SMALLHOLDER PRODUCER GROUPS IN MARKET ECONOMIES, THE CASE OF DAIRY COOPERATIVES IN KENYA

By

ELLENE KEBEDE

Bachelor of Arts
Addis Ababa University
Addis Ababa, Ethiopia
1978

Master of Arts
Institute of Development Economics and Planning
Dakar, Senegal
1983

Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
May, 1993

SMALLHOLDER PRODUCER GROUPS IN
MARKET ECONOMIES, THE CASE OF
DAIRY COOPERATIVES IN KENYA

Dean F. Schreiner
Thesis Adviser

Michael Applegate

Francis Epplin

Arthur Stoecker

Thomas C. Collins
Dean of the Graduate College

ACKNOWLEDGEMENTS

I am deeply indebted to many people without whom this work could not have been accomplished. First of all I would like to express my sincere appreciation to my major adviser, Professor Dean F. Schreiner, for his invaluable assistance and guidance throughout my graduate studies and at all stages of the research. Appreciation is also extended to the members of my advisory committee: Dr. Francis M. Epplin, Dr. Arthur L. Stoecker, and Dr. Michael J. Applegate.

Special appreciation is extended to the Rockefeller Foundation for the award to finance my research in Kenya. Thanks to the Agricultural Division of Oklahoma State University for administering my fund and to the administrative staff of the Department of Agricultural Economics for handling my correspondence while I was in Kenya.

I would like to express my appreciation to Egerton University, Njoro, Kenya who hosted my stay and allowed me to use their facilities during the seven months of data collection in Kenya. Sincere appreciation goes to Dr. I. K. Rop of the Department of Business and Economics at Egerton University who made the project possible. His assistance was indispensable in finishing the survey. Thanks are due to all the staff of the head office in the provincial and district branches of the Ministry of Cooperative Development in Kenya. Appreciation is expressed to the personnel of the District Cooperative office and District Cooperative unions of Kericho, Nakuru, Nandi and Uasin Gishu who helped me to identify the dairy cooperatives and allowed me to use their offices

while collecting data of the respective cooperatives. Furthermore, my appreciation is extended to staff members of Ainabkoi Farmers Cooperative Limited who were with us every day of the survey. Their help was indispensable in locating the sample households and acquainting me with the community which made most respondents more relaxed. I would like also to extend my appreciation to individual households for their cooperation which made the survey successful.

Last but not least, my sincere appreciation to my sister Hirut Kebede, her husband Efrem Bechere, my nephew Henok Amare, and my little niece, Betty, who were reasons for my stay in Stillwater. They gave me their affection during my period of study at Oklahoma State University.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Problem Statement

The demand for food and agricultural products in developing countries is at present estimated to increase by about 3 percent annually at current prices. During the 1990s African countries would have had to increase production by 3 to 4 percent a year to satisfy this increase in demand from domestic sources. Few countries in Africa have sustained such rates of agricultural growth (FAO, 1989, World Bank, 1989a).

Agriculture is the dominant sector in Africa where about 40 percent of gross domestic product (GDP) and 70 to 85 percent of the population is employed (World Development Report, 1989a and 1990a). The smallholder farmers are an important sub-division of the agricultural population, producing for both domestic consumption and export. Smallholder farmers are price responsive and allocate resources efficiently within the given socioeconomic environment (Schultz, 1964).

High productivity of small farms in low income countries is supported by studies which show an inverse relationship between agriculture productivity and farm size (Berry and Cline, 1979). During the 1970s, farm level evidence, mainly from India, supported the general tenet that there is an inverse relationship between farm size and per-hectare productivity (Lau and Yotopoulus, 1971). The ability of small farm households to employ greater

amounts of labor per unit of land is given as one explanation of the increase in productivity.

This indicates the potential of smallholders to increase productivity through increased use of improved technologies and financial resources. The increased productivity of smallholder agriculture further provides strong growth linkages with the rest of the economy through consumption, saving, and investment (Johnston and Mellor, 1961).

In most African countries, farmers belong to either formal or informal smallholder producer groups (a general term for cooperatives, farmer associations, farmer groups, etc. which are implied to be a component of the private sector). The main objective of these groups is to decrease both private and public overhead cost. The members capture private economies of scale and from the public sector, increased size of organization captures economies from group administered services such as credit, technology transfer, and market facilities.

Marketing cooperatives are the dominant smallholder producer groups in Africa. Cooperatives were introduced as an important institution for agricultural development in Africa and go back as far as the colonial period. During the colonial period, marketing cooperatives were used to off-set non-African private middlemen and, later, to formalize institutional arrangements for serving the growing world markets for raw materials (Hyden,1980). By the 1960s, almost all post independence African countries used cooperatives as suitable institutions for implementing smallholder agricultural development policies. Also it was during this period that most African countries invited foreign assistance to help them share in the cooperative development experiences of the developed countries.

However, by the 1970s most cooperatives had become controlled by the central government. The cooperative movement received criticism for having brought few benefits to the African farmers and having little impact on the general strategy of development (UNRISD,1975). Some studies have shown that the common failure was because of the nature and extent of public sector involvement in marketing parastatals where monopoly control by government allowed inefficiencies in marketing and allocation of financial resources. This was frequently interpreted as inefficiency of the cooperative movement.

This is not to say that public sector support was not crucial to the success of cooperatives. The pretext for government intervention was to assist cooperatives in being efficient managers of smallholder resources. This assistance was provided through training programs and regulations that curtailed potential for corruption and misuse of resources. Because of high costs of government subsides to agriculture most African countries in the later part of the 1980s gave increased emphasis towards market oriented development strategies and privatizing of government controlled economic activities. Smallholder cooperatives, however, must face this change if they are to remain a major institution in rural development. They must be efficient, offer competitive producer prices, and, as economic units, must compete with the private, unprotected sectors of the economy.

In a competitive economy efficiency of the cooperatives will be judged by how smallholders will utilize their services as compared to the available alternatives. It becomes important then to know why some cooperatives are more efficient than others in providing service to cooperators.

Kenyan agriculture contributes about 30 percent of the national GDP. Kenya has one of the highest population growth rates of 3.3 percent and an urban population growth rate of 4.8 percent between the inter-censual period of

1979 to 1989. Approximately 20 percent of the population is urban which leaves 80 percent of the population in rural areas predominantly engaged in agricultural activities. Kenya has given attention to the development of smallholder farmers since the time of independence. The major action was taken with the introduction of the settlement scheme which was used to redistribute land to landless and small farmers who had the potential but had small land holdings (Lofchine, 1989, Brett,1973).

The contribution of smallholders to the total agricultural output of the country increased from 22 percent in 1963 to 55 percent in 1991. The contribution of cooperatives to gross farm revenue for selected agricultural products equalled 66 percent by 1990 (Republic of Kenya (ROK), Economic survey of 1965 and 1991).

Government policy over the years has been to encourage cooperative development and has given support through training and technical assistance in management and administrative services (Alila,1985, Hedlund,1988). Since 1970 the government has increased control over the internal management of cooperatives because of apparent mismanagement of resources. The latest government policies relating to cooperatives were established in 1986 and 1987. The Sessional Paper No. 1 of 1986 states that cooperatives should be efficient marketing units and produce the most needed commodities. The last government policy in Sessional Paper No. 4 of 1987 refers to the decision that the structure should only include economically viable cooperatives and they should be able to exploit economies of scale (Republic of Kenya. The Sessional paper No. 1 of 1986 and Sessioal paper No. 4 of 1987). Cooperatives are expected to manage their affairs as efficiently and as responsibly as they can in accordance with their own by-laws and the Cooperative society Acts of 1966 and Cooperative Rules of 1969.

Objectives

The main objective of this dissertation is to review the government policies regarding the agricultural cooperative movement and to assess the efficiency of smallholder cooperatives as an institution of agricultural development for Kenya within the context of a specific case study. There are two sub-objectives. One is to review the existing cooperative legislation and the established government agencies for promoting a self-reliant and viable smallholder cooperative movement within the agricultural sector. The second sub-objective is to evaluate the management performance and efficiency of smallholder cooperatives within the organizational and political framework of the specific case study.

Specific objectives are stated as the following:

1. To develop a basic analytical framework for analyzing economic efficiency of smallholder cooperatives under competitive conditions.
2. To empirically estimate the cost structure of a selected cooperative system in the Rift Valley of Kenya within the analytical framework developed above.
3. To evaluate the production systems of the cooperative member households and the overall cooperative society economy.

This dissertation will bring out factors focusing on the following research questions:

a) Does government intervention assist in the development and performance of smallholder cooperatives?

b) Do smallholder cooperatives have the potential to improve their performance and compete under competitive free market conditions?

Hypotheses

The following hypotheses are proposed for testing:

1) Government support has assisted smallholder cooperatives to be economically efficient.
2) Smallholder cooperatives are giving efficient services thus significantly enhancing the income of their members.

Methodology and Data

Cooperatives are formally and legally registered bodies under the enacted law of the country. This dissertation focuses on cooperatives in four districts of the Rift Valley of Kenya. Dairy production is predominant in the area and cooperatives are established around dairy production, specifically, fresh milk. Cooperatives, however, are generally multi-purpose and handle other crops produced by the smallholder, sell merchandise to members, and provide transport services.

Both primary and secondary data were used for the study. The primary source of data was administered surveys to district cooperative offices and to cooperative members within one cooperative. The trend of cooperative development was established using ten years of time series data. The closed trial balances of the cooperatives for the fiscal year 1989/1990 were used to establish the cost structure of the cooperative. The trail balances show actual and budgeted monthly income and expenditure for an activity and the

summarized data for the year. Except for a few cooperatives, trial balances for most cooperatives were obtained from the District Cooperative Office or District Cooperative Union Office. In addition, specific questions were posed and responses summarized from an interview conducted with officials of the Ministry of Cooperative Development.

The Ainabkoi Farmers Cooperative Limited composed of four settlement schemes was surveyed at the household level for determining participation in the activities of the cooperative. All surveys were completed by field workers who spoke the local language. This researcher provided interview training of field workers and stayed in the field during the interview process to edit the data.

Secondary data were collected from government documents, from the Policy Analysis Matrix completed at the University of Egerton, and from a study completed by the University of Wisconsin for the same region.

Economic activities of all members of the smallholder family were identified and quantified. Material and resource balances of the activities and the household were quantified. Sources of income were determined and associated with resource use, resource ownership, and income transfers.

The ordinary least squares technique was used to complete the statistical cost analysis of the cooperatives based on the data from the closed trial balances. Enterprise budgets were developed using data from the cooperative member household activities. Descriptive analysis of the enterprise budgets was completed and the data were used to estimate a social accounting matrix for the cooperative economy. Interdependence coefficients were computed to identify the interrelationship of the different accounts and the direct and indirect impacts of exogenous changes on household incomes and services rendered by the cooperative to members.

Organization of Study

This dissertation includes eight chapters. Chapter one covered the research problem statement, objectives of the study, hypotheses to be tested, a brief description of methodology and data, and the organization of study. Chapter two is literature review of cooperative development in selected European and East African countries. Chapter three describes development of cooperatives in Kenya from a historical perspective, its present structure, and its relationship to other supporting government agencies. Chapter four presents the physical features and the agricultural and economic potential of the Rift Valley province. Chapter five gives the methodology and empirical results in determining the efficiency of the dairy cooperatives in the Rift Valley. Chapter six incorporates smallholder households in the analysis of cooperatives under conditions of competitive market behavior. Chapter seven develops a social accounting matrix of the cooperative society. The final chapter summarizes the development of cooperatives and their relation to smallholder households followed by conclusions and policy implications based on study results.

CHAPTER II

LITERATURE REVIEW

Definition and General Features

Cooperatives are businesses based on the classical principles of voluntary, self-help, and democratic system of organization. The primary purpose of a cooperative is to make profit for its members. Members are both owners and users of the cooperative, and cooperatives produce services for consumption by their members. The International Labor Organization (ILO) defines cooperative as an association of persons who have voluntarily joined together to achieve a common end through the formation of democratically controlled organization, making equitable contribution to the capital required and accepting a fair share of the risks and benefits of the undertaking in which members actively participate (ILO, 1965). Almost all cooperative legislation or by-laws make some reference to this definition, even though it may differ in practice.

The contractual agreement between a cooperative and its members requires that all margins above the cost of operation be returned to the members in proportion to their business with the cooperative. It is organized under single proprietorship but referred to as a legal entity distinct from its constituent members.

Cooperatives do not earn money directly but a successful farmer's cooperative does earn money for it's members. The cooperative increases the

total net farm income of it's members by reducing the cost of purchasing and distributing farm supplies or by increasing the net return from products marketed.

Cooperatives are free enterprises with freedom of decision making and rights of private property. They normally exhibit the classical principle of democracy where each member has one vote. A board of directors is elected by the members. The board of directors selects a manager and makes policy decisions.

Cooperatives may function under different economic systems. In a mixed economy, cooperatives are frequently used to bolster the free market and at the same time serve as an arm of the state. Governments generally limit the functions of the cooperative, lend them money, and provide technical assistance. Thus the operation of cooperatives frequently comes under close scrutiny of the government. However, cooperative members are generally promised that government control will withdraw after a time (Roy, 1989).

The primary objective of cooperatives is to improve the economic welfare of its members. Too much deviation from this primary objective may bring unexpected and perhaps undesirable results. The use of cooperatives for social and political development may bring too much government supervision and control and a loss in the individual objective of improved economic welfare. Without a certain amount of government assistance, large numbers of cooperatives may collapse at early stages of development in both developed and developing countries. However, too tight a control by government can easily lead to reduced efficiency and a lack of interest by members in their own cooperative society (Lindstad, 1990). Establishing the appropriate balance has been a major concern of cooperative development in African countries. With this general perspective of the objectives and functions of cooperative societies,

the following literature review shows similar experiences shared by developed and developing countries including East Africa.

Cooperative Experience in European Countries

The cooperative movement came into existence during the industrial development in England. In 1844 the Rochdale Pioneer groups laid the foundation and the principle of cooperatives which spread over Europe in the early twentieth century. It was used as an economic power and improvement of social and domestic conditions among people whose economic interest was jeopardized by the industrial revolution (International Alliances, 1967; Bailey, 1974). The movement has enabled a multitude of small farmers to increase market power and vertically integrate with commodity processing. There are four major types of cooperatives: producer, marketing, credit, and service. The cooperative movement is generally structured in a three tier system. The first level is the organization of individual members into local cooperatives. The second level groups local cooperatives into unions and the third level forms an apex body at the top. The apex body is an autonomous organization guided by its own initiative but frequently works in collaboration with the government in rural development policies. The role of the government is to enact legislation for registering cooperatives and protecting the interest of members by setting minimum rules for internal organization.

The Nordic countries (Norway, Sweden, Denmark, Finland and later Iceland) developed a strong cooperative movement both at the national and international level. These countries were the first to assist in cooperative development to emerging independent African countries. The assistance started in the 1960s in East Africa, mainly in Kenya, Tanzania, and Uganda.

The Nordic countries are continuing to provide technical and administrative assistance to the Kenyan Government in developing the cooperative movement (Kenyan Government Development Plan 1966-1970).

Nordic cooperative experiences developed out of a need for structural change in the agricultural sector. Agricultural production was in the hands of numerous small and medium sized family farmers but market power was dominated by large farmers. The government deliberately launched a cooperative policy to improve the competitive power of the small farmers. The main government support was given through domestic schooling for the farming population, extension services for improved agricultural techniques, and research and experimentation on farms to increase agricultural knowledge and skill.[1]. The absence of farm credit exposed farmers to usury practices and conditional sales. The government recommended the establishment of credit cooperatives but left the actual organization to the initiative of the farmers (Rabo Bank, 1990). All the members of Nordic countries have gone through the same experiences at the early stages of cooperative development.

In Sweden the initiative to start cooperatives was taken by local farmers in an area. The agricultural sector was subjected to detailed regulation, and thus it was a natural procedure for the government to negotiate with farmer organizations including cooperatives for policy matters.

The Finland cooperative movement started through sales of farm supplies and farm produce marketing. By the 1970s it accounted for 94 percent of gross value of industrial food production in the country. Cooperatives merged and created bigger production and marketing units (Kujula, 1975).

---

1 Publications of International Cooperative Alliance on the cooperative movements of Norway, Denmark and Finland.

Finland is famous for its dairy cooperatives. The Finnish International Development Agency (FINNIDA) is a major donor agency in dairy development in Kenya.

Cooperative development in these countries faced two major problems: financial barriers which limited the growth of farmers and the lack of dedication and education by most small farmers to conduct their own business. The financial barriers were removed by the development of credit cooperatives capable of mobilizing savings in the rural areas. The second problem was solved by education and strong commitment of farmers union.

Cooperative development spread to African countries with similar ideals but evolved within a different socioeconomic climate. The models from the developed countries were voluntary and with non-government interference. However, within the African socioeconomic environment government became the main agent for promoting and establishing cooperatives.

Cooperative Experience in East African Countries

The existence of rural and agricultural cooperatives in East Africa goes back to the early part of the twentieth century. The movement has passed through different stages since 1910 and the initial structure has had an influence on the present structure and function of cooperatives. The government was involved from the very beginning and increased its role during the 1960s and 1970s through legal acts, cooperative training, and introduction of other supporting agencies. Because of the limited number of literate and educated people, teachers, priests, traders, and politicians were frequently in leadership roles. These people with their connections and influence at times

used the cooperatives to reinforce their own positions rather than the promotion of the interest of the members (Hyden,1973, Ouma, 1980, Gyllstrom, 1990).

Marketing cooperatives were the first cooperatives to be used as major rural institutions for promoting development. They provided a wide range of services to the members including credit, agricultural education, marketing of agricultural products, and supplying of inputs such as fertilizer, herbicides, fungicides, etc. Producer cooperatives, where members jointly owned land resources, had limited or no success. Tanzania's Ujamaa villages tried communal farming in the 1970s and went back to marketing cooperatives in the late 1980s (Cliffe, 1970). Ethiopia's producer cooperatives during the 1975-89 period were not successful (Cohen,1988). Zimbabwe tried collective farming after independence in the early 1980s and the results were not encouraging (World Bank,1989b).

The history of marketing cooperative development in Africa can be divided into six stages: 1910-1950, 1951-1959, 1960-1964, 1965-1970, 1970 to mid 1980s, and the period since the mid 1980s (Hyden, 1973). During the first period, cooperatives were started either through initiative of the colonial powers for increased food production or for providing competition to non-African middlemen. In the second period, cooperatives were primarily organized to ensure that producers received world market prices for a number of important raw materials grown in Africa. The third period, 1960-64, was a period of independence, and cooperatives were created in a spirit of political freedom. The post independence period, 1965-70, reflects governments' attempt to put in practice African Socialism. The emphasis during this period was to expand cooperatives as a means of modernizing institutions which contribute to overall capital accumulation and development.

At the beginning of the 1970s cooperatives were blamed for mismanagement, corruption, and economic failure. This led to close government control over the cooperative movement during the 1970s and the first half of 1980s. Since the mid 1980's African countries are following the policy of liberalization and privatization which includes the cooperative movement.

The increasing central control over cooperatives has been regarded as a move to strengthen cooperatives to play their role adequately. The government consolidated existing marketing cooperatives and turned them into multi-purpose institutions (Widstrand, 1972).

With more government intervention, the cooperative structure was used as a means to implement government policies as part of their activities. The activities of the cooperatives come under a certain ministry as a commission or as a department, usually Ministry of Agriculture or Ministry of Community Development. This unit is generally given legal power to register, supervise, and monitor cooperatives. The legislation gives the respective ministry or commission the power to decide about establishment and dissolution of cooperatives.

The other government supporting agencies directly related to the cooperative movement were the cooperative colleges and training centers, the cooperative banks, and the marketing boards. The cooperative college and training centers provided education to the cooperative managers in areas of standard bookkeeping, accounting, and management. The cooperative banks were the main channel of finance for seasonal inputs, crop purchase, processing, etc. These banks were usually financed partially by the government and partially by foreign institutions.

Cooperatives generally have marketed their output through parastatals in the East African countries. The marketing boards generally have set both farm gate and consumer prices and generally have a country wide coverage for the commodity. The cooperatives relied on these agencies rather than taking the initiative to develop their own markets. Furthermore, it required wide spread facilities and efficient management services to execute their responsibilities. The absence of competitors and the lack of efficient management created increased cost which was passed on to members through the services provided (Lele and Christiansen, 1989).

Cooperative policies have undergone frequent and drastic changes during the last three decades in the three countries. In Tanzania the traditional cooperative structure which existed since the 1960s was replaced by other forms of cooperatives. Three approaches define the changes in development policy in Tanzania and are the improvement approach, transformation approach, and Ujamaa grassroots approach (Long, 1970). The improvement approach existed prior to 1961 and emphasized the expansion of extension services through cooperatives. The transformation approach from 1961-68 used settlement schemes with massive technical and financial assistance from the World Bank. This approach used technologically advanced production with farmers marketing their produce through local cooperatives.

In 1966 the government reappraised both the transformation and settlement scheme and concluded that they were not going to achieve rapid development breakthrough. The Arusha Declaration in 1967 introduced Socialist policy of self-reliance and called the establishment of Ujamaa villages as a cooperative movement (Nyrere, 1969, Nyrere, 1973). The policy introduced cooperatives as production units for families settling together and jointly working the land. This development continued through the 1970s but did

not meet objectives set for it and now Tanzania is reviving the former marketing cooperatives.

In Uganda cooperative societies were legalized in 1964 with the introduction of the Cooperative Society Act. This act increased the number of Ugandans in the economic activity through cooperatives (Widstrand, ed., 1973). There was a rapid expansion of the movement with government putting massive financial and technical resources behind it. In the second half of the 1960s the movement was in a state of crises because it failed to meet the requirement of economic efficiency. The cause was cited as lack of proper management by the controlling committee (Brett, 1970).

Shortly after independence in 1964, cooperative organizations were taken as a means of developing the available resources in Zambia. From 1964 to 1969 a number of cooperatives were registered and became operational. In 1970 a conference on cooperatives criticized the movement for low productivity and approved reorganization of cooperatives as family farm cooperatives, modelled after the Israel Moshav (Lombard, 1970). The government gave major incentives through subsidies and loans. But the cooperatives did not meet expectations and in 1983 cooperatives were declared a mass movement by the governing party and came under its political wing.

Since the late 1980s, there has been a policy movement by the Kenyan government and the governments of other East African countries for cooperatives to be autonomous and efficient in meeting social and economic goals of their members.

The most observed problems recorded in the literature include: a) unrealistic targets set by governments for cooperatives; b) poor financial structure of cooperatives resulting in strong dependence on government financing which generally increases government domination in management; c)

poor management of cooperatives because of an inadequately educated and trained staff; and d) lack of continuity in government policies towards cooperatives.

Cooperative development, however, has been effectively used to enhance the well-being of many African farmers since independence even though it has been a period of thirty years of constant policy changes. The assessment of cooperatives has generally been unfavorable. However, despite the criticism cooperatives remain one of the best ways for governments to provide credit to smallholders and to provide economic power to the large number of smallholders at this period of development. With the movement of East African countries towards privatization and market oriented economic policy, cooperatives must be efficient to survive in competition with other forms of economic organization in the private sector.

CHAPTER III

THE LEGAL FRAMEWORK AND THE STRUCTURE OF COOPERATIVE MOVEMENT IN KENYA

Legal Framework

The definition of cooperatives in Kenya is based on the universally accepted cooperative principles and modified to suit the nations aspiration (ROK, Sessional Paper No.4 of 1987):

a) voluntary and open membership with no artificial or undue restrictions;

b) democratic administration and control based on one man one vote irrespective of shares held by individual members; and

c) equitable distribution of the economic results arising out of joint effort and surplus shared among the members in proportion to their patronage and usage .

The cooperative movement in Kenya includes both agricultural and non-agricultural cooperatives. However, this study deals only with agricultural cooperatives. The establishment of cooperatives goes back to the 1945 Cooperative Society Ordinance, which provided the establishment of cooperatives and introduced cash crops among the African smallholders. Cooperatives were mainly used to distribute fertilizers, insecticides, seeds, animal feed, etc. (ROK, Development Plan 1965/66-1969/70). Late in the 1950s

the number of cooperatives increased and by 1960 around 790 agricultural marketing cooperatives were registered in African areas (Gyllstrom, 1990).

In the post independence period, multi-purpose and land purchase cooperatives were introduced as part of the settlement scheme. The million acre settlement scheme program was started in 1961 and was finished by 1974 (ROK, Development Plan 1970-1974). There were two major kinds of settlement schemes: (1) low density where farmers were given an average area of 38 acres and (2) high density where individual plot size was around 10 acres per household (De Wilde, 1967). Mixed farming was introduced in these areas combining cash crops such as coffee and tea with family subsistence crops. Financial assistance was made available from the World Bank, Common Wealth Development Corporation, and Land Development and Settlement Board. Land purchase cooperatives were formed for the purpose of acquisition of large scale European farms. Some large scale farms were also purchased by African farmers on individual basis or in partnership.

The establishment of cooperatives during this period had objectives for both the government and the smallholder farmers. The government encouraged the establishment of cooperatives so that farmers would have a common liability for repayment of land purchases. The farmers joined the cooperatives, primarily to acquire land within the settlement credit scheme and secondly to market produce. To achieve these objectives some of the cooperatives were established regardless of their economic viability (ROK, Economic Survey of 1983). Cooperatives were established in Kenya when the means of communication were poor and the population generally illiterate. These conditions and the rapid increase in the number of cooperatives led to various problems of mismanagement and inefficiency.

To address these problems and others the government legislated the Cooperative Society Act of 1966 (followed by additional rules in 1969) which defined government supervision of cooperatives (ROK, Cooperative Society Act of 1966 CAP 490 and Cooperative Rules of 1969). The Act describes the nature of the cooperative movement, the power of the primary cooperatives over their members, and the extent of government control and supervision. The same act established the Commission of Cooperative Development under the Ministry of Community Development which became an independent Ministry of Cooperative Development in 1974.

Part three of the Act states the conditions of registration for cooperatives. The conditions, as stated in articles 5-13 of the Act and articles 1-8 of the Cooperative Societies Rules, include the objective, the minimum number of members, the age of members, and land ownership. A proposed group applies to the Commission and if the Commission is satisfied with the application the cooperative will be registered as a body corporate or it will be given a provisional registration. The Commission has the power to cancel the provisional registration of the cooperative on its own discretion. The Commission can require cooperatives to form a union or join a cooperative union if it finds it desirable for the efficient functioning of the cooperative movement.

Articles 21-25 state the duties of a registered society and empowers the Commission to monitor and control the book of accounts[1] of the cooperative. Cooperatives must give the Commission access to all documents and records related to money affairs and security. Each cooperative must file the true copy of audited report and a balance sheet for every twelve months. Articles 26 and

---

1 Book of accounts include cash book, ledgers containing the transaction of the business, balance sheets, income statements, assets and liabilities.

27 state that amalgamation and division of registered cooperatives require the approval of the Commission.

Under article eight a cooperative takes on a body corporate by the name under which it is registered and has legal power to enter into contracts and to hold movable and immovable property. However, it needs approval of the Commission to make loans or credit to its members or to another registered cooperative. Article 43 states that any registered cooperative may invest or deposit its fund only by approval of the Commission.

Article 48 allows the formation of a country wide cooperative if its members are producing sixty percent of the produce of a particular commodity. Cooperatives are required to sell their produce through this country wide cooperative. The country wide cooperative union acts as the body between the cooperatives and the marketing board, usually handling transportation and storage of the commodity.

The Act was followed by the Cooperative Society Rules of 1969 which describes the form used to present the by-laws, how funds may be raised, auditing of accounts, forms for presenting financial accounts and balance sheets, standardized monthly trial balances, general meeting procedures, and the formation of a policy or governing committee of no less than five and no more than nine members. The Rules also specify general duties of committee members, procedures for resignation and expulsion of members, and other procedures for operation of the cooperative.

Structure of the Cooperative Movement

The Cooperative Society Act of 1966 defines the structure of the cooperative movement as primary society[2], cooperative union, and the apex society. They are all referred to as registered society in part one of the Cooperative Societies Act meaning registered as cooperative society under the Act of 1966. Members for cooperative are people who come together for common objective. Cooperatives join together to form a cooperative union. Both the cooperatives and unions come under an apex body which is registered as a cooperative. The conditions for registration are the the same for the three levels in the structure. They are required to have by-laws, an address, list of members, committee, and books of accounts.

A primary cooperative is referred to as a registered cooperative whose membership is restricted to individual persons (Figure 1). It is composed of a group of at least ten people whose objective is a common economic interest. The committee is elected at a general meeting of all members. Management committee develops policies and employs a manager to assist in the execution of the policies. The manager reports to the committee on their regular meeting or as needs arise.

The cooperative union (Figure 2) is a registered cooperative of which the membership is restricted to primary cooperatives. It is formed by a group of cooperatives based either on commodity or locality (art.7 of the Act). The objective is to provide efficient centralized service for marketing, accounting, banking, transport, bulk purchase of input supplies, and handling of commodity to gain from economies of scale (art. 14 of the Rules). The cooperative union

---

2 Society will be referred to as cooperative in this work.

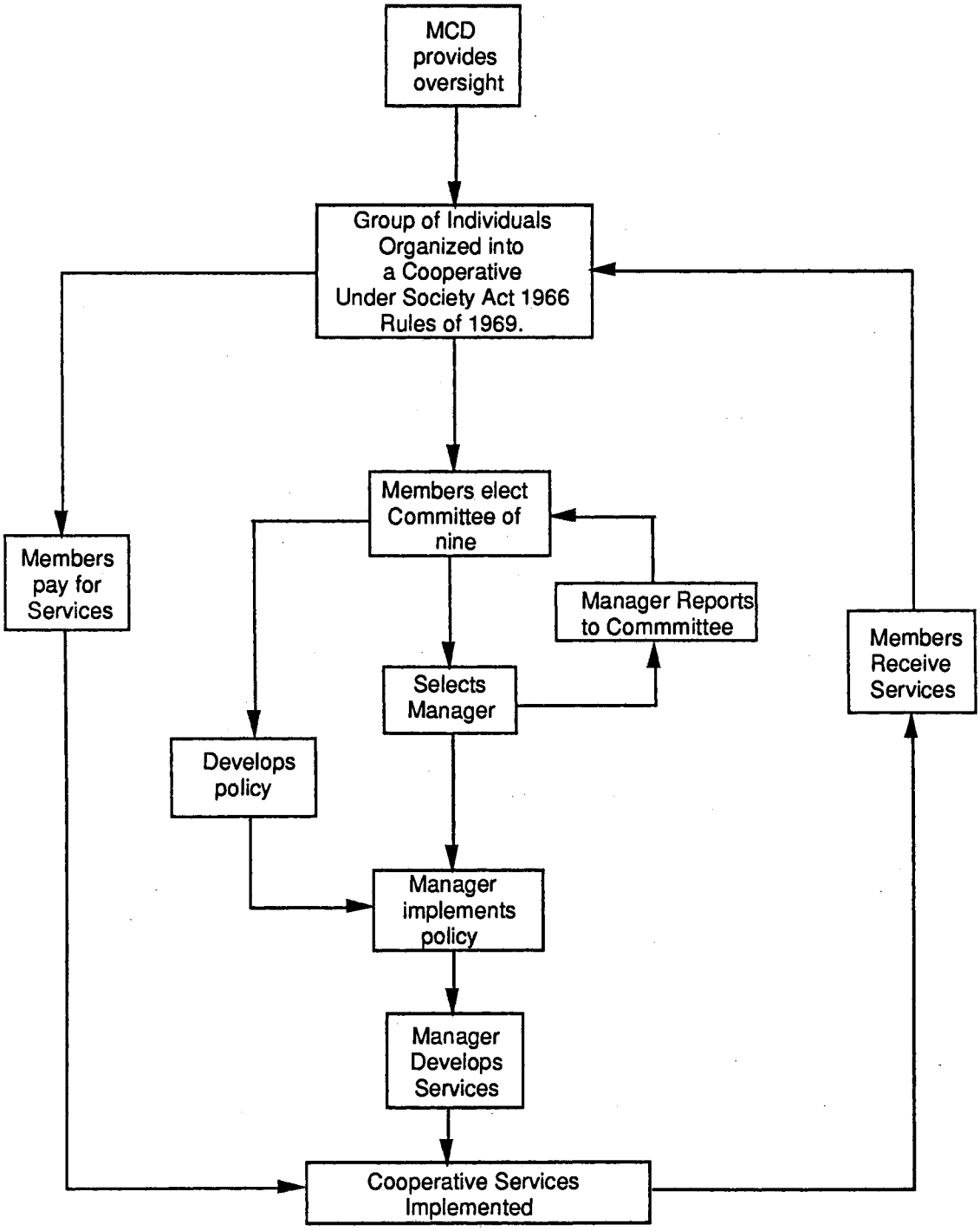


Figure 1. Structure of Primary Cooperative

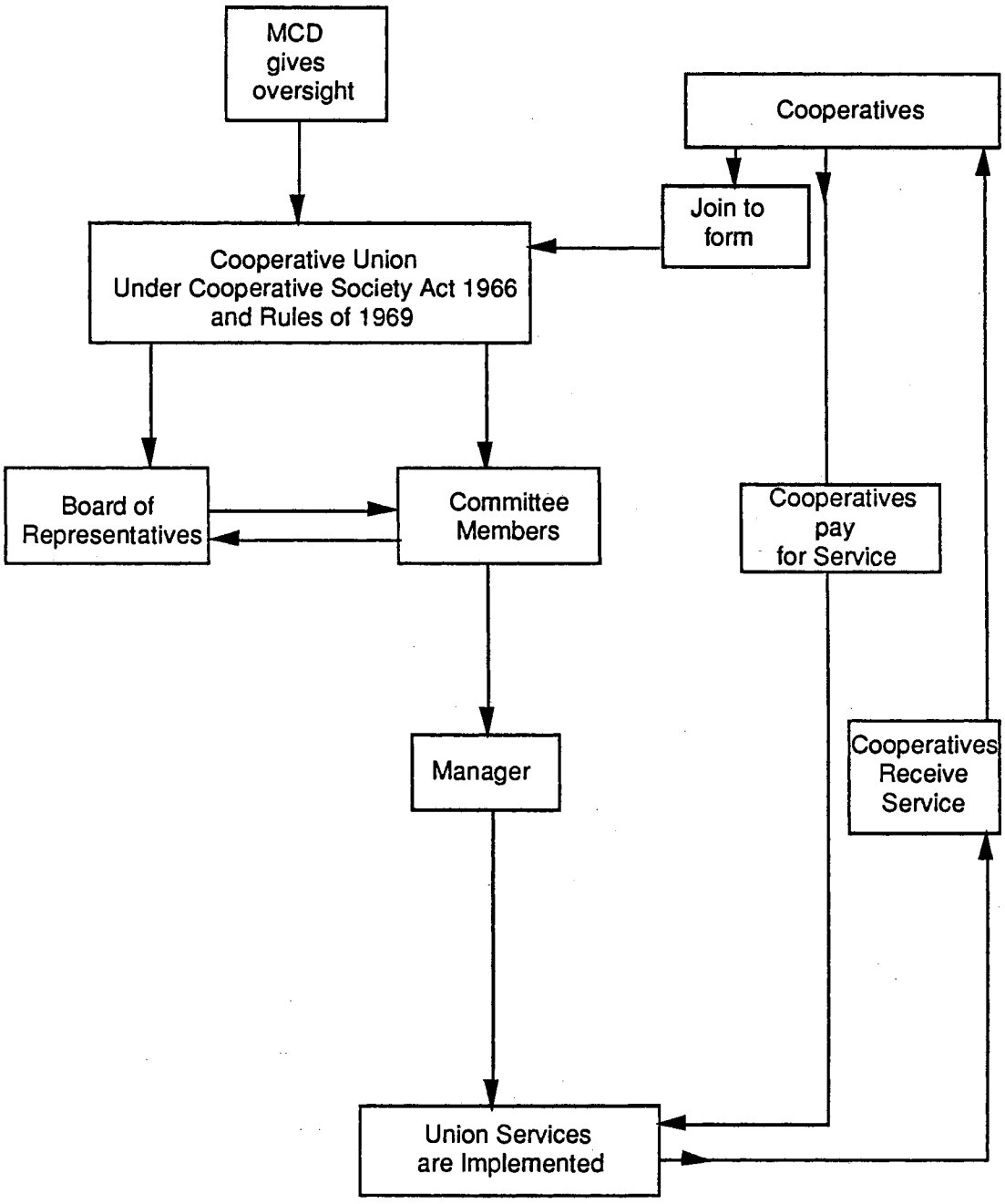


Figure 2. Structure of Cooperative Unions

has committee members and board of representatives. The committee members are elected from the member cooperatives. The board of representatives consists of one delegate from each affiliated cooperative. The committee is mandated to enter into contracts and other legal matters necessary to achieve the objectives as stated in the by-laws (art. 34 of the Rules). The board of representatives gives direction with regard to the business. The committee notifies the board about agendas and minutes and the board sends agenda and meetings to the committee. The committee appoints a secretary, either a member or employee, whose duty is as stated in the by-laws (art.36-39 of the Rules).

