I

AN ECONOMIC ANALYSIS OF THE CONSTRAINTS IN THE PRODUCTION

AND MARKETING OF MILK IN KILIFI DISTRICT OF THE COAST

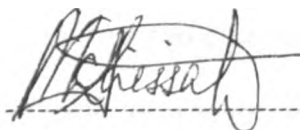*PROVINCE OF KENYA*

BY

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A Thesis Submitted to the University of Nairobi in

Partial Fulfilment of the Requirements for the Degree of

Master of Science in Agricultural Economics

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University
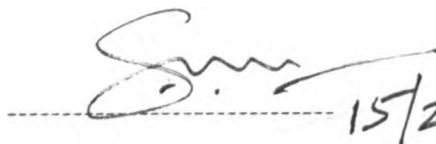
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Dr. Stephen G. Mbogoh

(University Supervisor)

III

ACKNOWLEDGEMENTS

DEDICATION

This thesis is dedicated to my late Dad, Gabriel Echessah,

who looked after me with tireless commitment during the formative years of my education, fror

standard one to standard seven.

ABSTRACT

This study investigates the milk production and marketing system in Kilifi District. The purpose is to examine the causes of high producer price in the informal sector and the decline in milk production in Kilifi District. The study is based on primary data obtained by interviewing 102 dairy farmers and 76 institutional milk consumers in Kilifi District. The data collected were analysed using descriptive statistics and regression analysis. The results of the study indicate that:

i) The genetic potential of dairy animals is one of the limitations to increased milk production;

ii) Use of credit to finance the dairy enterprise is low due to lack of collateral required by financial institutions. Access to existing credit facilities for investments and the initial capital requirement is a barrier to entry into dairy farming by the smallholders;

iii) Informal milk marketing channels are predominant in Kilifi District. Informal market outlets are also more remunerative to producers than formal market outlets. The PRODUCER - CONSUMER milk marketing channel is the most efficient one, based on the criterion chosen, and yields a net price of Kshs. 7.00 per litre;

iv) The dairy industry in Coast Province is faced with numerous problems, both at production and consumption levels. Cattle diseases, inadequate credit facilities, inadequate transportation and poor transport infrastructure, lack of organized milk marketing system and seasonally low milk prices are some of the factors contributing to low performance at farm level;

v) The number of lactating animals and market producer price for milk are the most important determinants of the quantity of milk marketed.

The following recommendations arise from the results of this study:

i) Access to credit by rural smallholder farmers should be improved in order to boost milk production;

ii) A competent veterinary service and a prophylactic drug supply system should be started if the disease problem is to be controlled. This is in view of the endemic cattle diseases in the area. In addition, genetic improvement of indigenous stock should be done. This can be achieved by upgrading dairy cattle through the use of artificial insemination or direct purchase of improved stock;

iii) The milk marketing system should be reorganized, for example, through the formation of the farmers cooperative societies, in order to streamline the marketing of milk by providing a suitable network of marketing channels that are close to the farmers. This may create incentives for an expanded output;

iv) Locational and seasonal price discrimination should be instituted in order to exploit the supply potential in different producing areas. Alternatively, prices should be decontrolled altogether. The decontrol of the producer price would ensure that quality and quantity signals from the market are reflected back to the producers. The decontrol of the consumer price would also ensure market competition for efficient resource allocation.

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ABBREVIATIONS

AEZ	Agro-ecological Zone
AFC	Agricultural Finance Corporation
AI	Artificial Insemination
CL	Coastal Lowland
DCS	Dairy Cooperative Society
FAO	Food and Agriculture Organization
IADP	Integrated Agricultural Development Programme
KCC	Kenya Cooperative Creameries
KDB	Kenya Dairy Board
NDDP	National Dairy Development Programme
OLS	Ordinary Least Squares
UHT	Ultra Heat Treated

CHAPTER ONE

INTRODUCTION

1.1 The Importance of the Dairy Industry in Kenya

The total land area of Kenya is about 44.6 million hectares. It is estimated that of the total land area, 8.6 million hectares are arable. Currently, it is estimated that 46% of all the land devoted to farming in Kenya is utilized for dairy production (Kenya, 1986).

Milk is important in Kenya's economy both as a source of animal protein and in terms of its gross marketed value. In 1990, milk and milk products ranked fifth after tea, coffee, cattle and sugar in terms of their estimated cash earnings as farm activities in Kenya (Kenya, 1991). Table 1.1 shows gross marketed value for various farm commodities in Kenya.

Table 1.1: Gross Marketed Value for Various Farm Commodities in Kenya, 1986 - 1990

| Commodity | Year and Gross Marketed Value K£ Million | | | | |
	1986	1987	1988	1989	1990
Tea	242.83	194.76	203.72	245.32	346.86
Coffee	288.32	192.16	278.11	243.90	203.35
Cattle	84.26	103.87	138.88	148.98	164.03
Sugar	52.79	55.47	68.77	78.41	96.40
Dairy Produce	56.51	62.08	60.67	66.21	84.33
Maize	66.50	68.09	54.18	69.89	56.87
Wheat	32.88	21.88	35.12	39.96	31.97
Sisal	15.42	13.54	13.76	19.63	18.05

Source: Kenya, 1991.

Milk, at the farm level, is used for home consumption and calf rearing, and the surplus is sold either in the rural markets or to processing plants such as the Kenya Cooperative Creameries Limited (K.C.C.). The dairy sector provides a source of income and employment for the dairy farmers and their employees, as well as employees of the processing and distribution sectors. The exact number of people employed in the dairy sector is, however, difficult to determine. This is because most of the marketed milk production in the country is from the smallholder sector where dairying is but one of the many enterprises undertaken in mixed farming operations. Mbogoh (1987), however, reported that the dairy sector in Kenya may be absorbing up to 250,000 households in some form of gainful employment. Income accruing from the dairy sector can play an important role as a driving force for more investment in either the dairy sector or the other enterprises.

Milk products are among the commonly consumed items in the diet of the Kenyan population and are particularly important as far as the nutrition of young children is concerned. Milk dominates the pastoralists'diet and, from a nutritional point of view, is one of the major sources of animal protein.

Apart from being a basic food, milk is a raw material in the food processing industry, for example, in the processing of baby foods and chocolates. Dairying also supplements the meat market by producing cattle and calves for the market. Dairying is also important as a source of manure which may be applied to crop farms as a substitute to the more expensive inorganic fertilizers.

Milk production also has implications for foreign currency reserves. Local m
production and processing play a role as a source of foreign exchange savings through
substitution of imported dairy products. Moreover, exports of dairy products from Kenya a
an important source of foreign exchange. In 1990, the exports of butter and ghee earn
672.4 thousand Kenya pounds (Kenya, 1991). The overall importance of dairying in Ker
is, therefore, much more than can be deduced from a mere consideration of local sales
milk and milk products.

1.2   Kenya's   Dairy Industry: A Review

1.2.1   Production

National milk production in Kenya is estimated at 2.4 billion litres per annum (Minis
of Livestock Development Report, 1990), primarily from about 12 million head of cattle,
which 3 million are of the improved type. It is estimated that 60% of the milk produc
nationally comes from the smallholder sector in high potential areas, 30% from large-sc
farms and 10% from pastoral herds (Mbogoh, 1987).

In contrast, the bulk of the quantity of milk officially marketed in the coastal sub-hun
lowlands of Kenya comes from a few medium and large-scale private and institutional he
(Thorpe, 1990). Relatively little milk is produced by the smallholder sector in Coast Provir
where growth in cattle population, and especially the grade cattle population, has be
limited by animal diseases. The most important diseases are Nagana (*Trypanosomiasis*) a
East Coast Fever (*Theileriosis*) (Thorpe, 1990).

Since 1971, milk production in Kenya has been increasing, as shown in Table 1.2. Temporary declines during 1974/1975 and 1983/1984 reflect drought conditions in the country during those periods.

Table 1.2:   Trends in Milk Production in Kenya, 1971-1990

Year	Milk Production (millions of litres)	Year	Milk Production (millions of litres)
1971	960	1981	1221
1972	998	1982	1380
1973	1052	1983	1465
1974	1076	1984	1263
1975	1052	1985	1321
1976	1033	1986	1387
1977	1081	1987	1500
1978	1106	1988	2160
1979	1126	1989	2420
1980	1207	1990	2450

Source: World Bank, 1990;
       Ministry of Livestock Development (Animal Production
       Division) Annual Reports: Various Issues.

The milk production trends revealed an annual growth rate of about 1.9% for the 1971-1980 period, and 2.3% for the 1980-1990 period. Reasons for this growth in production have been due to increase in dairy herds, commercialization of dairying, and expansion of milk collection and processing facilities in the country (Mbogoh and Ochuonyo, 1990).

Despite these impressive past production figures, future total milk production will have to more than double in order to meet the projected demand by the year 2000 (Kenya, 1986). The National Development Plan for 1989-1993 indicates that the projected supply of milk by the year 1993 will not meet the projected demand of 2500 million litres. The increase in

demand is due to population growth and increases in disposable income. With the milk output forecast at 1693 million litres, a deficit of about 807 million litres is expected. The bulk of this deficit will have to come from the smallholder herd, which in turn would need either to be upgraded or more than doubled in size. In response to these prospects, the government is actively trying to stimulate and intensify dairy farming in areas which were previously regarded as unsuitable for dairying (Kenya, 1986) such as the sub-humid zones of Coast Province. As part of this strategy, the National Dairy Development Programme (NDDP)[1] has been active in Kilifi District since 1980.

1.2.2 Milk Marketing

Milk was a scheduled commodity in Kenya until May 1992. This meant that its pricing and marketing were subject to government regulatory control. However, milk pricing has been deregulated since 1992 while milk marketing is still subject to some control. The control in marketing may be necessary for public health requirements and for orderly marketing. The regulation and control is by the Kenya Dairy Board (KDB) as provided for in the Dairy Industry Act, CAP 336, Laws of Kenya. The KDB was set up to organize, regulate and develop efficient production, marketing, distribution and supply of dairy produce in Kenya, including the regulation and control of milk quality and grades and prices of milk products. According to Mbogoh (1987), owing to lack of financial resources, KDB is now primarily involved in the regulation of processing and distribution of dairy products. The other functions it should be carrying out are undertaken by the KCC and other relevant

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[1] The main objective of the project is to improve the standard of management of dairy cattle on smallholder farms through an intensive programme. The project deals mainly with the introduction and improvement of the zero grazing system.

government departments, such as the Ministry of Agriculture, Livestock Development and Marketing.

In Kenya, milk is marketed through two distinct channels: the regulated "formal" channel and the unregulated "informal" channel. Formal channels include the KCC and the other licensed dairy processing plants. They are formal in the sense that they are under government regulation. The informal marketing channels refer to those which operate without the KDB licence or are not agents of a licensed dealer such as the KCC. In other words, the term "informal" is used to describe those marketing systems in which the government does not substantially intervene, either through trading or indirectly through regulation. Informal market thus refers to all milk sold other than to processors. This includes sales to neighbours, "hawked" milk and unprocessed milk sold by cooperatives in their locality (Kenya Dairy Master Plan, 1991).

Dairy cooperative societies in Kenya play an important role in the marketing of the smallholders' milk. Milk is delivered by the farmers to specific collection centres where it is weighed before being collected by hired or Cooperative Society vehicles. According to Muriithi (1990), most of the milk collected by societies from the farmers is first sold locally to individuals and institutions such as schools, hospitals and hotels along the market route. The remaining amount is then sold to the KCC plants for processing.

