. In some respect, the new methods have had some impacts on household employment, production, income and consumption. This impact should be seen as part of the overall impact or cumulative effect resulting from other employment activities among rural households. This verifies the premise that innovations in bee-keeping have had an impact on household welfare in the Kerio Basin.

5.2.2 Impacts of Intervention in Irrigation

Two main kinds of intervention are taking place in irrigation: a) rehabilitation of traditional irrigation furrows, and b) development of new irrigation projects, some on large scale and others on small-scale basis. Households participating in irrigation use both traditional and modern methods of irrigation. A variety of crops are grown on the irrigated farms, the dominant ones being maize, beans, cotton and vegetables.

The impact of irrigation on household welfare was assessed using quantitative and qualitative data with respect to employment, income, production and consumption. The results reveal that members of households are variously involved in irrigation activities such as ploughing, planting, weeding, harvesting and watering.

The responses given showed that during the 1989- 1995 period, there was a general increase in the amount of agricultural production under irrigation. The respondents also earned income from the sale of their irrigated crops. Majority of the respondents earned

up to Kshs, 40,000 in 1995 and 1996. The money earned was used essentially to satisfy the basic needs of the households, as well as attend to some needs of the community.

In their qualitative statements on the benefits received from irrigation, the respondents indicated two main benefits: increase in production and improvement of the general welfare of the households in health, shelter, education and food.

The irrigation farmers face problems that relate to their agricultural production activities, water shortage being a major problem by the majority of the respondents (37 or 94.9%). Other problems relate to important issues such as diseases, blockage of furrows, lack of market, crop failure and lack of funds.

The respondents identified improvements they would like to see done, which include construction of more dams, improvement in marketing of crops, provision of title deeds and loans, introduction of well researched programmes and control of diseases.

It is clear from the analysis in this chapter that the farmers interviewed have experienced benefits from irrigation in relation to employment, production, income and household consumption. These farmers are also experiencing problems related to water shortage, diseases, marketing of produce and diseases. With careful planning, it is possible to address these problems and increase the benefits of irrigation.

5.3 Policy Recommendations

5.3.1 Modern bee-keeping in the Kerio Basin Development Zone is faced with a number of problems related to four major issues: the suitability of the new methods, the physical environment, pests, and prices and marketing of honey. The respondents also identified their desired improvements in bee-keeping with respect to the bee-keeping technology, physical environment, awareness campaigns, provision of loans and improvement of marketing strategies. Finding solutions to these problems, by implementing the suggested improvements, is one of the ways that can be used by the intervening agencies to increase the possible impact of modern bee-keeping on household welfare. A reasonable starting point would be for these agencies to work with the local communities through sharing knowledge and developing the bee-keeping technology together. The KVDA and other agencies involved in bee-keeping activity need to respond to these needs and problems.

5.3.2 The irrigation farmers are also facing problems, the main one being water shortage. There is need to avail more water. More dams can be constructed. Along with this is the need to utilise other techniques of water harvesting and retention as well as efficient use of available water. This is an area that needs to be developed with the local communities.

The irrigation farmers have other problems related to marketing of their produce, diseases affecting their crops and payment of loans. Again, there is need for the government to look into these problems.

5.4 Issues for Further Research

The following are issues that need to be examined further in research:

- a) The possibility of harnessing and utilising the existing local knowledge and technology in bee-keeping and irrigation in modern interventions.
- b) Analysis of the contribution of different activities to household welfare.
- c) Evaluation of progress in all the development projects that have been initiated in the Kerio Basin Development Zone.

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