The Kenyan National Federation of Cooperatives (KNFC) is the apex cooperative, defined as a registered cooperative whose members are restricted to cooperative unions. Figure 3 presents the structure of KNFC. It includes all the cooperatives, cooperative unions, and the country wide cooperative organizations which are affiliated to it. The defined objectives of KNFC are:

a) to be a spokesman of the movement and to promote cooperative interest;
b) to be the custodian of the cooperative principle;
c) to promote the development of cooperative movement and to advise the government on cooperative development matters in the country;
d) to provide services as would be required by the cooperatives; and
e) to promote movement to movement collaboration both locally and internationally (ROK, Sessional Paper No.4 of 1987: 18 and art. 7 of the Act).

KNFC is composed of registered cooperatives and as stated in Rule number 36, it will have committee members and board of representatives who have the same responsibility and the same communication as expressed in the

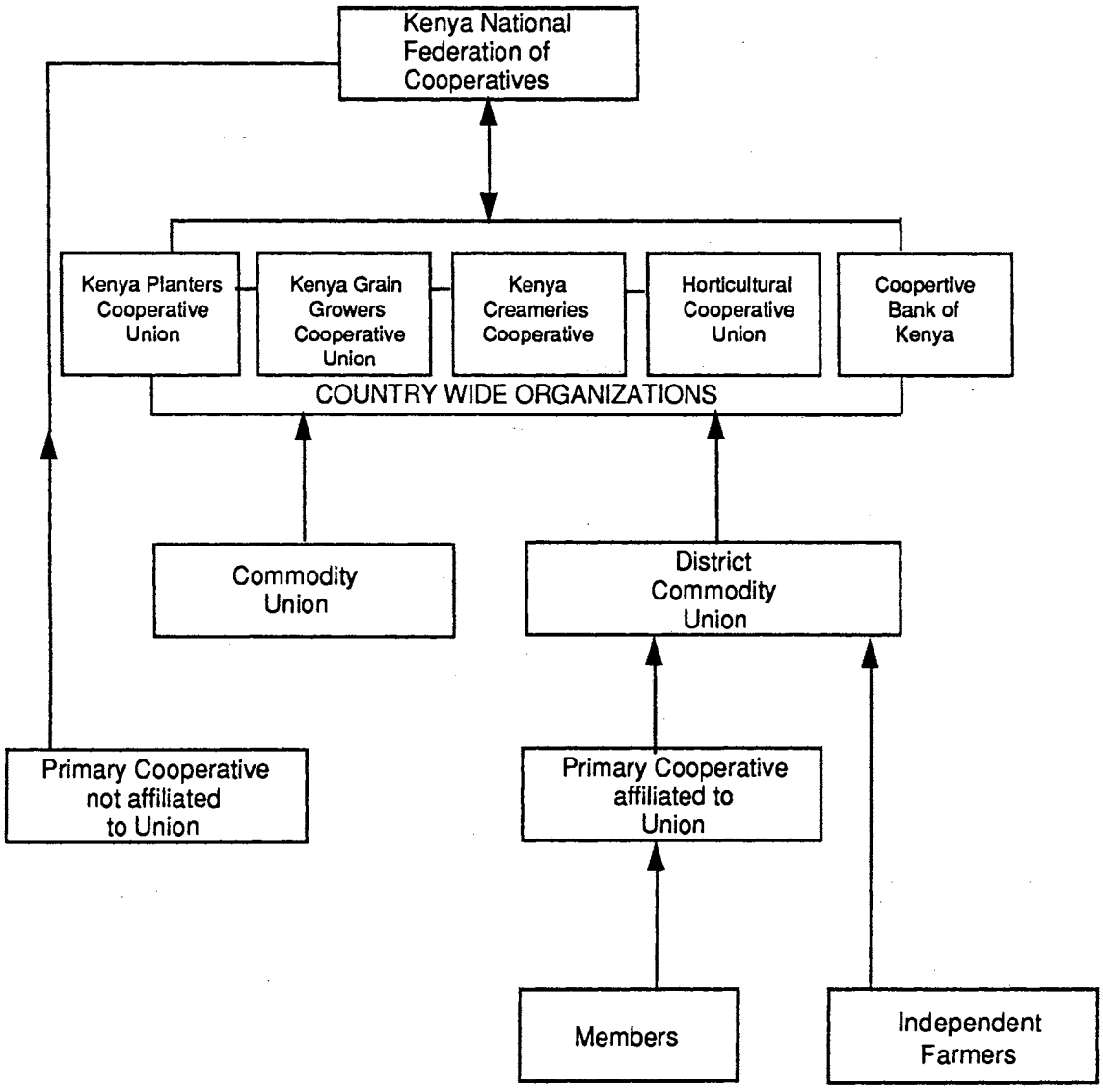


Figure 3. The Organizational Set-Up of the Cooperative Movement in Kenya

section of cooperative union. KNFC participates in the education and training programs for the cooperatives and provides all the necessary printing, stationary supply, and office equipment for the cooperatives. It is financed domestically through government assistance and internationally from other cooperative movement groups. One important international cooperative movement group up to the present is the Nordic Cooperative group.

Cooperative Development And Government Policies

The number of registered cooperatives increased from 1,030 in 1963 to 4,836 by the end of 1990. Membership has increased from 35,500 in 1963 to about 2,460,957 by 1990, of which 60 percent of the members are engaged in agricultural activities. Share capital has increased from 1.1 billion Ksh[3] in 1980 to 9.2 billion Ksh in 1990 (Ministry of Cooperative Development, Statistics Department). The largest membership is in coffee, cotton, and dairy production. The share of gross farm revenue from seven major agricultural commodities (coffee, tea, maize, wheat, sugar cane, pyrethrum, and livestock) accounted for through cooperatives has increased from 51 percent in 1980 to 66 percent in 1990 (ROK, Economic Survey 1985 and 1991).

Cooperatives have been an important institution for the implementation of government policies and programs especially for dispersing government credit. The government has consistently made reference to cooperatives in all the post independence development plans and policy papers.

In the Development Plan of 1970-74 which followed the Cooperative Society Act, government assistance was extended to smallholder cooperatives to consolidate them rather than increasing their number (ROK, Development

---

3 Ksh is Kenyan shillings.

Plans 1970-74, 1974-1978). The government intensified its role in guidance and supervision of the movement through the Ministry of Cooperative Development (ROK, Sessional Paper No.8 of 1970). The structure of the MCD was decentralized to the provincial and district levels. Even though priority was given to the improvement of existing cooperatives expansion of the movement to enter new sectors or provide new services was not ruled out if it could be done successfully.

In the later part of the 1970s the government introduced multi-purpose and area based approach to cooperative development as a means of opening up development to the less developed areas (ROK, Sessional Paper No.14 of 1975, Development Plan of 1984-1987). This continued through the 1980s with well established cooperatives in marketing, processing of agricultural products, and supply of farm inputs.

The latest government policy on cooperatives was stated in Sessional Paper No. 4 of 1987 (ROK, Sessional Paper No. 4, 1987). The government promotes cooperative development as a source of expanding employment and income for small scale farmers and the rural non-farm sector. It is projected that by the year 2000 the number of active cooperatives will be more than doubled and cooperatives will be the livelihood of more than 20 million Kenyans. The Sessional Paper emphasized the need for efficient management of cooperatives. Factors considered to ensure an efficient cooperative movement include:

a) evaluating whether a cooperative is a viable economic unit capable of providing services needed by the members;

b) facilitating proper integration and modernization with the national economy; and

c) exploiting economies of scale to ensure the highest possible return and benefits to the individual members.

It further states that cooperatives are part of the private sector and will be expected to adopt management principles and promote actions that enhance the return to capital and efficient resource use.

The new policy does not affect the existing structure of cooperative movement but there is a provision for evaluation of individual cooperatives and restructuring to enhance operational efficiency. Subsequently, cooperatives will be advised on better resource management for higher productivity. The government will continue giving assistance in proper record keeping and audit service.

Government Agencies Involved In The Cooperative Movement

The Ministry of Cooperative Development (MCD), Cooperative Bank of Kenya (CBK), the Cooperative College of Kenya (CCK), and the various marketing boards are closely related to and have significant influence on the functions and income of cooperatives.

The cooperative movement was provided for the Ministry of Cooperative Development (MCD) by the 1966 Society Act. The MCD was created in 1974 with the prime objective to develop cooperatives into viable self-sustaining business entities (ROK, Sessional Paper No. 4 of 1987: 31-32). The organizational structure of MCD is presented in Figure 4.

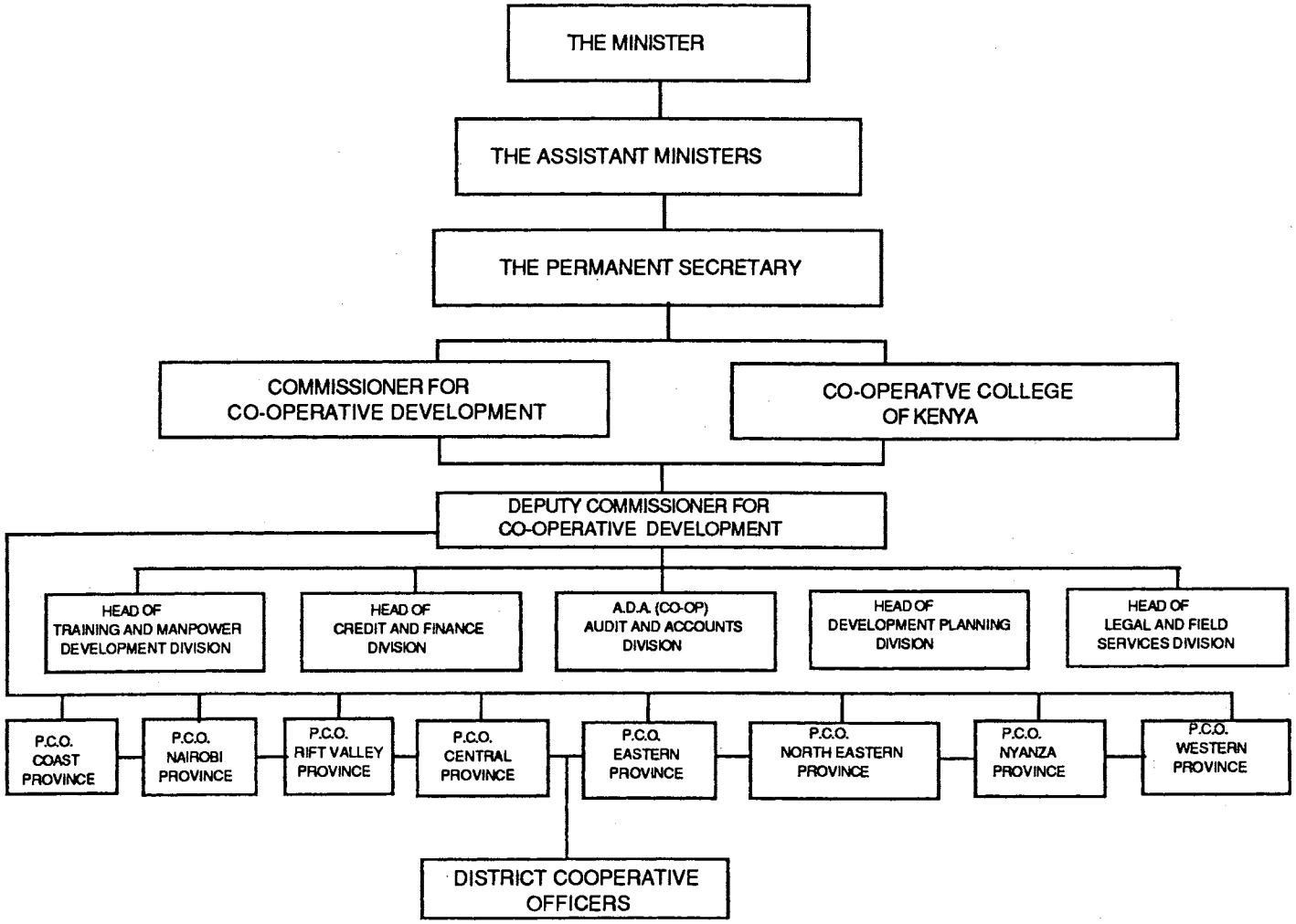


Figure 4. The Organization Structure of the Ministry of Cooperative Development

The structure goes down to the province (PCO), district (DCO), and division[4]. There are officers in each division who directly work with cooperatives in day to day activities.

With the strengthening of the Ministry the number of staff has increased. Since its establishment in 1974 employment and budget consistently have increased. There were 823 employees in 1974/75 and 1,936 at the end of 1989/90 (MCD, Statistics Department).

The Cooperative Bank of Kenya (CBK) was established in June, 1965 with the objective of mobilizing financial resources for the cooperative movement, and started functioning as a Commercial Bank in 1968. All cooperatives and cooperative unions are members of CBK. It operates current accounts and accepts deposits from member cooperatives. Farmers are served through their cooperatives and unions and the country-wide organizations. Because deposits made by the cooperatives and unions are not sufficient to finance all activities, the CBK obtains funds from the government, quasi-government lending institutions, and international sources. Cooperatives are used by the government and the CBK to distribute credit directly to members. This was one of the causes which lead to the introduction of a standardized accounting system. Cooperatives are used to administer the credit programs for individual members including establishment of repayment programs by deducting from receipts accruing to members. In the 1970s and 1980s different kinds of credit schemes were introduced by the government to smallholders through their cooperatives and CBK which was one of the major banks to administer the credit.

---

[4] The political and administrative divisions of Kenya are: province, district, division, location and sub-location.

The Cooperative College of Kenya (CCK) was established in 1976 as part of the MCD for training purposes. It gives courses in administration, bookkeeping, management, accounting, auditing, and cooperative laws. It has in-service programs for cooperative employees who come for three to six months of training and return to work. Another program is pre-service training. The pre-service leads to a diploma and after graduation, the trainees are assigned to work with the MCD. From 1971 to 1990 a total of 457 pre-service diplomas and 302 in-service diplomas were awarded. There are also many certificate programs in bookkeeping and accounting for those specially working in the cooperatives. The college is under the MCD administration with close association with Kenyan National Federation of Cooperatives (KNFC). It is financed by MCD with assistance from the Nordic group (Program Review and Forward Budget of 1990/91 up to 1992/93, 1990 and personal communication with CCK, administration Office).

The Nordic project started in 1976 as part of the government's effort to obtain foreign assistance for cooperative development. The project is part of the assistance program between Kenya and the Nordic countries (Sweden, Denmark, Finland and Iceland) and is still in existence. The project is involved not only in the training activities that take place in the cooperative college but also conducts workshops for unions, cooperatives, and members. The project is responsible for the standardization of the accounting system and its introduction to cooperatives through workshops. Currently, they are developing a computerized program for basic accounting information applicable to individual cooperatives. According to the officer in charge, the project is in its last phase and will terminate in 1993.

Marketing Boards

Marketing boards are the main statutory marketing bodies in Kenya, having a direct relation with cooperatives. The formation of most of these boards date to pre-independence times. There main objective was to serve as means of collecting and marketing produce from African farmers. This task was perpetuated in post independence by the government with the objective of reducing marketing costs through large scale operation, and thus helping the competitive conditions of smallholders.

The boards provide marketing service to farmers and cooperatives bring their produce to the collection centers. The board handles transport and sales of produce to direct buyers and wholesalers. Marketing boards are financially self-supporting and cover costs from members' deduction for services rendered. The board may also make deduction for repayment of loans to the CBK. In some cases where the boards may make payment to the CBK, the CBK will deduct repayment of the loan, and then write a check for the remaining amount to the cooperatives. Frequently, payments to cooperatives are delayed.

Some of the most important marketing boards are: Pyrethrum Board of Kenya, Coffee Board of Kenya, Kenya Dairy Board, National Cereal Produce Board, Cotton and Lint Marketing Board, Tea Development Authority, and Horticulture Development Authority. There are three major nation-wide cooperative unions, the Kenyan Planters Cooperative Union (KPCU), Kenya Cooperative Creameries (KCC), and Kenyan Grain Growers Cooperative Union (KGGCU) who handle marketing activities as an intermediary between the board and the cooperatives. The KPCU provides services of collection, storage, and delivery of coffee to the board. The KCC handles the collection,

processing, and marketing service for dairy production. The KGGCU handles mainly wheat, agricultural inputs, and agricultural machinery. Producers of the respective commodities are members of the nation-wide cooperative unions.

These boards set farm-gate and consumer prices for the respective commodities together with the Ministry of Agriculture and Ministry of Finance. Farmers have limited influence on the prices of either inputs or outputs. The important relation between the marketing boards and the cooperatives is the way prices are established and what farmers are charged for the marketing services. The income of farmers from their products is determined by the price paid minus the cost of marketing services. The boards frequently have branches in different parts of the country with the facilities and personnel available to provide marketing services. The production and marketing processes thus create an interdependent network between the smallholder represented by a cooperative society, a cooperative union, the marketing boards, the CBK, and the MCD.

Figure 5 shows channels of communication for affiliated cooperatives. The cooperative societies get service from the government agencies through the cooperative unions. Member's input demand is handled through the cooperatives who apply for loans from one of the credit schemes. The marketing of output is also done through the cooperatives. There is a direct communication among the different government agencies.

The Kenyan government has attached importance to smallholders in the country's economic development and the cooperative movement has been given due importance in all the development plans and sessional papers. In the last fifteen years the number of cooperatives has grown significantly and support from the government agencies has also increased in importance.

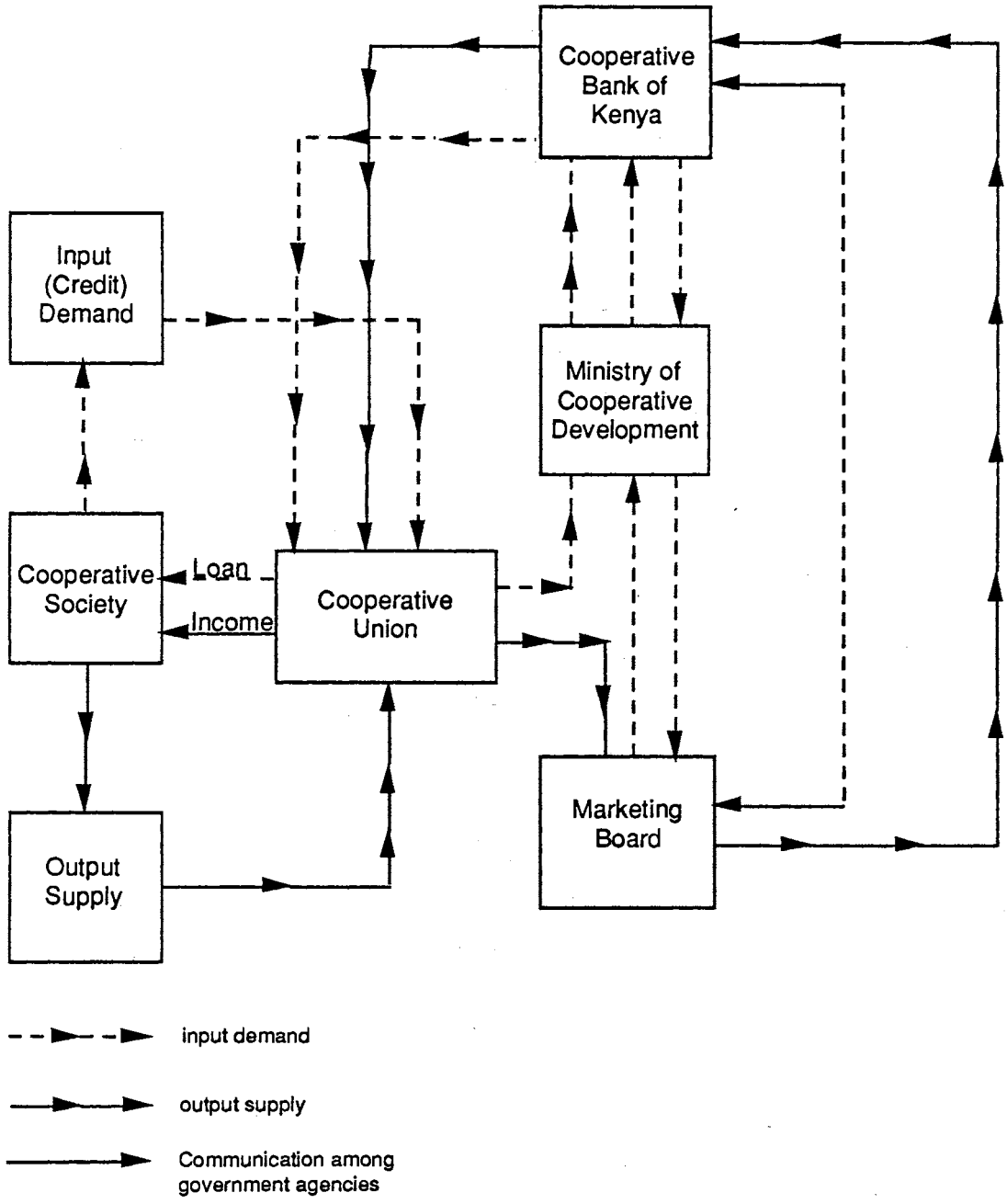


Figure 5. Functional Relationships of the Cooperative Movement and Government Agencies

CHAPTER IV

COOPERATIVE DEVELOPMENT IN THE RIFT VALLEY

Physical Characteristics

The Rift Valley of Kenya covers an area of approximately 171,108 sq. km. and has thirteen districts. According to the 1989 census it had a population of 4,890,000 with an average density of 3.5 hectares or 0.035 sq. km. per person. Kericho district has the highest density, 0.57 hectares or 0.0057 sq. km. per person and Turkana district which is in the arid area has a density of 33.2 hectares or 0.332 sq. km. per person. The bulk of the population is concentrated in the medium and high potential areas which are 17 percent of the total area.

The Rift Valley comprises 30 percent of the total land area as presented in Figure 6. It has 45 percent of the high potential area, 4 percent of medium potential area, and 29 percent of the low potential area in the country. The high potential area includes the districts of Nandi, Kericho, Tranzoia, Uasin Gishu, and parts of Nakuru and Elgeyo Marakwet. The high potential areas are highlands with an altitude between 2,000 and 3,000 meters and with annual rainfall of over 857 mm. Medium potential areas have annual rainfall of 735 mm. to 857 mm. and include parts of Nakuru and Elgeyo Marakwet and all of Baringo, Narok, and West Pokot. Low potential districts have more than

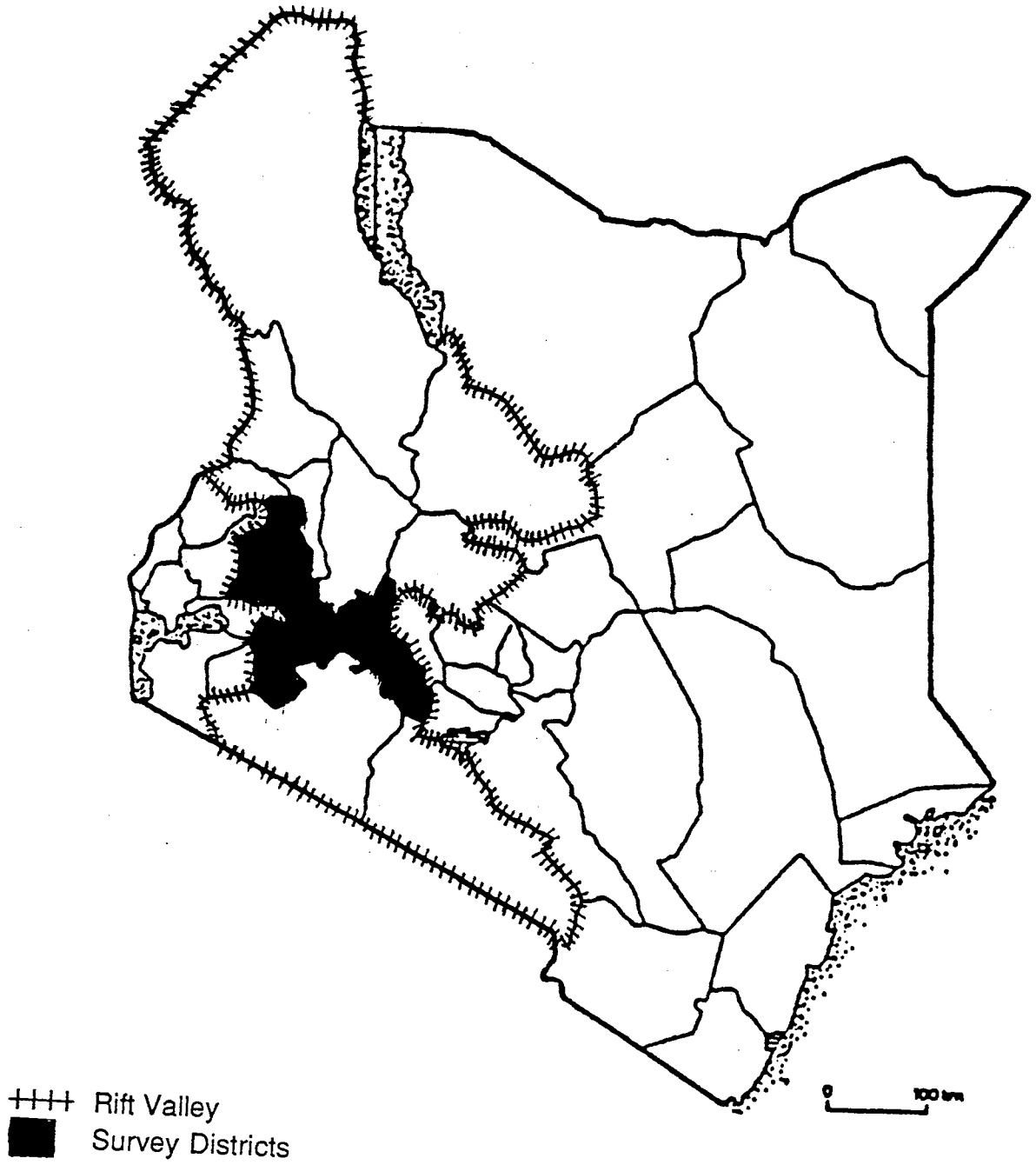


Figure 6. Map of Kenya

70 percent of their land in arid and semi-arid areas. The low potential areas have an annual rainfall of 612 mm. or less (ROK, Annual Report of 1985 and Statistical Abstract of 1990).

Agro-ecological zones (AEZ) have a major impact on the kind of production and productivity in a given environment. According to a study done by Jaetzold and Schmidt in 1983 the Rift Valley was divided into five major agro-ecological zones based on the nature and texture of the soils depth, organic matter, fertility, and water holding capacity and vegetation. They are a) upper highland, b) lower highland, c) upper midland, d) lower midland, and e) tropical alpine.

Upper and lower highlands comprise 38 percent of the land and are the main dairy and cereal producing areas. The upper and lower midlands comprise 59 percent of the land area and are for producing coffee and livestock. Having livestock, especially dairy cows, is traditionally accepted in most farm households. Dairy products are an important part of the diets of the rural population in this region.

The Europeans settled mainly in the high potential areas and concentrated in large scale farming. The rest of the land was left for traditional African farmers producing mainly for subsistence. After independence this situation resulted in concentration of settlement schemes in the high potential areas by the smallholder African farmers, which created the areas of concentration for cooperative establishments.

The large scale farming districts were Nakuru, Uasin Gishu, Tranzoia, Kericho, and Nandi (Kericho and Nandi have a history of both large and small farms). There are still some large farms in these districts, the average size of which is around 700 hectares. Most of the small farms are the result of the subdivision during the settlement schemes. In the traditional areas, subdivision

has taken place over a long period of time and holdings tend to be small due to the fast population increase. The average holding of small farms ranges between 1 and 15 hectares (ROK, Statistical Abstract, 1990). The traditional districts are Nandi and Elgeyo Marakwet. Liakpia also has some smallholder farmers doing mixed farming. The rest of the districts in the province have unfavorable climatic conditions and rely more on livestock grazing.

Fragmentation is a continuing problem for the area. During the ten years from 1979 to 1989, the total number of holdings registered increased by 8.6 percent. The distribution shows that the number of holdings within the size of 1-19 hectares increased by 56.4 percent; those ranging from 20-49 hectares increased by 102 percent; those with 50-99 hectares increased by 8 percent; and those above 99 hectares had decreased by 28 percent (ROK, Statistical Abstract, 1990). This distribution indicates the importance of small holdings in the agricultural sector and the possible trend in the continuing importance of cooperatives.

General Trends

Trends of cooperative development in the Rift Valley are similar to general trends observed for the whole of Kenya over the last 20 years. According to the annual report of the provincial office of the Ministry of Cooperative Development in Nakuru, for 1990 there were 1450 registered cooperatives and at least one cooperative union in each district in the Rift Valley (Table 1).

There were 31 registered cooperatives in the Rift Valley at the time of independence (Gyllstrom, 1990). By 1980 there were 670 cooperatives and by 1990 there were 1450, an increase of 116 percent over the 10 year period. The

TABLE 1

NUMBER OF COOPERATIVE SOCIETIES IN THE RIFT VALLEY, KENYA

District	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Baringo	25	26	27	22	21	25	28	30	46	67	52
Elgeyo/Marakwet	22	24	25	27	26	28	30	29	36	39	38
Kadiajo	28	33	34	29	32	32	34	64	67	88	76
Kericho	90	108	113	116	117	119	85	127	138	165	161
Laikpia	30	37	40	44	44	45	47	49	62	76	70
Nakuru	217	228	229	177	170	184	196	214	242	355	299
Nandi	54	64	71	74	81	81	86	100	118	140	129
Narok	25	28	28	28	28	28	28	34	40	47	51
Samburu	5	6	6	5	5	5	6	10	15	20	20
Tranzoia	83	95	102	108	121	121	129	167	187	265	254
Turkana	74	85	92	98	98	104	116	132	148	233	233
U/Gishu	11	15	16	15	15	15	16	16	19	21	20
W/Pokot	6	6	8	8	8	8	9	9	10	16	47
Total	670	755	791	751	766	795	810	981	1128	1532	1450

Source: MCD, Statistics Department.

highest numbers of cooperatives registered are in the districts of Nakuru, Tranzoia, Turkana, Kericho, and Nandi. The membership increased from 86,445 in 1980 to 320,432 in 1990 (Table 2).

The districts of Nakuru, Kericho, Liakipia, Nandi, Uasin Gishu, and Tranzoia have more than 25,000 members each. These districts are all in the high and medium potential areas as defined previously.

Share capital increased in the cooperatives from Ksh. 195,912 thousand to Ksh. 826,234 thousand from 1980 to 1990 which is a 322 percent increase in nominal value and a 137 percent increase in real value (deflated by the implicit GDP deflater, base year 1980). Turnover[1] increased from Ksh. 235,579 thousand in 1980 to 1,169,012 thousand in 1990 for a 290 percent increase in real value (MCD, Cooperative Statistics unit). According to the 1990 annual report of the provincial office, there were 23 cereal, 38 coffee, 11 pyrethrum, 83 dairy, 130 multi-purpose, and 106 farm purchase cooperatives. Compared with the number of cooperatives in 1980 the number of cereal cooperatives increased from 13 to 23, coffee from 20 to 38, pyrethrum from 8 to 11, and dairy from 40 to 83. There was no increase in multi-purpose, and farm purchase cooperatives decreased from 170 to 106. The number of all cooperatives increased except for farm purchase cooperatives which were established for the purpose of land purchase and were less important at this stage of development. Pyrethrum has the smallest number of single commodity cooperatives. However, pyrethrum is frequently included in the multi-purpose cooperatives or in the dairy cooperatives as a secondary product. Dairy cooperatives frequently include the production of other commodities such as cereals, pyrethrum, coffee, or tea depending on the area in which they are located.

---

1 Turnover is used here to mean income from sales.

TABLE 2

COOPERATIVE SOCIETIES MEMBERSHIP IN THE RIFT VALLEY, KENYA

District	1980	1981*	1982	1983	1984	1985	1986	1987	1988	1989	1990
Baringo	4860		8422	9921	10826	10826	14597	15693	16444	16600	17285
Elgeyo/Marakwet	8057		8952	9002	14422	10617	11876	10465	10972	12130	12995
Kadiajo	1039		1311	4094	5085	5085	5688	8055	8927	9016	8519
Kericho	10001		24302	28218	36713	34652	33610	39162	59844	50160	52800
Laikpia	7223		11786	9448	9448	10000	11186	40746	44095	44095	50000
Nakuru	21045		35600	38096	50506	52379	58591	45540	62950	63569	72371
Nandi	12506		16545	19915	25275	28375	31740	27623	28334	28424	34564
Narok					4526	2912	3512	3143	4038	4058	5000
Samburu			200		265	300	336	719	973	973	1037
Tranzoia	10726		15859	14163	22235	20335	23747	23747	22415	24415	25424
Turkana	2763		7078	6766	7677	6066	6785	6758	6468	6468	6468
U/Gishu	8225		15449	17028	26194	22476	31521	24010	24875	24875	27872
W/Pokot				3258	3258	3300	3691	3322	4939	4986	6097
Total	86445	104918	145504	159909	216430	207323	236880	248983	295274	289769	320432

Source: MCD, Statistics Department

* Distribution by district was not available.

Dairy is concentrated in the high and medium potential areas within the province. Kericho has the highest number of dairy cooperatives followed by Nandi and Liakpia. Uasin Gishu does not have a large number of diary cooperatives but produces 12 percent of the total milk supplied. One reason is that a number of the multi-purpose cooperatives in the district also produce milk.

By 1990 there were about 83 dairy cooperatives in the Rift Valley province. The latest production reports show that Kericho produced 48 percent, Uasin Gishu 12 percent, Nandi 9 percent, and Nakuru 8 percent of the total milk production by cooperatives (ROK, Annual Report of 1985, 1989 and 1990). These districts were selected for analyses of dairy cooperatives.

Dairy Cooperatives

Dairy production contributes significantly to general economic welfare in Kenya. Small scale farms are the backbone of the diary industry, and consumption of milk and other dairy products is wide spread. The government has given particular attention to the improvement of dairy production. The Ministry of Agriculture has financed cattle research projects at the national level since the 1910s. The main objective was to increase milk production per cow through improved feeding systems, introduction of better breeds by means of artificial insemination, and extension services for improved herd management. Dairy production has received foreign assistance since the 1970s, particularly from the Government of Finland through the Finnish International Development Agency (FINNIDA) and the Government of Denmark through the Danish International Development Agency (DANIDA).

Since 1980 the National Dairy Development Project (NDDP), assisted by the Danish government, introduced zero grazing through the use of napier

grass and other purchased animal feeds. By 1988 about 56 percent of the roughage used by the project farmers was napier grass and average daily milk yield per cow increased from 2 to 8 liters per day (DANIDA Report 1, 1990).

The two main activities of the dairy cooperative are (1) collecting milk from member farms and (2) marketing to local customers and/or delivering surplus to the Kenyan Cooperative Creameries (KCC). The KCC is a parastatal established as purchaser of last resort during the colonial time. The transportation involves two stages. First, the cooperatives establish collection points over certain radius allowing members to deliver their milk at the appropriate time. Second the cooperatives arrange transport, either owned or hired, to take the milk from the collection points to the point of sales, local and or KCC. On arrival milk is inspected, weighed, and recorded on a daily basis. The cooperative provides weighing scales. If milk is brought in large quantities it is delivered in the same container. Small quantities may be poured into one container for easier transport. This method provides a control to be sure members bring fresh milk and to avoid spoiling all the milk if poured into one large container. In most cases morning milk is collected, but when the cooperatives are close to the cooling or urban center, both the morning and evening milk are collected. The equipment used are pails, jugs, and cans.

Cooperatives collect a commission from members for handling the marketing activities. Cooperatives assist members by reducing costs of handling (marketing) products; supplying animal feed, drugs, and other agricultural inputs; and keeping records of member production and other transactions. If a cooperative is not efficient, members may leave and join another cooperative or sell their milk through individuals who have a KCC supply number. These are the cooperatives that generally go dormant. Factors affecting the cost structure of cooperatives most frequently mentioned are

management, volume of milk handled, and road access from farm to market. During interviews with several union members, the problem referred to repeatedly as the cause of shut down for cooperatives was the high cost of operation of cooperatives.

The number and location of cooling centers are critical to the marketing of fresh milk. The KCC has 11 cooling plants throughout the country with computerized recording of milk intake and treatment. These plants have received assistance from the Danish Government. The Rural Dairy Development project has additional cooling plants distributed over the country. Some large cooperatives have their own coolers.