The main marketing channels for fluid milk in Kenya can, therefore, be summarized as consisting of the following chains:

i)   producer -> consumer,

ii)   producer -> dairy co-operative societies (DCS) -> consumer;

iii)   producer -> DCS -> KCC -> consumer;

iv)   producer -> KCC -> consumer.

The above channels do not show the middlemen that may exist at the various levels of transactions.

The pricing policy for milk in Kenya is intended to encourage producers to maintain an adequate and stable supply, as well as to safeguard the consumers (Wayne and McDonald, 1988). Before May 1992, milk was one of the commodities whose prices were administered by the Government. Such prices were reviewed annually between September and December. In the case of milk, a uniform producer price was gazetted throughout the Country. Milk farmers were also offered a dry season production premium between the months of January and April each year. Even though the controlled producer price prevails in the formal system, it also serves as a bench mark or point of reference in the price formation in the informal market (World Bank, 1990; Wayne and McDonald, 1988).

Prices in the informal market usually tend to be higher than those in the formal market (Debrah and Anteneh, 1991). In the case of Kenya's Dairy Industry, there is, however, great price variations in the informal market between provinces, with the Coast Province having one of the highest producer prices in the country. This is especially so in Kilifi and Taita Taveta Districts. Table 1.3 shows the average prices per litre of milk sold locally and through cooperatives in some districts of Kenya as recorded by NDDP.

Table 1.3   Average Prices for Milk Sold in Some Districts of
             Kenya in 1989

| District | Average Prices (Kshs. per litre) | |
	Local Sales	Co-operatives
Kakamega	5.33	3.00
Kericho	3.79	3.20
Kiambu	4.11	3.30
Kilifi	6.01	5.75
Meru	4.79	3.99
South Nyanza	5.75	5.80
Taita Taveta	5.25	3.59

Source: NDDP, Ministry of Livestock Development, 1990.

The high milk price in informal markets could occur either as a result of demand outstripping supply or due to some institutional problem(s) such as high cost of production. It is thus worthwhile to examine the industry in order to determine what the causes of these high prices are.

1.3 Role of Marketing in Agricultural Development

Marketing is defined as the performance of all business activities that are involved in the flow of goods and services from the point of initial production until they are in the hands of ultimate consumers (Kohls and Downey, 1972). Hence, a marketing system is the organization in which marketing functions are performed. It helps to link a farmer with the rest of the economy as it enables him/her to sell off his/her surplus produce while obtaining the inputs required for his production process as well as the final goods that he does not produce but requires for his consumption. Iyadema (1988) recognizes three marketing channels that require to be harmoniously and simultaneously developed so as to provide

incentives to a farmer with an intent of making him more productive and integrated in the whole economy. These marketing channels are:

i)   Channel for his produce;

ii)   Channel for obtaining consumer goods and services that he requires but does not produce;.

iii)   Channel for acquiring farm inputs.

The existence of an efficient and flexible agricultural marketing system makes it easier to achieve a smooth transformation of the agricultural sector in line with national development strategies of any developing country (Orwa, 1979). Mosher (1966) identifies what he calls the five essential requirements that constitute a wheel for agricultural development. These are: markets for farm products, new farm technology, local availability of farm supplies and equipment, adequate incentives for the farmers, and transportation facilities. Of these, markets for farm products in combination with adequate transportation facilities are the prerequisites for a well developed marketing system for agricultural products. According to Mbogoh (1984), such a system should possess the following characteristics:

a)   it should have sufficient outlets to cater for increased output; and

b)   it should provide the right information to the producers so that they can provide the goods and services required by the consumers at prices they are willing to pay.

Furthermore, continued improvement of the marketing system is essential in order to provide the farmers with incentives to adopt new technologies. In fact, production benefits

may be lost or devalued if there is no appropriate and efficient marketing system for the product (IDRC, 1986).

1.4 The Problem Statement

The main objective of both Kenya's agricultural and dairy policies is to increase productivity. The Kenya Government's policy in the livestock sector is stated in the National Livestock Development Policy (Kenya, 1980). The policy is based on the fact that the prevailing and the projected demand situation for the major livestock products indicates large and possibly continuing deficits over domestic supplies.

According to Sessional Paper Number One of 1986 on Economic Management for Renewed Growth, total milk production would have to more than double by the year 2000 in order to meet the expected rise in demand (Kenya, 1986).

Total milk production can be increased by increasing dairy herd size in high potential areas, thus increasing the grazing land in those areas. However, this approach is not feasible because of the limited spatial availability and restriction of the high and medium potential arable land which constitutes only 12% of the total land area of Kenya. Another viable alternative is to intensify production in high potential areas where yields are on average 1000 - 1500 kg. per annum towards the yields of over 3000 kg. per annum achieved in large-scale commercial farming. Possibly these existing areas have a comparative advantage in milk production because the infrastructure already exists. Even with this comparative advantage, however, the policy of the government according to the National Development plan of 1989 - 1993 is to encourage commodity switching whereby high valued crops such as tea, coffee and

horticultural crops are produced. Sessional Paper Number One of 1986 argues that dairying could occupy less high potential areas (Kenya, 1986), one of which is the coastal region of Kenya. The coastal sub-humid zone (Coastal Lowland III and Coastal Lowland IV) of Kenya and similar environments elsewhere in Eastern and Southern Africa have good potential for milk production (ILCA, 1989; World Bank, 1990). This potential has not been exploited. Even with the good potential for milk production, the coastal region has the highest producer price in the informal market, as exemplified by Kilifi District (Table 1.3). As noted in section 1.2.2, the high milk producer price could occur as a result of demand outstripping supply or due to some institutional problem(s) such as high cost of production. The aim of the present study is therefore to examine the reason(s) for high producer price in the informal market.

Despite the favourable conditions in the coastal region, milk production is low and shows tendency towards declining. This has necessitated the importation of milk from the upcountry. Table 1.4 which shows the amount of milk received (both from local producers and imports from upcountry) and processed at the KCC Plant at Miritini in Mombasa attests to the decline. Further decline is expected, unless the following services, among others, are improved: regular and efficient A.I. service; well coordinated marketing services; good animal health care/veterinary services; well managed cooperatives giving prompt payment to members; and availability of good breeding stock (Ministry of Livestock Development, 1991).

Table 1.4:   Milk Received and Processed on Annual Basis at
              Miritini KCC Factory 1987-1989 (in litres)

Source	1987	1988	1989
Mariakani Collection Centre	1,322,531	1,245,240	603,538
Up-Country	20,158,973	16,429,777	11,480,811
Total	21,481,504	17,675,017	12,084,349

Source: Ministry of Livestock Development, 1991.

Mosher's (1966) five essential requirements that constitute a wheel for agricultural development, in this case, dairy development are; markets for farm products, new farm technology, local availability of farm input supplies and equipment, adequate incentives for farmers, and transportation facilities. With low and declining levels of milk production in Kilifi District, one or more of these essential elements could be a constraint to increased total milk production. It is therefore important to identify the factors which inhibit milk production in the relevant milk producing areas. This is necessary in order to determine the appropriate strategies to adopt and reach the potentially possible milk production.

Also, given that little is known about economic aspects of milk production, marketing and consumption in Kilifi District in particular and Coast Province in general, research is needed in order to reveal the nature and scope of the constraints in the coastal dairy industry. This study attempts to provide some baseline information which would be essential to future research and policy decisions on such issues as appropriate production and marketing interventions, and the scale and level of technology to be used. The study seeks among other

things to quantify the levels of supply of various dairy products as well as to identify the major constraints to increased dairy farming in Kilifi District.

1.5 Study Justification

The dairy industry has a vital role to play in the growth and development of the Kenyan economy. This alone points to the need for continued research and evaluation studies on production and marketing. According to the Sixth National Development Plan (Kenya 1989), the overall thrust of Kenya's agricultural policy is to achieve self-sufficiency with surplus stocks for strategic reserves.

By providing a clear understanding of the coast dairy industry, this study will be useful to policy-makers interested in agricultural production. It will provide direction for re-orientation of policies and re-organization of the dairy sector in order to increase milk production. The present study is therefore justified on the basis of being useful in identifying ways of streamlining the dairy industry in order to raise productivity.

1.6 Objectives of the Study

There are four objectives to the study:

i) to identify the factors that constrain the coast dairy industry at production and marketing levels, and to suggest appropriate strategies to overcome them;

ii) to determine the various farm factors that influence the marketed milk produced in Kilifi District;

iii) to identify and describe the marketing channels for dairy products in Kilifi District;

iv)   to compare the efficiency of different market outlets in terms of net prices as a measure of performance.

1.7   Hypotheses

The following hypotheses were derived from the study objectives. Hypothesis (i) derives from objective (iii), hypothesis (ii) derives from objective (ii) and finally, hypothesis (iii) derives from objective (iv). The hypotheses were that:

i)   the unregulated "informal" market does not constitute the major outlet for the marketed milk that is produced in Kilifi District;

ii)   the quantity of marketed milk bears no relationship with the average market producer price for milk;

iii)   the unregulated market does not yield the highest net producer price per litre of milk sold when compared with that for the regulated market.

1.8   Background to the Study Area

Kilifi District is one of the six districts of Coast Province. The district lies between latitudes 2° and 4° South and longitudes 39° and 40° East. The district has an area of 12,523 km^2, including 109 km^2 of water surface in the Indian Ocean (Kenya, 1989). Despite Kilifi District's relatively large surface area, only 2,335 km^2 (18.6%) of the district is suitable for arable farming. The altitude of the district ranges between 1 and 450 metres above the sea level. Kilifi District falls within Agro-Ecological Zones of Coastal Lowlands CL3 to CL6 (Jaetzold and Schmidt, 1982). Maps 1, 2, and 3 show the location of the study area. Map 1 is of Kenya showing the location of Kilifi District while in Map 2 the Agro-Ecological Zones of Kilifi District are identified. Map 3 shows the administrative boundaries of Kilifi District.

MAP 1: MAP OF KENYA SHOWING THE LOCATION OF
KILIFI DISTRICT.

KEY
1. NAIROBI
2. MURANGA
3. KIRINYAGA
4. NYANDARUA
5. ELGEYO MARAKWET
6. TRANS NZOIA
7. BUNGOMA
8. KAKAMEGA
9. BUSIA
10. NANDI
11. UASIN GISHU
12. SOUTH NYANZA
13. SIAYA
14. KISUMU
15. KERICHO

INTERNATIONAL BOUNDARY
PROVINCIAL   "
DISTRICT   "

MAP 2:   KILIFI DISTRICT IDENTIFYING THE AGRO ECOLOGICAL
           ZONES.

KEY
—·—·— DISTRICT BOUNDARY
— — — ZONE
———— ROADS
● TOWN

Livestock-Millet Zone

Ranching Zone

Livestock-Millet Zone

Livestock-Millet Zone

Millet Cassava Zone

Coconut-Cassava Zone

Livestock

Livestock Millet
Zone

Cashewnut-
Coconut Cassava

Coconut Cassava
Zone

INDIAN OCEAN

MALINDI

KILIFI

MOMBASA

N

0   10   20   30   40 KM

MAP 3: ADMINISTRATIVE BOUNDARIES OF KILIFI DISTRICT.