Milk processing is dominated by the KCC. It has 11 processing plants, the oldest was established in 1925 in Naivasha. Six of the processing plants are in the Rift Valley (Nakuru, Naivasha, Sosiani, Eldoret, Kitale, and Sotik). There are four processing plants owned by cooperative unions and four private enterprises engaged in liquid milk and cheese production.

Dairy Marketing

The Kenyan Dairy Board is the statutory body responsible for organizing the marketing of dairy products and handling of the surplus milk in areas of excess and shortages in areas of deficit. The Dairy Board was founded in 1985 for the following purposes of regulation:

a) licensing of milk distribution and setting prices for liquid milk;

b) services to the dairy industry for financing programs and providing training in the industry.

Independent retailing of milk in the scheduled area is not prohibited but has to be done under license from the Board. Both independent sales and

sales through cooperatives to the KCC pay two cents per liter of milk delivered to the KCC and are used to finance the Dairy Board.

The two principal market outlets of the farmers are (1) local sales to hotels, government institutions, hospitals, etc. within the area and (2) the KCC which accepts the surplus. Prices in the local markets are generally higher than the prices paid by the KCC. Payment from local sales is on delivery or by arrangement at the end of the month.

Producer price is reviewed periodically by the Ministry of Livestock Development and is based on estimated cost of production. The KCC purchase price per kilogram in 1989, 1990, and 1991 was 3.168 Ksh, 4.162 Ksh and 4.356 Ksh, respectively. The price for 1991 prevailed up to April 1992 when the author departed from Kenya. The KCC used this rate for milk delivered to a cooling station and made payments to the cooperatives and individual suppliers after deduction of the two cents levy.

The KCC's payments are on a monthly basis. The promptness of payment by cooperatives to members varies. The KCC sends separate statements for milk delivery and for milk payment. The cooperative offices delay payments to members until they have both documents. For example, in the cooperative where this author administered the household survey, the members were being paid in January for milk delivered in November.

After processing, liquid milk is sold to consumers in packages of half a liter for 4.04 Ksh in 1991 and early 1992. This price was 85 percent higher than the farm gate price which represents the processing costs of KCC. The consumer price of fresh milk is reviewed by the Ministry of Finance each year on the basis of submissions made by the KCC reflecting its processing cost. The KCC handles 98 percent of the sales of processed milk in the country. The KCC accepts all milk of suitable quality delivered to its premise by individuals,

cooperatives, and non-KCC processing enterprises. The surplus milk from the day to day liquid milk requirements is turned into storable products such as cheese and butter. Any surplus of these commodities is exported by KCC.

The KCC was registered as a public limited company in 1925 to handle milk specially from large European farmers. The KCC is currently in a liquidity crisis and has incurred losses for the last three years. The government is calling for a restructuring of the marketing system of milk for purposes of increasing efficiency. Studies are being completed and recommendations are being made on how to restructure the KCC so that the dairy industry is more competitive by including participation of other dairy processing units and cooperatives.

In summary, the number of cooperatives has increased rapidly in the Rift Valley in the last ten years. The number of dairy cooperatives has increased faster than the other cooperatives in turnover and number of members. Dairy cooperatives in the Rift Valley were chosen for analysis in this study because of their importance in smallholder development and because of their dynamic growth in this region. As referred to above, the major dairy producing districts are Kericho, Nandi, Nakuru, Uasin Gishu, and Tranzoia. Because of the limitation of time and finances it was not possible to cover all of the 83 dairy cooperatives in the Rift Valley. However, all of the dairy cooperatives in the four districts of Kericho, Nandi, Nakuru, and Uasin Gishu were surveyed for purpose of estimating their cost structure.

CHAPTER V

COST STRUCTURE OF DAIRY COOPERATIVES IN THE RIFT VALLEY

Introduction

The increase in production by small farmers requires easier access both to the factor and product markets. Most of the marketing activities are located in urban areas. The distance and cost involved to get these services are frequently beyond the financial capacity of individual small farmers. Marketing of milk is more problematic than other agricultural products because of its perishability. The local demand for milk is limited because almost all smallholders produce their own household consumption. Hence, the alternative markets are the surrounding and more distant urban centers. The transport of milk from the rural producers to the urban consumers requires a considerable organization and capital investment in transport facilities, chilling, and processing plants. The level of investment required for transporting and marketing of milk makes dairy cooperatives important for the smallholders. Cooperatives are important to minimize the cost of handling for the individual producers, and in some situations it is the only way for the producers to market their milk.

The Analytical Model

A firm produces commodities from different activities and incurs cost as a function of the different activities. The basic assumption of most economic analysis is that the firm chooses those activities so as to maximize profit, revenue minus cost.

There are two fundamental conditions for profit maximization. One is that marginal revenue from a product or service must be equal to the marginal cost of producing it. The other condition is that marginal revenue from employing one additional unit of input must be equal to the marginal cost of obtaining that additional unit. These conditions are used to determine the amount of specific input to use.

In a competitive market each firm is assumed to be a price taking unit. Therefore it is concerned only with determining the profit maximizing level of output and input use. The firm would like to produce the supply of output at minimum cost.

If a cooperative is defined as a private decision making unit the theory of the firm can be adopted to reflect its economic nature (Helmberger and Hoos, 1962, Heady, 1971). A cooperative as a profit maximizing economic agent will have a profit function as follows:

$$\pi = PQ - \sum_{i=1}^{2} r_i X_i - FC \qquad (4.1)$$

where Q = is the production of service

P = price of service

Q = $Q(X_i)$ production function

X_i = purchased inputs (labor and non-labor)

r_i = price of inputs

FC = fixed cost

However the goal of the cooperative is to maximize surplus (S) that goes to members which implies fulfillment of the cost minimization condition. Members pay a certain percentage of their sales as a commission to the cooperative office for the operation of service rendered by the cooperative office. Any surplus will be returned to members or equally can lead to a decrease in the percentage paid. Both situations imply a higher return to members. Therefore

$$S = PQ - \sum_{i=1}^{2} r_i X_i - FC$$

In order to maximize (S) any level of Q produced Q* must be produced at minimum total cost:

$$TC = \sum_{i=1}^{2} r_i X_i + FC \tag{4.2}$$

Then the objective function is to minimize total cost subject to production of Q.

$$C = \Sigma r_i X_i + FC - \lambda [Q(X_i) - Q^*] \tag{4.3}$$

If C is to be minimized

$$\frac{\partial C}{\partial X_1} = r_1 - \lambda \frac{\partial Q(X_1)}{\partial X_1} = 0 \tag{4.4}$$

$$\frac{\partial C}{\partial X_2} = r_2 - \lambda \frac{Q(X_2)}{\partial X_2} = 0 \tag{4.5}$$

$$\frac{r_1}{r_2} = \frac{\partial Q(X_1)}{\partial X_1} \Big/ \frac{\partial Q(X_2)}{\partial X_2} \tag{4.6}$$

The price ratio equals the ratio of marginal factor products. For each Q there will be a corresponding minimum total cost of production.

Hence $TC = C(Q) + FC$ (4.7)

and $S = PQ - C(Q) - FC$ (4.8)

$$\frac{\partial S}{\partial Q} = P - \frac{\partial C(Q)}{\partial Q} = 0 \quad (4.9)$$

$$P = MC \quad (4.10)$$

A maximum S implies that price is equated to marginal cost. Both Equation 4.6 and equation 4.10 confirm the marginal condition of optimization and the solution gives the optimal volume of service (Q) and inputs (X_i). The solution to equation 4.6 gives the optimal labor (X_1) and non-labor (X_2) inputs which in turn specify the optimal volume of service (Q). The solution to equation 4.10 gives the same volume of service (Q).

Cost Structure of Individual Firms

The cost can be expressed as a function of output and factor prices:

$$C = c(r,q) \quad (4.11)$$

where r=factor price and q= quantity

If factor prices are fixed at a given level then cost is a function of output,

$$C = c(q) \quad (4.12)$$

The short run is a period where some factors of production are fixed at a certain level. The total cost function is composed of variable and fixed costs:

$$TC = c(q) + b \tag{4.13}$$

where c(q) is variable cost (VC) and b is fixed cost (FC).

Average total costs are:

$$ATC = TC/q = c(q)/q + b/q \tag{4.14}$$

Average variable costs are:

$$AVC = VC/q = c(q)/q \tag{4.15}$$

Marginal costs are:

$$MC = dTC/dq = dVC/dq = dc(q)/dq \tag{4.16}$$

Average fixed costs are:

$$AFC = b/q \tag{4.17}$$

In the short run there will be a minimum total variable cost for each output level. For minimum condition to hold marginal cost (MC) should equal average cost (AC) at its minimum point. The relation of MC and AC shows the elasticity of the cost function and the returns to scale of the production function underlying the cost function. When the ratio of MC to AC is less than one, equal to one, and greater than one the corresponding production function is experiencing decreasing, constant, and increasing returns to scale, respectively. These results are shown graphically in Figure 8. At quantity Q_0, MC = AVC. To the left of Q_0, MC < AVC and to the right of Q_0, MC > AVC (mathematical derivation is given in Appendix A6).

The long-run is a period where all inputs are variable and the total variable cost is equal to the total cost. The fixed plant assumption is dropped as cooperatives are assumed to give variable level of service. The long-run cost function is an envelope of short run curves, and it shows the minimum cost of

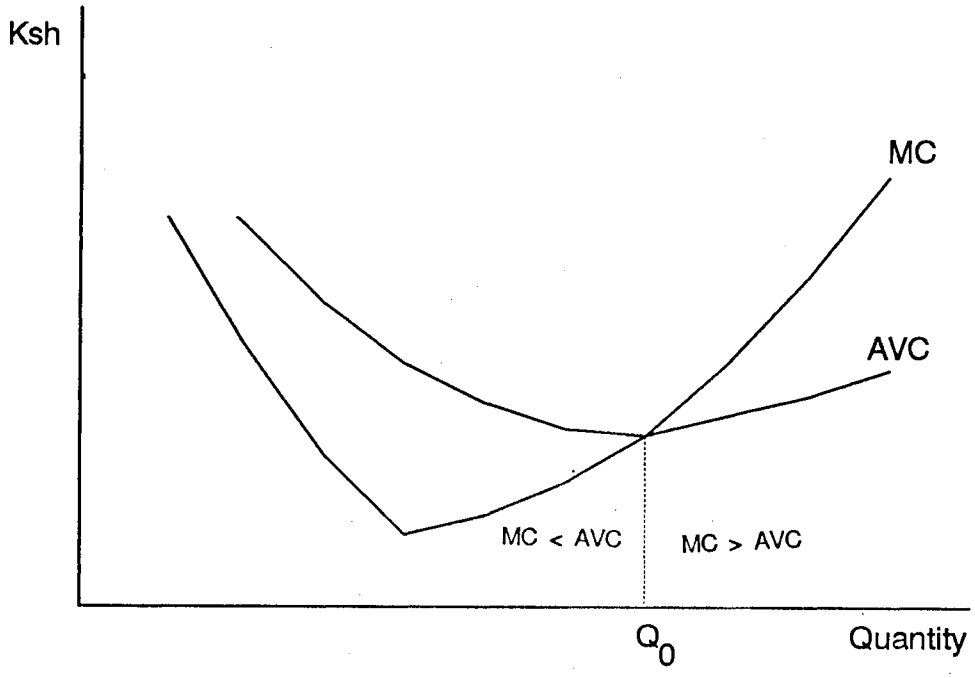


Figure 7. Geometric Relationship of Short-Run Cost Curves

producing each relevant level of output. The shape of the cost function depends on the size of the plant in the short-run and the prevailing input prices. In the long-run there are different possible choices. Once the cost function is set, then the firm is back to the conventional short-run optimization problem.The economic force behind the shape of the long-run total average cost curve is the economies of scale. Figure 9 is used as illustration.

Three plant sizes are indicated in Figure 9. Plant size one with short run marginal cost ($SRMC_1$) and short run average cost ($SRAC_1$) is enjoying scale economies. This implies that the firm can still produce more quantity at a lower per unit cost. For plant size two the long-run total average cost is at a minimum and this is where the long-run average cost (LRAC), long-run marginal cost

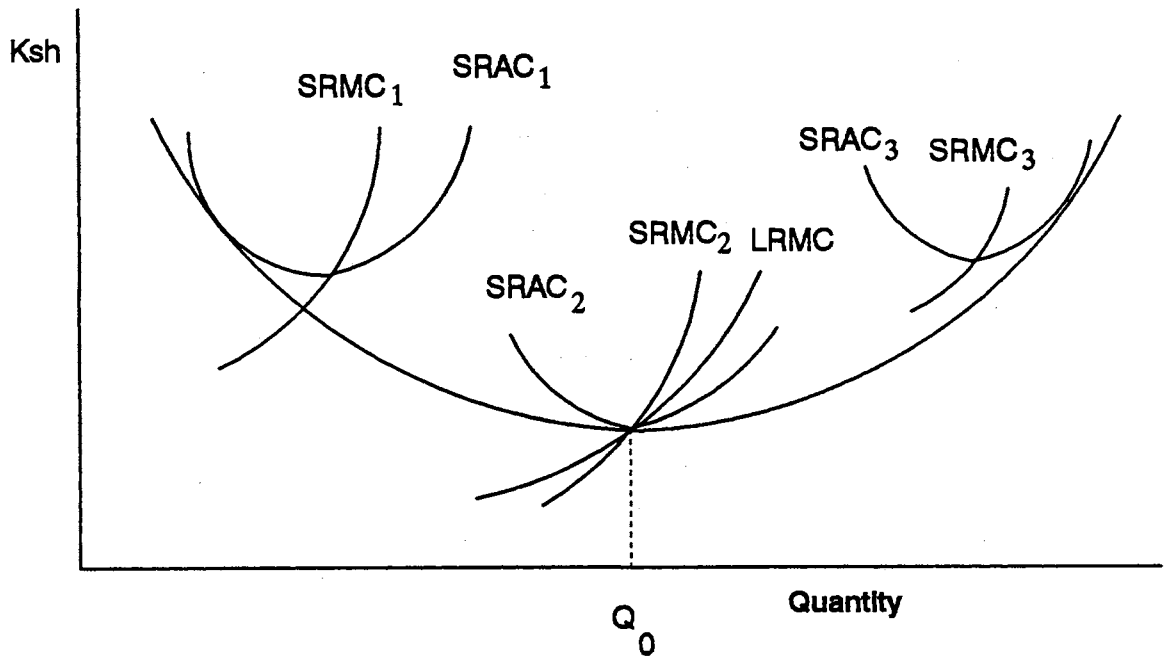


Figure 8. The Classical U Shaped Long-run Average Cost Curve

(LRMC), short-run average cost ($SRAC_2$),and short-run marginal cost ($SRMC_2$) are equal. This point indicates the optimal size of the plant. Economies of scale occur for production to the left of Qo, that is, increase in efficiency is possible through internal change or new investment in other activities leading to a further decrease of average cost per unit of output. Diseconomies of scale occur to the right of Qo indicated by plant three. It is assumed that eventually the long-run average cost will increase, that is, cost per unit of output increases as output increases. A common reason for increase in cost is managerial limitation.

Managers encounter problems in maintaining control of their organization. Communication and coordination becomes difficult and cost increases.

The U shaped long-run total average cost curve is not usually found in a theoretical concept which is useful for analytical purposes. It would be worthwhile to make distinction between return to scale and return to size. Return to scale is a theoretical concept implying the condition that all inputs be expanded in fixed proportion. It measures the percentage change in output when all inputs are varied in fixed proportion. Return to size on the other hand is used in practice. It shows the proportional change in output as factors are expanded on the least-cost expansion path proportion. Least cost proportion is assumed in deriving the cost function of the firm which makes it important to determine the optimum firm size and what happens (decreasing, constant or increasing) to cost as output is expanded (Beatie and Taylor, 1985).

Several studies have shown different shapes of long-run total average cost curves from real situations (Johnston, 1960). There are three common situations of the long-run total average cost curve. There is the situation where economies of scale are negligible, which is when the total average cost increase for a relatively small volume of output (Figure 10a).

The second result is a continuously declining total average cost. Economies of scale are extremely important. The total average cost may not increase until a very large volume of output is attained (Figure 10b). This is usually experienced by natural monopolies. It suggests significant scale economies and that substantial unit cost savings can be achieved at relatively high output.

The third represents most situations. The scale of operation enables firms to capture most economies of scale. Average cost per unit remains

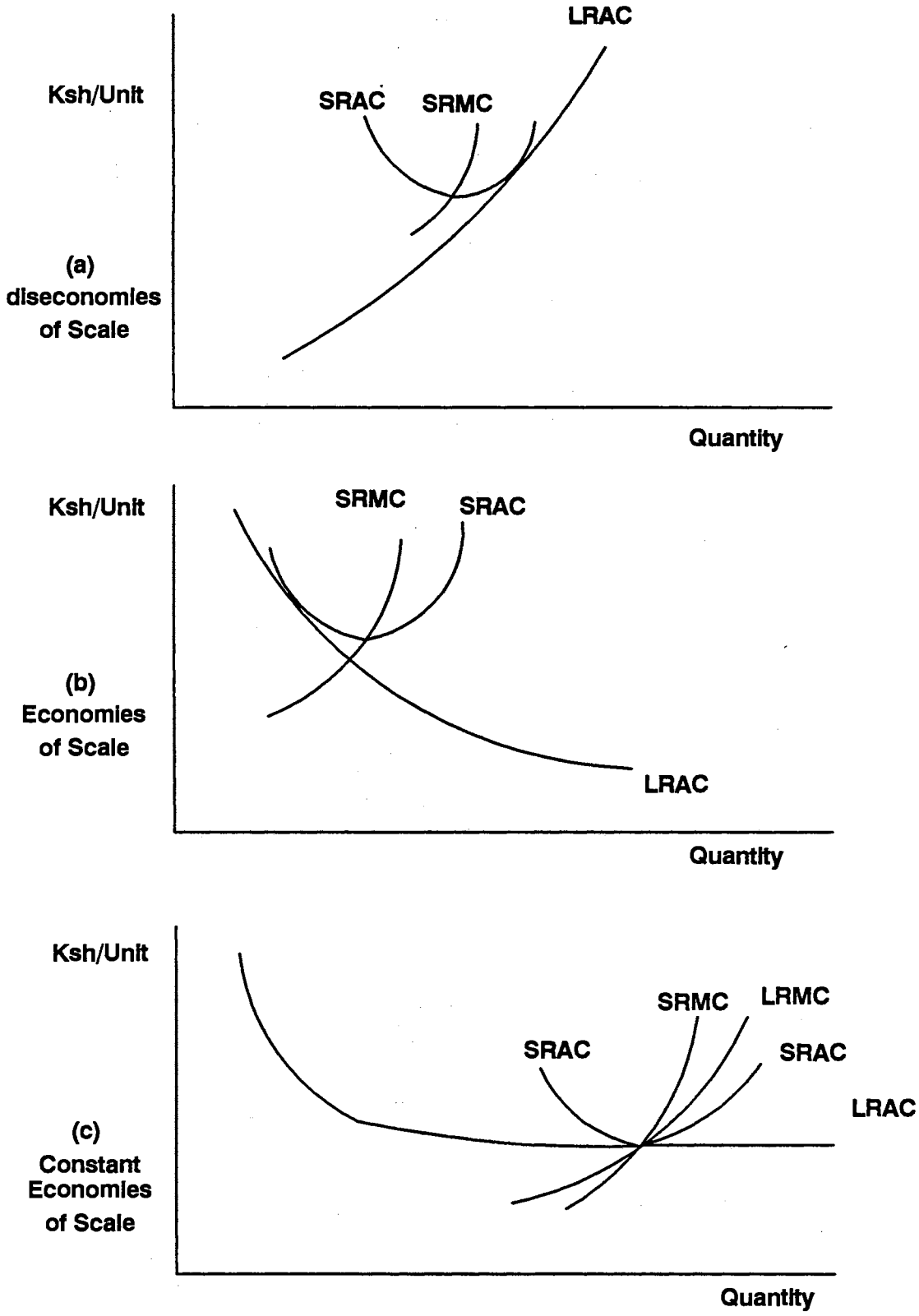


Figure 9. Alternative Shapes of the Long Run Average Cost Curve

constant over a large range of output as long as the firm employs the same method of production. Once the firm has expanded until it is using its lowest per unit cost, it would continue to expand with constant returns to scale by simply replicating the plant operating at minimum cost. Diseconomies are not incurred until output is very large as depicted in Figure 10c (Maurice and Smithson, 1985, Doll and Orazem, 1984).

Estimation of the long-run average or the frontier cost functions can be done from cross-section data to identify scale economies and/or inefficiency. Both functions reflect the minimum cost of producing a given output. However, the average function is associated with mean output from a sample with a given input level and ordinary least square regression method can be used for estimation. The average function permits a ranking of observation by efficiency (Schmidt and Lovell, 1979).

The frontier function on the other hand measures the average level of inefficiency in the industry. It reflects the minimum cost of producing any given output vector as defined by the least cost firm. Hence it puts a bound on the dependent variable, so that the points can lie above its cost frontier not below. The amount the firm lies above its cost frontier can be regarded as a measure of inefficiency. If the technology is the same in the industry the cost frontier is an absolute frontier, that is minimality of cost over all possible sample points (Forsund et al., 1980).

In the frontier model the error term is composed of two parts. One is the usual symmetric component which permits random variation of the frontier across firms to capture the effects of random shock outside the firm's control. The other is a one-sided components that captures the effect of technical inefficiency. Because of the one-sided disturbance term maximum likelihood estimator would be more efficient. If the disturbance about the frontier function

estimated tends to be symmetrically distributed, it is expected that the average estimate is simply a scaled version of the frontier function with the same shape (Greene, 1980). The more the disturbances about the frontier are skewed, the less the frontier function resembles the average estimator (detail is given in Appendix A9).

The cost function can also be used to show scale economies (SCE). SCE is related to the long-run average cost and the long-run marginal cost. It is defined as one minus the elasticity of cost with respect to output:

$$SCE = 1\text{-elasticity}$$

$$= 1 - (dc/dq)\,(q/c).$$

Elasticity here is defined as the percentage change in total cost for a one percent change in quantity of output (Christensen and Greene, 1976; Brown, Caves and Christensen, 1979; Cowing and Holtmann, 1983). Thus if LRMC < LRAC then SCE is positive and there are economies of scale. If LRMC > LRAC, SCE is negative and there are diseconomies of scale. When LRMC = LRAC, SCE = 0 and constant returns to scale exists.

Small farmers, all producing the same product with limited influence on either factor or product markets, are faced with the competitive market situation. They make choices on the most profitable allocation of their limited resources among different activities. However, for some activities they face sizeable economies of scale.

Cooperatives are the major institutions for smallholder organization and development and generally face competitive market situations. Smallholder farmers organized as cooperatives for some activities are presented here as a firm and analyzed within the analytical framework developed above. The objective is to specify and empirically estimate the cost function for these activities using sample data, and then analyze the estimated cost function.

Cooperatives are assumed to be producing a single homogeneous product with unrestricted entry and exit to the product market except for registration with MCD. The product or service is produced for cooperative members at zero profit with balances closed on an annual basis. Following are the additional assumptions of the analysis:

1) Product price is established by the marketing board based on demand and supply.
2) Factor prices are market prices.
3) All other purchased inputs are from competitive markets.
4) The cooperatives are expecting to continue operating in competitive markets.
5) Technology used by the cooperatives is the same.
6) Cooperatives have similar patterns of cost behavior and personnel management methods.

The major objective of the cooperatives is to minimize cost, which indirectly encourages members' retention. Output delivered by members is exogenous to the cooperative because of its limited control on volume of milk production. Hence it is left to make decisions on the amount of inputs to minimize total cost.

Empirical Model

Sample Data

Cross-section data were collected from all dairy cooperatives in the districts of Kericho, Nakuru, Nandi, and Uasin Gishu. The selected districts belong to the same agro-ecological zone to maintain homogeneity of the sample. The size of the cooperatives varied from small to large, and the

number in the sample was increased as much as possible to avoid the problem of averaging. About 54 percent of the cooperatives in the Rift Valley were covered in the survey.

The source of data was a twelve month, one financial year, trial balance for each cooperative. The trial balances were available either at the district cooperative office, the district cooperative union, or the individual cooperative office. The financial year varied with the cooperative but all cooperatives had one of the following accounting periods, June to July, October to September, or January to December. Hence the twelve months used for the survey were June 1989 to July 1990 for those who follow this period, October 1989 to September 1990, and finally January 1990 to December 1990 for the rest of the cooperatives. The affiliate cooperatives used the standardized trial balance format from the Kenyan National Farmers Cooperative which made comparison and aggregation of data easier. The expenditure items in the trial balance were aggregated into three major categories of total cost. Income and sales were measured in Kenyan Shillings and quantity in kilograms. The three major categories of total cost are:

1) Overhead cost. Includes management costs (including policy committee allowances), wages and salaries, interest and depreciation, repairs and maintenance, and licenses. If cooperatives were engaged in activities other than dairy, procedures developed by the Nordic advisory staff were used to allocate dairy overhead and other costs proportionally to the dairy activity. The overhead cost may be used as a proxy for fixed cost or size of plant. The assumption is that management costs, interest, and depreciation can not be changed in the short run and hence

must be distributed over all short run variations in volume of output. Overhead cost accounted for approximately 20 percent of total cost.

2) Transport Cost. These costs of milk collection and delivery to the cooling station accounted for about 49 percent of total costs. All but a few of the cooperatives contract for transport services.

3) Miscellaneous Cost. These costs include utilities, printing, stationary, communication, income tax, and sundry expenditure. These costs accounted for about 31 percent of total costs.

Estimation and Results

The cross-section survey data of the cooperatives were used to estimate the long run cost function of dairy activity output using ordinary least squares technique. Variables in the regression model include the following:

Dependent

TC = total cost of dairy activity output (1,000 Ksh)

TOC = total overhead cost (1,000 Ksh)

TTC = total transport cost (1,000 Ksh)

TMC = total miscellaneous cost (1,000) Ksh)

Independent

Q = quantity of milk delivered (Kgs)

Q^2 = quantity squared

D = district variable with value (0,1). Value of one indicates district with poor road access and longer distance to cooling station

I = index of other cooperative activities. The higher the index the greater the proportions of cooperative total revenue accounted for by other activities.

Glejser test was used to test the hetroscedasticity of the cross-section data from the survey in appendix A-3. The F-values were not significant for all the models under consideration indicating that there was no significant hetroscedasticity in the data (Maddala, 1977, Kennedy, 1987, Judge and et al., 1980).

Maximum likelihood estimation (MLE) method was used to estimate the frontier function. The results indicate that the OLS estimator is the same as MLE suggesting that the average function is a close estimate of the frontier function. It also suggests that the cooperatives are relatively technically efficient.

Three models were estimated using OLS (Table 3). The F-value is highly significant for all models indicating a strong relationship between total cost of dairy activity output and the independent variables. The adjusted R^2 ranged from 0.86 to 0.90 for the cross-section data regression. In each model the coefficient for quantity of milk delivered was positive and significant at one percent probability level or higher. Quantity squared was not statistically significant in the quadratic function.

The log function was re-estimated with a district dummy variable and index of other activities to identify the factors that could affect the total cost. Estimation of the three categories of the total cost was also done to see the impact. It was hypothesized that access to road, density of smallholders, and distance to cooling center were different in different regions and affect the cost. The other hypothesis is that the level of activities by the cooperative other than milk has an impact on overhead cost of cooperatives.

TABLE 3

REGRESSION PARAMETERS OF THE OLS ESTIMATE OF TOTAL COST OF DAIRY COOPERATIVE ACTIVITY OUTPUT

Variables	Log Function	Linear Function	Quadratic Function
Intercept	0.2258	10.389	3.240
	(0.2845)	(11.202)	(19.126)
LQ	0.916		
	(0.0535)**		
Q		0.761	0.8237
		(0.0377)**	(0.1393)**
Q^2			-0.00009
			(.00019)
R^2 adj	0.86	0.90	0.89
F-values	292.73**	406.21**	199.58**

Figures in parenthesis are standard errors of estimates.

** Indicates significance at 1 percent probability level or higher.

Results of the OLS regression of the major categories of cost is presented in Table 4. All regression models are log form. Some of the cooperatives provided own transport service, and in some cooperatives there are some supplementary volunteer work by members which made allocation of

TABLE 4

REGRESSION PARAMETERS OF THE OLS ESTIMATE OF MAJOR CATEGORIES OF TOTAL COST OF DAIRY COOPERATIVE ACTIVITY OUTPUT

Variables	Log Function Total Cost	Log Function Overhead Cost	Log Function Transport Cost	Log Function Miscellaneous Cost
Intercept	0.1259 (0.2712)	-0.2423 (0.5313)	-0.6731 (0.2848)**	-1.1691 (0.4309)**
LQ	0.9271 (0.0484)**	0.7723 (0.0976)**	0.9508 (0.0535)**	0.945 (0.0761)**
LI	-0.0003 (0.0306)	-0.1309 (0.0575)**		0.0249 (0.0461)
D	0.3443 (0.1037)**		0.2861 (0.1087)**	
R^2 Adj	0.89	0.60	0.88	0.78
F-value	124.60**	32.14**	161.40**	77.35*

Figures in parenthesis are standard errors of estimates.

** indicates significances at the 1 percent probability level or higher
* indicates significances at the 5 percent probability level or higher

expenditures between the categories of transport and overhead costs inconsistent. Therefore these observations were eliminated in the regression.

The regression coefficient of the dummy variable is significant in the total cost while the activity index is not significant. However, the regression coefficients for quantity of milk delivered are highly significant in explaining all

categories of total cost. In comparing the size of the quantity coefficient for each of the categories of cost with the coefficient for total cost, the coefficient of overhead cost is less, and the coefficient for transport and miscellaneous costs are more. This implies that overhead cost shows higher scale economies relative to the total cost.

The estimates of the total overhead cost have the expected signs and the activity index of other activities (I) is significant at a level of one percent and above. The coefficient shows the percentage change in total overhead cost associated with a unit change due to diversification of activities. It shows that total overhead cost will decrease by 0.13 percent for a one percent increase in the index. This result indicates efficiency in spreading overhead cost over more activities by the cooperative.

The coefficients of the estimated equation of total transport cost had the expected signs. The coefficient of district dummy variable (D) is significant at one percent level. The coefficient shows that districts with poor road access and greater distance to a cooling district (D=1) have 28.6 percent higher transport cost. The result indicates that district access roads and distance to cooling center are important in explaining transport cost.

The quantity variable for the total miscellaneous cost equation is positive and significant at the one percent probability level. The coefficient on the index of diversification is positive but not significant.

The linear and log functions of total cost of dairy cooperative activity output from Table 3 are used to analyze long run average cost and scale economies. Total (TC) and long run average cost (LRAC) for the two functional forms are expressed below:

Log function

$$TC = 1.253\ Q^{0.916}$$

$$LRAC = \frac{TC}{Q} = 1.253\ Q^{-0.084}$$

Linear function

$$TC = 10.389 + 0.761Q$$

$$LRAC = \frac{TC}{Q} = 0.761 + 10.389\frac{1}{Q}$$

The two forms of the long run average cost functions are graphed in Figure 11 and the corresponding total cost functions are graphed in Figure 12. Both functional forms show continuously decreasing LRAC and thus continuous scale economies. The average cost declines faster at smaller quantities of output and becomes relatively constant as quantity increases.

In the case of the log function of TC, the elasticity is constant and equal to about 0.92. This means for each one percent increase in quantity of milk handled by the dairy cooperative the total cost of dairy activity output increases by 0.92 percent. This is the same as saying that scale economies are equal to 0.08 percent or that for each one percent increase in the quantity of milk handled the total cost of dairy activity output decreases by 0.08 percent. The log function shows the average elasticity over the sample. This tends to overestimate the scale economies of large cooperative and underestimate scale economies of small cooperatives.

For the linear function of TC, the elasticity of cost with respect to output increases as output increases. This is equivalent to saying that as output increases, the scale economies decrease. The declining LRAC shows scale

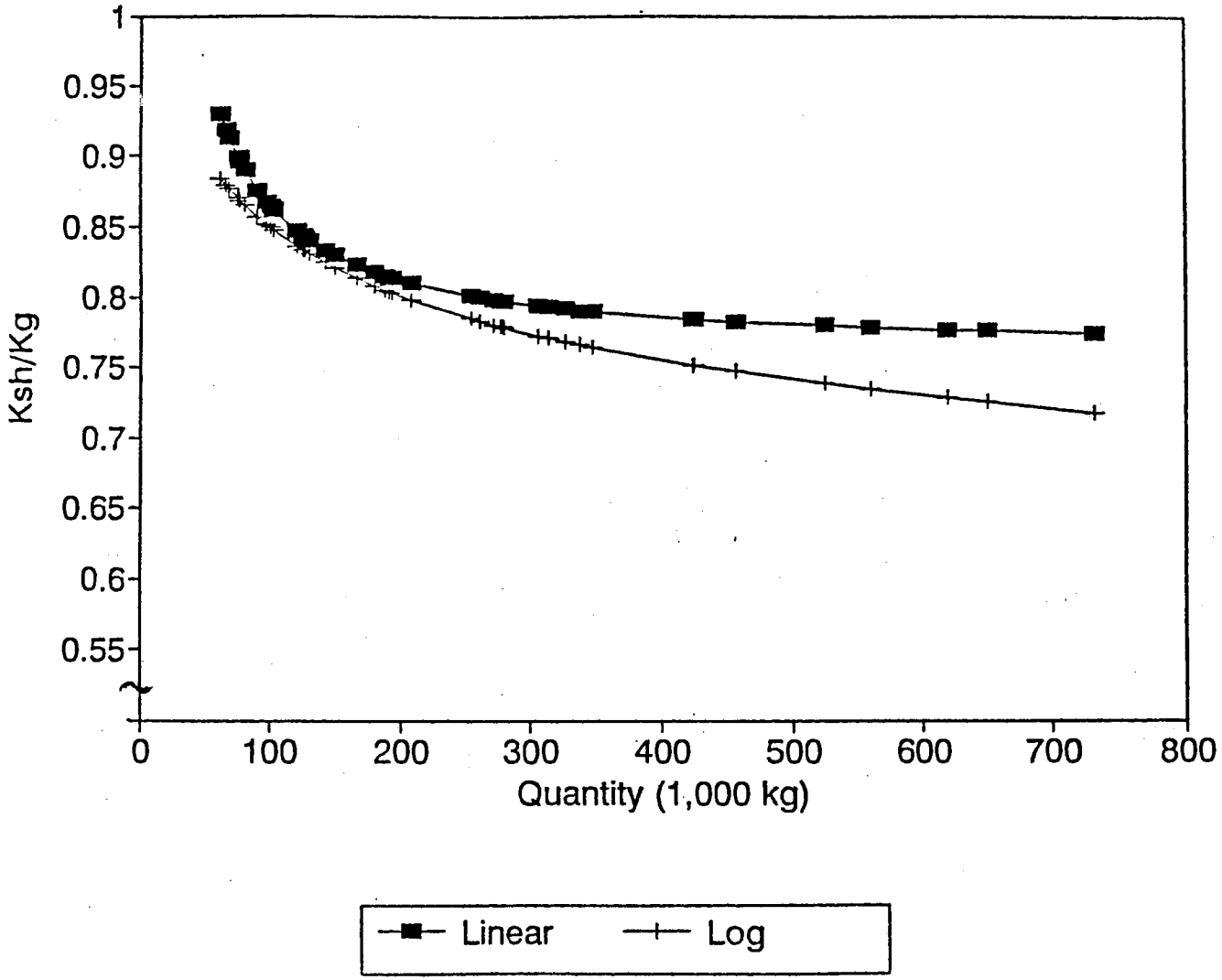


Figure 10. Alternative forms for the Long Run Average Cost of Dairy Cooperatives.