N

TANA RIVER

MALINDI

TAITA

GANZE

BAHARI

INDIAN OCEAN

KWALE

KALOLENI

MOMBASA

5 0 5 10 15 20 25 30
Kilometres
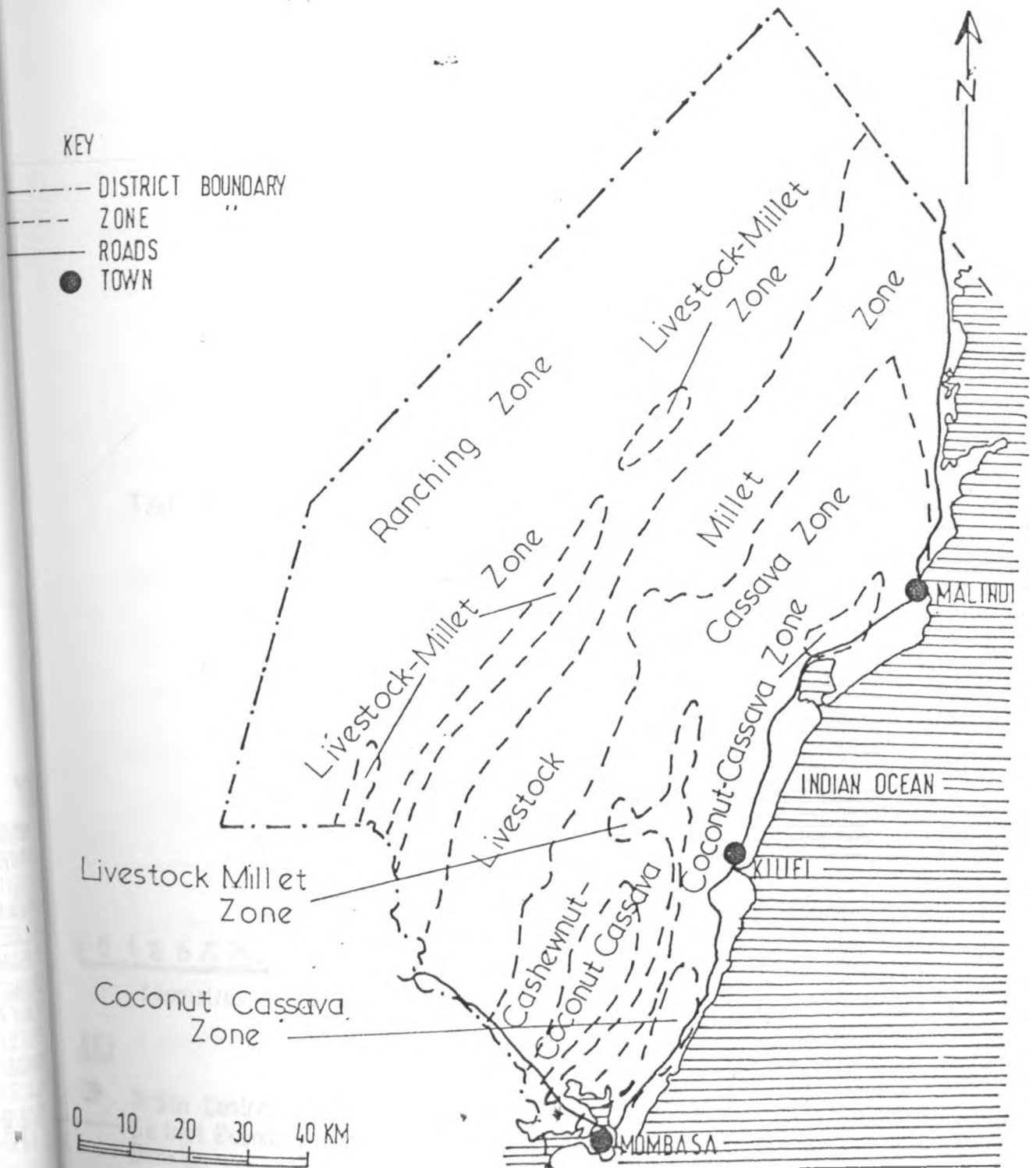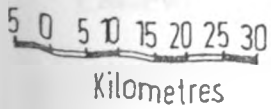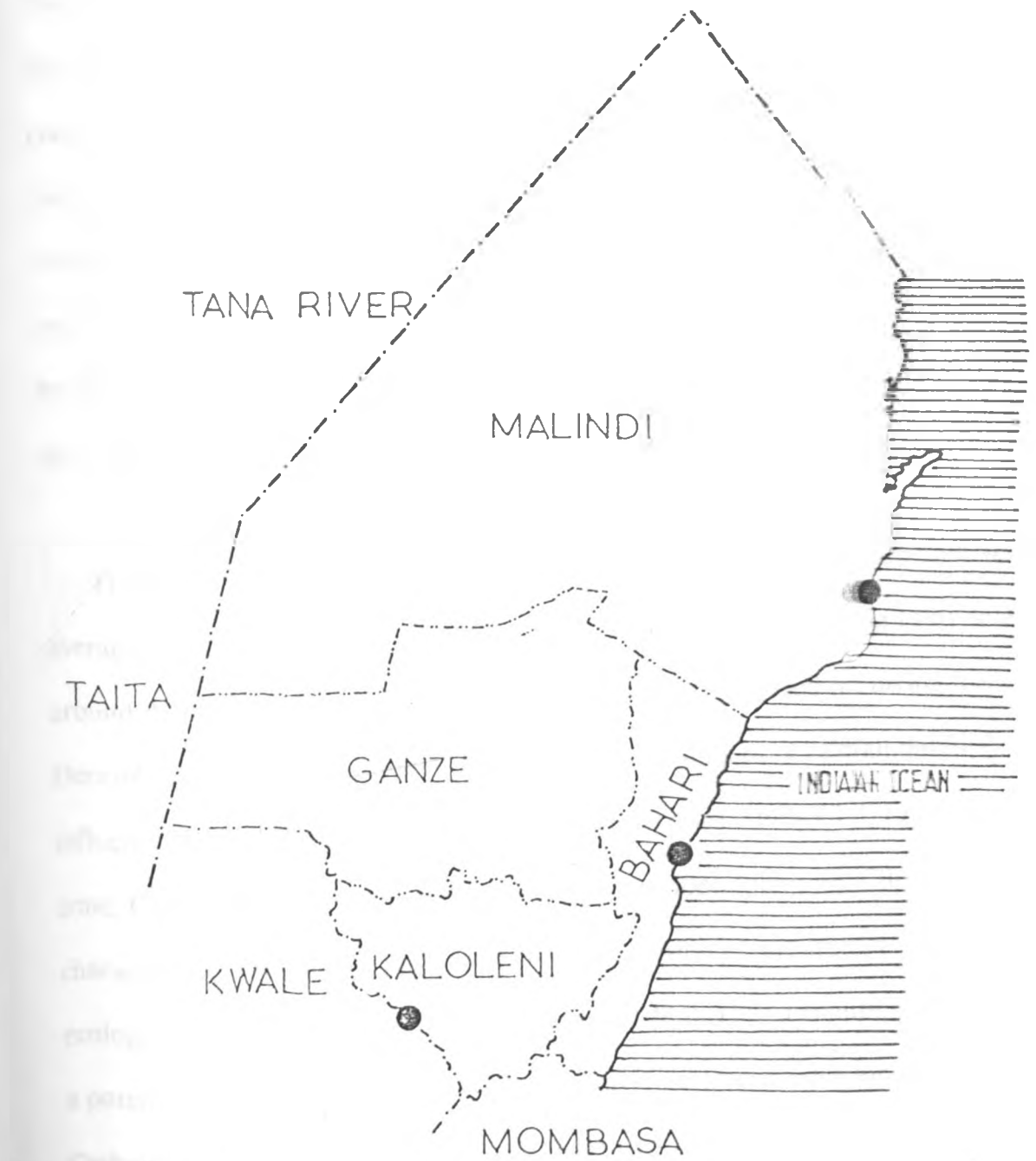
KEY

⊙ Urban Centres
⎯ ⎯ ⎯ District Boundary
⎯ ⋅ ⎯ Division

Four distinct topographic features, each with marked geological, soil and rainfall characteristics dictate the resource potential and the actual land use pattern of Kilifi District. These features are classified as the Coastal Plains, the Foot Plateau, the Coastal Range and the Nyika Plateau. The soils in Kilifi differ widely in depth, texture, and physical and chemical properties and enable different economic activities. In general, most of the soils in the district are low in fertility and therefore require high fertilizer input to produce good crop yields (Kenya, 1989). However, in view of the subsistence farming orientation objective of most farmers in the district and the relatively high fertilizer costs, little or no inorganic fertilizers are used (Kenya, 1989). Soil fertility is therefore a major constraint to agricultural development in the district.

The warmest period in Kilifi District is from January to April, when daily temperatures average more than 30°C. The rainfall pattern is bimodal with the long rainy season starting around April and continuing to June, and the short rainy season occurring from October to December. Moving inland from the coastal belt, the amount of rainfall diminishes under the influence of topography of the land, from 1200mm (coastal belt, CL3) to 400mm (rangelands zone, CL6) annually, while potential evapotranspiration increases. Climatic factors and soil characteristics are mostly responsible for the division of the district into four major agro-ecological zones (AEZs) (Jaetzold and Schimdt, 1982). The Coconut-Cassava zone (CL3) has a potential for a range of food and cash crops, while crop production is more limited in the Cashewnut-Cassava zone (CL4). Within these two zones, a mixed livestock/crop production sub-system is found at farms where the National Dairy Development Programme (NDDP) is operational. Here, crop production is combined with small-scale intensive dairy farming, including cultivation of fodder crops. The Livestock-Millet zone (CL5) offers little potential

for rain-fed agriculture and the Ranching zone (CL6) offers hardly any. The last two zones are only suitable for extensive livestock keeping.

Administratively, Kilifi District is divided into four divisions: Kaloleni, Bahari, Malindi and Ganze divisions. The study covered all the administrative divisions but focused on AEZs CL3 and CL4 where the concentration of grade dairy cattle is high. This implies that the two zones are the most important milk production areas in the district. The main crops that are presently cultivated in the two zones are coconut, maize, cassava, beans, tomatoes, cowpeas cashewnuts, and citrus.

Little is known about the economic aspects of milk production and marketing in Kilifi District in particular, and the Coast Province in general. What is known, however, is that consumption is low (Kenya, 1981b) and Kilifi District has one of the highest producer prices in the informal market. It is therefore hypothesized that the demand situation out-weighs the supply and possibly contributes to high producer prices in the informal market and seasonal shortages.

For the present case study of dairy supply and marketing in a sub-humid area, Kilifi District was chosen as a study area because it is an important milk producing area in Coast Province. It has the largest number of improved dairy cattle (Table 1.5) and produces the largest amount of milk per annum in Coast Province (Ministry of Livestock Development, 1991) (Table 1.6). The district also has the largest number of dairy farmers who are registered under NDDP (Table 1.7). Nevertheless, it has one of the highest producer prices in the informal sector in Coast Province and in the country as a whole (Table 1.3). It was

therefore judged important to establish the constraints facing the dairy industry in order to

determine the necessary strategies to adopt in improving the smallholder dairy sector.

Table 1.5:   Improved Dairy Cattle Distribution by District
                in Coast Province

District	Number of Improved Cattle
Taita Taveta	10,000
Kwale	1,616
Kilifi	15,183
Mombasa	
Lamu	1,600
Total	28,399

Source: Ministry of Livestock Development, 1991.