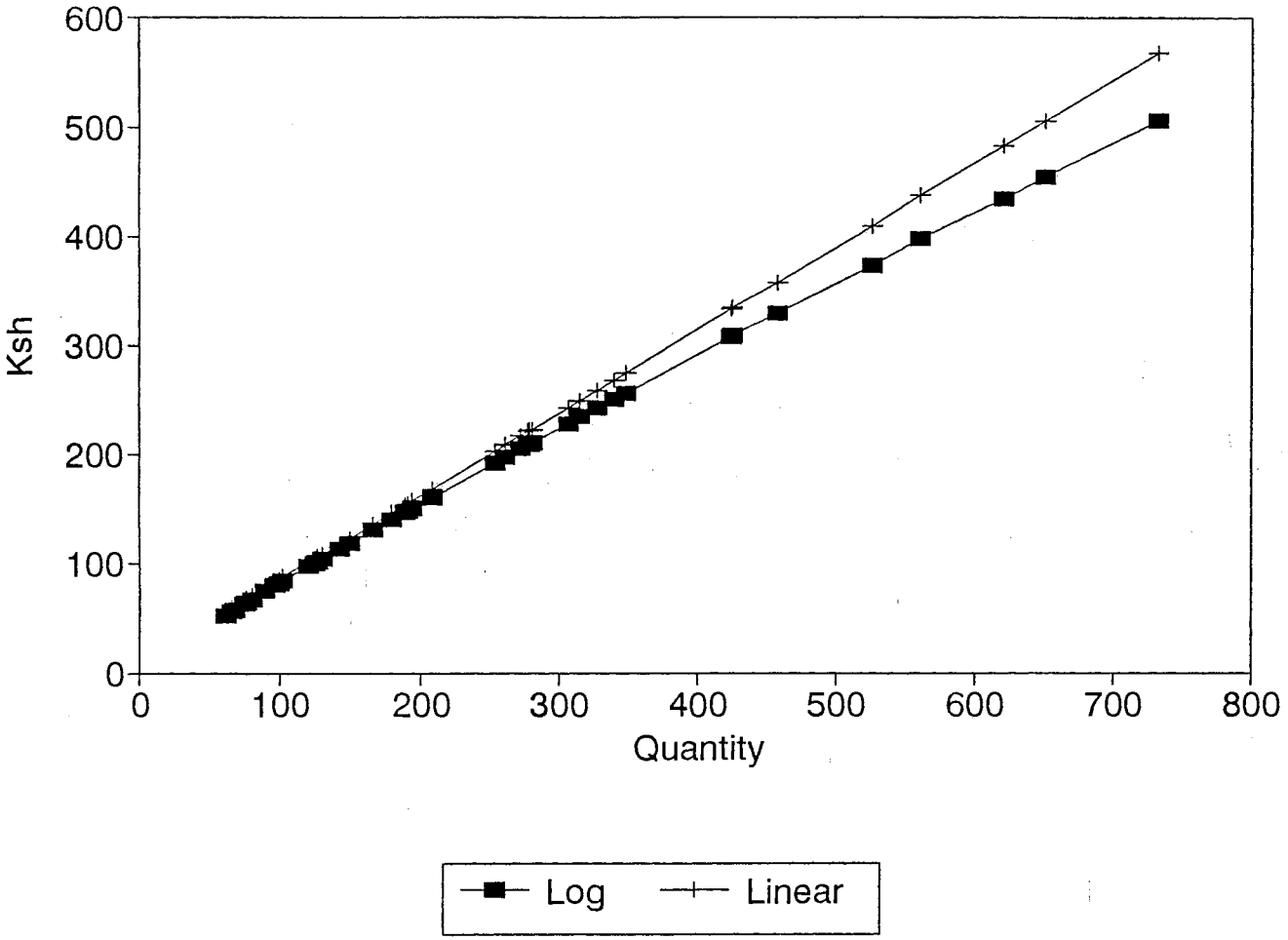


Figure 11. Alternative forms for the Long Run Total Cost of Dairy Cooperatives.

economies are more important at lower levels of output than at higher levels of output. It is possible to observe scale economies of individual cooperatives.

This result is presented in Table 5 where total cost (TC), long run average cost, elasticity of cost with respect to output, and scale economies (SCE) were computed from the estimated linear TC function of the dairy cooperative activity output. At output levels less than 130,000 Kgs of milk delivered per year, scale economies are 0.10 or higher. As output levels increase scale economies are reduced. At an output level of 600,000 Kgs, scale economies are 0.02 indicating that at this level a one percent increase in the amount of milk handled by a cooperative there is only a 0.02 percent decrease in total cost.

The declining slope observed in the estimated LRAC tends to reflect the situation in Figure 10.c, where the scale of operation enables a cooperative to capture most of the scale economies. Average cost per unit remains constant over a relatively large range of output. It supports the hypothesis of a natural monopoly in collecting and transporting milk to cooling centers. At a very high level of output cost of collecting and transporting milk in the same locality by two different cooperatives or agencies would increase total cost for the same group of producers. Without cooperatives, monopoly profit could be extracted by an alternative collecting and transporting firm or agency. Such a situation could exist if one large producer in the region established his own transport system and then provided service to the smallholders in the same region. Entry of another collecting agency (firm) including a cooperative would be infeasible because of the limited volume of milk produced.

The results of the activity index suggests that diversification reduces the cost of dairy activity output. The result of the estimated total overhead cost of the dairy activity output indicates that a one percent increase in the index of

TABLE 5

ESTIMATED TOTAL COST, AVERAGE COST,
ELASTICITY AND SCALE ECONOMIES
(ORDERED BY THE QUANTITY OF MILK)

Quantity	TC	AC	Elasticity	SCE
61.13	56.85	0.93	0.82	0.18
65.31	60.02	0.92	0.83	0.17
67.62	61.78	0.91	0.83	0.17
74.65	67.12	0.90	0.85	0.15
74.71	67.17	0.90	0.85	0.15
75.99	68.14	0.90	0.85	0.15
79.85	71.08	0.89	0.85	0.15
89.64	78.52	0.88	0.87	0.13
96.40	83.66	0.87	0.88	0.12
99.62	86.10	0.86	0.88	0.12
101.66	87.65	0.86	0.88	0.12
102.11	87.99	0.86	0.88	0.12
120.24	101.77	0.85	0.90	0.10
124.13	104.73	0.84	0.90	0.10
125.07	105.44	0.84	0.90	0.10
126.38	106.44	0.84	0.90	0.10
129.76	109.01	0.84	0.90	0.10
141.83	118.18	0.83	0.91	0.09
148.87	123.53	0.83	0.92	0.08
165.87	136.45	0.82	0.92	0.08
179.57	146.86	0.82	0.93	0.07
188.24	153.45	0.82	0.93	0.07
190.92	155.49	0.81	0.93	0.07
193.49	157.44	0.81	0.93	0.07
207.96	168.44	0.81	0.94	0.06
253.92	203.37	0.80	0.95	0.05
260.62	208.46	0.80	0.95	0.05
261.45	209.09	0.80	0.95	0.05
271.97	217.09	0.80	0.95	0.05
272.08	217.17	0.80	0.95	0.05
277.38	221.20	0.80	0.95	0.05
278.94	222.39	0.80	0.95	0.05
280.37	223.47	0.80	0.95	0.05
306.34	243.21	0.79	0.96	0.04
314.30	249.26	0.79	0.96	0.04
327.17	259.04	0.79	0.96	0.04
339.17	268.16	0.79	0.96	0.04
347.80	274.72	0.79	0.96	0.04
424.60	333.08	0.78	0.97	0.03
425.83	334.02	0.78	0.97	0.03
457.12	357.80	0.78	0.97	0.03
525.40	409.69	0.78	0.97	0.03
561.10	436.83	0.78	0.98	0.02
620.59	482.03	0.78	0.98	0.02
651.00	505.15	0.78	0.98	0.02
732.78	567.30	0.77	0.98	0.02

Source : Survey Result

other activity output decreases overhead cost by 0.13 percent. This would tend to support the importance of multifunction cooperatives.

In summary, s suggest that volume of service is important in capturing scale economies by cooperatives. This implies that smallholders are best served by forming a cooperative or some producer group to enjoy scale economies.

CHAPTER VI

COOPERATIVE SMALLHOLDER PRODUCTION, INCOME, AND EXPENDITURE

Ainabkoi Farmers Cooperative

Ainabkoi Farmers Cooperative is one of the largest dairy cooperatives in Uasin Gishu district located in Ainabkoi location which is part of the settlement scheme for smallholders in the district. It is composed of four settlement groups. The first group was settled in 1962. After the last group was moved into the settlement scheme in 1966 there was a total of 372 households. The farmers who were given the chance to settle in the Ainabkoi location already had a farm at another location and were well qualified farmers.

The land was surveyed and graded into four types according to soil fertility and productivity. Plots were demarcated into different sizes, with the size of a plot depending on the proportion of arable land. To ensure more equitable distribution of land, the plots with proportionally less arable land were increased in size to compensate for lower soil fertility.

The grades one and two areas were planned for mixed farming with more emphasis on crops than livestock while grades three and four were planned for livestock activity, especially dairy. However, at the time of the survey, which was about twenty-eight years later, all farmers were doing mixed farming with emphasis on dairy and maize.

Open grazing is practiced in the Ainabkoi location. Out of a total area of about 25,000 acres, only 1,000 acres are used for crop and garden vegetable production. About 180 acres of land are not accessible to animals and are used for growing wattle trees. The remaining 23,820 acres are used for open grazing.

The area has potential for growing wheat, maize, pyrethrum, vegetables, and dairy, all produced at a small scale level. Wheat and pyrethrum are cash crops. There is some maize-bean intercropping usually for domestic consumption. Dairy production is for both subsistence and the fresh milk market. Dairy is the dominant activity with every household participating. Labor is used to graze the cattle in the common field, to cut napier grass grown by the household, and to milk. Usually one or two people are employed on a permanent basis depending on the number of dairy animals in the household. Morning milk is delivered to the cooperative and evening milk is usually consumed by the family and sold to non-farming households. Consequently, the KCC established a cooling plant in the location to process the large volume of milk produced by the farmers.

The Ainabkoi Farmers Cooperative Society Limited was established with the settlement scheme in 1962 and was confirmed under the Cooperative Society Act of 1966. The objective of the Ainabkoi Farmers Cooperative Society is to promote the economic interest of the members. The by-laws specify the following responsibilities and obligations:

a) to arrange cooperative marketing, processing, grading, packing, transport and all such activities as may be necessary for the most profitable disposal of the produce of members,

b) to promote good farming practices in accordance with the advice of the concerned government body,

c) to provide measures to control pests and diseases of crops and livestock, and

d) to encourage savings by accepting deposits and to provide other banking services when approved by the Commission for Cooperative Development (Ainabkoi Farmers Cooperative Society Limited By-law).

The source of income for the cooperative is the commission it charges on produce or goods sold or bought through the cooperative and charges on other services rendered. The level of commission charged by the cooperative is decided by the general meeting of the members. The by-laws bind all the members to market their produce through the cooperative and each member shall buy his or her agricultural requirement through the cooperative if the cooperative is committed to supply.

The cooperative's by-laws were set by the first group of settlers in the scheme and revised in 1979. The main activities of the cooperative at the time of the survey was collecting, transporting, and selling of milk and pyrethrum and weekly animal dip service. The cooperative has a store for the sale of agricultural inputs but had limited items at the time of the survey. The cooperative administration was currently negotiating with input suppliers for future sales and financing.

Data Collection

Data on input use and output for the financial year 1991[1] was collected for the major activities of both the cooperative and the member households. There were 224 active households using the facilities of the cooperative.

---

1 Data for 1991 were used because it was the last complete fiscal year.

Households were classified for the sample as large and small producers based on the monthly average milk they delivered to the cooperative. Milk delivery was used as the smallholder size classification because the services rendered by the cooperative depended on the amount of milk members delivered to the cooperative. Amount of credit provided to members was assessed on their level of income thus giving a basis for deducting loan repayments from sales receipts. Fifty households were selected randomly for the survey (approximately 22 percent of the total number of households). On the basis of the size classification used above, 54 percent were small producers[2] and 46 percent were large producers[3]. The same ratio was used to determine the sample of fifty households. In the sample, thirty households were classified small producers and twenty were classified large producers.

There was a pre-test of the questionnaire and revisions were made. Single visit survey was used with some revisits for clarification. Interviewing went from January 6 to January 25, 1992 and was completed with assistance from the agricultural extension officers of the location and some staff members of the cooperative office.

Farmers were not familiar in keeping records and most of the responses were on a recall basis. However, because the survey was undertaken just after harvest, the output figures were easily recalled. The most difficult was the valuation of assets. Asset valuation was based on net income anticipated from service the asset would give or the income if sold. Assets were grouped into four major categories: land, equipment and machinery related to agricultural production, livestock inventory, and other assets (including housing and

---

2 Small producer is synonymous to small producer of milk.

3 Large producer is synonymous to large producer of milk.

consumer durables). The value of the different groups of assets were brought together to estimate the total capital (investment) used in the business. Land is valued at the official rent, which at the time was Ksh. 600 per annum per acre.

Equipment and machineries were valued at cost and depreciated to its present condition. A straight line depreciation was used to determine the present value of the machinery.

The sample average wage per worker ranged between Ksh 25-30 per day, and a day was taken to be eight man hours. Wages were imputed for family labor to show opportunity cost. Because all land in production was owned, it was imputed the market rent of Ksh 600 per year per acre. Outputs were valued at market prices. Livestock were valued at prices they would probably bring in the neighborhood. Other assets (including housing) were valued at replacement cost (Hopkins and Heady, 1976).

Household expenditures were composed of processed food, clothing, education, health payments, nonfood consumption, transport, depreciation and maintenance, and household labor. The survey results show that 32-35 percent of the total expenditure goes to finance education and tuition. The least expenditure was for entertainment (detail is given in appendix B-20 and B-21). The average household expenditure was estimated at 2,400 Ksh per month per household for small producers which is 28,800 Ksh per annum for the survey year. Large producer households had an estimated expenditure of 3,200 Ksh per month per household which is 38,400 Ksh per annum.

Asset Holdings

Asset holdings were divided into two major parts: land and other assets. Each household has its own plot of land. Rented land is a rare situation.

Settlers were selected farmers from nearby districts and had previous farming experience. Ownership of a parcel is not limited only to the Ainabkoi location. Ownership of other parcels of land were usually identified by respondents. The land owners generally had houses on each parcel. There was clear evidence of income from other parcels but it was not possible to record that production because respondents were not always the owners.

Other assets included livestock, equipment and machinery, and house and durables. Livestock formed 35 percent of the other assets. Livestock sales were an important supplement to farm income and food consumption in the household. Cows and heifers consisted of 70 percent and 15 percent of the total livestock inventory, respectively. The rest was composed of calves, oxen, sheep, and goats. Heifers were usually kept for dairy herd replacement. Calves, oxen, sheep, and goats were sold whenever cash income was required. They were also slaughtered for household consumption and for special occasions and celebration.

Equipment and machinery related to agricultural production composed six percent of the total other assets. The most important farm implement is the hoe which is available in every household. Four members reported having tractors, all of whom were wheat farmers in the northern part of the location.

Houses and durables included water tanks, storage, shades, vehicles, bikes, and radios. They were the major component of the other assets, accounting for about 59 percent of the total. Housing is around 70 percent of the sub category of houses and durables. Little new investment in housing has taken place since the settlement period. Most of the houses and water tanks were built with the establishment of the settlement scheme.

Input Use

There is a wide use of purchased inputs by the farmers. All of the farmers surveyed reported using improved seeds, fertilizers, and herbicides in the production of crops and animal feed and drugs in dairy production. Inputs were bought either in cash or credit if available in the cooperative store. The inputs were usually bought through loans from one of the credit schemes. The cooperative sets the store price by adding a certain percent of margin on the purchase cost to cover the interest rate, indirect taxes, and operating cost. The availability of store items frequently depends on the availability of funds from the credit schemes and the repayment rate of members.

Machinery use is usually limited to land preparation and labor is used for weeding and harvesting. Hired labor is usually available in the Ainabkoi location. The average family size is five. Children above ten years usually helped on the farm after school and during vacation. The landless migrants who came to the scheme for different reasons and remained there are the source of hired labor. Hired labor is usually used in weeding, planting, and harvesting. The daily wage rate tends to increase during peak seasons. However the average wage rate for the survey year was 30 Ksh. Capital was treated as a residual return because of lack of detailed data on capital used in production.

Production Systems

The production systems give an overview of resource allocation and the production strategy. Agriculture is the main activity in the area. Few people are

engaged in non-agricultural activities but the more common businesses are posho mills and small retail shops.

Dairy and crop production are the main agricultural activities. The cropping system includes maize, wheat, and pyrethrum. Survey results show that 84.5 percent of the land is used for grazing, 7.5 percent for maize production, five percent for wheat, two percent for pyrethrum, and less than one percent for vegetable gardens. There are some households growing wattle trees for commercial purposes.

Costs and returns of the different cropping activities are computed on a per acre basis. Costs and returns for dairy are computed on a per cow basis. Land and capital returns are taken as a residual in milk production assuming that the return to land is for the open grazing from the common area.

Returns are computed after some deductions are made on the gross prices of all commodities. Five percent of sales was deducted from all commodities as an agricultural income tax to the central government. Producers of maize and wheat pay an additional two Ksh per bag of 90 kgs that goes to the location. In the case of dairy the additional payment is 17 percent of the KCC price of milk which goes as a commission to the cooperative plus two cents per kilogram of milk which goes directly to KCC. Pyrethrum is the other product handled by the cooperative and members pay 7 percent of the sales price to the cooperative and one percent of the sales price for the location.

Cooperative Service Production

There are 224 household members in the cooperative which is larger than the district average. Its major service to the members is milk collection and transporting to the KCC cooling plant which is not far from the cooperative

office. The collection points are established at a walking distance for a group of households. Members bring their milk to the collection point in the morning starting at 7:00 a.m. The cooperative staff uses tractors and trucks to transport from the collection points to the cooling plant. Delivery to the KCC cooling plant is usually finished by 11:00 a.m. It has one of the lowest transport costs per kilogram of milk compared with other cooperatives. It spends 31 percent of the total cooperative costs on transport.

Dairy accounts for 56 percent of the activity and income of the cooperative. Pyrethrum delivery to the Pyrethrum Board and other activities account for 44 percent of the activity and income of the cooperative. The cooperative had delivered 1,908 thousand kilograms of milk to KCC in 1991. Extrapolating the average cost of the milk activity for 1991 using the long-run average cost function estimated in the last chapter:

$$TC = 10.38 + 0.761\ Q$$

$$AC = \frac{10.38}{Q} + 0.761$$

thus for Q = 1,908 thousand kg.

$$AC = \frac{10.38}{1{,}908} + 0.761 = 0.766$$

and

$$MC = \frac{dTC}{dQ} = 0.761$$

then

$$\varepsilon = \frac{MC}{AC} = \frac{0.761}{0.766} \cong 1$$

and

$$SCE = 1 - \varepsilon \cong 0$$

This result indicates that the cooperative has exhausted most of the scale economies.

Dairy Production

Dairy is the main activity in the Ainabkoi location and is produced by all households. This was the reason to use milk delivered to the cooperative by households in classifying farmers as large (20) and small (30) producers. The farmers in this cooperative have relatively higher milk output than the surrounding area. Costs and returns per cow for large and small producers are given in Table 6. The number of cows per farm was 11.75 for large producers and 7.67 for small producers. Milk is delivered to the KCC through the cooperative and consumed by the household and sometimes sold to local consumers. Yield per cow per year shows that the small producers yield is about 74 percent of the large producers.

The average yield per cow per day is about 5 kgs for large producers and 4 kgs for small producers during the lactation period. All farmers use supplementary feed along with the grazing system. There is a wide range in use of veterinary services, vaccination, and artificial insemination by the farmers. Purchased inputs per cow are higher for the small producer group relative to the large producer group.

Hired labor per cow is slightly higher for the large producers but total labor inputs are significantly greater for the small producers. Gross returns less purchased inputs (including labor) per cow are 61 percent higher for the large

TABLE 6

COSTS AND RETURNS FOR DAIRY PRODUCTION
PER COW, AINABKOI COOPERATIVE, 1991

Item	Price Per unit (Ksh)	Large Producers (Sample of 235 cows) Quantity (Per cow/yr.)	Large Producers (Sample of 235 cows) Value (Ksh)	Small Producers (Sample of 230 cows) Quantity (Per cow/yr.)	Small Producers (Sample of 230 cows) Value (Ksh)
Gross Output (kg)					
Sold to KCC	3.59	1009.26	3623.24	715.64	2569.15
Consumed		545.62	1958.78	439.48	1577.73
Total		1554.88	5582.02	1155.12	4146.88
Purchased Inputs (PI) Ksh					
Feed			686.63		809.09
Medicine and Vacc.			99.46		142.73
Dip			168.00		168.00
Vet. and A.I.			43.11		68.13
Total PI			997.20		1187.95
Factor Inputs (FI)					
Labor(hrs.)					
Family		16.34		57.04	
Hired	3.75	113.29	424.84	98.78	370.42
Total Purchased (FI)			424.85		370.42
Total PI + PFI			1422.05		1558.37
Gross Returns less (PI + PFI)			4159.97		2588.51
Imputed (FI)					
Family labor			61.28		213.90
Gross Farm Profit (Loss)			4098.69		2374.61

Source :Survey Results

producers compared to the small producers and gross farm profit is about 78 percent greater.

Maize Production

Maize is the staple food and is produced by all the farmers in the sample of this survey, and all the farmers in the cooperative. About 48 percent of maize harvested by small producers is for home consumption versus 28 percent for large producers. The remaining output is sold to the National Cereals Producer Board or, more recently, to the private market. Maize is sometimes intercropped with beans. Maize is planted in rows and beans are planted randomly. The costs and returns of maize production are presented in Table 7. Eighty percent of the seed used by the farmers is certified maize varieties. There is wide spread use of commercial fertilizer in the area.

The seeding rate is inversely related to size of farm, 9.32 kgs per acre in the case of large producers and 10.20 kgs by the small producers. Fertilizer use is 13 percent greater by large producers relative to small producers. This is also reflected in that yields are about 16 percent higher for large producers compared to small producers. Fertilizer application is very much related to the financial position of the individual household. The use of herbicides and fungicides in the production of maize was not reported by any of the farmers in the survey.

About 70 percent of the total labor used in maize is hired labor. Hired labor is mostly used for planting, weeding, and harvesting. Almost 59 percent of the family labor used in maize production originates from the small producers.

Wheat Production

Wheat is the principal commercial crop in the area, there is no domestic consumption of wheat. It is produced by the larger producers who usually have

TABLE 7

COSTS AND RETURNS FOR MAIZE PRODUCTION
PER ACRE, AINABKOI COOPERATIVE, 1991

Item	Price per unit (Ksh)	Large Producers (Sample of 69.5 acres) Quantity	Large Producers (Sample of 69.5 acres) Value (Ksh)	Small Producers (Sample of 70.3 acres) Quantity	Small Producers (Sample of 70.3 acres) Value (Ksh)
Gross Output (kg)					
Sold	3.02	1349.60	4075.78	841.79	2542.22
Consumed		530.71	1602.75	774.76	2339.77
Total		1880.31	5678.53	1616.55	4881.99
Purchased Inputs (PI)					
Seed (kgs)	17.00	9.32	158.39	10.20	173.46
Fert.(kgs)	9.40	64.31	604.53	56.55	531.55
Total PI			762.92		705.01
Factor Inputs (FI)					
Labor(hr)					
Family		94.72		135.01	
Hired	3.75	291.28	1092.29	238.21	893.28
Total		386.00		373.22	
Tractor (hrs)					
Own		0.65		0.26	
Hired	400.00	1.09	434.19	1.52	606.66
Total		1.74		2.18	
Total Purchased (FI)			1526.48		1499.95
Total PFI + FI			2289.40		2204.94
Gross Returns less (PI + PFI)			3389.13		2677.04
Imputed (FI)					
Family Labor	3.75	94.72	355.20	135.01	506.29
Tractor hours	400.00	0.65	260.00	0.26	104.00
Land	600.00	1.00	600.00	1.00	600.00
Gross Farm Profit (Loss)			2173.93		1466.76

Source: Survey Results.

their own tractor and other machinery. Costs and returns for wheat are presented in Table 8. The large producers allocate more land to wheat than do the small producers (appendix B-8). Production is concentrated in the northern part of the location where households have better conditions for mechanized production.

There is a substantially higher use of fertilizers and chemicals in wheat production compared with the production of other crops. Large producers tend to use more purchased inputs per acre than do the small producers. The total number of machine hours used per acre is not too different between the large and the small producers but large producers have less hired tractor hours.

The output is sold to the Kenyan Grain Growers Cooperative Union at a fixed price. The area has a potential for wheat production but the availability of machinery is a major constraint.

Pyrethrum Production

Pyrethrum is an international export crop. There is no domestic use either at the household or national level. The raw dry flower is exported to the international market. The fluctuating world market price causes uncertainty in production by farmers. It is produced by approximately 70 percent of the farmers. There is a concentration of production in the eastern and western areas of the location. One of the factors limiting the acreage is the high labor input required in the production. Weeding is done at least four times a year but can be more with high levels of rainfall. Picking is done manually every fortnight.

Yield per acre is not significantly different between the small and the large producers (Table 9). However, the small producers use relatively more

TABLE 8

COSTS AND RETURNS FOR WHEAT PRODUCTION
PER ACRE, AINABKOI COOPERATIVE, 1991

Item	Price per unit	Large Producers (Sample of 61 acres) Quantity	Large Producers (Sample of 61 acres) Value per acre (Ksh)	Small Producers (Sample of 34 acres) Quantity	Small Producers (Sample of 34 acres) Value per acre (Ksh)
Gross Output (kg)					
Sold	6.20	1091.80	6769.16	937.87	5814.79
Purchased Inputs (PI)					
Seeds (kg)	6.60	113.88	751.64	103.65	684.12
Fertilizer (kg)	9.40	84.84	797.46	71.32	670.44
Herbicides(lt)	7.50	22.30	167.21	15.75	118.12
Total PI			1716.31		1472.68
Factor Inputs (FI)					
Labor					
Family		26.88		26.88	
Hired	3.75	13.48	50.55	13.48	50.55
Total		40.36		40.36	
Tractor (hrs)					
Own		1.04		0.46	
Hired	400.00	0.66	263.11	1.17	467.65
Total		1.70		1.63	
Planter and Harvester	400.00		898.36		787.65
Total Purchased (FI)			1212.02		1305.85
Total PI + PFI			2928.33		2778.53
Gross Returns less PI + PFI			3840.83		3036.26
Imputed (FI)					
Family Labor	3.75	26.88	100.80	26.88	100.80
Tractor	400.00	1.04	416.00	0.46	184.00
Land	600.00	1.00	600.00	1.00	600.00
Gross Farm Profit (Loss)			2724.03		2151.46

Source: Survey Results

labor than the large producers and 63 percent of it comes from family labor. The output is sold to the Pyrethrum Board of Kenya at a fixed price based on the pyrethrum content. The average price for the survey year was 36.47 Ksh per kilogram. Gross farm income per acre is higher than the other crops. However, expansion is constrained by the high labor demand and the uncertainty of world market price.

Summary

Input and yield data were compared for maize and wheat from the current study and a study completed in 1988 by the University of Wisconsin for a similar agro-ecological area (Table 10). Results show relatively higher input levels and higher yields per acre for the current study. This may be the result of higher output prices and better access to inputs.

The enterprise budgets for maize and wheat were also compared to a survey done in the Uasin Gishu district for the Policy Analysis Matrix (PAM) by Egerton University. That survey was completed for the 1989-1990 period. The gross returns per acre for maize and wheat were 4,980 Ksh and 5,960 Ksh, respectively, at 1990 prices. The survey completed for this study shows gross returns per acre for maize and wheat of 5278 Ksh and 6425 Ksh, respectively, at 1991 prices. Results appear to be consistent.

Enterprise budgets for dairy, maize, wheat and pyrethrum were used to show resource use and productivity for a sample of large and small producers in Ainabkoi Farmers Cooperative. Gross returns, purchased inputs, factor input (labor, tractor and land) use, and gross farm profit were computed per cow or per crop acre. Gross returns equal yield times output price which was taken as market price and the same for both large and small producers. Purchased

TABLE 9

COSTS AND RETURNS FOR PYRETHRUM PRODUCTION PER ACRE, AINABKOI COOPERATIVE, 1991

Item	Price per unit	Large Producers (Sample of 16.25 acres) Quantity	Value (Ksh)	Small Producers (Sample of 20.75 acres) Quantity	Value (Ksh)
Gross Output (kg)					
Sold	36.47	265.85	9695.55	258.51	9427.86
Purchased Inputs (PI)					
Seedlings			667.69		597.59
Fert.(kgs)	9.40	60.71	570.65	139.16	1308.14
Total PI			1238.34		1905.73
Factor Inputs (FI)					
Labor(hr)					
Family		386.46		432.00	
Hired	3.75	268.96	1008.60	258.06	967.71
Total		655.42		690.66	
Tractor (hrs)					
Own		0.49		0.45	
Hired	400.00	0.73	292.00	0.71	284.00
Total		1.22		1.16	
Total Purchased (FI)			1300.60		1251.71
Total PI + PFI			2538.94		3157.44
Gross Returns					
Less PI + PFI			7156.61		6270.42
Imputed(FI)					
Family Labor (hr)	3.75	386.46	1449.22	432.00	1620.00
Tractor (hrs)	400.00	0.49	196.00	0.45	180.00
Land	600.00	1.00	600.00	1.00	600.00
Gross Farm Profit (Loss)			4911.39		3870.42

Source: Survey Results

TABLE 10

COMPARISONS OF INPUT AND YIELD DATA FOR MAIZE AND WHEAT, NJORO AND AINABKOI AREAS, KENYA

	1988[1]		Current Study, 1991	
	Maize	Wheat	Maize	Wheat
Seed (kg)	8.39	65.03	10.20	110.00
Fert.(kg)	22.76	13.90	28.43	80.65
Chemicals(ksh)	46.83		42.72	
Labor (hrs)	300.50	40.36	379.57	40.36
Tractor(hrs)	266.49	540.42	560.00	676.08
Yield/acre (kg)	1102.00	967.63	1747.67	1047.7

1 Blarel et al. (1989).

inputs included feed, seed, medicines, fertilizer, and chemicals. Factor inputs included family and hired labor, tractor and machinery hour use (owned and hired), and land. Family labor and owned tractor and machinery time were imputed market values and summed with purchased factor input use plus an imputed land rent to estimate total factor costs. Gross farm profit was calculated as the difference between gross returns and the total cost of purchased inputs and factor costs. Thus gross farm profits is a measurement of the returns to remaining physical capital inputs (including the open grazing area), and human capital represented by management and other assets of the producers.

A summary of total gross returns, purchased inputs, factor input costs, and gross profits per farm for large and small producers is given in Table 11. On average, large producers had 11.75 cows, 3.475 acres of maize, 3.05 acres of wheat, and 0.8125 acres of pyrethrum. Gross returns for the activities equalled Ksh 113,846 and gross profits equalled Ksh 68,013. Small producers on average had 7.67 cows, 2.343 acres of maize, 1.133 acres of wheat, and 0.692 acres of pyrethrum for a total gross return of Ksh 56,358 and total gross profits of Ksh 26,247. Small producers thus had 34 percent fewer dairy cows, 43 percent fewer crop acres, 50 percent less gross returns, and 61 percent less gross profits per farm compared to large producers.

Dairy represents 71 percent of total gross profits for large producers and 67 percent for small producers. These results show the importance of the dairy cooperative for the Ainabkoi settlement scheme. Results from Table 6 show that small producers on average have 74 percent of the physical (yield) productivity per cow of large producers and 56 percent of the gross profit per cow of large producers.

Maize represents 11 percent of total gross profits for large producers and 13 percent for small producers. Because maize represents the basic food commodity it is expected to be of more importance to small producers who are closer to subsistence levels of production compared to large producers. However, large producers on average have 48 percent more acres of maize compared to small producers, have a 16 percent higher yield per acre, and a 84 percent higher gross profit per acre.

TABLE 11

SUMMARY OF GROSS RETURNS, PURCHASED INPUTS, FACTOR COSTS, AND GROSS PROFITS PER FARM BY ACTIVITY AND TOTAL FOR LARGE AND SMALL PRODUCERS IN AINABKOI COOPERATIVE, 1991

Item	Dairy	Maize	Wheat	Pyrethrum	Total
		Large producers			
Size	11.75 Cows	3.475 Acres	3.050 Acres	0.8125 Acres	N/A
Gross Returns (Ksh)	65,589	19,733	20,656	7,878	113,846
Purchased Inputs (Ksh)	11,717	2,651	5,235	1,006	20,609
Factor costs					
Labor (Ksh)	5,712	5,030	462	1,997	13,201
Tractor/machine (Ksh)	--	2,412	4,811	397	7,620
Land (Ksh)	--	2,085	1,830	488	4,403
Gross profits (Ksh)	48,160	7,555	8,308	3,990	68,013
		Small Producers			
Size	7.67 Cows	2.343 Acres	1.133 Acres	0.692 Acres	N/A
Gross Returns (Ksh)	31,807	11,439	6,588	6,524	56,358
Purchased Inputs (Ksh)	9,112	1,652	1,669	1,319	13,752
Factor costs					
Labor (Ksh)	4,999	3,279	171	1,791	10,240
Tractor/Machine (Ksh)		1,665	1,631	322	3,618
Land (Ksh)		1,406	680	415	2,501
Gross profit (Ksh)	17,696	3,437	2,437	2,677	26,247

Source: Survey Results and Tables 6 - 9.

Wheat represents a cash crop for producers that is highly mechanized and requires little labor input. Wheat accounts for 12 percent of total gross profits for large producers and 9 percent for small producers. Yields are 16 percent higher and gross profits are 27 percent higher for large producers compared to small producers.

Pyrethrum is a high value crop per acre but also a high labor crop. It represents 10 percent of the total gross profits for small producers but less than 6 percent for large producers. However, large producers on average have 17 percent more acreage than small producers but only a 2.8 percent higher yield than small producers. Gross profit per acre is about 27 percent greater for large producers compared to small producers.

When the settlement scheme and the cooperative were established members were allotted comparable size land plots. However, after about twenty-eight years it is possible to observe a significant difference between the two sample groups of producers. The sample of large producers had larger dairy herds, more crop acres, and higher total gross profits compared to the sample of small producers. The cooperative in handling milk has increased in size to the extent of exhausting virtually all scale economies and has diversified into providing other services including marketing of pyrethrum and supplying inputs.

The information from the enterprise budgets developed above is combined with other data to estimate a Social Accounting Matrix (SAM) for the cooperative and household members in the next chapter. The purpose of the SAM is to better understand the aggregate economic structure of the cooperative unit and to trace the effects of change in the exogenous variables on the cooperative including distribution effects on household income.

CHAPTER VII

SOCIAL ACCOUNTING MATRIX FOR AINABKOI COOPERATIVE

Social Accounting Matrix Methodology and Assumptions

A Social Accounting Matrix (SAM) is a structure for organizing information through which the sequence of production, income, and expenditure can be traced around an economic unit of interest. It is a square matrix divided into sub-matrices or accounts. The basic properties of a SAM are that each transaction is represented in a single entry. Receipts are read along the rows and outlays are read down the columns. The row sum must correspond to the column sum and serves as a control for balancing the whole matrix (World Bank, 1990b). An empirical SAM provides the initial static image of the unit that reveals its economic structure. This initial information forms a base for developing plausible models for further economic analysis of the unit.

SAM was originally developed at a national level usually compiled from national accounting data to capture structure of production and disaggregation of production activities into output level of different industries (Pyatt and Round, 1985). But later it was developed for various levels of analysis down to a village level (Adelman,Taylor and Vogel, 1988, Taye, 1991). These studies identified how it is possible to observe the effect of an external shock at a village and household level.

The household is a basic economic unit because it involves production, consumption, and distribution. If production is involved there is marketing of goods and services which generate income in the household and expenditure of the income. Hence, it is conceptually possible to construct standard accounting for a nation at the household level (Johnson, McKay and Round, 1990). The basic accounting structure is to assemble separate accounts for production, consumption, and accumulation. Exogenous account is also included because the household is not independent of the rest of the economy. These interrelationships are represented in the SAM.

The accounting relationships and equations in a SAM are given in Figure 13 and are expressed by the following equations:

$$N = A_n \hat{y}_n \quad (7.1)$$

(equation showing the transaction between endogenous accounts).

$$L = A_{\ell} \hat{y}_n \quad (7.2)$$

(equation of leakage)

Receipt equations for endogenous accounts

$$y_n = n + X \quad (7.3)$$

$$y_n = A_n y_n + X \quad (7.4)$$

Receipt equations for exogenous accounts

$$y_x = \ell + Ri \quad (7.5)$$

$$y_x = A_{\ell}\, y_n + Ri \quad (7.6)$$

Expenditure equations (columns) of the endogenous account

$$y'_n = (i'A_n + i'A_{\ell})\hat{y} \quad (7.7)$$

if equation 7.8 holds

$$i' = i'A_n + i'A_{\ell} \quad (7.8)$$

Expenditure equations (columns) of the exogenous account

$$y'_x = i'X + i'R \quad (7.9)$$

		Expenditures		
		Endogenous Accounts	Exogenous Accounts	Total
Receipts	Endogenous Accounts	$N = A_n \hat{y}_n$ (7.1)	X	$y_n = n + x$ (7.3) $= A_n y_n + x$ (7.4)
	Exogenous Accounts	$L = A_\ell \hat{y}_n$ (7.2)	R	$y_x = \ell + Ri$ (7.5) $= A_\ell y_n + Ri$ (7.6)
Total		$y_n' = (i'A_n + i'A_\ell)\hat{y}_n$ (7.7) $\therefore i' = i'A_n + i'A_\ell$ (7.8)	$y_x' = i'X + i'R$ (7.9) $\therefore A_\ell y_n - X'i = (R-R')i$ (7.10)	$\lambda_a' y_n = x'i$ (7.11)

Note:

$A_n = N\hat{y}_n^{-1}$ = matrix of average endogenous expenditure propensities

$A_\ell = L\hat{y}_n^{-1}$ = matrix of average propensities to leak

$N_i = n$ = vector of row sums of $N = A_n y_n$

$X_i = x$ = vector of row sums of X

$L_i = \ell$ = vector ofr row sums of $L = A_\ell y_n$

$\lambda_a' = i'A_\ell$ = vector of column sums of A_ℓ, i.e., the vector of aggregate average propensities to leak

N = matrix of SAM transactions between endogenous accounts

X = matrix of injections from exogenous into endogenous accounts

L = matrix of leakages from endogenous into exogenous accounts

R = matrix of SAM transactions between exogenous accounts

Figure 13. Notations and Accounting Balances of a SAM (Adapted from Pyatt and Round, 1985)

if equation 7.10 holds

$$A_{\ell} y_n - x'i = (R-R')i \quad \text{..... (7.10)}$$

$$\lambda' a y_n = x'i \quad \text{..... (7.11)}$$

(aggregate injection to the system equals leakage)

It is possible to develop a SAM multiplier from the given detail. The SAM multiplier takes into account all the interest within each step of the process and linkages among income, expenditure, and production. The matrix of multipliers potentially shows the effect of expansion in one cell of the original SAM on any other cell. The analysis shows how the initial changes in demand affect the production in different sectors, factor demands, and back again to the consumption pattern of the various groups of households. It also shows the distribution of disposable income among households.

The SAM multiplier analysis is based on the assumption of fixed coefficients similar to the I/O model. The I/O model emphasizes the production account and its linkages while the primary purpose of SAM is to show the circular flows of income between production, factors, and institutions. The SAM shows more the interrelationships between the structure of production and income distribution as well as capital flows and transactions with the rest of the economy.

Fixed-price multiplier analysis is used to measure the effect of an injection into the economy on the level of endogenous accounts. Some of the specifications of the fixed price multiplier model as is applied to this work are the following assumptions: the Leontif interindustry technology, no scale effect and both input and output prices fixed hence average consumption is equal to marginal consumption, wages are set so as to clear the labor market, and household consumption pattern is given by linear expenditure system (Miller and Blair, 1985, Pyatt and Round, 1985). SAM, however, has its own

limitations. It is static and takes no account of time to allow changes to take place. Another limitation is linearity and arbitrary categorization of accounts to endogenous and exogenous.

After categorizing the accounts as endogenous and exogenous the general form of the multiplier for impact analysis is given by $Y = (I-A)^{-1} X$ developed from equation 7.4 above, where Y is the vector or columns of endogenous accounts, I is identity matrix, A is matrix of technical coefficients or matrix of marginal propensity to consume, and $(I-A)^{-1}$ is the Leontif inverse to obtain the direct and indirect impacts of X which is a vector of columns or rows of the exogenous account (Pyatt and Round, 1985).

The schematic in Figure 14 represents the SAM developed for the Ainabkoi Cooperative Society. It is composed of four endogenous and one exogenous accounts. The endogenous accounts are the activity account, commodity account, factor account, and institution account. The exogenous account is composed of government, finance, and the rest-of-Kenya sub-matrices.

Activity Account- includes all economic activities by the cooperative and members. The total receipts and total outlays of all activities are recorded in this account. It includes four production activities, food crops (maize and wheat), export crop, dairy, and cooperative service. The row is the total output (entry 1,2), balanced by (entry 1,6). The column is the total outlays (entry 2,1) for intermediate inputs and the factors of production (entry 3,1). The exogenous account includes imported intermediate inputs (entry 5,1).

Commodity Account- depicts the demand and supply of local commodity output. It involves the valuation of output of marketed goods and services as well as non-marketed output and can be disaggregated into different commodities. The commodity account describes the structure of the input and

Expenditure / Receipt	Activity Account (1)	Commodity Account (2)	Factor Account (3)	Institution Account (4)	Exogenus Account (5)	Total Receipts (6)
Activity Account (1)		Make Matrix				Total Output
Commodity Account (2)	Use Matrix			Consumption	Exports	Total Local Commodity Demand
Factor Account (3)	Value Added					Total Factor Payment
Institution Account (4)			Factor Payments	Transfers	Income Inflows	Total Income
Exogenous Account (5)	Indirect Taxes/ Imports		Factor Outflows	Savings/ Imports/ Taxes		Total Outflow
Total (6) Expenditures	Total Outlay	Total Local Commodity Supply	Total Factor Distribution	Total Expenditure	Total Inflow	

Figure 14. Schematic of Ainabkoi Farmers Cooperative and Member Households.

output markets. It is composed of five commodities, maize, wheat, pyrethrum, dairy, and cooperative service. It is a link between demand and supply of goods and services in the cooperative society. The row sum is total local commodity demand and includes intermediate inputs (entry 2,1), institution demand (entry 2,4), and exports (entry 2,5). Total local commodity supply (entry 1,2) is the output of the activity account.

Factor Account- the factor account is disaggregated into the various factors of labor, land, and capital. It is an important component of distributional analysis because it links production to household income. Households are the owners of factors of production and returns from productive activities accrue directly to the households according to their factor endowments. Three factors are identified in the survey: land, labor, and capital. Labor is of two kinds: family and hired. Capital is taken as a residual. The row matrix shows factor payments by the different activities (entry 3,1) and the column matrix shows distribution of factor payments among the different categories of the institution account (entry 4,3). The row matrix represents value added by activity and the column matrix shows distribution of value added to owners of resources by household group. A portion of value added flows out of the region as factor outflows.

Institution Account. Member households and the cooperative represent decision making units in the society. The households are classified as small producers and large producers. Both groups are owners of factors of production from which income is generated and is used for consumption of goods and services. The classification of households by size class is to allow analysis of income distribution. The row accounts show sources of income and include factor payments (entry 4,3), transfers from households (entry 4.4), and transfers from government (entry 4,5).

The column accounts show expenditure by household group and the cooperative. The demand for local output by household group is recorded in (entry 2,4) as consumption from society producers. Expenditure on the consumption of processed food, clothing, education, health, non-food consumption, etc. is expressed in (entry 5,4). Taxes as outflows of income are also recorded in (entry 5,4). Savings is arrived at as a residual from total income and expenditure and included in (entry 5,4). Inter-institution income transfers (entry 4,4) are assumed zero.

The treatment of the institution account involves two main tasks. One is to determine household consumption expenditures and the second is to determine household endowment of resources and compensation for resource use (Gauthier and Kyle, 1990).

Exogenous Account- indicates flows of goods and services into and out of the cooperative society and the corresponding compensating money flows. The row accounts show imports of goods and services and monetary outflows for factor payments, taxes, and savings. The entries are (entry 5,1) by activity account, (entry 5,3) by factor account, and (entry 5,4) by institution account. The column accounts show exports of goods and services from the cooperative society (entry 2,5) and monetary inflows as exogenous sources of income (entry 4,5).

Estimated Social Accounting Matrix for the Ainabkoi Cooperative Society

The purpose is to construct a SAM for the cooperative society as presented in the schematic defined in Figure 14 and discuss the different accounts in detail. The enterprise budgets for the different crops and household

expenditures developed from the household survey were used to estimate the SAM. The cooperative service is taken to be one of the activities and commodities. This allows analysis of the cooperative service as part of the production process. The SAM contains 26 rows and 26 columns. The production activities are seven rows, five rows of commodities, four rows of factors of production, three rows of institutions, and three rows of exogenous account. The detailed SAM is given in appendix B-18. The data used for the SAM are presented in appendix B 14-17. The enterprise budgets were multiplied by the corresponding acres under cultivation to arrive at the activity level output. The estimated number of cows in the cooperative society was used for dairy production.

Activity Account

The activity account shows total receipts and outlays of 18,344,027 Ksh as presented in Table 12. The activity/commodity receipt (row) account is usually referred to as the make matrix. It indicates the output generated by activities from the member households. Large producers produce 55 percent and small producers 37 percent of the total production and the cooperative accounts for the remaining 8 percent of receipts. The distribution shows that 59 percent comes from dairy, 18 percent from maize, 8.6 percent from pyrethrum, 8.5 percent from cooperative services, and 5.8 percent from wheat production.

The expenditure (column) includes commodity account, factor account, and exogenous account with 9.3 percent, 60.7 percent, and 30.0 percent, respectively. The commodity account shows the intermediate inputs mainly of seeds and cooperative services for marketing of pyrethrum and milk. The factor account shows payment by the different activities for the factors of production of

TABLE 12

RECEIPTS AND EXPENDITURES OF THE ACTIVITY ACCOUNT FOR THE AINABKOI COOPERATIVE SAM, 1991 (KENYAN SHILLINGS)

Receipts		Expenditures	
Commodity account		Commodity Account	
SPHHS			
Maize	1,464,597	Maize	21,178
Wheat	261,582	Wheat	24,046
Pyrethrum	810,783	Pyrethrum	104,140
Milk	4,180,056	Cooperative Service	1,560,644
Sub-total	6,717,018	Sub-total	1,710,009
LPHHS		Factor Account	
Maize	1,930,700	Family Labor	830,604
Wheat	805,273	Hired Labor	2,010,890
Pyrethrum	765,937	Land	581,400
Milk	6,564,455	Capital	7,706,546
Sub-total	10,066,365	Sub-total	11,129,439
Cooperative service		Exogenous Account	
SPHHS		Gov't tax	1,968,525
Pyrethrum	56,755	Imports	3,536,054
Milk	548,237	Sub-total	5,504,579
Sub-total	604,992		
LPHHS			
Pyrethrum	53,616		
Milk	902,036		
Sub-total	955,652		
Total Receipts	18,344,027	Total Expenditure	18,344,027

Source: Survey Results

SPHHS is Small Producer Households
LPHHS is Large Producer Households

labor, land, and capital. The exogenous account includes indirect taxes that go to the central and local governments, and value of imported inputs from the rest-of-Kenya. The distribution of imports show that dairy accounts for 67.0 percent including inputs of animal feeds, drugs, and artificial insemination.

The dairy activity is prominent on both the receipt and expenditure side. Small producer households account for 39 percent of the total milk production and large producer households for 61 percent. It is also observed that the factor account is dominant on the expenditure side.

Commodity Account

This account has receipts and expenditures of 18,344,027 Ksh as presented in Table 13. The receipt side is composed of the income from the activity account, the institution account, and the exogenous account with the distribution of 9.3 percent, 6.8 percent, and 83.9 percent, respectively. The commodity/activity account is usually referred to as the use matrix which shows the income generated from the use of intermediate inputs such as seeds and cooperative services. This is an expenditure for the activity account but an income for the commodity account. The institution account indicates the amount of cooperative society consumption by the different households from their own activities. Households are consuming only 6.8 percent of what is produced locally. The major component of receipts is exports which are part of the exogenous account. Maize is sold to the National Cereals Producers Board, wheat to the Kenyan Grain Growers Cooperative Union, and milk to the Kenyan Creameries Cooperative through the local cooperative. Milk is 65.0 percent of exports, maize 18.6 percent, pyrethrum 9.6 percent, and wheat 6.8 percent.

TABLE 13

RECEIPTS AND EXPENDITURES OF THE COMMODITY ACCOUNT FOR THE AINABKOI COOPERATIVE SAM, 1991 (KENYAN SHILLINGS)

Receipts		Expenditures	
Activity Account		Activity Account	
Maize	21,178	SPHHS	
Wheat	24,046	Food Crop	1,726,179
Pyrethrum	104,140	Export Crop	810,783
Cooperative Service		Dairy	4,180,056
Pyrethrum	110,370	Sub-total	6,717,018
Milk	1,450,274	LPHHS	
Sub-total	1,710,009	Food Crop	2,735,973
Institution Account		Export Crop	765,937
SPHHS	566,056	Dairy	6,564,455
LPHHS	438,265	Sub-total	10,066,365
LLHHS	238,302	Cooperative Service	
Sub-total	1,242,623	Sub-total	1,560,644
Exogenous Account			
Regional Exports			
Maize	2,870,221		
Wheat	1,042,809		
Pyrethrum	1,472,580		
Milk	6,850,635		
Sub-total	12,236,245		
Local Exports			
Milk	3,155,150		
Total Receipts	18,344,027	Total Expenditure	18,344,027

Source: Survey Results

SPHHS is Small Producer Households
LPHHS is Large Producer Households
LLHHS is Landless Households

The expenditure side of the commodity account is the activity/commodity or the make matrix. The total output of maize, wheat, pyrethrum, and milk produced by both small and large produces is recorded in this account. The cooperative service rendered to the members is also part of this account. The share of small producers, large producers, and cooperative service to the total output is 36.6 percent, 54.9 percent, and 8.5 percent, respectively. The distribution by activity shows that dairy accounts for 58.6 percent, food crops 24.3 percent, export crops 8.6 percent, and cooperative service 8.5 percent.

The receipt side is dominated by the exogenous account where dairy contributes 65.0 percent of total exports. Expenditure side also shows that dairy is 58.6 percent of the total output.

Factor Account

The factor account shows a receipt and outlay of 11,129,440 Ksh as presented in Table 14. Receipts come from the payment (value added) for the use of labor, land, and capital. The value added by the different activities shows that food crops (maize and wheat) account for 31.4 percent, export crops 10.0 percent, dairy 47.4 percent, and cooperative services 11.2 percent.

The expenditure side shows the payment from factor account that goes out mainly to the institution account which is composed of small producer households, large producer households, and the landless households. The small and large producer households generate income from family labor, land, and capital while the landless get income only from their labor. The distribution shows that 57.9 percent goes to capital, 25.5 percent to labor, and 5.2 percent to land. The remaining 11.4 percent is an expenditure or outflow to the exogenous account. The latter is paid to the rest-of-Kenya as payment for hired

TABLE 14

RECEIPTS AND EXPENDITURES OF THE FACTOR ACCOUNT FOR THE AINABKOI COOPERATIVE SAM, 1991 (KENYAN SHILLINGS)

Receipts		Expenditures	
Activity Account		Institution Account	
Maize		Labor	
Labor	912,018	SPHHS	511,354
Land	384,000	LPHHS	319,250
Capital	1,473,697	LLHHS	2,010,890
Sub-total	2,769,715	Sub-total	2,841,494
Wheat		Land	
Labor	24,821	SPHHS	258,600
Land	98,400	LPHHS	322,800
Capital	598,040	Sub-total	581,400
Sub-total	721,261	Capital	
Pyrethrum		SPHHS	2,006,480
Labor	416,712	LPHHS	4,431,415
Land	99,000	Sub-total	6,437,896
Capital	594,313	Exogenous Account	
Sub-total	1,110,025	ROK	1,268,650
Dairy			
Labor	1,160,208		
Capital	4,119,716		
Sub-total	5,279,924		
Cooperative			
Labor	327,735		
Capital	920,780		
Sub-total	1,248,515		
Total Receipts	11,129,440	Total Expenditure	11,129,440

Source: Survey Results

SPHHS is Small Producer Households
LPHHS is Large Producer Households
LLHHS is Landless Households
ROK is Rest-of-Kenya

machinery by the different activities and interest payment by the cooperative office.

Institution Account

This account refers to the income generated by the different household groups and the way the income is expended. The account involves a receipt and expenditure of 12,340,324 Ksh as presented in Table 15. Receipts are composed of 80 percent from the factor account and 20 percent from the exogenous account. The main source of income for the households is factor payments from production. The factor income distribution is shown in the factor account. The exogenous account is composed of bonus from the government to farmers producing pyrethrum and receipts from land owned by members of the cooperative from outside the scheme.

The expenditure side of the account is absorbed by commodity and exogenous accounts. The commodity account is mainly expenditure for home consumption by producers and the purchase by the landless from the cooperative society. This expenditure accounts for about 10 percent of the total household expenditure. The exogenous account is about 90 percent of the total household expenditure and is composed of imports from the rest-of-Kenya and financial expenditures. The finance account includes interest payments, depreciation, maintenance, and savings and is about 21.1 percent of total expenditure. The other exogenous expenditure is on imports of processed food, non-food consumption, health services, education, etc. from the rest-of-Kenya. Imports account for 68.9 percent of expenditure. There is a heavy reliance of the member households on the rest-of-Kenya for consumption imports which is typical of any small economy.

TABLE 15

RECEIPTS AND EXPENDITURES OF THE INSTITUTION ACCOUNT FOR THE AINABKOI COOPERATIVE SAM, 1991 (KENYAN SHILLINGS)

Receipts		Expenditures	
Factor Account		Commodity Account	
Family Labor	830,604	SPHHS	
Hired Labor	2,010,890	Maize	243,989
Land	581400	Milk	322.066
Capital	6.437.896	Sub-total	566,055
Sub-total	9,860,790	LPHHS	
Exogenous Account		Maize	187,769
Government	484,534	Milk	250.496
ROK		Sub-total	438,265
SPHHS	1,171,800	LPHHS	
LPHHS	823.200	Maize	72,139
Sub-total	1,995,000	Milk	166.163
		Sub-total	238,302
		Exogenous Account	
		Finance	
		SPHHS	257,264
		LPHHS	2.343.818
		Sub-total	2,601,082
		Imports	
		SPHHS	3,374,784
		LPHHS	3,349,248
		LLHHS	1.772.588
		Sub-total	8,496,620
Total Receipts	12,340,324	Total Expenditures	12,340,324

Source: Survey Results

SPHHS is Small Producer Households
LPHHS is Large Producer Households
LLHHS is Landless Households

Exogenous Account

This account has transactions with the activity account, commodity account, factor account, and institution account. It has receipts and expenditures of 21,956,003 Ksh as presented in Table 16. The receipt side shows that 50.5 percent of the income comes from the expenditure by households on imported consumption goods, depreciation, maintenance, and savings. Receipts from the activity account include government tax and imports of purchased inputs from the rest-of-Kenya and accounts for a total of 25.1 percent. About 8 percent is accounted for in the factor account as payment to machinery rent and interest payment to the rest-of-Kenya. A net flow of government receipts and financial receipts flow back out to the rest-of-Kenya as payment for government services and capital formation. These flows account for a total of 18.6 of exogenous receipts.

The expenditures as expressed by the commodity account shows the amount spent by the rest-of-Kenya to import the outputs of the members of the cooperative society. Dairy exports account for 65 percent of the imports by the rest-of-Kenya. Maize, pyrethrum, and wheat account for 18.6 percent, 9.6 percent, and 6.8 percent respectively. Expenditures from the exogenous account to the institution account include bonus to pyrethrum producers from the government and land rent to households in the Ainabkoi scheme by the rest-of-Kenya. The exogenous account has transactions with all the endogenous accounts and form important linkages with the rest of Kenya through imports, exports, government, and finance.

TABLE 16

RECEIPTS AND EXPENDITURES OF THE EXOGENOUS ACCOUNT FOR THE AINABKOI COOPERATIVE SAM, 1991 (KENYAN SHILLINGS)

Receipts		Expenditures	
Activity Account		Commodity Account	
Government Taxes	1,968,525	Maize	2,870,221
ROK	3,536,054	Wheat	1,042,809
Sub-total	5,504,579	Pyrethrum	1,472,580
Factor Account		Milk	10,005,785
Capital	1,268,650	Sub-total	15,391,396
		Institution Account	
Institution Account		Government Bonus	
Finance	2,601,082	SPHHS	249,868
Imports	8,496,620	LPHHS	234,666
Sub-total	11,097,702	Sub-total	484,534
Exogenous Account		ROK	
Government	1,483,991	SPHHS	1,171,800
Finance	2,601,082	LPHHS	823,200
Sub-total	4,085,073	Sub-total	1,995,000
		Exogenous Account	
		Government	1,483,991
		Finance	2,601,082
		Sub-total	4,085,073
Total Receipts	21,956,003	Total Expenditures	21,956,003

Source: Survey Results

SPHHS is Small Producer Households
LPHHS is Large Producer Households
LLHHS is Landless Households
ROK is Rest-of-Kenya

The summary Table 17 shows the interdependence of the endogenous accounts and the exogenous accounts. For the endogenous accounts, there is a limited amount of intermediate inputs from cooperative commodity output and a small amount of consumption from own production. There is significant interdependence between the activity and commodity accounts, the activity and factor accounts, and factor and institution accounts. There is no transfer between the households in the institution account. The activity and institution (households) accounts are dependent on the rest-of-Kenya for imports of consumer items and purchased inputs. The cooperative society is dependent upon export markets and other sources of income outside of the society. This indicates that any change in the exogenous accounts will have major impacts on the performance of the cooperative society.

Direct Income Analysis

Income sources for the members of the cooperative include returns to resources of labor, land, and capital. Resource ownership may be by households in the cooperative or households outside the cooperative. Cooperative households may have sources of income outside the cooperative structure.

Agricultural Income

Gross agricultural income by major activity and resource for the cooperative society is presented in Table 18. Gross capital includes deprecation, interest payments, and returns to owner-operator physical and human capital resources.

TABLE 17

THE AGGREGATE SAM FOR AINABKOI COOPERATIVE,
1991 (KENYAN SHILLINGS)

	Endogenous Accounts					
Expenditure Receipts	Activity	Commodity	Factor	Institution	Exogenous Accounts	Total
Endogenous Accounts Activity		18,344,027				18,344,027
Commodity	1,710,008			1,242,623	15,391,396	18,344,027
Factor	11,129,440					11,129,440
Institution			9,860,790		2,479,534	12,340,324
Exogenous Accounts	5,504,579		1,268,650	11,097,701	4,085,072	21,956,003
Total	18,344,027	18,344,027	11,129,440	12,340,324	21,956,003	82,113,820

TABLE 18

GROSS AGRICULTURAL INCOME BY RESOURCE USE
OF LABOR, LAND, AND CAPITAL, 1991
(KENYAN SHILLINGS)

Activity	Labor	Percent	Land	Percent	Capital	Percent	Total Income	Percent
Maize	912,018	32	384,000	66	1,473,697	19	2,769,714	25
(%)	(33)		(14)		(53)		(100)	
Wheat	24,821	1	98,400	17	598,040	8	721,261	6
(%)	(3)		(14)		(83)		(100)	
Pyrethrum	416,712	15	99,000	17	594,313	8	1,110,025	10
(%)	(38)		(9)		(54)		(100)	
Dairy	1,160,208	41			4,119,716	53	5,279,924	47
(%)	(22)				(78)		(100)	
Cooperative	327,735	12			920,780	12	1,248,515	11
(%)	(26)				(74)		(100)	
Total	2,841,493	100	581,400	100	7,706,546	100	11,129,439	100
(%)	(26)		(5)		(69)		(100)	

Source: Survey Results

The maize activity accounts for 25 percent of the total agricultural income, wheat 6 percent, pyrethrum 10 percent, dairy 47 percent, and cooperative services 11 percent. Factor shares are shown as the percentage of income by resource for each activity. In the production of maize, factor shares are 0.33 for labor, 0.14 for land, and 0.53 for capital. Dairy has factor shares of 0.22 for labor and 0.78 for capital. Pyrethrum has factor shares of 0.38 for labor, 0.09 for land, and 0.54 for capital.

Labor income accounts for about 26 percent of the total agricultural income, land 5 percent, and capital 69 percent. Labor is composed of family

and hired labor. The family labor is imputed at the market wage rate. The hired labor which is from the landless households accounts for about 70 percent of the total labor compensation. Labor use by activity shows that dairy activity generates 41 percent of the labor income, maize 32 percent, pyrethrum 15 percent, cooperative service 12 percent, and wheat accounts for only one percent. Wheat does not use a significant amount of labor because it is highly mechanized.

Land income is computed using an imputed land rent per acre. Because this was a settlement scheme, there was a relatively equal distribution of land resources among the cooperative members. Most of the land, however, is used for open grazing. In the dairy enterprise budget, grazing land is considered as a return to capital. This underestimates the compensation to land in the settlement scheme and overestimates the compensation to capital in accounting for total agricultural income.

Gross capital income has been reduced for machinery rental but includes interest payments, depreciation, and returns to owner-operator physical capital and management resources. The gross capital income is computed as a residual. Capital by activity shows that 53 percent is generated by dairy, 19 percent by maize, 8 percent by pyrethrum, 8 percent by wheat, and 12 percent by cooperative services. Despite mechanization, wheat shows a relatively low capital income. This is because only 10 percent of the farmers are producing wheat. However, wheat shows the highest factor share for gross capital.

Distribution of agricultural income by producer group is presented in Table 19. This shows the share of income from labor, land, and capital generated by producer group. About 38 percent of the total gross farm income

TABLE 19

AGRICULTURAL INCOME GENERATED BY SMALL AND LARGE PRODUCERS, 1991

Source	Small Producers		Large Producers		Total	
	Ksh	Percent	Ksh	Percent	Ksh	Percent
Labor	1,238,234	33	1,275,524	21	2,513,759	26
Land	258,600	7	290,769	5	549,369.	6
Capital	2,232,596	60	4,553,170	74	6,785,765	69
Total	3,729,430	100	6,119,462	100	9,848,893	100
(%)	(38)		(62)		(100)	

Source: Survey Results

is generated by the small producer households and 62 percent by the large producer households. The distribution of the use of factors by each producer group shows that small producers have factor shares of 0.33 for labor, 0.07 for land, and 0.60 for capital. The large producer group has factor shares of 0.21 for labor, 0.05 for land, and 0.74 for capital. This shows clearly that small producers use more labor and land but less capital compared to large producers.

The distribution of labor income in Table 20 shows that small producers generate 511,354 Ksh of family labor and 726,880 Ksh of hired labor. Large producers use 319,250 Ksh of family labor and 956,274 Ksh of hired labor. The ratio of family labor to hired labor is 1 to 1.42 for small producers while this ratio for large producers is 1 to 3. The small producers use significantly more family

TABLE 20

DISTRIBUTION OF LABOR INCOME BY SMALL AND LARGE PRODUCERS AND BY ACTIVITY FOR AINABKOI COOPERATIVE, 1991 (KENYAN SHILLINGS)

Activity	Small Producers			Large Producers			Overall
	Family	Hired	Total	Family	Hired	Total	Total
Maize	151,887	267,984	419,871	120,768	371,379	492,147	912,018
Wheat	4,536	2,275	6,811	11,995	6,015	18,010	24,821
Pyrethrum	139,320	83,223	222,543	114,489	79,680	194,169	416,712
Dairy	215,611	373,398	589,009	71,998	499,200	571,198	1,160,209
Total	511,354	726,880	1,238,234	319,250	956,274	1,275,524	2,513,759

Source: Survey Results

labor to hired labor in dairy production relative to large producers. The ratios of family labor to hired labor in maize and pyrethrum production are more similar for small and large producers.

Land use distribution is directly related to land income (Table 21). Maize generates 70 percent and 63 percent of the agricultural land income for the small and large producers, respectively. The land income generated by wheat and pyrethrum shows a reverse relationship between small and large producers. The small producers allocate 20 percent of their land to pyrethrum which is labor intensive and 10 percent to wheat. The large producers allocate 22 percent to wheat and 15 percent to pyrethrum.

The distribution of capital income by producer group shows that 67 percent of the total agricultural income from capital is generated by large

TABLE 21

DISTRIBUTION OF LAND INCOME BY SMALL AND LARGE PRODUCERS AND BY ACTIVITY FOR AINABKOI COOPERATIVE, 1991

Activity	Small Producers		Large Producers		Total
	Ksh	Percent	Ksh	Percent	Income
Maize	180,000	70	204,000	63	384,000
Wheat	27,000	10	71,400	22	98,400
Pyrethrum	51,600	20	47,400	15	99,000
Total	258,600	100	322,800	100	581,400

Source: Survey Results

producers while the remaining 33 percent comes from small producers (Table 22). For small producers about 55 percent of the capital income comes from dairy and 27 percent from maize. Pyrethrum and wheat account for the remaining 18 percent. For large producers, dairy accounts for 64 percent of capital income and maize 19 percent. The remaining 17 percent is from wheat and pyrethrum. The distribution between returns to physical capital and human resource capital (management) was not made because of lack of data.

TABLE 22

DISTRIBUTION OF CAPITAL INCOME BY SMALL AND LARGE PRODUCERS AND BY ACTIVITY FOR AINABKOI COOPERATIVE, 1991

Activity	Small Producers		Large Producers		Total
	Ksh	Percent	Ksh	Percent	Income
Maize	598,311	27	875,386	19	1,473,697
Wheat	143,110	6	454,930	10	598,040
Pyrethrum	267,345	12	326,967	7	594,312
Dairy	1,223,829	55	2,895,887	64	4,119,716
Total	2,232,596	100	4,553,170	100	6,785,765

Source: Survey Results

Farm Family Income

Farm family income consists of Ainabkoi location farm income and off-farm income. As presented in Table 23 small producer households generate 68 percent of their income on-farm in the Ainabkoi scheme and 32 percent off-farm. Of farm income labor income is about 12 percent, returns to land is about 6 percent, and gross capital income is about 50 percent. Other sources of income include government bonus for pyrethrum production (6 percent) and income from farming operations in other locations (26 percent).

TABLE 23

FARM FAMILY INCOME OF SMALL PRODUCERS, LARGE PRODUCERS, AND LANDLESS, AINABKOI COOPERATIVE, 1991 (KENYAN SHILLINGS)

Source	Small Producer Households		Large Producer Households		Landless Households
	Ksh	Percent	Ksh	Percent	Ksh
Ainabkoi Settlement Scheme					
Labor	511,354	12	319,250	5	1,683,154
Land	258,600	6	290,769	5	--
Capital	2,232,596	50	4,553,170	73	--
Other Sources					
Government	249,868	6	234,666	4	--
Other	1,171,800	26	823,200	13	--
Total	4,424,218	100	6,221,055	100	1,683,154
	Income Per Household[a]				
Ainabkoi Settlement Scheme					
Labor	4,058	12	3,257	5	
Land	2,052	6	2,967	5	
Capital	17,719	50	46,461	73	
Other Sources					
Government	1,983	6	2,394	4	
Other	9,300	26	8,400	13	
Total	35,112	100	63,480	100	[b]

Source: Survey Results

[a] There were 126 small producers and 98 large producers.

[b] Total information not available.

For large producers a higher percentage of household income is from the Ainabkoi settlement (83 percent). Other sources of income account for about 17 percent of household income. Labor and land income from Ainabkoi scheme accounts for a total of 10 percent of large producer household income versus 73 percent for gross capital returns. Government bonus is about four percent and income from other farming operations is 13 percent. Income for landless is incomplete. Survey data identified only labor as used on the farms of the small and large producers in the Ainabkoi scheme.

In summary, dairy and maize production are the two important sources of agricultural income for both types of producers. Even though the magnitude is different, capital has the highest factor share of farm family income for both the small and large producers. Land share is comparable while labor share is higher for small producers compared to large producers.

Direct and Indirect Income Analysis Using Fixed Price SAM Multiplier

To analyze the interrelationships among the endogenous and exogenous accounts underlying the Ainabkoi SAM an interdependence coefficient matrix was constructed (appendix B-19). The interdependence coefficients indicate the total change in each endogenous account as a result of a one unit change in an exogenous account. The total change is composed of the direct and indirect change in the row account for each unit change in the column account. The analysis of interdependence is shown by taking an exogenous change in the commodity account, the activity account, and the factor account. The exogenous change for elements of the column accounts are multiplied by the corresponding interdependence coefficients to show the

total effect on the row accounts. For this analysis, only the effects on the factor and institution accounts are identified.

Commodity Account Change

A change in commodity demand is associated with changes in all row accounts as expressed by the column of the interdependence coefficients for the specific commodity. Hence a 1,000 Ksh change in the demand for maize would change the activity account, commodity account itself, factor account, and institution account. The results of applying the associated interdependence coefficients to the 1,000 Ksh change in commodity demand to the factor and institution accounts are given in Table 24.

The direct and indirect change is computed by multiplying the interdependence coefficients of the respective commodity accounts by 1,000. For example, the coefficient for small producer family labor (F1) under the column account for maize (C1) multiplied by 1,000 shows that the associated direct and indirect change in family labor associated with the change in maize demand is 41.71 Ksh. The total factor compensation associated with 1,000 Ksh change in maize demand is 847.47 Ksh.

Wheat has a similar total factor compensation as maize, 838.18 Ksh. The factor distribution, however, shows that wheat has a higher compensation to capital and a lower compensation to labor. Pyrethrum has the highest compensation of 869.78 Ksh and a commodity demand multiplier of 0.87. Dairy has the lowest commodity demand multiplier of 0.63 Ksh for a one Ksh increase in demand for milk. The cooperative service has a multiplier of 0.82 Ksh. However, cooperative service is dependent upon a change in activity output of

TABLE 24

DIRECT AND INDIRECT EFFECTS ON FACTOR AND INSTITUTION ACCOUNTS FOR 1,000 KSH CHANGE IN COMMODITY DEMAND, AINABKOI COOPERATIVE, 1991

Account	Maize	Wheat	Pyrethrum	Dairy	Cooperative Service
Commodity Demand (Ksh)	1,000	1,000	1,000	1,000	1,000
Factor Account (Ksh)					
Small Producers					
Family Labor	41.71	24.62	96.91	21.50	0.60
Land	53.87	31.38	36.78	1.07	0.40
Capital	198.63	117.56	193.42	121.30	3.60
Sub-total	294.21	173.56	327.11	143.87	4.60
Large Producers					
Family Labor	29.19	38.11	79.01	7.48	0.30
Land	59.85	78.43	34.13	1.19	0.40
Capital	302.52	391.07	244.69	283.70	7.00
Sub-total	391.56	507.61	357.83	292.37	7.70
Hired Labor	157.81	153.41	136.70	116.01	213.20
Cooperative Capital	3.90	3.60	48.14	82.13	591.45
Total	847.47	838.18	869.78	634.38	816.95
Commodity Demand Multiplier	0.85	0.84	0.87	0.63	0.82
Institution Account					
Small Producer HHS	274.10	161.65	307.54	131.59	4.34
Large Producer HHS	383.47	497.15	351.29	284.79	7.83
Landless HHS	157.80	153.41	136.70	116.01	213.20
Total	815.37	812.21	795.53	532.39	225.37
Commodity Demand Multiplier	0.82	0.81	0.80	0.53	0.23

Source: Survey Results

dairy and pyrethrum. The highest share of factor return accrues to labor and capital, and to pyrethrum among the commodities.

The compensation for each factor is different for the different commodities. Capital has the highest compensation in all commodities with the average of 64 percent of the total factor return. Pyrethrum has the highest family labor compensation, while hired labor has higher compensation than family labor in the other commodities. Land receives the highest compensation for a change in maize demand which is the result of strong interdependence of the institution account (household demand) with commodity demand. A significant amount of maize production is for household consumption.

The commodity demand multiplier of the institution account shows the direct and indirect change in income of the different household groups. The commodity demand multiplier is not significantly different among the different crops. Maize has a multiplier of 0.82, wheat 0.81, and pyrethrum 0.80. Dairy has a commodity multiplier of 0.53. The large producer households have the highest income effect from all the commodities. Their income effect is approximately 65 percent higher than for the small producer households. The landless households, who are the major source of labor, have the highest income effect from the cooperative service.

The change in the marginal demand of the cooperative service has higher impact on large producer households than small producer households. This is the result of the interdependence of the cooperative service with dairy and pyrethrum production. The cooperative service multiplier is 0.23, that is one Ksh change in demand for the cooperative service is associated with an income change of 0.23 Ksh. Of this income 2 percent is associated with small producers households, 3 percent with large producer households, and 95 percent with landless households.

The relative size of the institution account changes mean little because adjustment has not been made for the difference in magnitude of total output in the cooperative society between small and large producer households. From Table 12 it is indicated that large producers generate 64 percent more agricultural income in the Ainabkoi cooperative society than the small producers and from Table 16 it shows that large producers receive 74 percent more of the agricultural income from the society than small producers. To focus on the effects from a common unit of change the next section deals with a unit change in an activity such as an acre of food crops, an acre of export crops, and a dairy cow.

Activity Account Change

The direct and indirect effects of the marginal unit in the activity account on factor returns and household incomes are presented in Table 25. The total effects are presented by activity for each of the producing groups. For example, small producers producing food crops have a direct revenue of 5,348 Ksh per acre. The direct and indirect effects in the factor account include 502.18 Ksh return to own family labor, 655.56 Ksh return to own land, and 2,386.53 Ksh return to own capital. In addition, there are indirect effects with resources of large producers that yield a total return of 198.46 Ksh. Total returns to hired labor resources equal 915.74 Ksh and indirect effects on cooperative resources equal 26.83 Ksh.