Table 1.6:   Milk Production by District in Coast Province
                in the Year 1990

District	Milk production (litres/year)[*]
Taita Taveta	7,500,000
Lamu	1,429,340
Kilifi	17,640,600
Mombasa	1,422,600
Total	32,665,474

[*] Information not available on Kwale.
Source: Ministry of Livestock Development, 1991.

Table 1.7:   Number of Dairy Farmers Registered Under
               NDDP by District in Coast Province

District	Number of registered farmers
Taita Taveta	80
Kwale	4
Kilifi	142
Lamu	0
Mombasa	0
Total	226

Source: Ministry of Livestock Development, Animal
        Production Division, 1988.

1.9 Organization of the Study

This thesis is organized into five chapters. Chapter One gives the background information on the study including the problem statement, objectives and hypotheses which were tested. Chapter Two presents a review of the literature which has a bearing on this study. Research methodology is given in Chapter Three. Chapter Four discusses the results of the descriptive and regression analyses. The summary, conclusions and recommendations arising from the study are given in Chapter Five. Finally, References and Appendices are presented.

CHAPTER TWO

LITERATURE REVIEW

This chapter focuses on the review of literature on the studies on production and marketing aspects of the dairy industry and some other agricultural products.

2.1 The Concept of Marketing

Although there are many definitions of marketing, the broad one adopted in this study is that of Kohls and Downey (1972) as "the performance of all business activities involved in the flow of goods and services from the point of initial production until they are in the hands of ultimate consumers". This definition embraces the creation of form, time, place and possession utilities. Marketing is a productive activity whose output may be defined in terms of either the objectives set externally or the utilities afforded to users of a particular marketing system. Hence the output of a marketing system can be evaluated in terms of the subjective satisfaction derived by external users.

The marketing of any product involves a number of major functions, where a marketing function refers to any specialized activity that is undertaken in order to ensure that the particular product flows in an orderly manner from the initial point of production to ultimate consumers. These major marketing functions can be classified into three categories:

i)   exchange functions, which are further subdivided into buying and selling functions

ii)   physical functions, which comprise transportation, processing and storage functions;

iii)   facilitating functions, which consist of standardization, financing, risk-bearing, market intelligence (information) and management (entrepreneurial) functions.

According to Mbogoh (1984), the major objectives of a dairy marketing policy could be one or more of the following:

i)   provision of higher and more stable prices to producers;

ii)   assurance of reliable milk supplies to urban consumers at reasonable prices;

iii)   improvement of hygiene and quality of the dairy products that flow through various marketing channels;

iv)   provision of convenient services to dairy consumers at reasonable prices; and

v)   assurance of the supply of dairy products to vulnerable sectors of the population in order to guarantee certain minimum nutritional standards for those sectors.

The type of marketing policies pursued with regard to particular products affects the functions as well as the structure and performance of the marketing systems for that product (Mbogoh, 1984). The structure of the marketing system for a given product refers to the network of various competitive and complementary channels that characterize the marketing of that product. An analysis of such a structure should include a description of the directions of the flow of the product through the different marketing channels. The marketing channels may be as described in section 1.2.2. The volume of production normally influences the type of marketing channel that is used (Mbogoh, 1984). Most large-scale milk producers in Kenya, for instance, sell their milk directly to the KCC factories. Most small-scale farmers, however, sell their milk either directly to consumers or to cooperative societies. Such dairy producers'

cooperatives normally sell the milk which they receive from their members to both the KCC and local consumers.

The performance of a marketing system may be evaluated in terms of the extent to which that marketing system succeeds in achieving the goals that the system is expected to achieve over a given period of time. The performance of a marketing system, however, may also be evaluated in terms of efficiency. Mbogoh (1992) reports that since a marketing system also requires inputs such as labour, transport and other facilities, a holistic concept of marketing efficiency would ideally relate to the optimization of the output in relation to the inputs. In practice, such holistic optimization procedures in evaluation of marketing efficiency are difficult to operationalize, and partial efficiency criteria are often substituted. One such partial efficiency criterion is the ability of a marketing system to offer a given level of services at the lowest price while recovering costs. According to Abbott and Makeham (1979) (as cited by Mbogoh (1992)), a marketing system will be judged to be efficient by this criterion if it provides physical and facilitating functions at the lowest cost with the available techniques, skills and knowledge and such efficiency will be reflected in both the consumer price levels and the quality of goods and services provided. Other partial efficiency criteria relate to particular aspects of goods and services, and higher net prices to producers.

Bressler and King (1970) identify two attributes of an efficient marketing system. They are: (i) provision of efficient and economical services and ownership transfers in the movement of commodities from seller to buyer; and (ii) provision of an effective price making mechanism. The direct objective of the marketing system, therefore, can be described as providing for and participating in the price formation with the understanding that the

pricing system has as its prime function the guiding of the flow of resources into production (including marketing) and of goods and services into consumption. An efficient market will establish prices that are interrelated through space by transportation costs, through form by costs of processing, and through time as a consequence of costs of storage.

A dairy marketing study, according to Mbogoh (1992), would require a close scrutiny of one or more of the following:

i)   marketing options available to different kinds of producers;

ii)   marketing activities of all kinds of middlemen; and/or

iii)   purchasing patterns of different kinds of consumers.

In this study, the marketing system is examined from the production end of the system and, therefore, adopts the first of these three perspectives.

2.2   Past   Studies

Many studies have been done on the dairy industry in Kenya but for the present study, the following studies will be reviewed. These include Ruigu (1976; 1978), Heyer (1962), Heyer et al. (1976), Kidane (1978), Omiti (1988), Muriithi (1990), Mwangi (1981), Mbogoh and Buteyo (1981), Wayne and McDonald (1988) and the Kenya Dairy Master Plan (1991).

Ruigu (1976) reviewed the opportunities and problems in smallholder milk production and marketing in Kenya. Ruigu (1976) found that the price the farmers are paid is an important incentive for sustained and increased milk output. He further noted that the dairy cooperatives and unions usually deduct some commission for the services rendered in the process of handling the farmers' milk. The residual, he said, is the key price that affects milk

output, yet, in most cases, this residual price is low relative to the costs of production and thus does not act as an incentive for increased milk output. Similar observations are shared by Heyer (1962) and Heyer *et al*. (1976). Heyer *et al*. (1976) observed that smallholder dairy cooperatives in Kenya are few and are a source of inefficiency in the marketing of dairy products. Heyer (1962) pointed out some of the problems experienced in the dairy industry as:

i)   surplus milk production in a limited area, which depresses returns to producers to uneconomic levels;

ii)   lack of transportation facilities; and

iii)   lack of experience in handling milk which is a perishable commodity.

All the aforementioned studies were carried out many years ago and the effect of time coupled with many changes in the industry may render their findings less applicable today. Many of the issues raised, however, may still have significance to current policy issues in the country's dairy industry. The problems mentioned in these studies warrant attention and periodic re-appraisal in the process of modernization of Kenya's dairy industry. Therefore, it was necessary that the present study re-examines some of these issues.

In a study entitled "An Economic Analysis of the Kenya Milk Subsystem", Ruigu (1978) examined milk production in the smallholder farms of Kenya's Central Province. The source of his data was a survey of smallholdings by the Central Bureau of Statistics and the Integrated Agricultural Development Programme (IADP) of the Ministry of Agriculture. Ruigu considered five factors to be influencing milk supply at farm level. These are the number of cows and heifers two years and over, past and present milk price, prices of

competing commodities, cost of inputs such as feeds, labour and capital, and level of technology. Based on the results from a parametric linear programming, Ruigu concluded that milk prices and input prices are significant at 5% level in determining milk production but that supply is more responsive to input prices than to milk prices.

Ruigu (1978) observed that marketing and price reforms are necessary but not sufficient conditions for improving the performance of the milk subsystem. He advocated an integrated approach to the expansion of dairy production where progress would be required on many fronts, including marketing and pricing reforms, dairy breeding, nutrition and extension services. The point of divergence between the study carried out by Ruigu (1978) and the present study is that the latter looks only at the factors affecting household level milk sales. In the present study, a broader set of explanatory variables are considered, including the size of the household. In addition, dairy marketing operations at the farm level are examined extensively.

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In a study of the Meru District's smallholder milk producers, Muriithi (1990) looked at the efficiency of resource use. Although the study was designed to evaluate factors affecting milk yield, he also discussed some of the problems encountered by milk farmers in the district. Inadequate water for animals, lack of irrigation schemes, unavailability of feeds and lack of credit for the dairy enterprise are identified as the major milk production constraints. On the marketing side, Muriithi (1990) remarked that the major problems mentioned by most producers included low and delayed milk payment by cooperative societies, and non-collection and/or rejection of milk by societies, especially during the rainy season. The present study addresses most of these issues but under a different location with different

physical and socio-economic environments. This type of parallel research is in line with research efforts to develop more specific advice for different agro-ecological zones (AEZs) and particular farmer groups within each AEZs. The present study also addresses the factors that affect marketed milk as opposed to Muriithi's (1990) study which dealt only with the factors affecting milk yield per cow.

In a study by Mwangi (1981), the economics of milk production in the Kenya Highlands was analyzed. In contrast to Muriithi's (1990) study, Mwangi's (1981) study covered eleven districts and was therefore relatively large in terms of its geographic coverage. It is, therefore, probable that the factors which determine the farmers' socio-economic circumstances were also more heterogeneous. The study by Mwangi (1981) did not include labour and capital as important variables which determine milk yield. Mwangi (1981) did not cover any aspects of dairy marketing.

In a dairy marketing study carried out in Ethiopia, Debrah and Anteneh (1991) found that the main factor which determine the types of products produced and sold appeared to be proximity to market outlets and that for some categories of producers, obtaining the highest net profit for their products did not seem to be the most important criterion that determine the marketing strategy. The study also indicated that the number of lactating cows alone explained 79% of the variation in the marketable supply of fresh milk for intra-urban producers, leaving other variables (breed, calf milk-intake, and milk: feed price ratio) explaining only 21% of the variation in the marketable supply. For peri-urban producers, the number of lactating cows explained 75% of the total variation in the marketable supply of milk. The present study is similar to Debrah and Anteneh's (1991) study in that it also looks

at the factors affecting marketable supply of fresh milk. However, the present study somehow differs from Debrah and Anteneh's (1991) one in that it is carried out in different geographical location and thus under different socio-economic conditions.

A one-shot diagnostic survey on milk production constraints was carried on a sample of about 200 producing households within 100 km radius of Bamako by Debrah *et al.* (1988). The study found that the major constraints faced by the producers were feed availability, disease, watering problems and high costs of production. The feed availability and disease problems relate to the irregularity of supplement and drug supply in the quantities and periods desired. Watering problems relate to the lack of adequate water facilities while costs of production problems relate to the high costs of labour during certain periods of the year, high costs of feed supplements, and drugs and high producer cooperative membership dues. Debrah *et al.* (1988) suggested that in the short-term one can increase milk production by introducing interventions which alleviate feed and watering problems and the substitution of the agro-industrial supplements with locally produced supplements. However, they suggested that a long-term multi-disciplinary research of the production systems is necessary in order to better understand the constraints and to propose interventions. Debrah, *et al.* (1988) did not, however, deal with any aspects of milk marketing.

Mbogoh and Buteyo (1981) critically reviewed policy issues in the development of Kenya's dairy marketing system. Three policy issues were examined: first, the question of market sharing between the local dairies and the Kenya Cooperative Creameries Limited (KCC); second, the question of regulatory control of the dairy industry; and third, the

question of control of investments in the dairy industry. After reviewing the aforementioned policy issues, Mbogoh and Buteyo (1981) made the following recommendations:

(i) the rural dairy processing facilities of the capacities between 8,000 and 24,000 litres of milk per day be established in those areas that are remote with respect to the KCC dairy marketing plants. Furthermore, Mbogoh and Buteyo (1981) recommend that any such rural dairy plants be licensed to supply milk to urban areas;

(ii) the KCC should continue supplying milk to urban areas. There should, however, be a link between rural dairies and the KCC so that: (a) there is an orderly marketing of milk, and (b) the various marketing institutions can be coordinated to supplement each other's efforts in meeting milk shortages in certain areas when the situations arise;

(iii) the Kenya Dairy Board should be reconstituted and given its full powers as provided for in the Dairy Industry Act (Chapter 336, Laws of Kenya);

(iv) all future investments in the dairy industry should be regulated and controlled to ensure that low cost methods of milk supply to urban centres, rural areas and primary schools are used.

The Mbogoh and Buteyo's (1981) study addressed broad issues, but the present study looks at the marketing of milk at farm level as well as the factors affecting the quantities of milk sold in order to reveal problems in the rural dairy industry and make appropriate suggestions on how to resolve them.

The Kenya Dairy Master Plan (1991) reviewed the supply and demand situations of milk in the country. The plan also outlined the important role the government had given the dairy industry. It emphasised the fact that the government was overstretched and the level of

support accorded the dairy industry was declining. The plan noted that almost all the government dairy institutions -- the Artificial Insemination (AI), Veterinary, Extension and Research Services -- were suffering from shortages of funds, inadequate staff training and the consequent and inevitable decline in morale. Access to credit for investments by dairy farmers in grade cattle, improved pastures and other on-farm activities is a further limiting factor.

Projections of demand and supply suggested a permanent tendency towards surplus milk, although the plan pointed out that these projections have to be treated with caution at least because the sources of supply and demand figures were different.

On the marketing side, the dominance of KCC in the formal market is emphasised as well as KCC's operations. The plan noted that KCC's operation involves several key activities, none of which was cost effective and all of which needed improvement. These activities include reception, capacity utilization, quality control, the product mix (which is weighted in favour of the costly and loss-making UHT lines), packaging (which is dependent on unnecessarily sophisticated and costly Tetrapak technology) and transport.

On pricing, the plan noted that gazetting producer and consumer prices had helped price stability but it was done with no reference to international prices. It had, as a result, generated surpluses which could not be exported profitably and this had added to KCC's financial problems.

The possibility of a general tendency to oversupply raised the question of whether Kenya should aim for export strategy. The plan noted that this would require a reduction of farm-gate prices which might be possible if productivity could be increased, but with the risk of land degradation.

The plan made recommendations on the basis of three objectives: (i) to aim for self-sufficiency, but allow imports if required; (ii) to increase productivity; and (iii) to improve marketing performance. In order to achieve these objectives, the plan recommended the following strategies: (i) the introduction of a competitive market structure with eventual government withdrawal from all commercial activities; (ii) improved performance of KCC and its eventual transformation into an apex for independent regional cooperatives; (iii) strengthened government support services; and (iv) investments in physical marketing infrastructure. Specific recommendations made by the plan included the following:

(i) change in licensing regulations and practices to give free entrance to new processors, subject only to public health requirements:

(ii) support to the cooperatives to cover training for management, finance for investments and help with the planning and establishment of zones to protect their catchment areas and markets in the transition period;

(iii) the transfer of one of the major KCC dairies to private operation to demonstrate government's intention to intensify competition;

(iv) a commitment to the eventual restructuring of KCC into regional cooperatives;

(v) the abolition of fixed pricing system;

(vi) the establishment of a reformed KDB, backed by the provisions of an amended Dairy Industry Act, to function as the legislative and administrative framework within which the development of a modern, dynamic and competitive dairy industry can take place;

(vii) improving the commercial operations of KCC so that operational deficits turn into surpluses by: (a) paying farmers the prices prevailing in the local markets and that consumer prices should reflect the actual procurement, processing and distribution costs; (b) change in the product mix, away from UHT towards pasteurized milk; (c) a change in packaging technology in favour of the cheaper plastic sachets; and (d) a transport plan designed to reduce transfer as well as distribution costs;

(viii) a reorganization of KCC's entire structure and introduction of cost and profit centre principles;

(ix) the government to reject any idea of an export strategy in favour of one of increasing productivity to supply the growing domestic market. This would reduce the risk of damaging the resource base through overgrazing;

(x) the government to introduce full cost recovery in the services it was rendering and to investigate the possibilities for privatization in future;

(xi) with the limited availability of credit for on-farm investments, it was necessary to consider possibilities for expansion of existing farm credit programmes;

(xii) in view of the need to encourage the independent sector, any extra capacity required should be built, if at all possible, outside KCC.

In its report on an assessment of the economic trends of dairy products in sub-Saharan Africa, ILCA (1979) used dairy imports as an illustration of the inadequacy of domestic supplies in tropical Africa. The report noted that the transportation of milk from remote

areas to urban areas presents specific marketing problems. These problems arise because of the perishability of milk, hygienic requirements and also the state of infrastructural facilities in the remote areas. For these reasons, milk supplies to urban areas from the remote ones cannot be guaranteed by producers. In the case of many farming areas, milk production was more for household consumption and any milk surplus was sold locally in the relatively populous rural regions. ILCA (1979) therefore argued that urban milk supplies should depend more on smallholder dairy farmers in peri-urban areas who raise few animals with a view to producing and selling milk at relatively high prices. The present study examines some of the issues raised in ILCA's study, such as the factors affecting quantities of milk sold and the general constraints to increased dairy marketing.

Kidane (1978) analyzed pricing efficiency and seasonal supply patterns of milk in Kenya, with particular reference to the situation in Kiambu District. Using regression analysis, Kidane (1978) showed that a high proportion of the milk sold through the dairy co-operative societies in Kiambu District was determined by the quantity of production at the farm level. This implies that, in order to meet the expected rise in demand for milk, there is need to find means of increasing production at the farm level. This would ensure that there is an increase in the surplus milk which could be marketed. The difference between Kidane's (1978) study and the present one is that the two are carried out at different periods and in locations with differing physical environments, economic conditions and socio-cultural factors. Furthermore, identification of variables thought to affect milk that is sold is a specific objective of the present study.

Omiti (1988) looked at the supply pattern of commercial milk production and the factors influencing the magnitude of the marketed milk production for the period 1957 through 1985. He used the KCC milk intake as a proxy for the total marketed milk production, graphical analyses to study the pattern of marketed milk production and a semi-log regression model to determine the factors which influence the milk production. The variables considered in the model were the marketed milk production, the previous levels of marketed milk production, the method of determining the producer price of fluid milk, technological changes and weather.

The results of graphical analyses by Omiti (1988) indicated that during the period 1957 to 1971, when a quota and contract pricing system was in force, there was a stable and predictable pattern of marketed milk production. The results also showed that there is a 4 to 5 years cycle between any two different consecutive periods, each of which is composed of milk surplus and deficit. The results of multivariate regression analysis by Omiti (1988) indicated that the previous levels of marketed milk production, technology, method of determining milk producer price and weather were the significant factors that influenced the magnitude of commercial milk production in Kenya for the period covered in the analysis. Producer price of fluid milk was not found to be a significant explanatory variable for the observed variations in marketed milk production in Kenya. Previous surplus production of milk and the quota and contract pricing systems, however, appeared to have a negative effect on the magnitude of commercial milk production.

In his concluding remarks, Omiti (1988) advocated, inter alia, a regular review and adjustment, not necessarily a shift, in the method of producer pricing in order to appraise the

effectiveness of various price tools implemented in the dairy sector. He also recommended harmonization of patterns of international trade with observed surplus patterns since there was a 4 to 5 years cycle between highest and lowest levels of production. The present study deviates from the study by Omiti (1988) in that it deals with factors affecting the quantity of milk sold through either informal or formal channels, such as the KCC. In addition, the present study considers a different set of variables and utilizes cross-sectional primary data gathered through personal interviews of dairy farmers and institutional consumers.

An analysis of the factors that affect output levels from the African livestock sectors (beef, sheep and goat meat, pig meat, poultry meat, all meat, cow milk and all milk, that is, cattle, sheep and goat milk) was carried out in 1983 by McClintock. He used data collected by various organizations, including FAO and World Bank, from specific countries of Africa. Using correlation analyses, McClintock (1983) found that increases in the level of milk supply are closely linked to climatic zones and increases in cereal output. The results further showed that public expenditure in agriculture, the number and increases in the number of scientists in agriculture, and absolute and relative expenditures in agriculture, all appeared to play an insignificant role with regard to increasing output levels from the livestock sectors. McClintock (1983) noted, however, that it is possible for the effects of research to require more than four years as assumed in the analysis to bear any fruit. With specific regard to milk, McClintock (1983) concluded that changes in production levels are not associated with the rate of growth of the livestock population. McClintock (1983) does not, however, study the constraints in the production and marketing of milk at farm and consumer level. The present study looks at the factors affecting the quantity of milk sold at the farm level. This

is in contrast to McClintock's work which looked at production in a relatively large and presumably heterogeneous area in terms of the farmers' socio-economic circumstances.

The linkages between the regulated formal and the unregulated informal markets in Kenya were assessed by Wayne and McDonald (1988). Wayne and McDonald (1988) used a supply response model for the regulated fluid milk market in Kenya. While the model did not explicitly estimate the relationship between the regulated and unregulated markets, it did allow testing the hypothesis that an increase in a regulated price may actually decrease supply in the regulated market. Milk supply to the regulated market was approximated by the intake for eight KCC plants that account for 98% of the total KCC milk intake. Lagged rainfall was used as a proxy for available feed. "Counter-intuitive results were obtained: an increase in the regulated price was significant in decreasing intake in the regulated market, indicating that a price increase in the regulated market also increases price and quantity of milk supplied in the unregulated market" (Wayne and McDonald, 1988). Lagged rainfall was highly significant in explaining milk intake in the regulated market. Wayne and McDonald (1988) conclude that since a nominal increase in the KCC price resulted in decreased deliveries to the KCC, there exists a linkage between the regulated and unregulated markets that is driven by the regulated price. The results also indicated that lagged rainfall can be used as a proxy for available feeds where purchased feed inputs are not used. It also concluded that there is need to determine the relationship between regulated and unregulated markets if government intervention in agricultural markets is to have its desired results.