With respect to the institution account, a unit change in the food crop activity of the small producers is associated with a change in small producer household income of 3,302.65 Ksh, change in large producer household

TABLE 25

DIRECT AND INDIRECT EFFECTS ON FACTOR AND INSTITUTION ACCOUNTS FOR A UNIT CHANGE IN THE ACTIVITY ACCOUNT BY PRODUCER GROUPS, AINABKOI COOPERATIVE, 1991

	Small Producers			Large Producers		
Account	Food Crop	Export Crop	Dairy	Food Crop	Export Crop	Dairy
Revenue/Acre or Cow (Ksh)	5348.00	9427.86	4147.00	6223.83	9695.50	5582.00
Unit (acre or cow)	1	1	1	1	1	1
Factor Account (Ksh)						
Small Producers						
Family Labor	502.18	1701.73	216.89	13.13	81.54	7.20
Land	655.56	640.34	5.14	10.89	37.13	5.34
Capital	2386.55	3347.74	1249.67	67.09	215.97	37.12
Sub-total	3544.29	5689.81	1471.70	91.12	334.64	49.66
Large Producers						
Family Labor	10.31	60.44	3.77	310.32	1511.20	65.14
Land	16.69	40.73	5.74	640.36	636.80	5.94
Capital	171.46	381.45	67.97	3159.78	4468.46	2533.78
Sub-total	198.46	482.62	77.48	4110.46	6616.46	2604.86
Hired Labor	915.74	1295.48	515.64	918.76	1318.10	618.02
Cooperative Capital	26.83	458.54	332.78	19.65	461.67	465.15
Total	4685.312	7926.45	2397.61	5139.99	8730.88	3737.70
Institution Account						
Small Producer HHS	3302.65	5351.06	1349.06	84.40	131.47	45.97
Large Producer HHS	193.88	472.43	75.64	4025.95	6271.63	2537.13
Landless HHS	915.74	1295.48	515.64	918.76	1431.25	618.02
Total	4412.27	7118.98	1940.34	5029.10	7834.35	3201.12

Source: Survey Results

HHS - households

income of 193.88 Ksh, and a change in landless household income of 914.74 Ksh. Total institution account changes by 4,412.27 Ksh.

A unit change in the export crop activity of small producers has a total income effect on small producer household income equal to 5,351.06 Ksh or

about 62 percent higher than the unit change in food crop activity. A unit change (one cow) in the dairy activity for small producers has a total income change for small producer households of 1,349.06 Ksh.

Because of higher yields and subsequent higher returns for the large producer activities, the total factor returns and total income effects are higher for each of the large producer activities compared to the small producer activities. For example, a unit change (one cow) in the large producer dairy activity has a total (direct plus indirect) factor income change of 2,604.86 Ksh compared to 1,471.70 Ksh for a unit change in the small producer dairy activity. Similarly, a unit change in the large producer dairy activity has a total institution account income change of 3,201.12 Ksh compared to 1,940.34 Ksh for the small producer dairy activity.

For the crop activities, landless households benefit most from a unit change in the export crop of large producers (1,431.25 Ksh). A unit change in food crop activity for either large or small producers has similar total effects or incomes of the landless. However, a unit change in dairy activity of large producers has 20 percent more total income effect on landless household income compared to a unit change in dairy activity of small producers.

Factor Account Change

Labor is employed in all activities in Ainabkoi. The direct and indirect effects of employing the marginal 100 hours of labor for the various households are presented in Table 26. The wage rate per hour is given in the first row with value for 100 hours of labor in the second row. The wage rate is the same for family labor and hired labor.

The direct and indirect effect can be interpreted from Table 26. The coefficients from the interdependence matrix (appendix B-19) are used to compute the values in the table. The coefficients are rows I1, I2, and I3 under columns F1, F4, and F7. The employment of 100 hours of small producer family labor generates a total income of about 401 Ksh. Of this amount 382 Ksh accrues to the small producer households, 15 Ksh to large producer households, and 4 Ksh to landless households. Similarly, the employment of 100 hours of large producer family labor generates 382 Ksh of income for the same households, about 4 Ksh of income for the small producer households, and about 3 Ksh of income for the landless households. One hundred hours of employment from landless households generates income of 379 Ksh for the same households, 8 Ksh of income for the small producer households, and 11 Ksh of income for the large producer households. A wage income multiplier can be computed by dividing the total household income effect by the direct income effect from the 100 hours of wage income. The wage income multipliers range from 1.04 for large producer households to 1.07 for small producer households.

Because of the interdependence between household income and commodity consumption within the cooperative society, the wage income multiplier is greater than one. This can be seen by the indirect effects of wage income change and the activity account (Table 26). If the small producer family labor increase by 100 hours it will generate additional 23.35 Ksh (0.06226 x 375) of food crop activity. A similar indirect effect on dairy activity occurs and is equal to 30.75 Ksh (0.08201 x 375). A similar indirect effect occurs with the wage income increase for large producer family labor income and landless labor income. The results are based upon the marginal (equal to average)

TABLE 26

DIRECT AND INDIRECT EFFECTS ON THE INSTITUTION ACCOUNT FOR THE MARGINAL ONE HUNDRED HOURS OF LABOR BY PRODUCING GROUPS, AINABKOI COOPERATIVE, 1991

	SPHHS Family Labor	LPHHS Family Labor	LLHHS Hired Labor
Wage Rate per Hour (Ksh)	3.75	3.75	3.75
100 Hours of Labor (Ksh)	375.00	375.00	375.00
Institution Account			
Small Producers HHs	382.50	3.75	7.50
Large Producers HHs	15.00	382.50	11.25
Landless HHs	3.75	3.37	378.75
Total Household Income	401.25	389.63	397.50
Wage Income Multiplier	1.07	1.04	1.06
Activity Account			
Food Crops	23.35	12.31	16.48
Dairy	30.75	16.37	32.62

Source: Survey Results

propensities to consume for maize and milk products per unit increase in income.

The importance of dairy activity in terms of individual household incomes and in the cooperative society economy shows the importance of the dairy cooperative. The cooperative allows more intensive use of resources by members. Furthermore, unlike other private firms they can have control of the cooperative and use it to serve their best interest. Another firm or agency can compete with the cooperative only if it can give the service at a lower cost than the cooperative.

The different accounts of the estimated SAM were used to show total production, resource use, income, and income distribution in the cooperative society economy. Sources of agricultural income were identified by production activity and resource. The farm family income was identified by producer groups and resource ownership. The direct and indirect income analysis showed the association of exogenous changes with endogenous accounts of factor and institution income. Furthermore, the SAM may be used for further modeling and introducing changes in policy as they effect the cooperative economy.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Summary

Problem Statement

Agriculture generates 70 to 80 percent of the employment and 40 percent of GDP in Africa. The majority of those employed in the agricultural sector are smallholder farmers who are the backbone of the economy. In most African countries marketing cooperatives have existed since colonial times to organize smallholder farmers. During the early independence period 1960s and 1970s, cooperatives were used as institutions for implementing government development policies. However, in the later part of the 1980s the emphasis has shifted towards a market oriented development strategy and privatization of government controlled economic units. Smallholder cooperatives must face this change to remain a major institution of rural development.

The contribution of smallholders to total agricultural output has increased from 22 percent in 1963 to 55 percent by 1990 (ROK, Economic Survey of 1965 and 1991). The cooperative movement has been an important instrument for the implementation of government policies and projects. Government policy over the years has been to encourage the development of cooperatives and to give support through training and technical assistance in management and administration services. The government established the Ministry of

Cooperative Development (MCD) to register and approve formation of cooperatives. Other complementing agencies were established to give training, handle credit, and serve as marketing outlets for cooperatives. Government has subsidized much of the development of cooperatives. However, as stated in government Sessional Papers since 1986, cooperatives are expected to function in a more competitive economy and should be able to exploit scale economies.

Objective

The main objective of this study was to review government policies regarding the agricultural cooperative movement and to assess the efficiency of smallholder cooperatives as the country moves to a more competitive economy.

Specific objectives were stated as the following:

(1) To develop a basic analytical framework for analyzing economic efficiency of smallholder cooperatives.

(2) To empirically estimate the analytical framework above for a selected cooperative system in the Rift Valley of Kenya.

(3) To evaluate production systems of the cooperative member households and the overall cooperative society.

Research Questions

(1) Has government intervention assisted in the development and performance of cooperatives?

(2) Do smallholder cooperatives have the potential to maintain and improve their performance under a more competitive economy?

Hypotheses

(1) Government support has assisted smallholder cooperatives to be economically efficient.

(2) Smallholder cooperatives are giving efficient services and thus enhancing the income position of their smallholder members.

Methodology and Data

To achieve the objective and to test the hypotheses ordinary least squares was used to estimate the cost function of dairy cooperatives in the Rift Valley of Kenya which was used to determine scale economies.

Descriptive analysis of the cooperative service of the Ainabkoi Cooperative Society and enterprise budgets of the major commodites produced by the member households were completed. A Social Accounting Matrix (SAM) of the Ainabkoi dariy cooperative society was constructed and included the cooperative services as one of the activities and commodities. The SAM has four endogenous accounts (activity account, commodity account, factor account, and institution account) and one exogenous account which includes the government account, finance account, and rest-of-Kenya account.

The activity account consists of four activities and the commodity account includes five commodities. Cooperative service is included as a service activity in the activity account and as a commodity in the commodity account.

Two sets of survey data were used for the empirical analysis. For the estimation of the cost function 46 dairy cooperatives were surveyed. The source of data were the annual trial balances of the individual cooperatives which included the income and expenditure for handling of milk marketing by

the cooperatives. Total cost was categorized into three major components of overhead cost, transport cost, and other miscellaneous cost. A sample of the trial balances and the data used for estimation are in Appendix A.

The enterprise budgets completed for the different commodities were supplemented with other data and utilized for estimation of the SAM. The detail of the enterprise budget data is included in Appendix B.

In the commodity account the use matrix was composed primarily of seeds used by the different cropping activities. The commodities for household consumption and the amount sold to marketing agencies were estimated from the survey. The difference between the marketed amount and household consumption was assumed to be purchased by the landless and other local consumers. The local consumption was included in the rest-of-Kenya account. The production activities result in the use of labor, land, and capital with returns going into the factor account. Returns to factors owned by member households were imputed using the hired labor wage rate for family labor and the current land rent per acre. Returns to capital were computed as a residual. These returns were payments to households who are the owners of the facotrs in the institution account.

Each account in the SAM was presented as a T-account with receipts and expenditures. Direct income formation was analyzed as agricultural income (returns to labor, land, and capital) and farm family income. A linear expenditure model of the SAM was constructed to identify interdependence among endogenous and exogenous accounts. A matrix of interdependence coefficients was computed based on the linear model. Assumptions of the linear model are fixed prices and unitary expenditure elasticities. The interdependence coefficients represent the total effect (direct, indirect, and

induced) an exogenous change in a column account has on any corresponding endogenous row account.

Empirical Results

The government encouraged the development of smallholder farmers through the establishment of cooperatives and through different programs, especially the settlement schemes which started in 1961 and continued to around the mid 1970s. The number of registered cooperatives in the country of Kenya increased from 1,030 in 1963 to 4,836 in 1990. Membership increased from 35,500 in 1963 to about 2,460,957 by 1990. Cooperatives are composed of both agricultural and non-agricultural activities. Sixty percent of the cooperatives, however, are in agriculture. There are six major kinds of agricultural cooperatives and include coffee, cotton, dairy, pyrethrum, multi-purpose, and land settlement. The share capital of cooperatives increased from 1.1 billion Kenyan Shillings (Ksh) in 1980 to 9.2 billion Ksh in 1990. The largest memberships are in coffee, dairy, and cotton. The contribution of cooperatives to gross farm income for major agricultural commodities equalled about 66 percent in 1990.

The Ministry of Cooperative Development (MCD) was established in 1974. Other government agencies have interlinked with the cooperative movement to create a very complex set of interdependencies. These agencies are directly and indirectly involved in the production and distribution of much of the output of cooperatives. This interdependence has an impact on how cooperatives are functioning.

In the Rift Valley the number of cooperatives increased from 376 in 1979 to 1,450 by 1990. Membership increased from 87,445 in 1980 to 320,432 in

1990. Share capital increased from 195.9 million Ksh in 1980 to 862.2 million Ksh in 1990. Dairy cooperatives increased faster than the other cooperatives, more than doubling from 40 to 83 in the ten-year period.

Estimated Cost Function. Ordinary least squares (OLS) was used with cross section data from cooperatives in the Rift Valley to estimate three functional forms of the total cost function: linear, quadratic, and log-function. The regression results indicate that both the linear and log-functions fit the data well. The corresponding long-run average cost curves have declining unit costs over the range of cooperative services output. Scale economies were estimated for the sample of cooperatives. Scale economies is interpreted as the percent decrease in total cost of handling milk for a one percent increase in volume of milk. For the linear total cost function, low volume cooperatives have higher potential for scale economies than cooperatives at high volume of output. For example, the lowest 50 percent of cooperatives in volume of milk for the sample have estimated scale economies ranging from 0.07 to 0.18. For the 50 percent with the highest volume of milk, scale economies ranged from 0.02 to 0.07.

Transport access and diversification of cooperative services were incorporated into the cost functions. Results indicate that those cooperatives with better road access have about 28.6 percent lower transport costs. Similarly, for each one percent increase in the index of cooperative service diversification there is a 0.13 percent decrease in overhead costs for milk handling services.

Enterprise Budget Analysis. Members of the Ainabkoi Cooperative Society were classified into small and large producers based on volume of milk

produced. Large producers on average had 7.4 acres of land under cultivation compared to 4.1 acres for small producers. Large producers had on average about 11.8 dairy cows with a yield of 5 kilograms of milk per day per cow. Small producers on average had 7.8 dairy cows and a yield of 4 kilograms of milk per cow per day during the lactation period.

Large producers used more purchased inputs and had higher crop yields compared to the small producers. Large producers had 68,013 Ksh gross profits per holding with 70.8 percent accounted for through dairy and 29.2 accounted for through crops. Small producers had 26,247 Ksh gross profits with 67.4 percent accounted for through dairy and 32.6 percent through crops. Gross profits are exclusive of factor costs of labor, land, and tractor/machinery services thus it represents a return to other physical capital and human resource capital including management. The factor shares for labor, land, and tractor/machinery services were 0.52, 0.30, and 0.18, respectively, for large producers and 0.63, 0.22, and 0.15 for small producers. Thus, large producers have higher factor shares for tractor/machinery services and land and lower factor share for labor when compared to small producers. When gross profits (returns to other physical capital and human resource capital) are added to tractor/machinery services, total gross capital share is 0.81 for large producers and 0.70 for small producers.

Enterprise budget data were used to estimate the aggregate agricultural income from the Ainabkoi Cooperative Society. Agricultural income was then combined with household survey data on other sources of income to estimate family income for the small producers (126 households), large producers (98 households), and landless households. This total information (enterprise budgets and household surveys) was used to estimate a Social Accounting

Matrix (SAM) for the Ainabkoi Cooperative Society including the cooperative services.

Gross agricultural income from the Ainabkoi Cooperative scheme was estimated at 11,129,439 Ksh for 1991. Agricultural income by activity shows that 47 percent originated from dairy, 25 percent from maize, 10 percent from pyrethrum, 6 percent from wheat, and 11 percent from cooperative services. Factor shares show that labor accounted for 26 percent, land 5 percent, and capital 69 percent. Labor is composed of family and hired labor. Hired labor was 70 percent total labor returns and hired labor was 30 percent which was allocated to landless households. Distribution of agricultural income by producer group shows that small producers formed 38 percent and large producers formed the remaining 62 percent of the total. In terms of aggregate factor shares, small producers used more labor and land but less capital compared with large producers. The ratio of family labor to hired labor is 1 to 1.42 for small producers as opposed to 1 to 3 for large producers.

The sources of farm family income were returns to resources used on-farm in the Ainabkoi scheme and from off-farm. Small producers generated 68 percent of their income from on-farm and 32 percent from off-farm. The shares show that 12 percent of their income was from labor, 6 percent from land, and 50 percent from capital. Large producers generated 83 percent of their family income from on-farm and 17 percent from off-farm. Of the farm income, 10 percent was from land and labor and 73 percent from capital.

The SAM for the Ainabkoi Cooperative Society was formed by identifying a set of endogenous accounts (activity, commodity, factor, and institution) and a set of exogenous accounts (government, finance, and rest-of-Kenya). In the aggregate, the commodity account shows total receipts of 18,344,027 Ksh of which 16 percent was used within the society as intermediate inputs and

household consumption and 84 percent was sent out of the society. Similarly, aggregate institution income of 12,340,224 Ksh shows that 80 percent was from factor payments originating within the society and 20 percent was from outside-income sources.

In the aggregate, activity account expenditures of 18,344,027 Ksh shows that 9 percent was for intermediate inputs from within the society, 61 percent was for factor payments, and 30 percent was for purchased inputs from outside the society and for government taxes. Factor payments of 11,129,440 Ksh was distributed 89 percent to institutions (households and cooperative) within the society and 11 percent to the exogenous accounts of government, finance, and rest-of-Kenya. Institutional income of 12,340,324 Ksh was distributed 10 percent for commodity purchases from within the society and 90 percent for expenditures to the exogenous accounts of rest-of-Kenya, finance, and government.

Impact Analysis. Interrelationships among the endogenous and exogenous accounts underlying the Ainabkoi SAM were expressed by a set of interdependence coefficients. The interdependence coefficients indicate the total change (direct, indirect, and induced) in each endogenous account as a result of a one unit change in an exogenous account. Impacts of changes in commodity demand, activity output, and institutional income were analyzed. These impacts were analyzed by impacts on households of small and large producers and the landless.

A change in milk commodity demand of 1,000 Ksh has a proportional effect of changing incomes of small producer households by 132 Ksh, large producer households by 285 Ksh, and landless households by 116 Ksh. However, if the dairy activity of small producers changes by one cow, the effect

on incomes of small producer households is 1,349 Ksh, on large producer households 76 Ksh, and landless households 516 Ksh. A change in the dairy activity of large producers of one cow has income effects on large producer households of 2,537 Ksh, small producer households of 46 Ksh, and landless households of 618 Ksh.

A change in off-farm income has small income multiplier effects within the cooperative society from increased consumption of food crops and milk. However, because of stronger linkages of small producers and the landless, the income multipliers for those two groups are larger (1.07 and 1.06, respectively) compared to large producers (1.04).

Conclusions

The increase in number of cooperatives and smallholder output from 1963 to 1990 was significant. Government assistance has had a positive impact on the development of smallholder agricutlure through the development of cooperatives as a major institution for organizing smallholders. The contribution of cooperative development to smallholder producers has proven to be important in the Kenyan economy.

The analytical framework developed and the estimated cost functions have helped to identify the level of efficiency and the existing scale economies of dairy cooperatives. The SAM has proven to be useful to identify the production systems, evaluate resource use, and show income distribution of a cooperative society. The cooperative is central to the cooperative society economy. The level of efficiency achieved by the dairy cooperatives is attributed to the service and assistance given by the government in the development of cooperatives. The observed technical efficiency and scale

economies shows that diary cooperatives have the potential to maintain and improve their performance under competitive market conditions:

Conclusions drawn from the empirical analysis of this study are the following:

1. Formulation of dairy cooperatives has allowed smallholders to benefit from economies of scale in marketing of milk.
2. Transport access and proximity to cooling centers are important factors contributing to cost of dairy cooperatives.
3. Diversification of activities is important for dairy cooperatives to capture additional economies of scale.
4. Smallholder cooperatives have increased access of improved seeds and other purchased inputs by small producers.
5. Dairy cooperatives have allowed smallholders to increase returns to resources through adoption of the more intensive milk production system.

Policy Implications

The major purpose of this study was to evaluate the ability of smallholder producer organizations such as cooperatives in Kenya to adjust as national economies move towards more competitive conditions. Certain policy implications may be drawn from this study.

1. Because of economies of scale in marketing of milk and handling of other activities of smallholders through cooperatives, the fact that governments are reducing subsidies and requiring agricuture to be more market oriented should not limit the apparent advantages of smallholder producer organizations.

2. Where size of cooperative is small in terms of volume of output, government should encourage merging of cooperatives and increased diversication of activities so that smallholders may gain from the additional economies of scale.

Limitations and Further Research

The results and conclusions of this study are limited by the accuracy of the data and the assumptions used. The cost data used to estimate the cost functions were from District Cooperative Union Offices and are subject to accounting errors and errors in the process of transferring data from the accounts of individual cooperatives to those of the Unions.

The household data for production systems was compared with two other studies and appeared to be consistent with results of those studies. However, definition of small and large producers applies only to this study. The cooperative is located in a settlement scheme where all members were allocated almost equal land at the time of establishment and all members were considered smallholders. The distinction of size of producer was made on volume of milk produced rather than size of land holding.

This study concentrated on primary cooperatives. However, primary cooperatives are generally organized into cooperative unions as part of the overall structure of the cooperative movement. Currently cooperative unions are highly centralized and are heavily regulated by government. The function of unions needs to be researched and evaluated for efficiency in handling activities of the primary cooperatives.

This study utilized an analytical framework in which cooperatives were treated as a special type of firm that maximizes returns to members which

implies cost minimization for the optimum output of service. Further work should go further and incorporate the internal organization and decision making of both the cooperative and individual members into the framework of empirical investigation.

BIBLIOGRAPHY

Adelman, I., Taylor, E. J., and Vogel, S. (1988). Life in a Mexican Village, A SAM Perspective. Department of Agriculture and Resource Economics, Berkley University of California.

Alila, Patrick O. (1985). Administration of Cooperatives in Rural Development in Kenya. In F. G. Kiros (Ed.), Challenging Rural Poverty (pp 169-182). Trenton, N. J.: African World Press.

Bailey, J. (1974). The British Cooperative Movement. Westport, Connecticut: Greenwood Press Publisher.

Beatie, B. R. and Taylor, C. R. (1985). The Economics of Production. New York: John Wiley and Sons.

Berry, R. A. and Cline, W. R. (1979). Agrarian Structure and Productivity in Developing Countries. Baltimore: John Hopkins University Press.

Blarel, B., Carter, M. R., Onyango, C., and Wiebe, K. (1989). Economic Constraints to Agricultural Productivity in Njoro Division, Kenya, University of Wisconsin-Madison (unpublished)

Brett, E. A. (1970). Problems of Cooperative Development in Uganda. In R. J. Apthrope (Ed.), Rural Cooperatives and Planned Changes in Africa (P117). UNRISD.

Brett, E. A. (1973). Colonialism and Underdevelopment in East Africa The Political Economy of Change. London: Heinman.

Brown, R. S., Caves, D. W., and Christensen, L. R. (1979). Modelling the Structure of Cost and Production for Multiproduct Firms. Southern Economics Journal, 46, 256-73.

Budiyanti, Rini. (1983). Analysis of Rural Economic Structure for Central Java Using Social Accounting Methodology with Emphasis on Income Distribution Effects Including Women and Landless Groups. M.S. Thesis, Oklahoma State University, Stillwater, Oklahoma.

Christensen, L. R., and Greene, W. (1976). Economies of Scale in U.S. Electric Power Generation. Journal of Political Economics, 84, 655-675.

Cliffe, Lionel. (1970). Traditional Ujaama and Modern Cooperatives in Tanzania. In C. G. Widstrand (Ed.), Cooperative and Rural Development in East Africa, (pp 20-65). Uppsala: Scandinavian Institute of African Studies.

Cohen, J. M. and Isaksaan, N. I. (1988). Food Production Strategy Debates in Revolutionary Ethiopia. World Development, 16,(3), 323-339.

Cowing, T. G., and Holtmann, A. G. (1983). Multiproduct Short-Run Hospital Cost Function Empirical Evidence and Policy Implication from Cross-Section Data. Southern Economics Journal, 49, 637-653.

DANIDA. (1991). Study on Collection Processing and Marketing Milk, Nairobi, Kenya: Ministry of Livestock Development.

DeWilde, J. C. (1967). Experience with Agricultural Development in Tropical Africa, Vol II. The Case Studies IBRD. Baltimore, Maryland:188-218.

Doll, J. P. and Orazem, F. (1984). Production Economics. New York:John Wiley and Sons, Inc.

Douglas, E. J. (1983). Managerial Economics Theory Practice and Problems (2nd ed). New Jersey: Prentice-Hall.

Egerton University. (1990). Agricultural Growth in Kenya: Application of the Policy Analysis Matrix, Working Paper Series No 13. Njoro, Kenya: Research and Extension Division Agricultural Resource Center.

FAO. (1989). The State of Food and Agriculture, World and Regional Reviews Sustainable Development and Natural Resource Management. Rome: FAO.

Forsund, et al. (1980), A Survey of Frontier Production Function and of Their Relationship to Efficiency Measurement. Journal of Econometrics, 13, 5-25.

Garoyan, L. (1983). Development in Theory of Farmers Cooperatives: Discussion. American Journal of Agricultural Economics, 65 (5), 1096-1098.

Gauthier, M. and Kyle, S. (1990). A Social Accounting Matrix for Cameroon. Ithaca, New York: Cornell University.

Greene, W. H. (1980). Maximum Liklihood Estimation of Econometeric Frontier Functions. Journal of Econometrics, 13, 27-55

Gyllstrom, Bojorn. (1990). State Administered Rural Change Agricultural Cooperatives in Kenya. New York: Routledge.

Heady, E. O. (1971). Optimal Size of Farm Under Varying Tenure Forms, Including Renting, Ownership, State, and Collective Structures. American Journal of Agricultural Economics, 53 (1), 17-25.

Hedlund, H. A. (1988). Cooperatives Revisited in Kenya. Uppsala: Scandinavian Institute for African Studies.

Helmberger, P. G., and Hoos, S. (1962). Cooperative Enterprise and Organization Theory. Journal of Farm Economics, XLIV (2), 275-290.

Helmberger, P. G. (1964). Cooperative Enterprise as a Structural Dimension of Farm Markets. Journal of Farm Economics, 46(3), 603-617.

Hopkins, J. A. and O. E. Heady. (1962). Farm Records and Accounting. Ames, Iowa: Iowa State Unviersity Press.

Hyden, Goran. (1973). Efficiency Versus Distribution in East African Cooperatives. A Study in Organization Conflict and Rural Development in East Africa. Nairobi: East African Literature Bureau.

Hyden, Goran. (1980). Cooperatives and the Poor Comparing European and Third World Experience. Rural Development Participation Review, Vol II (1).

International Alliances. (1967). Cooperatives in European Market Economies. New York:Asian Publishing House.

International Labor Organization. (1965). The Role of Cooperatives in the Economic and Social Development of Developing Countries. International Labor Conference Fifth Session, IV(1). Geneva; ILO.

Jaetzold, R. J. and Schmidt, H. (1983). Farm Management Handbook of Kenya, Vol II. Nairobi, Ministry of Agriculture.

Johnson, M., McKay, A. D., and Round, J. I. (1990). Income and Expenditure in a System of Household Accounts: Concept and Estimation. Washington, D.C.:World Bank.

Johnston, J. (1960). Statistical Cost Analysis. New York:McGraw-Hill Book Company, Inc.

Johnston, B. F. and Mellor, J. W. (1961). The Role of Agriculture in Economic Development. American Economic Review, 51, (PT2), 586-593.

Judge, et al. (1980). Theory and Practice of Econometrics. New York:John Wiley and Sons, Inc.

Kennedy, Peter. (1987). A Guide to Econometrics, Massachusetts: MIT Press, Cambridge.

Kujula, Matti. (1975). The Cooperative Movement in Finland, Development of Cooperative Research, University of Helenski.

Lau, L. J. and Yotopolus, P. A. (1971). A Test for Relative Efficiency and Application to Indian Agriculture. American Economic Review, 61, 94-109.

Lele, U. and Christiansen, R. E. (1989). Markets, Marketing Boards and Cooperatives in Africa Issues in Adjustment Policy. MADIA Discussion Paper, 11. Washington, D.C:World Bank.

Lindstad, O. (1990). Cooperative Tools for Development. Paper presented on Donor Support for the Promotion of Rural Cooperative in Developing Countries. World Bank, Washington, D.C., June 16-17.

Lofchine, M. F. (1989). The Policy Factor, Agricultural Performance in Kenya and Tanzania. Boulder & London: Lynne Rienner Publisher, Inc.

Lombard, C. S. (1970). Farming Cooperative Development in Zambia and a Note on Communal Society. In R. J. Apthrope (Ed.), Rural Cooperatives and Planned Changes in Africa (pp221-234). UNRISD..

Long, N. (1970). Cooperative Enterprise and Rural Development in Tanzania. In R. J. Apithorpe (Ed).Rural Cooperative and Planned Changes in Africa (pp290-302). UNRISD.

Maddala, G. S. (1977). Econometrics, New York:McGraw-Hill.

Maurice, S. C. and Smithson, C. W. (1985). Managerial Economics, Homewood, Illinois: Irwin.

Miller, R. E. and Blair, P. D. (1985). Input Output Analysis Foundations and Extensions. New Jersey: Prentice-Hall, Inc.

Ministry of Cooperative Development, Statistics for Cooperative Development in Kenya 1980-1990. Statistics Unit of Ministry of Cooperative Development, Nairobi, Kenya.

Ministry of Cooperative Development. (1983). Statistics for Cooperative in Kenya, Ministry of Cooperative Development, Nairobi.

Nyrere, J. K. (1969). Freedom and Socialism, Nairobi: Oxford University Press.

Nyrere, J. K. (1973). Freedom and Development. Nairobi: Oxford University Press.

Ouma, S. (1980). A History of Cooperative Movement in Kenya. Nairobi: Bookwise Limited.

Pyatt, G. and Round, J. I. (1985). Social Accounting Matrices for Development Planning. In Pyatt and Round (Ed.), Social Accounting Matrices: A Basis for Planning. (pp 52-69). Washington D.C:World Bank.

Pyatt, G. and Round, J. I. (1985). Accounting and Fixed Price Multipliers in SAM Framework. In Pyatt and Round (Ed.), Social Accounting Matrices: A Basis for Planning: (pp 86-205). Washington D.C: World Bank.

Rabo Bank. (1990). The Dutch Experience with Rural Cooperatives and its Applicability to Developing Countries. Paper presented on Donor Support for the Promotion of Rural Cooperative in Developing of Countries, World Bank, Washington D.C. June 16-17.

Republic of Kenya. Annual Report of 1985, 1989, and 1990. Ministry of Cooperative Development Provincial Commissioner Office of the Rift Valley. Nakuru.

_____. Cooperative Society Act of 1966, CAP 490. Nairobi: Government Printers.

_____. Cooperative Rules of 1969, Nairobi: Government Printers.

_____. Development Plan 1965/66-1969/70, Nairobi: Government Printers.

_____. Cooperative Development Policy of Kenya, Sessional Paper No. 8, 1970. Ministry of Cooperative and Social Service, Nairobi: Government Printers.

_____. Plan for Cooperative Development in Kenya with Nordic Assistance 1972-77. Nairobi: Government Printers.

_____. 1975. Cooperative Development Policy for Kenya Sessional Paper No. 14. Nairobi: Government Printers.

_____. Development Plan 1970-74. Nairobi: Government Printers.

_____. Development Plan 1974-78. Nairobi: Government Printers.

_____. Development Plan 1978-82. Nairobi: Government Printers.

_____. Development Plan 1986-90. Nairobi: Government Printers.

_____. Economic Survey of 1965. Central Bureau of Statistics, Ministry of Planning and National Development. Nairobi: Government Printers.

_____. Economic Survey of 1983. Central Bureau of Statistics, Ministry of Planning and National Development. Nairobi: Government Printers.

_____. Economic Survey of 1985. Central Bureau of Statistics, Ministry of Planning and National Development. Nairobi: Government Printers.

_____. Sessional Paper No. 1 of 1986. Nairobi: Government Printers.

_____. Statistical Abstract 1990. Nairobi: Government Printers.

_____. Economic Survey of 1990. Central Bureau of Statistics, Ministry of Planning and National Development. Nairobi: Government Printers.

_____. 1987. Renewed Growth Through the Cooperative Movement, Sessional Paper No. 4. Nairobi: Government Printers.

Roy, E. P. (1981). Cooperatives: Development, Principles and Management. U.S.A: Interstate Printers and Publishers, Inc.

Sah, Jaysingh. (1991). Analysis of Income Distribution by Caste and Farm Size for a Panchayat (Village System) in the Tarai Region of Nepal by Means of Social Accounting Matrix, Ph.D., Oklahoma State University, Stillwater, Oklahoma.

Schmidt, P. and Lovell, C. A. K. (1979). Estimating Technical and Allocative Inefficiency Relative to Stochastic Production and Cost Frontiers. Journal of Econometrics, 9, 343-366.

Schultz, T. W. (1964). Transforming Traditional Agriculture. New Haven: Cornell Yale University Press.

Shephard, R. W. (1970). Theory of Cost and Production Functions. New Jersey: Princeton University Press.

Stone, R. (1985). The Disaggregation of the Household Sector in the National Accounts. In Pyatt and Round (Ed.), Social Accounting Matrices A Basis for Planning: (pp 145-181). Washington, D.C: World Bank.

Taye, Mingistae. (1991). Social Accounting of Three Ethiopian Villages. A Study of Institutions and Policy Issues in African Rural Development.

Arlington, Virginia: Winrock International Institute for Agricultural Development.

UNRISD. (1975). Rural Cooperatives as Agents of Change in Rural Institutions and Planned Change, Vol. VII. Geneva.

Widstrand, C. G. (1972). Problems of Efficiency in the Performance of Cooperatives. In C. G. Widstrand (Ed.), African Cooperatives and Efficiency (pp 9-70). Uppsala: Scandinavian Institute of African Studies.

World Bank. (1989a). World Development Report, Washington, D.C: World Bank.

World Bank. (1989b). Zimbabwe Agricultural Sector Review. Washgton, D.C: World Bank.

World Bank. (1990a). World Development Report. Washington, D.C: World Bank.

World Bank. (1990b). Making Adjustment Work for the Poor A Framework for Policy Reform in Africa. Washington, D.C: World Bank.

APPENDICES

APPENDIX A

SURVEY DATA OF DAIRY COOPERATIVES IN THE RIFT VALLEY OF KENYA

APPENDIX A-1

TRIAL BALANCE -- **UNION COPY**

Page No. 1A
From
To
C.S./No.

_____, C.S. Ltd. Activity Name_____/No._____.
C.U.Ltd.

INCOME		ACTUAL		BUDGET	VARIANCES + or -
ACCOUNT NAME	A/C No.	CR		CR	(ACTUAL -- BUDGET)
Sales of	- 001				
Sales of	- 002				
Sales of	- 003				
Commission, Bonus	- 024				
Total Refunds, Rebates	- 040				
Grants for running expenditure	- 091				
Sundry Income	- 099				
TOTAL INCOME	- 000				
Loss to Surplus and Loss A/C	- 700				
TOTAL					
EXPENDITURE		DR		DR	
Marketing charges (KPCU/KCC etc.)	- 121				
County Council Cess	- 122				
Commission, Bonus	- 124				
Wages, Salaries to Permanent Staff	- 131				
Wages to Casual Labour, Overtime	- 132				
Housing Allowance	- 134				
N.S.S.F.	- 135				
Education Staff	- 136				
Travel, Subsistence Allowance	- 137				
Other Staff Expenditure	- 139				
Fuel, Oil, Water, Electricity	- 141				
Depreciation	- 143				
Processing Materials, Containers	- 146				
Repairs, Maintenance	- 147				
Transport	- 148				
Interest Bank	0 172				
Insurance	- 173				
Licences	- 176				
Other Committee Allowances	- 182				
Printing, Stationery	- 191				
Post, Telephone	- 192				
Rents, Rates	- 198				
Sundry Expenditure	- 199				
SUB-TOTAL					
Payment to Producers for	- 101				
Payment to Producers fro	- 102				
Payment to Producers for	- 103				
TOTAL EXPENDITURE	- 100				
Surplus to Surplus and Loss A/C	- 700				
TOTAL					

APPENDIX A-2

TRIAL BALANCE

-- UNION COPY

Page No.
From
To
C.S./No.