Mbogoh and Ochuonyo (1990) also studied Kenya's marketing system and pricing policies for fresh liquid milk. In the study, they gave a general description of the present dairy industry in Kenya with a view to recommending a strategy for rehabilitation, improvement and expansion. They concluded that the marketing system was either inefficient or inadequate to promote increased milk production in the country. Much more milk, they contended, was being consumed at the source than would be the case if the marketing system was efficient. Moreover, no effort had been made either to organize the system or to collect seasonal excess milk from the pastoral areas. KCC on many occasions failed to take up the farmers' milk claiming there was no local demand. Given the dominant role of the KCC in the marketing of milk and milk products in Kenya, Mbogoh and Ochuonyo (1990) argued that the KCC had not been aggressive enough in its marketing strategies in the past. This was because the KCC had continued to have stock-piles of powdered milk, which implied tied-up capital, without devising measures which exploit the local market and also seek external markets for Kenyan milk. Marketing was thus believed to be one of the major constraints to increased milk supply in Kenya. Mbogoh and Ochuonyo, (1990) therefore suggested more aggressive marketing strategies to fully exploit the local market and also look for external market for milk. The observations on issues related to problems in marketing are relevant to policy issues. Certain problems such as pricing systems and location of collection centres need frequent appraisal . The present study addresses some of the issues of inadequacy in the marketing system raised by Mbogoh and Ochuonyo (1990) and offers suggestions as to how they may be resolved.

Many of the reviewed studies have attempted to analyze the dairy sector in general, but no detailed analyses have been made so far to expose fully the problems that exist in

relation to the marketing of dairy products at the farm level. Moreover, the system(s) of farm level milk marketing in Kenya's coastal region have/(has) not been studied.It would therefore appear that many of the observations made by the various cited authors are still relevant to current dairy policies and will form the background for the present study.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter presents the methodologies used in selecting the farm household and institutional samples for primary data collection. It also sets out the analytical framework used in this study.

3.1 Sources of Data

To cover the overall marketing system for milk in Kilifi District, all sectors directly participating in the marketing operations would have been sampled. Given time and other resource constraints, the strategy adopted for the present study was to examine the milk marketing system from the production and retail consumption ends of the system. Thus, data were collected at two levels, the production and consumption levels.

3.2 Methods of Data Collection

The approach used in data collection involved personal interviews of cross-sectional farm household and institutional samples. The survey involved the use of two sets of structured questionnaires, one administered to dairy farmers and the other to institutional milk consumers. A total of 102 dairy farmers and 76 institutional milk consumers were interviewed. Four enumerators assisted with the data collection. They had secondary school level of education and were trained for three days on data collection techniques.

Before data collection began, the original questionnaires were pre-tested using 10 dairy farmers and 10 institutional milk consumers. This was done as part of the training exercise

for the enumerators and also to determine on the appropriateness of the questionnaires in obtaining the desired information. After going through all the responses together with the enumerators, any necessary changes were made to the questionnaires to improve on their content and design. The 10 farmers and the 10 institutions participating in the pre-test were also interviewed using the final questionnaire. The sample sizes therefore remained 102 and 76 for the farmers and institutional milk consumers respectively.

Data collection was conducted during the months of May through July, 1991. Appointments for interviews at various levels of data collection were made the day prior to the planned visits. A single visit approach was used. This was considered appropriate for the study. In this approach, the farmer is visited on his farm and interviewed once only. On average, 2 farmers were visited by each interviewer each day. Depending on the preference of the respondents, the survey questions were posed in either English, local dialect or Kiswahili. Completed questionnaires were checked by the author for omissions, inconsistencies, illegible writing and other problems before they were accepted for data processing. In cases where problems were sighted (such as missing data), the respondent was re-visited. The data were then processed and analyzed as necessary.

3.3 Sample and Sampling Design

3.3.1 Producer Sample

A list of dairy farmers registered under the National Dairy Development Project (NDDP) was obtained from the office of the project coordinator, Coast Province. These NDDP farmers are mainly found in AEZs III and IV. The list was used to sample 51 out of 142 dairy farmers using a Table of random numbers. This was a good representation given that

Kilifi District was not a traditional commercial dairy farming district as compared to the districts in Central and some in the Rift Valley Provinces. Because non-NDDP farmers were not documented in the district, each of the selected NDDP farmers was asked to name 3 of his/her neighbours with cattle who were non-NDDP farmers. One of the 3 non-NDDP farmers was then selected at random using paper chips. The inclusion of non-NDDP farmers was important to make the sample more representative and to reduce sample bias. A total of 102 dairy farmers were, therefore, sampled from all the four administrative divisions of Kilifi District, namely Kaloleni, Malindi, Bahari and Ganze. This sample size was considered large enough for the purpose of generating sufficient data for statistical inferences after data processing. The Ministry of Livestock Development field staff, primarily NDDP personnel, assisted in identifying and locating the farmers from each respective division.

3.3.2 Retail Consumers Sample

Institutional consumers, such as hotels and supply shops for milk, were the types of consumers studied. Apart from the farm households, no individual consumers were sampled. This was necessitated by the following reasons: first, resources were limiting, particularly time and money; second, institutional consumers use the bulk of the marketed milk and other dairy products; third, retail shops play a distributive role in reaching the general public and, therefore, can provide relevant information concerning dairy marketing constraints.

Seventy-six institutional consumers were sampled throughout the district. This sample was considered large enough for the purposes of generating sufficient data for statistical inferences after data processing. These institutions included local hotels, tourist hotels, schools and supply/retail shops. A list of tourist hotels was obtained from the Provincial

Tourist Office and 18 out of 28 hotels were randomly selected. Similarly, a list of schools was obtained from the District Education Office in Kilifi and 6 out of 8 Secondary schools were randomly selected for interview. At the time of carrying out the study, no primary school was purchasing any milk and none was, therefore, included in the sample. It was difficult to establish a sampling frame for supply shops and local hotels that sold dairy products as no sampling frame was readily available. A sample was, therefore, drawn by identifying such institutions within the major trading centres throughout Kilifi District, followed by selection of samples from the identified ones. Twenty seven local hotels/restaurants and 25 supply shops were sampled.

3.4 Types of Data Collected

In order to meet the objectives of the present study, various types of data were collected. The farmers were interviewed to provide information regarding production, processing and marketing of milk. Information was also solicited from the farmers on socio-demographic characteristics, such as education level, age, sex and household size. Information was also sought on the number of lactating animals, quantities of fresh milk consumed at home and the amount of milk sold, prices, places of sale and distance to sales outlets. The types of dairy products processed and the methods of their disposal were also sought. The same group of farmers was asked to provide information on the modes of transport and the transportation costs to the market, credit use, and marketing losses associated with milk spoilage. Finally, the farmers were asked to elaborate on the factors that constrain milk production and marketing and the type of solutions they thought might be required to

alleviate these constraints. The details of the data collected at farm level are contained in Appendix I.

The institutional milk consumers were interviewed to give information regarding the dairy products purchased and marketed, the purchase and sales prices according to dairy product type, the sources of supply, the purchase arrangements, and the problems encountered in the procurement of these products (see Appendix II).

3.5 Methods of Data Analysis

The data generated by this study were analyzed using descriptive statistics and regression analysis.

3.5.1 Descriptive Analysis

Descriptive analysis involved constructing frequency distributions, calculating means and tabulations. The purpose of this type of analysis was to synthesize the socio-economic characteristics of the farmers interviewed, to describe the smallholder milk production and marketing systems, and to identify the principal problems faced by farmers in the study area.

Marketing performance was analyzed on the basis of producer price and marketing costs, which included the direct cost of transporting milk and the imputed marketing losses due to milk spoilage. Based on the assumption that the objective of the dairy marketing system is to provide the highest average net prices to the dairy producers, the performance of the various dairy marketing outlets was evaluated and compared on the basis of average net prices. The data used for this evaluation were the unit prices received by the producers at

different sales outlets (points of first sale) and the unit marketing costs. The farmers were thus responsible for marketing costs upto points of first sale. Net prices were then calculated as:

Net price = unit price - unit marketing cost

Net price in the present study is similar to the concept of site price. The decision to market a product, such as fresh milk, is a function of producer price and transfer cost from the site of production to the market outlet. According to Fetter (1924), in what has become to be known as the "Law of Market Areas", the boundary between two markets that compete for the same product is a locus of points so situated that the site prices, that is, market prices less transfer costs, for shipments made to the competing markets are equal. Because there were no central markets for milk in Kilifi District, the use of net price was appropriate for this study. The efficiency of each channel was then judged by the level of the net price.

3.5.2 Regression Analysis

The second methodology used for data analysis was statistical regression. This method was found to be appropriate for quantifying, testing and validating economic relationships between the actual amount of milk marketed and the various hypothesized determinants. The method reveals structural relationships between variables. This method was found more appropriate because one of the objectives of the present study was to investigate the relationships between the households' marketed surplus of milk and the factors that were expected to affect it. These factors include the prices received by the farmers, the number of lactating cows and the household size. The method of Ordinary Least Squares (OLS) is

widespreadly used in the estimation of economic relationships because the estimates of the

parameters have some optimal properties. These properties are: unbiasedness; least-variance;

efficiency; best, linear, unbiasedness (BLU); least mean-square-error(MSE); and sufficiency.

The general form of the regression model used in the study was:

$$Y = f(X_1, X_2, \ldots\ldots\ldots\ldots, X_n)$$

where:

Y is the dependent variable (regressand) and

$X_1, X_2, \ldots\ldots\ldots\ldots, X_n$ are the

explanatory

variables (regressors).

The functional form of the regression model which was actually used was the multiple

linear regression model of the form:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + U_i$$

where:

Y is the average amount of milk marketed daily and measured in litres.

a is a constant.

X_1 is the average market price for milk (price received by farmers) in Kshs.

X_2 is the number of lactating animals.

X_3 is the household size.

b_1, b_2 and b_3, referred to as beta coefficients, are regression coefficients for X_1 through X_3.

U_i is the error term.

In a multiple linear regression model, the coefficients refer to the increase in the regressand if one of the regressors is increased by one unit while all other regressors are held constant. On the other hand, in the log-linear model, the coefficients refer to the elasticities, that is, the percentage change in the regressand brought about by a 1% increase in one of the regressors while the other regressors are held constant. The coefficient of multiple determination (R^2) indicates the proportion of variance in the dependent variable accounted for by the independent variables included in a particular equation. It is desirable that R^2 be as close to unity as possible, with the coefficients that have low standard errors and expected signs. Otherwise there may be a problem of multicollinearity. Multicollinearity refers to the presence of linear relationships (or near linear relationships) among explanatory variables. In particular, the problem arises if one or more of the explanatory variables is/are a linear combination of the others. Hence, the cause of multicollinearity is the inclusion of related variables in the regression model. Multicollinearity renders the values of the estimates seriously imprecise and unstable. An F-test of the regression mean squares provides an overall test of the significance of the fitted regression model. It is a test of the null hypothesis that all the regression coefficients are not significantly different from zero. The F-statistic refers to the ratio of the explained to the unexplained variance. If the calculated F-value is larger than the tabulated value of F at the desired probability level, the null hypothesis is rejected. Conversely, if the calculated value of the F-statistic is less than or equal to the tabulated value, one "fails to reject" the null hypothesis.

The significance of the beta coefficient is determined by the t-statistic. The t-statistic is ratio of the estimated regression coefficient to its standard error. The regression ficient is statistically significant if the corresponding standard error is smaller than half

of the numerical value of the regression coefficient. In general, the null hypothesis that the beta coefficient is not significantly different from zero is accepted if the absolute value of the calculated t-ratio is less than the t-ratio corresponding to a particular level of significance. It is rejected if the absolute value of the calculated t-ratio exceeds this value. Failure to reject the null hypothesis means that the dependent variable is not linearly related to the relevant explanatory variable. Conversely, rejecting the null hypothesis means that the coefficient is significantly different from zero, and, therefore, the dependent variable is linearly related to the explanatory variable.

3.5.3   Definition of Variables included in the Regression Model

This section describes the different variables which were considered to be important in determining the quantity of the marketed surplus of milk.

The Dependent Variable

The dependent variable in the present study was the quantity of the daily marketed surplus of milk. This variable was obtained by asking the farmers to state the amount of milk that was sold on average per day. This was the total amount of milk produced on the farm less the amount consumed by the household and the amounts expended in other uses, such as calf-feeding and spoilage.

Independent Variables

The variables considered important in explaining marketed milk surplus were market price for milk, number of lactating animals, and household size.

i) Price Received by the Farmers

Neoclassical economic theory suggests that the quantity of a commodity supplied to the market depends on its price, ceteris paribus. When price increases, the quantity supplied increases and vice versa. In other words, neoclassical theory presumes that the quantity supplied is a positive function of price (Koutsoyiannis, 1988). The price of milk was taken to be the average of the market price which the farmers received from various outlets. Price was expressed in Kshs. per litre. Although this was a cross-sectional rather than a longitudinal study, price was nevertheless considered as an important variable because of the wide price range of five shillings per litre observed within the sample.

ii) Number of Lactating Animals

Number of lactating animals was considered important because it was believed that milk sales depended on the amount of milk produced which in turn depends on the number of cows in milk. The sign of the coefficient of this variable was hypothesized to be positive, which means that an increase in the number of lactating animals would increase the amount of milk produced, and thereby increase the amount of milk marketed.

iii) Household Size

The household size is included because as household size increases, a larger amount of milk produced is assumed to be retained for home use. The household size was defined as the number of individuals taking at least one meal a day at the household. The sign of the regression coefficient on this variable was hypothesized to be negative.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results of the descriptive and regression analyses of the survey data and their interpretation.

4.1 Descriptive Analysis

The purpose of this section is to present a description of the farm household and institutional milk consumer samples in the survey. Included in this description are the socio-economic characteristics of the dairy farmers in the study area. Some of these qualitative variables could influence dairy farming in the region.

4.1.1 Household Size

The household size was assumed to affect the amount of total milk produced per day which is retained for household consumption and thus affect the households milk sales. The average household size for the sample farmers was found to be about 12 members, with a minimum of 2 and a maximum of 28 people. Table 4.1 shows the sample distribution according to household size.

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Table 4.1:   Distribution of Sample Farmers According to Household Size.

Household size category	No. of farmers	Percent of all farmers interviewed
1 - 5	16	16.5
6 - 10	34	35.0
11 - 15	25	25.8
16 - 20	9	9.3
Over 20	13	13.4
Total	97*	100.0

*The remaining 5 farms belonged to women's groups. They
were therefore, left out in the computations.
Source: Survey Results, 1991.

Table 4.1 shows that about 49% of the sample farmers had households of 11 people or more.

Kilifi District is said to have the highest average household size in Kenya (Kenya, 1976)

results of which appear to support the government statistics.

4.1.2   Education Level of the Farmers

Education is important in the process of agricultural development. Education has been

shown to be positively related to adoption of new and improved practices by farmers

(Nyangito, 1986). Hayami and Ruttan (as cited by Musebe, 1990) argue that in less

developed countries, substantial investment in rural education is needed to increase the

productivity of the farm to any reasonable magnitude.

Table 4.2 indicates the education levels of the farmers interviewed.

Table 4.2:   Education Level of the Sample Farmers

Level of education	No. of farmers	Percentage
No formal education	19	18.6
Primary (Standard 1-7)	52	51.0
Secondary ("O" level)	25	24.5
High school ("A" level)	1	1.0
College level	1	1.0
Adult literacy course	4	3.9
Total	102	100.0

Source: Survey Results, 1991.

The results show that 18.6% of the interviewed farmers did not have any formal education. Furthermore, about one half of these farmers only had limited formal education, that is, primary school education . Such limited education levels are likely to negate the adoption of new and improved farming practices by farmers.

4.1.3   Farm Size and Land Ownership

Land ownership was categorized into two parts. The first part referred to that land where the homestead was located; and the second part considered land owned by the farmer elsewhere. Table 4.3 shows the distribution of the sample farmers according to the category of the total land area owned.

Table 4.3:   Distribution of Sample Farmers According to Farm
             Size Category.

Farm Size Category (in acres)	No. of farmers	Percentage of all farmers interviewed
1 - 10	32	31.4
11 - 20	32	31.4
21 - 30	14	13.6
31 - 40	12	11.8
Over 40	12	11.8
Total	102	100.0

Source: Survey Results, 1991.

Table 4.3 shows that over 68% of the sample farmers owned over 10 acres of land. The mean farm size was found to be about 16 acres, but the mode was found to be about 12 acres. This suggests that farm size is not a limiting factor to dairy farming because the Coastal Lowland Zones III and IV where the study was carried out are relatively well suited for farming, and in particular, for fodder crop production. Most of the land owned, however, is scattered in terms of plots in different areas. Table 4.4 shows the distribution of the sample farmers according to the number of plots owned but in different areas.

Table 4.4:   Distribution of Sample Farmers According to
the Number of Plots Owned

No. of plots	Frequency	Sample percentage	Cumulative percentage
1	43	42.2	42.2
2	29	28.4	70.6
3	15	14.7	85.3
4	9	8.8	94.1
5	4	3.9	98.0
6	1	1.0	99.0
7	1	1.0	100.0
Total	102	100.0	_____

Source: Survey Results, 1991.

From Table 4.4, approximately 42% of the farmers interviewed owned only one plot of land while the rest owned two or more plots, ranging from 2 to 7 separate plots.

The issue of land ownership is important in agricultural production. Plots of land that are legally owned, that is, where land title deeds are held, act as an incentive for the owners to develop them. Land title deeds are important as collateral when the farmers wish to request for loans from financial institutions. This is because land is a major resource in the agricultural sector. Table 4.5 shows the distribution of the sample farmers by land ownership category for the pieces of land around the homestead.

Table 4.5: Distribution of Sample Farmers by Land
Ownership Category for the Land Around the Homestead

Homestead Land Ownership Category	No.of farmers	Percentage of all farmers interviewed	Cumulative percentage
With title deed	50	49.0	49.0
Without title deed	49	48.0	97.0
Rented	2	2.0	99.0
Do not know	1	1.0	100.0
Total	102	100.0	------

Source: Survey Results, 1991.

ble 4.5 reveals that approximately 49% of the sample farmers were cultivating land plots

which they have title deeds. Approximately 51% of the farmers were cultivating land

els for which they had no title deeds. This high percentage (51%) of the farmers without

deeds was expected as the government had just embarked on the process of land

ication and registration within Kilifi District. A dairy enterprise requires a heavy capital

and for most small scale farmers who do not have sufficient capital, borrowed funds

essary. Because majority of the farmers (51%) do not have title deeds, it is unlikely

h farmers can get loans from the financial institutions.

ccupation of Sample Farmers

e 4.6 shows the distribution of the sample farmers according to their main

Table 4.6:   Main Farmer's Occupation

Main Occupation	No. of farmers	Percentage
Dairy farmer	47	46.1
Crops farmer	34	33.3
Businessman	7	6.9
Civil servant	5	4.9
Teacher	2	2.0
Other	7	7.0
Total	102	100.0

Survey Results, 1991.

From Table 4.6, about 46% of the sample farmers had dairy farming as their main

occupation. Such a number of farmers with a dairy enterprise as the main occupation

indicated that dairying has not picked up yet as a major farming activity in Kilifi District

despite the existing favourable climatic conditions. The reason why dairying has not picked

up could be that commercial dairying is just being introduced in the district by the National

Dairy Development Programme (NDDP) and therefore may not be competing favourably

with other farm enterprises. The farmers who have dairying as the main occupation need

incentives to improve their dairy farming enterprise. These incentives are also needed to

attract new entrants into the dairy industry. These incentives may be in the form of

favourable milk producer prices, access to credit facilities, and an efficient marketing system.

4.1.5 Crop Enterprises

Table 4.7 shows the kinds of crop enterprises undertaken by the sample farmers.

Table 4.7:   Distribution of Sample Farmers by Type of Crops Grown

Crop enterprise	Number of farmers*	Percentage
Coconut	86	84.3
Fodder crops	82	80.4
Cashewnuts	66	64.7
Maize	59	57.8
Mango	55	54.0
Citrus	34	33.3
Horticultural crops	28	27.5
Cassava	15	14.7
Field Beans	7	6.8
Rice	1	1.0

*Farmers had more than one enterprise on their farms.
Source: Survey Results, 1991.

Table 4.7 shows that both food crop production and cash crop production are undertaken. The common food crops grown during the study period were maize (57.8%), cassava (14.7%) and beans (6.8%). Coconut was the main cash crop, and was being grown by a majority (84%) of the farmers interviewed. Other important cash crops included cashewnuts (68%), mangoes (54%) and citrus fruits (33%). Fodder crop production was practised by 80% of the farmers interviewed. Napier grass was the main type of fodder crop (n = 44). Leucaena leucocephala (a multi-purpose tree species) was the other type of fodder crop (n = 38). The growing of fodder is becoming popular with intensification of dairy farming, with zero-grazing being encouraged in the area as a system of keeping dairy

animals, and because it was a requirement (at the time) in order for one to become an NDDP-registered farmer.

4.1.6   The Dairy Enterprise

4.1.6.1   Dairy Cattle

Each farm had, on average, 6 head of cattle. The households' number of cattle ranged from 1 to 20 head of cattle. The mode was 3 head of cattle. The total number of cattle owned by sample farmers was 817, of which 50% were of an improved type and 50% were of indigenous type. The mean number of improved dairy cattle per farm was 5, the minimum being 1, the maximum being 16, and the mode 2. The mean number of indigenous zebu (*Bos indicus*) cattle per farm was 9, with a minimum of 1 and a maximum of 20 and the mode being 3 cattle. The number of farmers who had improved dairy cattle only was 56, this being 55% of the farmers interviewed. Those with zebu cattle only were 23, this being 22.5% of the farmers interviewed. The farmers with both improved and zebu cattle were 23, this being 22.5% of the farmers interviewed. Since the percentage of the improved dairy cattle is almost the same as the percentage of the indigenous cattle in the study area, it can be argued that the genetic potential of the dairy animals in the study area is one of the major limitations to increased milk production.

4.1.6.2   Milk Production

As mentioned earlier, the total number of cattle kept in the sampled farms was 817. About 27% of the total number of the dairy animals were in lactation at the time of the survey. The rest were either dry cows, calves, heifers, bulls or oxen. The low percentage of lactating cows is a reflection of poor management. A percentage between 45% and 70% is

usually acceptable. Possibly the ineffectiveness of artificial insemination services coupled with high cost of providing it could be responsible for the low percentage.

The sample farmers had, on average, 2.4 lactating cows per household during the survey period, with a range of 1 to 11 lactating cows. Approximately 62% of the lactating cows were of the improved type and the rest were zebu cattle. This implies that most of the milk produced in the area came from improved cattle. Table 4.8 shows the distribution of the sample farms according to the number of cows in milk.

Table 4.8: Distribution of Sample Farms by Number of Cows in Milk

Number of cows in milk	Number of producers in a given lactation category	Percentage of producers in a given lactation category	Cumulative percentage
0	12	11.9	11.9
1 - 2	56	55.4	67.3
3 - 5	26	25.7	93.1
Over 5	7	6.9	100.0
Total	101*	100.0	_____

*Information missing on one farm.
Source: Survey Results, 1991.