_____ C.S. Ltd. C.U.Ltd. Activity No _____.

INCOME		ACTUAL		BUDGET	VARIANCES + or -
ACCOUNT NAME	A/C No.	CR		CR	(ACTUAL -- BUDGET)
Commission, Bonus	- 024				
Interest Bank	- 072				
Dividends	- 075				
Grants for running expenditure	- 091				
Rents	- 098				
Sundry Income	- 099				
TOTAL INCOME	- 000				
Loss to Surplus and Loss A/C	- 700				
TOTAL					
EXPENDITURE		DR		DR	
Wages, Salaries to Permanent Staff	- 131				
Wages to Casual Labour, Overtime	- 132				
Housing Allowance	- 134				
N.S.S.F.	- 135				
Education Staff	- 136				
Travel, Subsistence Allowance	- 137				
Other Staff Expenditure	- 139				
Fuel, Oil, Water, Electricity	- 141				
Depreciation	- 143				
Repairs, Maintenance	- 147				
Transport	- 148				
Security	- 152				
Legal Fees	- 156				
Audit, Supervision Fees	- 157				
Bank Charges	- 171				
Interest Bank	- 172				
Insurance	- 173				
Licences	- 176				
Income Tax	- 177				
Bad Debts	- 178				
Committee Sitting Allowance	- 181				
Other Committee Allowances	- 182				
Education Members	- 184				
Entertainment	- 185				
Printing, Stationery	- 191				
Post, Telephone	- 192				
Public Relations, Advertising	- 193				
Membership Subscriptions	- 194				
Rents, Rates	- 198				
Sundry Expenditure	- 199				
TOTAL EXPENDITURE	- 100				
Surplus to Surplus and Loss A/C	- 700				

APPENDIX A-3

QUANTITY OF MILK AND COST OF SERVICES PROVIDED FOR THE SAMPLE OF DAIRY COOPERATIVES 1990

OBS.	Quantity (1,000 Kg)	Total Cost (1,000 Ksh)	Overhead Cost (1,000 Ksh)	Transport Cost (1,000 Ksh)	Misc. Cost (1,000 Ksh)	D*	I**
1	101.66	77.86	7.57	39.62	30.67	0	48
2	75.99	63.42	8.39	37.23	17.80	0	65
3	74.65	70.18	14.49	35.65	20.04	0	20
4	260.62	214.28	41.40	99.99	72.89	0	15
5	61.13	70.27	12.18	38.11	19.97	0	2
6	207.96	151.19	24.63	82.23	44.34	0	2
7	261.45	95.93	22.99	0.75	72.19	0	62
8	124.13	95.22	15.38	47.66	32.19	0	62
9	193.49	158.05	41.75	72.74	43.56	0	20
10	125.07	180.90	25.25	57.65	98.00	1	61
11	74.71	82.19	13.22	39.30	29.67	1	34
12	306.34	299.73	42.73	183.75	73.25	1	10
13	148.87	152.40	37.71	82.26	32.43	1	5
14	278.94	323.87	106.55	155.20	62.11	1	8
15	67.62	83.83	27.29	43.43	13.12	1	3
16	425.83	470.00	66.22	266.83	136.96	0	10
17	339.17	301.79	110.99	98.15	92.65	0	28
18	96.40	72.98	17.17	39.23	16.58	0	33
19	272.08	153.86	104.55	7.68	41.63	0	2
20	525.40	351.49	80.27	192.43	78.79	0	30
21	277.38	245.97	40.25	122.16	83.57	0	22
22	89.64	66.09	17.01	30.62	18.47	0	49
23	141.83	109.21	12.45	56.89	39.87	0	5
24	457.12	357.69	97.32	187.64	72.74	0	2
25	65.31	56.99	6.54	27.61	22.84	0	51
26	179.57	177.85	39.46	76.50	61.89	0	31
27	190.92	129.91	29.93	46.80	53.18	0	4
28	347.80	276.14	46.68	110.13	119.33	0	49
29	99.62	100.81	26.75	45.41	28.65	0	33
30	620.59	475.56	69.90	228.63	177.03	0	18
31	561.10	398.21	34.60	163.79	199.82	0	29
32	424.60	410.80	41.63	226.57	142.61	0	64
33	327.17	259.38	23.87	126.37	109.14	0	13
34	79.85	48.21	16.08	10.78	21.35	0	8
35	102.11	73.13	11.07	61.52	0.55	0	14
36	280.37	218.99	25.17	139.32	54.49	0	60
37	314.30	214.95	52.36	103.43	59.16	0	60
38	253.92	161.38	22.41	111.84	27.13	0	60
39	188.24	136.82	20.64	74.84	41.34	0	60
40	271.97	184.44	18.85	119.50	46.09	0	60
41	120.24	117.88	45.16	50.91	21.82	0	60
42	126.38	101.52	23.47	53.68	24.38	0	60
43	129.76	106.33	19.20	62.54	24.60	0	60
44	165.87	66.25	4.96	49.62	11.66	0	60
45	651.61	499.33	73.40	240.06	185.88	0	80
46	732.29	561.16	82.48	269.78	208.89	0	85

Source: Survey Results

* District dummy variable for transport.

** Index for the quantity of activities other than milk.

a/ All data are for a consecutive twelve month period but varied from June, 1989 to December, 1990.

APPENDIX A-4

ESTIMATED TOTAL COST, AVERAGE COST, MARGINAL COST, AND ELASTICITY OF THE LINEAR FUNCTION (TC = 10.389+0.761Q)

Quantity	Total Cost	Average Cost	Marginal Cost	Elasticity
61.13	56.91	0.93	0.76	0.82
65.31	60.09	0.92	0.76	0.83
67.62	61.85	0.91	0.76	0.83
74.65	67.20	0.90	0.76	0.85
74.71	67.24	0.90	0.76	0.85
75.99	68.22	0.90	0.76	0.85
79.85	71.15	0.89	0.76	0.85
89.64	78.61	0.88	0.76	0.87
96.40	83.75	0.87	0.76	0.88
99.62	86.20	0.87	0.76	0.88
101.60	87.71	0.86	0.76	0.88
102.11	88.09	0.86	0.76	0.88
120.24	101.89	0.85	0.76	0.90
124.13	104.85	0.84	0.76	0.90
125.07	105.57	0.84	0.76	0.90
126.38	106.56	0.84	0.76	0.90
129.76	109.14	0.84	0.76	0.90
141.83	118.32	0.83	0.76	0.91
148.87	123.68	0.83	0.76	0.92
165.87	136.62	0.82	0.76	0.92
179.57	147.04	0.82	0.76	0.93
188.24	153.64	0.82	0.76	0.93
190.92	155.68	0.82	0.76	0.93
193.49	157.63	0.81	0.76	0.93
207.96	168.65	0.81	0.76	0.94
253.92	203.62	0.80	0.76	0.95
260.62	208.72	0.80	0.76	0.95
261.45	209.35	0.80	0.76	0.95
271.97	217.36	0.80	0.76	0.95
272.08	217.44	0.80	0.76	0.95
277.38	221.48	0.80	0.76	0.95
278.94	222.66	0.80	0.76	0.95
280.37	223.75	0.80	0.76	0.95
306.34	243.51	0.79	0.76	0.95
314.30	249.57	0.79	0.76	0.96
327.17	259.37	0.79	0.76	0.96
339.17	268.50	0.79	0.76	0.96
347.80	275.06	0.79	0.76	0.96
424.60	333.51	0.79	0.76	0.97
425.83	334.45	0.79	0.76	0.97
457.12	358.26	0.78	0.76	0.97
525.40	410.22	0.78	0.76	0.97
561.10	437.39	0.78	0.76	0.98
620.59	482.66	0.78	0.76	0.98
651.00	505.80	0.78	0.76	0.98
732.78	568.03	0.78	0.76	0.98

APPENDIX A-5

ESTIMATED TOTAL COST, AVERAGE COST, MARGINAL COST, AND ELASTICITY OF THE LOG-FUNCTION

$$TC = 1.253Q^{.916}$$

Quantity	Total Cost	Average Cost	Marginal Cost	Elasticity
61.13	54.22	0.89	0.81	0.92
65.31	57.61	0.88	0.81	0.92
67.62	59.47	0.88	0.81	0.92
74.65	65.11	0.87	0.80	0.92
74.71	65.16	0.87	0.80	0.92
75.99	66.18	0.87	0.80	0.92
79.85	69.25	0.87	0.80	0.92
89.64	76.99	0.86	0.79	0.92
96.40	82.29	0.85	0.78	0.92
99.62	84.81	0.85	0.78	0.92
101.60	86.35	0.85	0.78	0.92
102.11	86.75	0.85	0.78	0.92
120.24	100.76	0.84	0.77	0.92
124.13	103.74	0.84	0.77	0.92
125.07	104.46	0.84	0.77	0.92
126.38	105.46	0.83	0.77	0.92
129.76	108.04	0.83	0.76	0.92
141.83	117.21	0.83	0.76	0.92
148.87	122.53	0.82	0.76	0.92
165.87	135.29	0.82	0.75	0.92
179.57	145.49	0.81	0.74	0.92
188.24	151.91	0.81	0.74	0.92
190.92	153.89	0.81	0.74	0.92
193.49	155.79	0.81	0.74	0.92
207.96	166.43	0.80	0.73	0.92
253.92	199.83	0.79	0.72	0.92
260.62	204.65	0.79	0.72	0.92
261.45	205.25	0.79	0.72	0.92
271.97	212.80	0.78	0.72	0.92
272.08	212.88	0.78	0.72	0.92
277.38	216.67	0.78	0.72	0.92
278.94	217.79	0.78	0.72	0.92
280.37	218.81	0.78	0.72	0.92
306.34	237.31	0.77	0.71	0.92
314.30	242.95	0.77	0.71	0.92
327.17	252.05	0.77	0.71	0.92
339.17	260.50	0.77	0.70	0.92
347.80	266.57	0.77	0.70	0.92
424.60	320.02	0.75	0.69	0.92
425.83	320.87	0.75	0.69	0.92
457.12	342.40	0.75	0.69	0.92
525.40	388.97	0.74	0.68	0.92
561.10	413.12	0.74	0.68	0.92
620.59	453.06	0.73	0.67	0.92
651.00	473.36	0.73	0.67	0.92
732.78	527.55	0.72	0.66	0.92

APPENDIX A-6

II. Mathematical Derivation of Short-run Cost Functions

$$TC = VC + FC$$

$$MC = \frac{dTC}{dY}$$

$$AVC = \frac{VC}{Y} \qquad VC = AVC \cdot Y$$

$$MC = \frac{dVC}{dY} = \frac{d(AVC \cdot Y)}{dY} = AVC\frac{dY}{dY} + Y\frac{dAVC}{DY}$$

$$MC = AVC + Y\frac{dAVC}{dY} = AVC + Y\frac{dAVC}{dY}\left(\frac{AVC}{AVC}\right)$$

$$MC = AVC + AVC\left[\frac{dAVC}{dY}\ \frac{Y}{AVC}\right] = AVC\left[1 + \varepsilon_{AVC,Y}\right]$$

Therefore

If $\varepsilon_{AVC,Y} = 0$ Then $MC = AVC$

slope of $AVC = 0$

If $\varepsilon_{AVC,Y} > 0$ Then $MC > AVC$

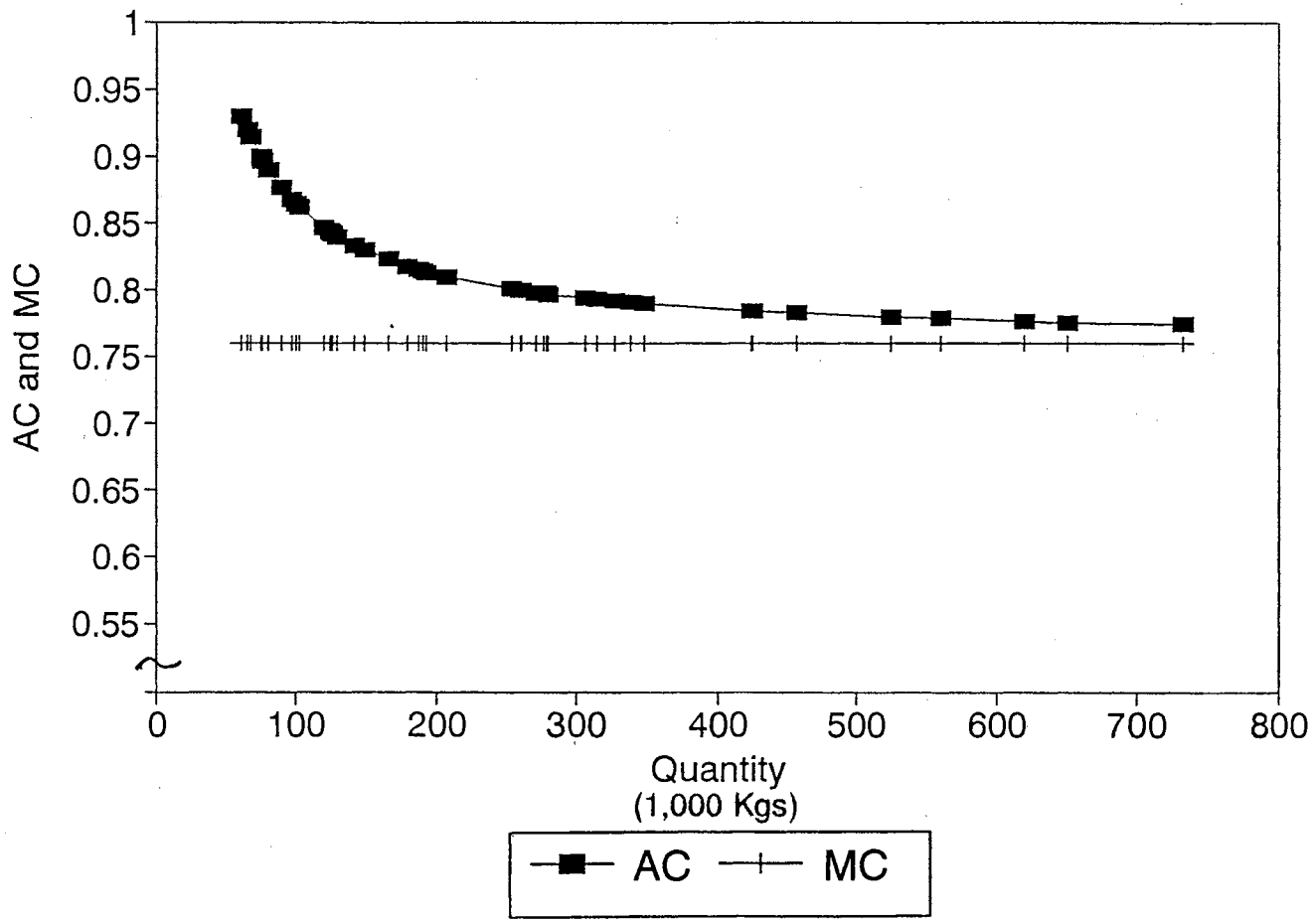
if AVC is increasing MC is above it

If $\varepsilon_{AVC,Y} < 0$ Then $MC < AVC$

if AVC is decreasing MC is below it

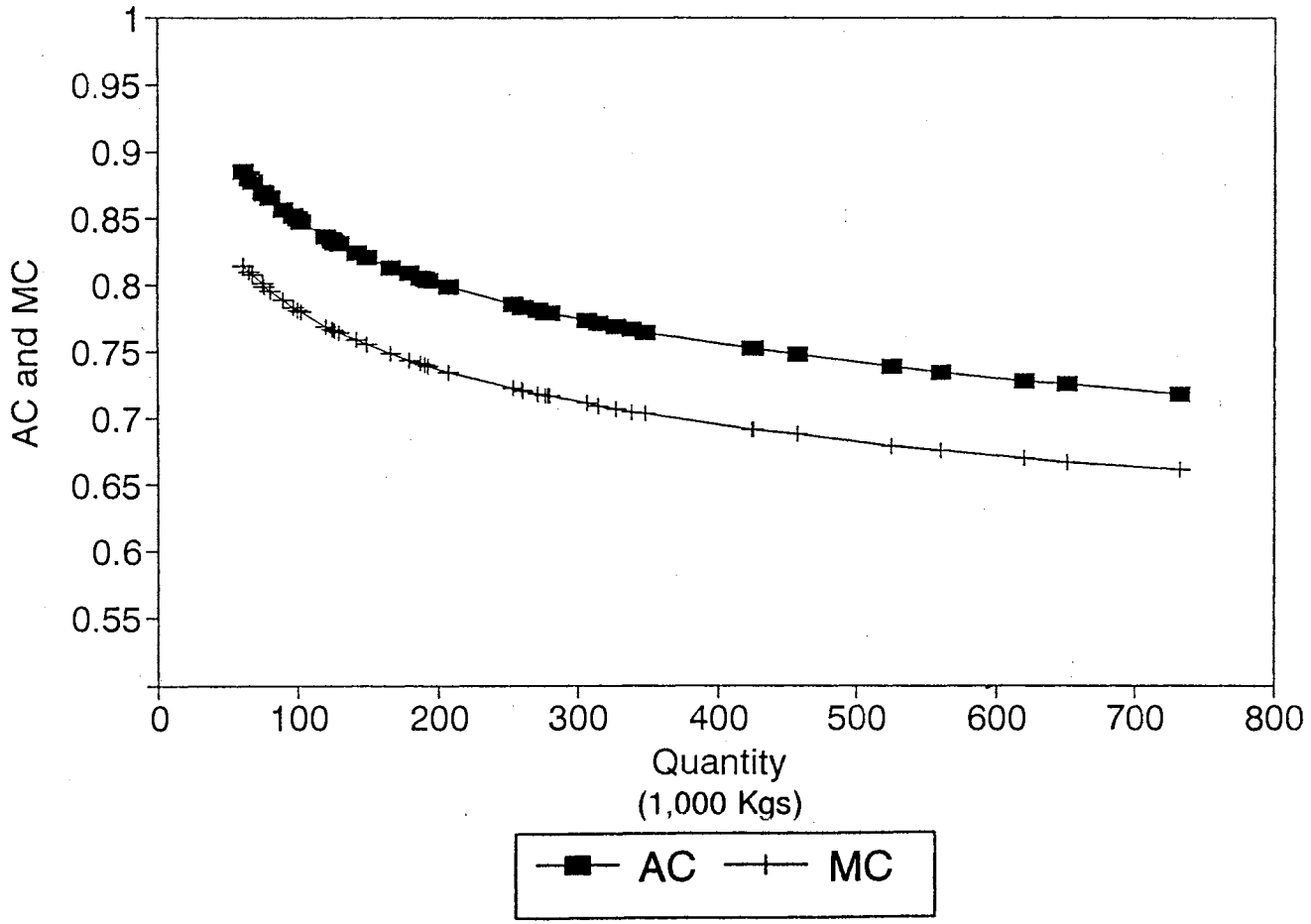
APPENDIX A-7

LINEAR FUNCTION, AVERAGE COST AND MARGINAL COST CURVES OF DAIRY COOPERATIVES



APPENDIX A-8

LOG-FUNCTION, AVERAGE COST AND MARGINAL COST CURVES OF THE DIARY COOPERATIVES



APPENDIX A.9

Cost Frontier Function and Estimation of Inefficiency

Equation to be estimated is:

$$C_i = B_0 + B_i Q_i + \varepsilon_i$$

Where C = cost (Ksh)

Q = quantity of milk (Kgs)

ε = disturbance term

$\varepsilon_i = u_i + v_i$

$u \sim N(0, \sigma_u^2)$

$v \sim N(0, \sigma_v^2)$ normal truncated distribution

V is assumed to be distributed independent of U and it satisfies that $V_i \geq 0$

V_i reflect technical inefficiency.

$$\lambda = \frac{\sigma_u}{\sigma_u} \qquad \lambda \geq 0$$

λ indicates the relative variability of the two sources of random errors. The large values of λ are evidence of substantial technical inefficiency.

r = returns to scale or elasticity

$\frac{1}{r}$ E(v) is the percentage that cost on average is above the frontier.

The parameters. r, σ_u^2 and σ_u^2 can be obtained from a maximum likelihood estimator algorithm.

APPENDIX A.9 (Continued)

The procedure underlying the compututon of the parameters is as follows:

$$\varepsilon_i = u_i + v_i$$

$$E(\varepsilon) = O + E(v)$$

$$E(\varepsilon) = E(v)$$

$$E(v) = \sqrt{\frac{2}{\pi}}\ \sigma v$$

$$v(\varepsilon) = v(u) + v(v)$$

$$= \sigma u^2 + \frac{\pi-2}{\pi}\ \sigma v^2$$

Let the second moment and third moment of the disturbance of the cost function be u_2 and u_3

$$u_2 = \left[\sigma u^2 + \frac{\pi - 2}{\pi}\ \sigma v^2\right] / r^2$$

$$u_3 = \left\{\sqrt{\frac{2}{\pi}}\ \left[\frac{4-\pi}{\pi}\right]\ \sigma v^2\right\} / r^3$$

$$\sigma u^2 = r^2 u^2 - \frac{\pi-2}{\pi}\ \sigma v^2$$

$$\sigma v^2 = \left[\sqrt{\frac{\pi}{2}}\ \left(\frac{4-\pi}{\pi}\right)\right]^{2/3} r^2$$

Run OLS on the cost data and calculate the second and third moments of the OLS residuals. Substitute the OLS residual $\hat{u}^2$ and $\hat{u}^3$ in the place of u^2 and u^3 and obtain the consistent estimate $\sigma\hat{u}^2$ and $\sigma\hat{v}^2$.

then $\lambda = \dfrac{\sigma\hat{v}}{\sigma\hat{u}}$

As $\sigma v^2 \Rightarrow 0$ the symmetric component of the disturbance term will dominate the one-sided component.

Then the OLS estimators are MLE.

(Schmidt and Lovell, 1979, Green, 1980)

APPENDIX B

HOUSEHOLD SURVEY DATA OF AINABKOI COOPERATIVE

APPENDIX B-1

SURVEY INSTRUMENT FOR HOUSEHOLDS

Name _____ Interviewer _____

Cooperative Code # _____ Date _____

Type (S.M.L) _____ S = small farmer

Address _____ M = medium farmer

_____ L = large farmer

I Member Description: Information on member's household.

relation to head of household	sex	age	education		occupation	members working out of the organization
			school	training		

II Assets

1-Land

Parcel (location)	unit	size	Tenure		
			own	leased in	leased out

APPENDIX B-1 (Continued)

2-Equipment and machinery

Code #	Items	no	# of years used	purchase value	current value	source of finance	
						loan	own
	pumpset thresher plough spade mow mill others						

3-Livestock Inventory

Code #	Items	no	purchase value	current value	source of finance	
					loan	own
	1) cows 2) heifers 3) calves 4) sheep 5) goats 6)poultry others					

4-Other Assets

Code #	Items	no	purchase value	current value	source of finance	
					loan	own
	watertank house storage shade vehicle bikes radio cash Milking parlor					

APPENDIX B-1 (Continued)

III

Item	Unit	price per unit	use per acre	Total use	Source of input purchase gov't	private	coop.
Land Area							
Seeds							
own							
purchased							
Fertilizer							
Herbicides							
Family Labor							
planting							
weeding							
Stooking							
Harvesting							
Hired Labor							
Planting							
weeding							
stooking							
harvesting							
Tractor							
own							
rented							
Planters & Harvesters							
own							
rent							
Total Cost							
Total Output							

Distribution of Output

Item	Unit	price per unit	crops	destination of sale gov't	private	coop.
total product						
household cons.						
difference						

APPENDIX B-1 (Continued)

IV Dairy Production

Item	Unit	Price per Unit	Amount per Month	Amount per year	Source of Input Purchases		
					Government	Private	Cooperative
No of Cows							
Feed							
Napier							
Dairy Meal							
Salt							
Bran							
Molasses							
Medicine &							
Vaccinations							
Deworming							
Vet Services							
A.I.							
dip							
Labor							
Family							
Hired							
Total Cost							
Total Output							

Distribution of Dairy Products

Item	Unit	quantity	Sales			
			Home cons.	Private	Cooperative	Total
milk						

APPENDIX B-1 (Continued)

V- Income

Item	Source	Inflow			Outflow			
		Kind	cash		source	kind	cash	
			principal	interest			principal	interest
credit								
gifts								
pension								
salary								
labor								
subsidy								
tax								
any other								

VI- Household Consumption

#	Item	Qyt	price per unit	value	Source of Purchase		
					gov't	private	coop.
1	Processed Food						

2	Clothing						

3	Education						
	school feeds						
	books						
	others						
4	Health						
	doctors fees						
	others						
5	Non-food household consumption						

6	Transport and entertainment						
7	Maintenance						
	house						
	shades						
	barns						
	machinery						
	others						
	marriage						
	others						
8	employed labor in the household						

APPENDIX B-2

INPUT USE AND OUTPUT OF MAIZE PRODUCTION BY ALL SAMPLE HOUSEHOLDS IN AINABKOI, 1991

Households	Land	Seeds	Machinery Hired	Machinery Own	Family Labor	Hired Labor	Total Output	Output Sold	Output Consumed
023/Ns	2	340	1300	0	2600	140	8700	6380	2320
130/WL	3	340	1800	0	3820	500	14500	11600	2900
081/Es	2	340	1600	0	400	2160	8700	5800	2900
042/NL	6	340	5700	0	0	9980	34800	29000	5800
037/Ws	1	170	800	0	0	900	2900	0	2900
057/WL	0.5	170	220	0	392	0	2320	0	2320
142/EL	1	170	650	0	0	1520	5800	2900	2900
007/EL	3	637.5	0	1800	2430	700	17400	10150	7250
060/Es	4	680	2800	0	0	4328	23200	11600	11600
116/Ws	1	170	0	700	530	720	2900	0	2900
056/Es	0.5	85	350	0	305	0	2900	0	2900
011/EL	3	510	1800	0	0	4420	20300	18560	1740
137/Es	1	170	400	0	748	544	5220	1450	3770
024/Ns	5	850	5500	0	0	10580	34800	30450	4350
062/Es	2	340	2600	0	0	1790	10150	2900	7250
170/Ws	4	680	1200	0	616	5364	17400	15950	1450
034/EL	2	340	1000	0	115	2301	6960	0	6960
126/Es	3	510	1200	0	3680	0	11600	0	11600
058/Ns	4	680	0	3400	0	4470	23200	20300	2900
041/NL	4	510	4600	0	0	5270	23200	17400	5800
063/Ns	2.8	476	1960	0	5480	0	14500	10150	4350
043/Ns	4	680	2600	0	0	7840	23200	5800	17400
107/Es	1.5	255	0	0	1135	1050	7250	2900	4350
034/NL	5	850	0	3000	0	8000	29000	20300	8700
060/Ws	2.5	340	1500	0	1785	1712	11600	8700	2900
141/Ws	2	340	0	1400	1040	740	5800	2320	3480
022/Es	2	340	1800	0	3504	280	10440	4060	6380
084/Es	2	510	2000	0	1104	1296	11600	0	11600
039/Ws	4	850	3800	0	0	3740	17400	13050	4350
074/Es	1.5	540	675	0	1710	100	4350	1450	2900
155/WL	0.5	170	220	0	572	0	2320	0	2320
136/EL	6	1020	0	4200	3927.6	7873	34800	31900	2900
092/WL	2	340	1600	0	1540	1400	14500	10150	4350
092/Es	0.75	170	1500	0	0	754	3480	0	3480
064/NL	5	850	0	3750	700	5040	17400	10150	7250
056/Ns	4	340	3000	0	80	4280	17400	10440	6960
156/WL	2.5	340	1125	0	3000	0	14500	0	14500
065/Es	1.5	255	1200	0	2045	0	8700	4350	4350
104/WL	4	680	0	2400	3680	1560	17400	0	17400
057/Ns	4	680	0	1000	1600	5960	23200	11020	12180
166/WL	10	1700	5000	0	0	13940	31900	29000	2900
122/Ws	2	340	1360	0	1860	0	8700	0	8700
103/Ws	1	170	1150	0	990	260	4350	0	4350
089/NL	4	680	2800	0	0	6200	23200	19720	3480
129/Es	2	340	600	0	1133	2107	11600	8700	2900
019/EL	1	170	860	0	0	1012	5220	1450	3770
029/NL	3	510	0	2850	4510	0	18850	14500	4350
059/Ns	2	340	0	1600	3060	100	11600	5800	5800
085/Es	1.25	213	500	0	188	1582	8700	5800	2900
Total	135.8	22521.5	68770.0	26100.0	60279.6	132513.0	689910.0	4416,150.0	273760.0

Land is in acres.
The rest of the inputs and outputs are in Ksh.

APPENDIX B-3

INPUT USE AND TOTAL OUTPUT IN THE PRODUCTION WHEAT BY ALL PRODUCING HOUSEHOLDS IN THE SAMPLE, AINABKOI, 1991

Households	Land	Seeds	Tractors Own	Tractors Hired	Planter & Harvest	Fertilizer	Herbicides	Total Output
064/N	9	5400	5400	0	7900	6345	1500	47200
057/N	1	600	450	0	1370		200	10800
056/N	3	1500	2250	0	2700	2820	900	21240
042/N	14	14700	0	9800	11800	9870	4200	118000
059/N	5	2800	3500	0	5620	3760	350	31270
039/W	1	1000	1050	0	550	940		3540
041/N	6	3500	0	4500	7800	5640	1000	53100
024/N	3	2700	0	2400	2400	1410	166	21830
007/E	7	3500	4900	1750	6300	940	300	41300
058/N	4	2560	2400	0	4000	1880	750	23600
063/N	15	10500	8250	0	12000	10575	1500	88500
034/N	25	18750	15000	0	21000	23500	3750	177000
043/N	1	800	0	650	690	470	150	4130
043/N	1	800	0	650	780	470		2360
Total	95	69110	43200	19750	84910	68620	14766	643870

Land is in acres.
The rest of the inputs and outputs are in Ksh.

APPENDIX B-4

INPUT AND OUTPUT OF PYRETHRUM PRODUCTION BY ALL PRODUCING SAMPLE HOUSEHOLDS, AINABKOI, 1991

Member # Household	Land	Seeds and seedlings	Machinery own	Machinery Hired	Family Labor	Hired Labor	Fertilizer	Total Output
130/W	1	200	600		2480		470	7056
081/E	1	600		600	2480		470	7560
042/N	1	500		950		3085	940	12600
007/E	0.25	150	100		620		114	3024
060/E	1	500		550	2280	200	940	11088
057/W	0.5	800		300	640	600	470	15120
142(138)/E	1	1200		750		1260	470	12600
116/W	0.5	300	250			620	235	10080
056/E	0.25	150	50			2480	57	4032
24/N	1	600	400			2480	470	14112
62/E	1	600		400		2480	470	7560
170/W	1	500		300	2415	60	470	11088
34/E	1	600	500			2840	940	7560
026/E	0.5	150		200	1340		470	6048
058/N	0.25	150	125		1080	1320	235	5040
063/N	0.25	150	137.5			620	235	5040
107/E	2	1500	800			5360	940	12600
085/E	0.5	300	200		1280	240	235	8064
034/N	4	2400	1600		9120	800	1880	40320
060/W	2	1000		600	4960		1880	25200
141/W	2	1200	1000		3560	1400	940	20160
084/E	1	600		500	1280		940	10080
074/E	0.25	150	100		620		235	7560
155/W	0.5	800	300		640	150	470	15120
136/E	1	600	800		2480		470	7560
092/W	1	600		400		3330	470	10080
056/N	0.25	150		113	620		114	4032
056/E	1	800		400	2980		470	10080
104/W	1	600	450		2480		470	10080
057/W	1	600	400			2480	470	7560
122/W	2	1200		960	4960		1880	12600
089/N	0.5	300		225	1240		114	7560
103/W	1	600		500	2480		470	13608
085/E	0.5	300		200	1280	240	235	8064
029/N	2	1200	800		2560	2400	1410	12600
059/N	0.5	300	200			1240	470	4032
Total	35.50	22350.00	8812.50	7948.00	55875.00	35685.00	22019.00	386568.00

Land is in acres.
The rest of the inputs and outputs are in Ksh.

APPENDIX B-5

INPUT USE AND TOTAL OUTPUT OF MILK PRODUCTION BY ALL THE SAMPLE HOUSEHOLDS, AINABKOI, 1991

Member	# cow	Family Labor	Hired Labor	Animal Feed	Medicine and Vaccination	Dip	Veterniary and A.I.	Total Output	Total Sold	Total Consumed
041/NL	25		5400	9780	3000		1000	141134.4	117612	23522.4
122/Ws	21		4800	5112	4071	3528	3240	42340.32	31363.2	10977.12
155/WL	12		4800	5025	955	2016	480	94089.6	70567.2	23522.4
136/#L	6		5400	8685	1286	1008	240	62726.4	47044.8	15681.6
074/Es	4	4800		5280	218	672	1360	31363.2	21954.24	9408.96
039/Ws	6		4200	9240	1078	1008	240	47044.8	31363.2	15681.6
084/Es	6	4800		5156	926	1008	240	23522.4	15681.6	7840.8
022/Es	8		1200	8633	785.2	1344	320	54885.6	39204	15681.6
141/Ws	7		3600	6480	1034	1176	680	32931.36	23522.4	9408.96
060/Ws	10	4800		5280	1744	1680	800	31363.2	23522.4	7840.8
156/WL	19		6000	13320	1888	3192		78408	62726.4	15681.6
056/Ns	8	4800		1800	1837	1344	320	54885.6	47044.8	15681.6
064/NL	11		5400	6744	875	1848		90953.28	56453.76	34499.52
092/ES	4	4800		3000	566	672	190	23522.4	15681.6	7840.8
092/WL	6		6000	10005	478	1008	240	94089.6	65862.72	28226.88
166/WL	5		4800	5156	298	840		70567.2	50181.12	20386.08
057/Ns	8	4800		3908	637	1344		42340.32	28226.88	14113.44
065/Es	8		4800	8513	435	1344	920	23522.4	15681.6	7840.8
064/WL	10		6000	7065	544	1680	400	86248.8	70567.2	15681.6
042/NL	12		6000	12120	955	2016		86248.8	54885.6	31363.2
059/Ns	8		4800	4800	1435	1416		34499.52	28226.88	6272.64
029/NL	16		9600	17640	1764	2688	640	127020.96	92521.44	34499.52
085/Es	7		3600	7765	964.2	1176	390	56453.76	47044.8	9408.96
103/Ws	10		4800	7455	2140	1680	400	62726.4	47044.8	15681.6
089/NL	8		5400	7905	637	1344	1800	77623.92	56453.76	21170.16
129/Es	4	4800		6225	318	672	240	15681.6	7840.8	7840.8
019/EL	6		5640	6225	326	1008	740	62726.4	42340.32	20386.08
034/NL	25		8400	11970	3820	4200	1000	78408	62726.4	15681.6
107/Es	8		5400	4193	1237	1344	320	31363.2	23522.4	7840.8
043/Ns	5	4800		4800	398	840	200	15681.6	9408.96	6272.64
063/Ns	6		6000	4976	958	1008		48612.96	28226.88	20386.08
058/Ns	15		6000	10080	1674	2520	600	62726.4	39204	23522..4
126/Es	10	1200		2513	1290	1680	1200	42340.32	31363.2	10977.12
034/EL	4	4800		1425	518.4	672	150	15681.6	7840.8	7840.8
170/Ws	6		3600	6480	1078	1008		34499.52	23522.4	10977.12
062/Es	10		4800	9225	791	1680	790	51749.28	43908.48	7840.8
024/Ns	6		4800	8033	477.6	1008		47044.8	31363.2	15681.6
137/Es	6		5400	2760	628	1008	720	21170.16	14113.44	7056.72
011/EL	20		6000	6413	1450	3360	800	77623.92	63510.48	14113.44
056/Es	6	4800		8940	1634	2352	560	32931.36	23522.4	9408.96
116/Ws	7		4800	8100	2208	1176	880	56453.76	53317.44	3136.32
142/EL	8		4800	5640	637	1344	320	34499.52	26658.72	7840.8
130/WL	10	4800		8265	1396	1680	400	70567.2	54885.6	15681.6
081/Es	7		4800	7790	381	1176	280	42340.32	28226.88	14113.44
107/EL	9	4800		8332	716	1512	1440	70567.2	56453.76	14113.44
057/WL	12		4800	2900	955	2016	480	94089.6	70567.2	23522.4
037/Ws	6		4800	3720	578	1008	260	43124.4	31363.2	11761.2
060/#s	5	4800		6600	272	840	200	15681.6	0	15681.6
023/Ns	8		3000	9233	1035	1344	320	34499.52	18817.92	15681.6
082/NL	11		5400	6744	875	1848		78408	56453.76	21954.24
Total	465.00	63600.00	185040.00	347449.00	56201.40	75336.00	25800.00	2748984.48	2009597.04	739387.44

Cows are given in number.
The input and output are Ksh.

APPENDIX B-6

COST AND RETURN PER FARM AND PER ACRE OF MAIZE PRODUCTION BY SAMPLE LARGE PRODUCERS AINABKOI COOPERATIVE, 1991 (KENYAN SHILLINGS)

Item	Price Per Unit	Quantity	Value (Ksh)	Per Farm (Sample 20) Quantity	Per Farm (Sample 20) Value (Ksh)	Per Acre (69.50 Acres) Quantity	Per Acre (69.50 Acres) Value (Ksh)
Output (kgs)							
Sold	3.02	93796.88	283266.58	4689.84	14163.33	1349.60	4075.78
Consumed		36884.38	111390.83	1844.22	5569.54	530.71	1602.75
Total		130681.26	394657.41	6534.06	19732.87	1880.31	5678.52
Purchased Inputs (PFI)							
Seeds (kgs)	17	647.53	11008.01	32.38	550.40	9.32	158.39
Fert. (kgs)	9.4	4469.68	42014.99	223.48	2100.75	64.31	604.53
Total PFI			53023.00		2651.15		762.92
Factor Inputs (FI)							
Labor (hr)							
Family		6583.20		329.16		94.72	
Hired	3.75	20243.70	75913.88	1012.19	3795.69	291.28	1092.29
Tractor (hr)							
Own		45.00		2.25		0.65	
Hired	400	75.44	30176.00	3.77	1508.80	1.09	434.19
Land (acre)							
Own	600	69.50		3.48		1.00	
Total FI			106089.88		5304.49		1526.48
PFI + FI			159112.88		7955.64		2289.40
Gross Farm Income			235544.43		11777.23		3389.13
Imputed Value of Family			24687.00		1234.35		355.20
Imputed Value of Machinery			18000		900.00		260.00
Imputed Value of Own Land			41700		2085.00		600.00
Gross Farm Profit (loss)			151157.53		7557.88		2173.93

APPENDIX B-7

COSTS AND RETURNS PER FARM AND PER ACRE MAIZE PRODUCTION BY SAMPLE SMALL PRODUCERS, AINABKOI, 1991 (KENYAN SHILLINGS)

Item	Price Per Unit	Quantity	Value (Ksh)	Per Farm (Sample 30) Quantity	Per Farm (Sample 30) Value (Ksh)	Per Acre (70.3 Acres) Quantity	Per Acre (70.3 Acres) Value (Ksh)
Output (kgs)							
Sold	3.02	59178.12	178717.92	1972.60	5957.26	841.79	2542.22
Consumed		54465.62	164486.17	1815.52	5482.87	774.76	2339.77
Total		113643.74	343204.09	37788.12	11440.14	1616.55	4881.99
Purchased Inputs (PFI)							
Seeds (kgs)	17	717.29	12193.93	23.91	406.46	10.20	173.46
Fert. (kgs)	9.4	3975.32	37368.01	132.51	1245.60	56.55	531.55
Total PFI			49561.94		1652.06		705.01
Factor Inputs (FI)							
Labor (hr)							
Family		9491.50		316.38		135.01	
Hired	3.75	16746.00	62797.50	558.20	2093.25	238.21	893.28
Tractor (hr)							
Own		18.50		0.62		0.26	
Hired	400	106.62	42648.00	3.55	1421.60	1.52	606.66
Land (acre)							
Own	600	70.30		2.34		1.00	
Total FI			105445.50		3514.85		1499.94
PFI + FI			155007.44		5166.91		2204.94
Gross Farm Income			188196.66		6273.22		2677.05
Imputed Value of Family			35593.13		1186.44		506.30
Imputed Value of Machinery			7400		246.67		104.00
Imputed Value of Own Land			42180		1406.00		600.00
Gross Farm Profit (loss)			103023.53		3434.12		1466.75

APPENDIX B-8

COSTS AND RETURNS PER FARM AND PER ACRE WHEAT PRODUCTION BY SAMPLE LARGE PRODUCERS, AINABKOI, 1991 (KENYAN SHILLINGS)

Item	Price Per Unit	Quantity	Value (Ksh)	Per Farm (Sample 5) Quantity	Per Farm (Sample 5) Value (Ksh)	Per Acre (61.00 Acres) Quantity	Per Acre (61.00 Acres) Value (Ksh)
Output (kgs)							
Sold	6.20	66600.00	412920.00	13320.00	82584.00	1091.80	6769.16
Purchased Inputs (PFI)							
Seeds (kgs)	6.6	6946.97	45850.00	1389.39	9170.00	113.88	751.64
Fertilizer (kgs)	9.4	5175.00	48645.00	1035.00	9729.00	84.84	797.46
Herbicides (lts)	7.5	1360.00	10200.00	272.00	2040.00	22.30	167.21
Total PFI			104695.00		20939.00		1716.31
Factor Inputs (FI)							
Labor (hr)							
Family		1639.7		327.94		26.88	
Hired	3.75	822.28	3083.25	164.46	616.65	13.48	50.55
Tractor (hrs)							
Own		63.25		12.65		1.04	
Hired	400	40.13	16050.00	8.03	3210.00	0.66	263.11
Planter & Harvester	400	137	54800.00	27.4	10960.00	2.25	898.36
Land (acre)							
Own	600	61.00		12.20		1.00	
Total FI			73933.25		14786.65		1212.02
PFI + FI			178628.25		35725.65		2928.33
Gross Farm Income			234291.75		46858.35		3840.83
Imputed Value of Family			6148.88		1229.78		100.80
Imputed Value of Machinery			25300		5060.00		416.00
Imputed Value of Own Land			36600		7320.00		600.00
Gross Farm Profit (loss)			166242.87		33248.57		2724.03

APPENDIX B-9

COSTS AND RETURNS PER FARM AND PER FARM WHEAT PRODUCTION BY THE SAMPLE SMALL PRODUCERS, AINABKOI, 1991 (KENYAN SHILLINGS)

Item	Price Per Unit	Quantity	Value (Ksh)	Per Farm (Sample 9) Quantity	Per Farm (Sample 9) Value (Ksh)	Per Acre (34.00 Acres) Quantity	Per Acre (34.00 Acres) Value (Ksh)
Output (kgs)							
Sold	6.20	31887.69	197703.75	3543.08	21967.07	937.87	5814.80
Purchased Inputs (PFI)							
Seeds (kgs)	6.6	3524.24	23260.00	391.58	2584.44	103.65	684.12
Fertilizer (kgs)	9.4	2425.00	22795.00	269.44	2532.78	71.32	670.44
Herbicides (lts)	7.5	535.47	4016.00	59.50	446.22	15.75	118.12
Total PFI			50071.00		5563.44		1472.68
Factor Inputs (FI)							
Labor (hr)							
Family		911.2		101.24		26.8	
Hired	3.75	458.32	1718.70	50.92	190.95	13.48	50.55
Tractor (hr)							
Own		15.75		1.75		0.46	
Hired	400	39.75	15900.00	4.42	1766.67	1.17	467.65
Planter & Harvester	400	66.95	26780.00		2975.56		787.65
Land (acre)							
Own	600	34.00		3.78		1.00	
Total FI			44398.70		4933.18		1305.85
PFI + FI			94469.70		10496.62		2778.53
Gross Farm Income			103233.97		11470.45		3036.30
Imputed Value of Family			3417.00		379.67		100.50
Imputed Value of Machinery			6300		700.00		184.00
Imputed Value of Own Land			20400		2268.00		600.00
Gross Farm Profit (loss)			73116.97		8104.78		2151.80

APPENDIX B-10

COSTS AND RETURNS PER FARM AND PER ACRE PYRETHRUM PRODUCTION BY SAMPLE LARGE PRODUCERS, AINABKOI, 1991 (KENYAN SHILLINGS)

Item	Price per Unit	Quantity	Value (Ksh)	Per Farm (Sample 15) Quantity	Per Farm (Sample 15) Value (Ksh)	Per Acre (16.25 Acres) Quantity	Per Acre (16.25 Acres) Value (Ksh)
Output(kgs)							
Sold	36.47	4320.00	157550.40	288.00	10503.36	265.85	9695.54
Purchased Inputs (PFI)							
Seedlings			10850.00		723.33		667.69
Fert.(kgs)	9.4	986.50	9273.10	65.77	618.21	60.71	570.65
Total PFI			20123.10		1341.54		1238.34
Factor Inputs (FI)							
Labor(hr)							
Family		6280.00		418.67		386.46	
Hired	3.75	4370.64	16389.90	291.38	1092.66	268.96	1008.61
Tractor (hrs)							
Own		8.00		0.53		0.49	
Hired	400	11.88	4752.00	0.79	316.00	0.73	292.00
Land (acre)							
Own	600	16.25		1.08		1.00	
Total FI			21141.90		1408.66		1300.61
PFI + FI			41265.00		2750.02		2538.94
Gross Farm Income			116285.40		7753.34		7156.60
Imputed Value of Family Labor			23550.00		1570.00		1449.23
Imputed Value of Own Machinery			3200		212.00		196.00
Imputed Value of Own Land			9750		650.00		600.00
Gross Farm Profit (loss)			79785.40		5321.34		4911.37

APPENDIX B-11

COSTS AND RETURNS PER FARM AND PER ACRE PYRETHRUM PRODUCTION BY SAMPLE SMALL PRODUCERS, AINABKOI, 1991 (KENYAN SHILLINGS)

Item	Price per Unit	Quantity	Value (Ksh)	Per Farm (Sample 23) Quantity	Per Farm (Sample 23) Value (Ksh)	Per Acre (20.75 acres) Quantity	Per Acre (20.75 acres) Value (Ksh)
Output(kgs)							
Sold	36.47	5364.00	195625.08	233.22	8505.44	258.51	9427.86
Purchased Inputs (PFI)							
Seeds(kgs)			12400.00		539.13		597.59
Fert.(kgs)	9.4	2887.66	27144.00	125.55	1180.17	139.16	1308.14
Total PFI			39544.00		1719.30		1905.74
Factor Inputs							
Labor(hr)							
Family		8964.00		389.74		432.00	
Hired	3.75	5354.67	20080.01	232.81	873.04	258.06	967.71
Tractor (hrs)							
Own		9.25		0.40		0.45	
Hired	400	14.81	5924.00	0.64	257.57	0.71	284.00
Land (acre)							
Own	600	20.75		0.90		1.00	
Total FI			26004.01		1130.61		1251.71
PFI + FI			65548.02		2849.91		3157.44
Gross Farm Income			130077.06		5655.52		6270.42
Imputed Value of Family Labor			33615.00		1461.52		1620.00
Imputed Value of Own Machinery			3700		160.87		180.00
Imputed Value of Own Land			12450		541.30		600.00
Gross Farm Profit (loss)			80312.06		3492.83		3870.42

APPENDIX B-12

COSTS AND RETURNS PER FARM AND PER COW MILK PRODUCTION BY SAMPLE LARGE PRODUCERS, AINABKOI, 1991 (KENYAN SHILLINGS)

Item	Price Per unit	Quantity	Value (Ksh)	Per Farm (Sample 20) Quantity	Per Farm (Sample 20) Value (Ksh)	Per Cow (235 cows) Quantity	Per Cow (235 cows) Value (Ksh)
Output(kgs)							
Sold	3.59	237175.88	851461.40	11858.79	42573.07	1009.26	3623.24
Consumed		128220.97	460313.30	6411.05	23015.67	545.62	1958.78
Total		365396.85	1311774.70	18269.84	65588.74	1554.88	5582.02
Purchased Inputs (PFI)							
Feed			161359.00		8067.95		686.63
Medicine and Vacc.			23373.40		1168.67		99.46
Dip			39480.00		1974.00		168.00
Vet. and A.I.			10130.00		506.50		43.11
Total PFI			234342.40		11717.12		997.20
Factor Inputs (FI)							
Labor(hrs.)							
Family		3840.00		192.00		16.34	
Hired	3.75	26624.00	99840.00	1331.20	4992.00	113.29	424.85
Total FI			99840.00		4992.00		424.85
PFI + FI			334182.40		16709.12		1422.05
Gross Farm Income			977592.30		48879.62		4159.97
Inputed Value			14,400		720.00		61.27
Gross Farm Profit (loss)			963192.00		48159.62		4098.70

APPENDIX B-13

COSTS AND RETURNS PER FARM AND PER COW MILK PRODUCTION BY SAMPLE SMALL PRODUCERS, AINABKOI, 1991 (KENYAN SHILLINGS)

Item	Price Per unit	Quantity	Value (Ksh)	Per Farm (Sample 30) Quantity	Per Farm (Sample 30) Value (Ksh)	Per Cow (230 cows) Quantity	Per Cow (230 cows) Value (Ksh)
Output(kgs)							
Sold	3.59	164597.20	590903.95	5486.57	19696.80	715.64	2569.15
Consumed		101080.40	362878.64	3369.35	12095.95	439.48	1577.73
Total		265677.60	953782.58	8855.92	31792.75	1155.12	4146.88
Purchased Inputs (PFI)							
Feed			186090.00		6203.00		809.09
Medicine and Vacc.			32828.00		1094.27		142.73
Dip			38640.00		1288.00		168.00
Vet. and A.I.			15670.00		522.33		68.13
Total PI			273228.00		9107.60		1187.95
Factor Inputs (FI)							
Labor(hrs.)							
Family		13120.00		437.33		57.04	
Hired	3.75	22720.00	85200.00	757.33	2840.00	98.78	370.43
Total FI			85200.00		2840.00		370.43
PFI + FI			358428.00		11947.60		1558.38
Gross Farm Income			595354.58		19845.15		2588.50
Inputed Value			49200.00		1639.98		213.90
Gross Farm Profit (loss)			546154.58		18205.17		2374.60

APPENDIX B-14

ESTIMATED EXPENDITURE AND RECEIPT OF TOTAL MAIZE PRODUCTION FOR SAM, AINABKOI, 1991

Item	Large Producers (130 acres) Quantity	Value per Acre (Ksh)	Total	Small Producers (130 acres) Quantity	Value per Acre (Ksh)	Total
Output(kgs)						
Sold	1349.60	4075.78	1385765.20	841.79	2542.22	762666.00
Consumed	530.71	1602.75	544935.00	774.76	2339.77	701931.00
Total	1880.31	5678.52	1930700.20	1616.55	4881.99	1464597.00
Purchased Input (PI)						
Seed (Kgs)	9.32	158.39	53852.60	10.20	173.46	52038.00
Fertilizer (kgs)	64.31	604.53	205540.20	56.55	531.55	159465.00
Total PI		762.92	259392.80		705.01	211503.00
Labor						
Family	94.72	355.2	120768.00	135.01	506.29	151887.00
Hired	291.28	1092.29	371378.60	238.21	893.28	267984.00
Total labor	386.00	1447.49	492146.60	373.22	1399.57	419871.00
land	1.00	600.00	204000.00	1.00	600.00	180000.00
Tax			69288.26			38133.30
County Council Tax			30486.83			16778.65
Capital			875385.71			598311.05

APPENDIX B-15

ESTIMATED EXPENDITURE AND RECEIPT OF TOTAL WHEAT PRODUCTION FOR SAM, AINABKOI, 1991

Item	Large Producers (80 acres)			Small Producers (45 acres)		
	Quantity	Value per Acre	Total	Quantity	Value per Acre	Total
Output (kg)						
Sold	1091.80	6767.00	805272.61	937.87	5812.94	261582.22
Purchased Input (PI)						
Seeds (kg)	113.88	751.64	89445.08	103.15	684.12	30785.29
Fertilizer (kgs)	84.84	797.46	94897.62	71.32	670.44	30169.85
Herbicides (lts)	22.30	167.21	19898.36	15.75	118.12	5315.29
Total PI	107.13	964.67	204241.07	87.07	788.56	66270.44
Labor						
Family	26.88	100.8	11995.20	26.88	100.8	4536.00
Hired	13.48	50.55	6015.45	50.55	50.55	2274.75
Total labor	40.36	151.35	222251.72	77.43	151.35	6810.75
land	1.00	600.00	71400.00	1.00	600.00	27000.00
Tax			39369.18			12771.26
County Council Tax			17322.44			5619.35
Capital			250688.21			143110.42

APPENDIX B-16

ESITMATED EXPENDITURE AND RECEIPT OF TOTAL PYRETHRUM PRODUCTION FOR SAM, AINABKOI, 1991

Item	Large Producers (57.2 acres)			Small Producers (72.8 acres)		
	Quantity	Value per Acre (Ksh)	Total	Quantity	Value per Acre (Ksh)	Total
Output(kgs)						
Sold	265.85	9695.41	765937.33	258.51	9427.71	810783.46
Purchased Input (PI)						
Seedlings		667.69	52747.69		597.59	51392.77
Fert.(kgs)	60.71	570.65	45081.53	139.16	1308.14	112500.45
Total PI		1238.34	97829.22		1905.74	163893.22
Labor(hr)						
Family	386.46	1449.23	114488.78	432.00	1620.00	139320.00
Hired	268.96	1008.61	79680.13	258.06	967.71	83223.18
Total labor	655.42	2457.83	194168.90	690.06	2587.71	222543.18
land	1.00	600.00	47400.00	1.00	600.00	51600.00
Tax			38296.87			40539.17
County Council Tax			7659.37			8107.83
CooperativeService			53615.61			56754.84
Capital			326967.35			267345.21

APPENDIX B-17

ESTIMATED TOTAL EXPENDITURE AND RECEIPT OF MILK PRODUCTION FOR SAM, AINABKOI, 1991

Item	Large Producers (1176 cows) Quantity	Value per Cow (Ksh)	Total	Small Producers (1008 cows) Quantity	Value per Cow (Ksh)	Total
Output(kgs)						
Sold	1009.26	3623.24	4260934.24	715.64	2569.15	2589700.70
Consumed	545.62	1958.78	2303520.34	439.48	1577.73	1590355.00
Total	1554.88	5582.07	6564454.58	1155.13	4146.92	4180055.80
Purchased Input (PI)						
Feed		686.63	807481.63		809.09	815559.60
Med. & Vac.		99.46	116966.46		142.73	143872.20
Dip		168.00	197568.00		168.00	169344.00
Vet. and A.I.		43.11	50693.11		68.13	68675.40
Total PI		997.20	1172709.20		1187.95	1197451.40
Labor(hrs.)						
Family	16.34	61.28	71998.13	57.04	213.90	215611.20
Hired	113.29	424.85	499200.00	98.78	370.43	373398.20
Total Labor	129.63	486.13	571198.13	155.83	584.33	589009.40
Land						
Tax			937405.53			569734.10
Capital levy			85218.68			51794.00
Cooperative Service			902036.22			548237.40
Capital			2895886.82			1223829.30

DIFFERENT ACCOUNTS OF AINABKOI
SOICIAL ACCOUNTING MATRIX

Activity Account

Small producers
- A1 = food crops
- A2 = cash crop
- A3 = Dairy

Large producers
- A4 = food crop
- A5 = Cash crop
- A6 = Dairy

- A7 = Cooperative Service

Commodity Account
- C1 = Maize
- C2 = Wheat
- C3 = Pyrethrum
- C4 = Milk
- C5 = Cooperative Service

Factor Account

Small producers
- F1 = Family labor
- F2 = land
- F3 = Capital

Large producers
- F4 = family labor
- F5 = land
- F6 = capital
- F7 = Hired labor
- F8 = Cooperative capital

Institution Account
- I1 = Small producer household
- I2 = Large producer household
- I3 = Landless households

Exogenous Account
- X_1 = Government Tax
- X_2 = Capital Account
- X_3 = Rest-of-Kenya

APPENDIX B-18

ESTIMATED SOCIAL ACCOUNTING MATRIX FOR THE AINABKOI COOPERATIVE SOCIETY, 1991

	A1	A2	A3	A4	A5	A6	A7	C1	C2	C3	C4	C5	F1
A1								1464597	261582.22				
A2										810783.4			
A3											4180055.84		
A4								1930700.2	805272.6				
A5										765937.3			
A6											6564454.57		
A7												1560644.16	
C1	10407.6			10770.52									
C2	6157.05			17889.01									
C3		51392.77			52747.69								
C4													
C5		56754.84	548237.59		53615.61	902036.22							
F1	156423	139320	215611.2										
F2	207000	51600											
F3	741421.47	267345	1223829.29										
F4				132763.2	114488.7	71998.12							
F5				275400	47400								
F6				1330315.42	326967.3	2895886.8							
F7	270258.75	83223.18	373398.26	377394.05	79680.12	499200	327735.273						
F8							920780.05						
I1													511354.2
I2													
I3													
X1	73302.56	48647	621528.18	156466.71	45956.24	1022624.21							
X2													
X3	261208.84	112500.00	1197451.40	434974.20	45081.53	1172709.20	312128.832						
Total	1726179.27	810782.79	4180055.92	2735973.11	765937.19	6564454.55	1560644.16	3395297.20	1066854.82	1576720.7	10744510.4	1560644.2	511354.2

APPENDIX B-18 (Continued)

F2	F3	F4	F5	F6	F7	F8	I1	I2	I3	X1	X2	X3	Total
													1726179.22
													810783.40
													4180055.84
													2735972.80
													765937.30
													6564454.57
													1560644.16
							243989.42	187769.55	72138.98			2870221.33	3395297.40
												1042808.75	1066854.81
												1472580.2	1576720.66
							322066.08	250495.84	166163			10005785.49	10744510.41
													1560644.26
													511354.2
													258600
													2232595.76
													319250.02
													322800
													4553169.52
													2010889.63
													920780.05
258600	2006480.98									249868.03		1171800	4198103.21
		319250.02	322800	4431415.3						234666.17		823200	6131331.49
					2010889.63								2010889.63
													1968524.90
							257263.71	2343818.11					2601081.82
	226114.00			121755		920780.0	3374784	3349248	1772587.65	1483990.70	2601081.82		17386395.23
258600.0	2232595.0	319250.02	322800.00	4553170.30	2010889.63	920780.0	4198103.21	6131331.50	2010889.63	1968524.90	2601081.82	17386395.8	82113820.3

APPENDIX B-19

INTERDEPENDENCE COEFFICIENTS OF THE SOCIAL ACCOUNTING MATRIX, AINABKOI COOPERATIVE SOCIETY, 1991

	A1	A2	A3	A4	A5	A6	A7	C1	C2	C3	C4	C5
A1	1.02226584	0.01715239	0.01040258	0.01459484	0.0118581	0.00798680	0.00353946	0.44926428	0.261665780	0.0145805	0.00892663	0.00353946
A2	0	1.03489983	0	0	0.0379171	0	0	0	0	0.5505869	0	0
A3	0.02451219	0.02215401	1.01399667	0.01543198	0.0159845	0.01102936	0.00710807	0.01934882	0.017658361	0.0191570	0.40122484	0.00710807
A4	0.03101309	0.02270156	0.01376803	1.02214649	0.0156944	0.01057070	0.00468455	0.59461072	0.779130413	0.0192976	0.01181459	0.00468455
A5	0	0.03296945	0	0	1.0358199	0	0	0	0	0.5201328	0	0
A6	0.03849451	0.03479117	0.02198070	0.02423473	0.0251024	1.01732076	0.01116267	0.03038583	0.027731091	0.0300845	0.63009260	0.01116267
A7	0.00850452	0.08243726	0.13601172	0.00535413	0.0807074	0.14123885	1.00246615	0.00671309	0.006126582	0.0815969	0.13920528	1.00246615
C1	0.04942987	0.03964434	0.02404348	0.03000603	0.0274076	0.01845990	0.00818077	1.03838471	0.034768566	0.0337000	0.02063214	0.00818077
C2	0.00384906	0.00020961	0.00012712	0.00673530	0.0001449	0.00009760	0.00004325	0.00549029	1.006027628	0.0001781	0.00010908	0.00004325
C3	0	0.06786929	0	0	0.0737371	0	0	0	0	1.0707197	0	0
C4	0.06300671	0.05694519	0.03597738	0.03966671	0.0410869	0.02835012	0.01827075	0.04973466	0.045389452	0.0492415	1.03131744	0.01827075
C5	0.00850452	0.08243726	0.13601172	0.00535413	0.0807074	0.14123885	0.00246615	0.00671309	0.006126582	0.0815969	0.13920528	1.00246615
F1	0.09390010	0.18052795	0.05324556	0.00211855	0.0084145	0.00129265	0.00068738	0.04170948	0.024622477	0.0969189	0.02150446	0.00068738
F2	0.12258809	0.06792018	0.00124745	0.00175018	0.0038351	0.00095776	0.00042444	0.05387488	0.031378442	0.0367890	0.00107046	0.00042444
F3	0.44625608	0.35509810	0.30134420	0.01078686	0.0222758	0.00665961	0.00360134	0.19863107	0.117559600	0.1934201	0.12130402	0.00360134
F4	0.00192711	0.00641129	0.00090917	0.04986550	0.1558664	0.01167079	0.00034974	0.02918677	0.038111484	0.0790134	0.00748408	0.00034974
F5	0.00312174	0.00432542	0.00138587	0.10288812	0.0656814	0.00106403	0.00047154	0.05985285	0.078426397	0.0341308	0.00118924	0.00047154
F6	0.03206125	0.04046038	0.01639115	0.50769056	0.4608812	0.45392739	0.00720215	0.30252287	0.391070972	0.2446918	0.28370783	0.00720215
F7	0.17123156	0.13741097	0.12434064	0.14762349	0.1359547	0.11071704	0.21320205	0.15780708	0.153411957	0.1367035	0.11601718	0.21320205
F8	0.00501767	0.04863798	0.08024691	0.00315894	0.0476173	0.08333092	0.59145502	0.00396072	0.003614683	0.0481422	0.08213112	0.59145502
I1	0.61754811	0.56758241	0.32531751	0.01356312	0.0322694	0.00823555	0.00434843	0.27409837	0.161654254	0.3075387	0.13159346	0.00434843
I2	0.03625277	0.05011517	0.01824789	0.64686818	0.6701048	0.45452388	0.00783085	0.38347283	0.497151340	0.3512929	0.28479460	0.00783085
I3	0.17123156	0.13741097	0.12434064	0.14762349	0.1359547	0.11071704	0.21320205	0.15780708	0.153411957	0.1367035	0.11601718	0.21320205

APPENDIX B-19 (Continued)

	F1	F2	F3	F4	F5	F6	F7	F8	I1	I2	I3
A1	0.02679560	0.02679560	0.02408178	0.01412323	0.0141232	0.01374557	0.01685460	0	0.026795601	0.0141232	0.01685460
A2	0	0	0	0	0	0	0	0	0	0	0
A3	0.03190531	0.03190531	0.02867399	0.01698461	0.0169846	0.01653042	0.03384796	0	0.031905318	0.0169846	0.03384796
A4	0.03546454	0.03546454	0.03187274	0.01869239	0.0186923	0.01819255	0.02230742	0	0.035464541	0.0186923	0.02230742
A5	0	0	0	0	0	0	0	0	0	0	0
A6	0.05010483	0.05010483	0.04503029	0.02667301	0.0266730	0.02595976	0.05315561	0	0.050104837	0.0266730	0.05315561
A7	0.01106957	0.01106957	0.00994846	0.00589282	0.0058928	0.00573524	0.01174358	0	0.011069576	0.0058928	0.01174358
C1	0.06193268	0.06193268	0.05566023	0.03264303	0.0326430	0.03177014	0.03895604	0	0.061932683	0.0326430	0.03895604
C2	0.00032745	0.00032745	0.00029429	0.00017259	0.0001725	0.00016797	0.00020597	0	0.000327459	0.0001725	0.00020597
C3	0	0	0	0	0	0	0	0	0	0	0
C4	0.08201015	0.08201015	0.07370428	0.04365762	0.0436576	0.04249019	0.08700358	0	0.082010156	0.0436576	0.08700358
C5	0.01106957	0.01106957	0.00994846	0.00589282	0.0058928	0.00573524	0.01174358	0	0.011069576	0.0058928	0.01174358
F1	1.00407387	0.00407387	0.00366127	0.00215590	0.0021559	0.00209825	0.00327324	0	0.004073871	0.0021559	0.00327324
F2	0.00321327	1.00321327	0.00288783	0.00169363	0.0016936	0.00164834	0.00202117	0	0.003213275	0.0016936	0.00202117
F3	0.02085031	0.02085031	1.01873862	0.01103887	0.0110388	0.01074369	0.01714926	0	0.020850319	0.0110388	0.01714926
F4	0.00227046	0.00227046	0.00204051	1.00119959	0.0011995	0.00116751	0.00166547	0	0.002270461	0.0011995	0.00166547
F5	0.00356982	0.00356982	0.00320827	0.00188155	1.0018815	0.00183124	0.00224544	0	0.003569821	0.0018815	0.00224544
F6	0.03934754	0.03934754	0.03536248	0.02085553	0.0208555	1.02029784	0.03429598	0	0.039347544	0.0208555	0.03429598
F7	0.01807208	0.01807208	0.01624176	0.00957266	0.0095726	0.00931668	1.01524788	0	0.018072080	0.0095726	0.01524788
F8	0.00653105	0.00653105	0.00586959	0.00347676	0.0034767	0.00338379	0.00692871	1	0.006531050	0.0034767	0.00692871
I1	1.02602577	1.02602577	0.92211136	0.01377040	0.0137704	0.01340217	0.02070682	0	1.026025776	0.0137704	0.02070682
I2	0.04413564	0.04413564	0.03966565	1.02337899	1.0233789	0.99601311	0.03728979	0	0.044135645	1.0233789	0.03728979
I3	0.01807208	0.01807208	0.01624176	0.00957266	0.0095726	0.00931668	1.01524788	0	0.018072080	0.0095726	1.01524788

APPENDIX B-20

HOUSEHOLD CONSUMPTION EXPENDITURE PER YEAR
BY LARGE PRODUCER HOUSEHOLDS,
AINABKOI, 1991
(KENYAN SHILLINGS)

HHS	Processed Food	Cloth	Education	Health	Non-food Consump.	Transport	Entert.	Maint.	Household Labor	Total
130/WL	2400.00	3000.00	18000.00	1800.00	3600.00	3600.00	1400.00	2400.00	250.00	36450.00
042/NL	6000.00	7000.00	20000.00	2000.00	5000.00	5000.00	2400.00	7000.00	3600.00	58000.00
057/WL	2400.00	4000.00	20000.00	2000.00	2940.00	900.00	2400.00	3000.00	3600.00	41240.00
142/EL	5000.00	6000.00	2000.00	1000.00	5000.00	4000.00	3600.00	7200.00	1200.00	35000.00
007/EL	8640.00	5000.00	20200.00		600.00	4800.00	2400.00			41640.00
011/EL	6000.00	2000.00	2000.00	2400.00	1200.00	1000.00	2000.00	1000.00	3600.00	21200.00
034/EL	3600.00	5000.00	1700.00	1000.00	3600.00	4800.00	1200.00	1200.00		22100.00
041/NL	9600.00	4000.00	17400.00	1800.00	6000.00	2400.00	1200.00	1200.00	400.00	44000.00
034/NL	9600.00	3000.00	12400.00	1000.00	7200.00	3500.00	2000.00	8400.00	3000.00	50100.00
155/WL	2400.00	4000.00	18000.00	2000.00	2400.00	5000.00	2400.00	3000.00	1200.00	40400.00
136/EL	4200.00	1000.00	3620.00	1800.00	6000.00	1000.00	500.00	8000.00	1200.00	27320.00
092/WL	1700.00	2000.00	6450.00	300.00	3600.00			6000.00	4800.00	24850.00
064/NL	7200.00	4000.00	22000.00	3000.00	8000.00	5200.00	2400.00	600.00	3600.00	56000.00
156/WL	6000.00	1000.00	2400.00	3000.00	4800.00	4000.00	1200.00	6000.00		28400.00
104/WL	6000.00	4800.00	11800.00	910.00	7000.00	1000.00	600.00	2540.00	3600.00	38250.00
166/WL	3600.00	3000.00	8500.00		1800.00	1200.00		3000.00	3600.00	24700.00
089/NL	3600.00	2000.00	15000.00	600.00	4800.00	5000.00		8400.00	3600.00	43000.00
019/EL	7200.00	3000.00	9600.00	960.00	480.00	4800.00	960.00	600.00	4800.00	32400.00
029/NL	9000.00	8000.00	20240.00	740.00	1200.00	5000.00	3600.00	6000.00	3600.00	57380.00
082/NL	3600.00	4000.00	15000.00	600.00	4800.00	5000.00		6400.00	3600.00	43000.00
Total	107740.00	75800.00	246310.00	26910.00	80020.00	67200.00	30260.00	81940.00	49250.00	765430.00

APPENDIX B-21

HOUSEHOLD CONSUMPTION EXPENDITURE PER YEAR BY SMALL PRODUCER HOUSEHOLDS, AINABKOI, 1991 (KENYAN SHILLINGS)

HHS	Processed Food	Cloth	Education	Health	Non-food Consump.	Transport	Entert.	Maint.	Household Labor	Total
023/Ns	3240.00	2250.00	12350.00	1620.00	3672.00	405.00	1620.00	4320.00	1836.00	31313.00
081/Es	4320.00	1440.00	1900.00	2160.00	4140.00	2295.00		2160.00	3672.00	22087.00
037/Ws	1080.00	1800.00		2520.00	2160.00	229.50			2754.00	10543.50
060/Es	1350.00	1800.00	7315.00	2250.00	1080.00	3060.00		1080.00		17935.00
116/Ws	2160.00	4500.00	13395.00	540.00	4320.00	2295.00	450.00	180.00	2754.00	30594.00
056/Es	6480.00	2700.00	3800.00		900.00	2601.00		3240.00		19721.00
137/Es	4320.00	4500.00	4750.00	3600.00	4500.00	1530.00	1620.00	2700.00	1836.00	29356.00
024/Ns	5940.00	2700.00	2850.00	450.00	2880.00	1836.00		3600.00	918.00	21174.00
062/Es	5400.00	3600.00	17100.00	360.00	3600.00	918.00		2160.00	3672.00	36810.00
170/Ws	3240.00	900.00	17100.00	2250.00	2160.00	2754.00	2160.00	1800.00	918.00	33282.00
126/Es	5400.00	4500.00	15675.00	2520.00	3240.00	3060.00	1620.00	3600.00	1836.00	41451.00
058/Ns	2250.00	1800.00	11970.00	2700.00	450.00	3060.00	360.00	3240.00	3672.00	29502.00
063/Ns	4500.00	900.00	7030.00	1350.00	2160.00	3825.00	2160.00	3510.00	3672.00	29107.00
043/Ns	2700.00	1350.00	9500.00	720.00	2160.00	1836.00		2160.00	459.00	20885.00
107/Es	4320.00	2250.00	9500.00	3420.00	2160.00	2754.00	2160.00	1080.00	1377.00	29021.00
060/Ws	6480.00	1800.00	11400.00	3240.00	3240.00	3825.00	1080.00	2160.00	1836.00	35061.00
141/Ws	6750.00	2700.00	20900.00	3330.00	2160.00	3060.00	1800.00	4500.00	2754.00	47954.00
022/Es	3240.00	4500.00	1900.00		648.00	2754.00		2160.00	918.00	16120.00
084/Es	3780.00	2250.00	7125.00	2700.00	3600.00	3060.00	1080.00	3150.00		26745.00
039/Ws	5184.00	2700.00	5700.00	540.00	1620.00	2754.00	540.00	900.00	2754.00	22692.00
074/Es	3240.00	3600.00	19000.00	900.00	1800.00	3442.50		2160.00	1836.00	35978.50
092/Es	5940.00	1440.00	3800.00	450.00	1440.00	1912.50	1620.00	1080.00	1071.00	18753.50
056/Ns	4320.00	3600.00	5700.00	675.00	4500.00	3672.00	2160.00	720.00	1836.00	27183.00
065/Es	5400.00	3600.00	3990.00	1080.00	4500.00	1836.00	1080.00	4320.00	2754.00	28560.00
057/Ns	6030.00	2700.00	19000.00	2232.00	4500.00	3825.00		3240.00	2754.00	44281.00
122/Ws	5760.00	2700.00	5795.00	900.00	1350.00	918.00	2160.00	900.00		20483.00
103/Ws	5400.00	4500.00	20900.00	450.00	900.00	2065.50	2160.00	1800.00	1836.00	40011.50
129/Es	6480.00	3600.00	15010.00		3240.00	2754.00		1080.00		32164.00
059/Ns	5400.00	2700.00	22325.00	1620.00	4860.00	3672.00	2160.00	900.00	3672.00	47309.00
085/Es	4860.00	2250.00	6175.00		1260.00	2677.50	1080.00	1953.00		20255.50
Total	134964.00	81630.00	302955.00	44577.00	79200.00	74686.50	29070.00	65853.00	53397.00	#VALUE!

VITA

Ellene Kebede

Candidate for the Degree of

Doctor of Philosophy

Thesis: SMALLHOLDER PRODUCER GROUPS IN MARKET ECONOMIES, THE CASE OF DAIRY COOPERATIVES IN KENYA.

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Addis Ababa, Ethiopia, April 11, 1952, daughter of Bazeto Engida and Kebede Ambachew.

Education: Graduated from high school in July 1970; received the Bachelor of Arts in Economics from Addis Ababa University in July 1978, Addis Ababa, Ethiopia; received the Masters of Arts in Development Economics and Planning from the Institute of Development Economics and Planning in June, 1983 in Dakar, Senega. Completed requirements for the Doctor of Philosophy degree from Oklahoma State University with major in Agricultural Economics.

Professional Experience: High School teacher from 1970-1973 in Ethiopia. Central planning office, Addis Ababa, Ethiopia November 1978 - October 1982, Regional Center for Technology Dakar, Senegal June 1983 to October 1983. Central Planning Office, Addis Ababa, Ethiopia November 1983 - July 1987.