Milk was being produced on approximately 88% of the sample farms during the survey period. The other 12% had no lactating animals. For those farmers who had no lactating animals, the implication was that they did not breed their animals carefully to ensure that they had at least one lactating cow in the herd at any given time. Had they followed such

a strategy, it would have ensured that the farmers had a continuous source of income from milk sales if they did not consume all the milk produced and if there was a market for the milk. Approximately 55% of the milk producing households had between 1 and 2 lactating cows; 26% had between 3 and 5; and only 7% had more than five lactating cows.

The overall average daily milk production per producing farm was 6 litres, with a range of production of 0.5 of a litre to 30 litres per farm. The mean milk production per farm for those keeping improved dairy cattle was 16 litres per day, with a range of 0.7 of a litre to 30 litres per farm per day. The mean milk production per farm for those keeping indigenous cattle was 3 litres per farm per day with a range of 0.5 of a litre to 12 litres per farm per day. The yield per indigenous cow was about 1 litre per day. The yield per improved cow was about 8 litres per day. Table 4.9 shows the distribution of the sample farms according to the total daily milk production.

Table 4.9: Distribution of Farms by Total Daily Production of Milk.

Total Daily Production category (litres)	Sample number	Percentage	Cumulative percentage
0	12	11.76	11.76
0.5 - 5	33	32.35	44.12
6 - 10	21	20.59	64.12
11 - 20	23	22.55	87.25
over 20	13	12.75	100.00
Total	102	100.00	

Source: Survey Results, 1991.

4.1.7 Fresh Milk Disposal

The utilization of the day's milk production was divided among household consumption, sales, raw milk for processing and amount fed to calves.

4.1.7.1 Daily Household Consumption of Milk

Table 4.10 shows the daily consumption of milk by sample farm households.

Table 4.10: Distribution of Sample Farmers by Households' Daily Milk Consumption.

Quantity consumed (litres/day)	No.of sample farmers	Percentage of sample farmers	Cumulative percentage
0.5 - 1	25	29.8	29.8
1 - 2	21	25.0	54.8
2 - 3	23	27.4	82.1
over 3	15	17.9	100.0
Total	84*	100.0	

* 12 households had no lactating animals while 6 households sold all the milk that was produced.

Source: Survey Results, 1991.

From Table 4.10 about 30% of the interviewed households consumed one litre or less of milk on a daily basis, while about 25% consumed between one and two litres; about 27% consumed between two and three litres, and about 18% consumed over three litres. For all the producing households, about 21% of the milk produced daily was consumed by the farm family. The mean daily milk consumption per producing household was 3.7 litres. There is no significant difference in the amount of milk consumed among the households per day,

yet there is a wide difference in the household size. The *apriori* expectation was that larger families would retain a larger proportion of milk for consumption and vice versa. It is thus likely that there are some factors other than the family size that may affect the proportion of the milk produced that is retained for home consumption.

4.1.7.2. The Proportion of Total Daily Milk Production that is Sold

At the time of the survey, approximately about 69% of the interviewed farmers sold milk and about 73% of the total daily milk production was sold. Those who did not sell any milk, even though they were producing some, constituted 6% of the sample. Such producers claimed that they only produced milk just enough for their family consumption. Table 4.11 shows the distribution of the sample farmers according to the average daily milk sales.

Table 4.11: Distribution of Sample Farmers According to Daily Milk Sales

Quantity of Milk sold (litres)	Number of Sample farmers	Percentage of total	Cumulative percentage
0.5 - 5	25	35.7	35.7
5 - 10	19	27.1	62.8
10 - 20	14	20.0	82.8
over 20	12	17.1	100.0
Total	70*	100.0	_____

*32 farmers did not sell any milk during the survey period.
Source: Survey Results, 1991.

The channel through which any given farmer will sell his milk will depend, among other things, on the proximity of the market outlet, the price of milk at the particular market outlet, risks to be borne and promptness of payment. Table 4.13 shows the points of the first milk sales among the sample farmers.

Table 4.13: Points of First Milk Sales Among the Sample Farmers

Points of first sale	Number of farmers	Percentage of farmers	Cumulative percentage
Farm gate	23	33	33
Consumers' compound	30	43	76
Farmers' Dairy Club	7	10	86
Hotel/Restaurant premises	6	9	95
Village Market	3	4	99
KCC plant	1	1	100
Total	70	100	----

Source: Author's Investigation, 1991.

Approximately 33% of the sample farmers never left their farms in order to sell their produce while the rest delivered their milk to various destinations, mainly to the consumers' premises. Table 4.14 gives the distribution of the sample farmers according to the milk market outlets used.

Table 4.14: Milk Market Outlets Used by Sample Farmers

Marketing outlet	Number of farmers	Percentage of farmers
Individual consumers	55	78.6
Farmers' Dairy Club	7	10.0
Local govt institutions	3	4.3
Hotels/Restaurants	3	4.3
KCC	1	1.4
Itinerant traders	1	1.4
Total	70	100.0

Source: Author's Work, 1991.

This Table shows that milk was being sold directly to individual consumers, institutions such as schools and hotels, intermediaries, the farmers' "dairy club" (being the equivalent of a farmers' dairy cooperative society) and the Kenya Cooperative Creameries Limited (KCC). About 79% of the farmers interviewed sold their milk to individual consumers; 10% sold to the farmers' dairy club; about 9% sold to institutional consumers (schools and hotels), and only about 1% sold through intermediaries or to the KCC . The main reasons given by the farmers for preferring to sell to local informal market outlets to taking milk to the farmers' dairy club or the KCC were that the prices in the local informal markets were higher and the payments were made more promptly. Hence, the following were established as the alternative marketing channels for fresh milk in Kilifi District:

(i) PRODUCER -> CONSUMER chain, consisting of direct sales to individual consumers, including transactions at the farm-gate or deliveries to individual homes or business premises;

(ii) PRODUCER -> CATERING INSTITUTIONS -> CONSUMER chain, which involves deliveries to catering institutions, such as coffee houses, hotels and restaurants, either at the farm-gate or by direct delivery;

(iii) PRODUCER -> GOVERNMENT INSTITUTIONS -> CONSUMER chain, consisting of sales made to such government institutions as schools and hospitals, either at the farm-gate or by direct delivery;

(iv) PRODUCER -> ITINERANT TRADER -> CONSUMER chain, consisting of sales made at the farm gate to middlemen;

(v) PRODUCER -> KCC -> CONSUMER chain, consisting of direct delivery to the KCC plant by the producer.

Figure 4.1 gives a schematic representation of the milk marketing channels which constitute the alternative marketing systems for fresh milk in Kilifi District. The figures in parentheses show the percentage of the sample farmers using the particular channel. The study did not investigate the details of the intermediate stages in the marketing process. This was due to the insignificance of the percentage of the farmers who used either the intermediaries or the KCC outlets.

Fig 4.1 : Alternative Marketing Channels for Liquid Milk in Kilifi District
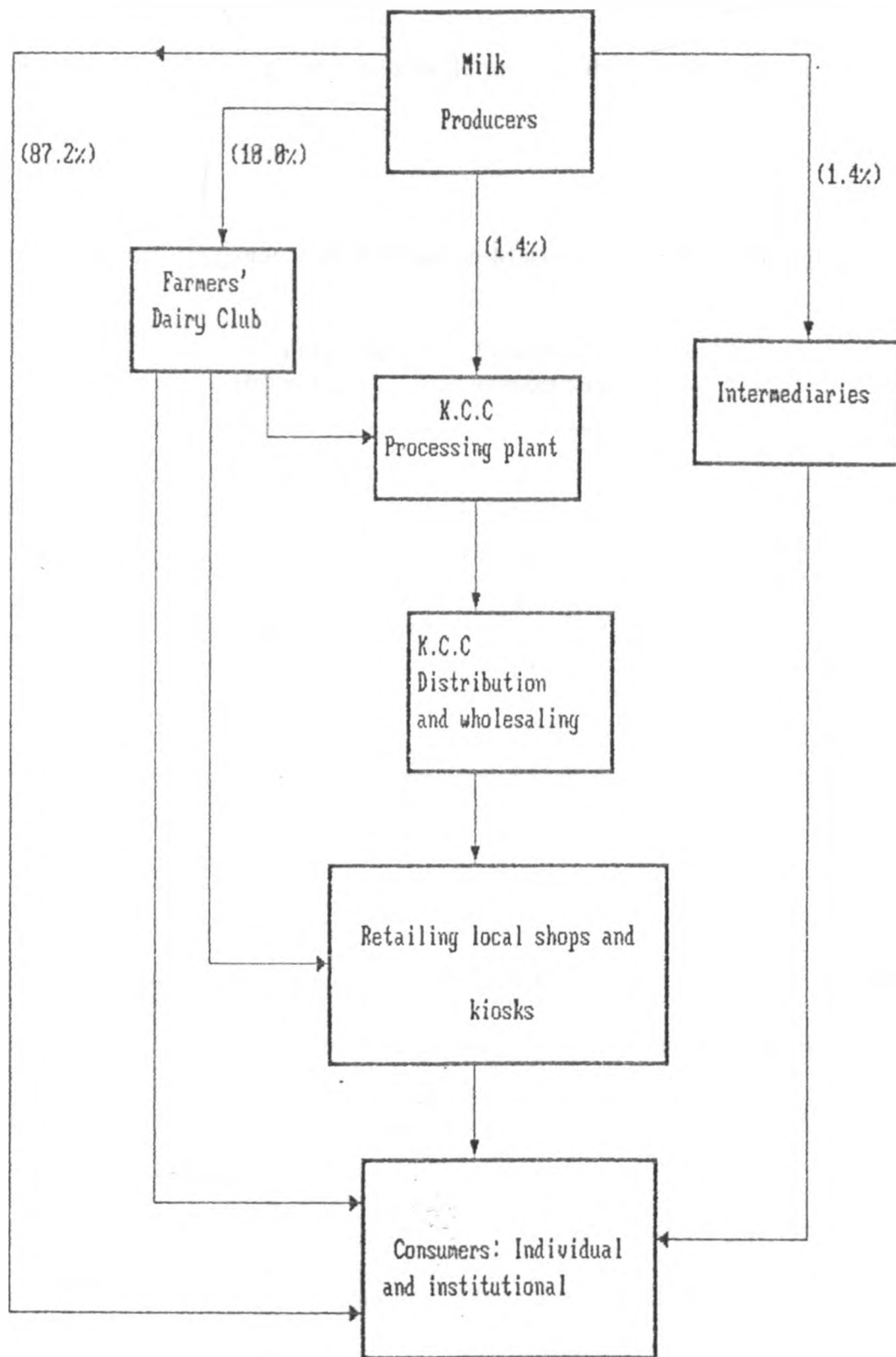
Figures in parentheses show the percentage of the sample farmers using the particular channel.

Table 4.15 shows the relative importance of the six marketing outlets in terms of their share of the milk sold by the sample farmers. The total market share for fresh liquid milk is defined in volume terms, rather than in terms of the number of the farmers that patronised a particular outlet.

Table 4.15:   Relative Importance of Alternative Market Outlets Used by Sample Farmers

Market outlet	Quantity sold (litres/day)	Percentage market share
Individual consumers	581.8	54.6
Hotel/Restaurant	295.3	27.7
Farmers Dairy Club	131.0	12.3
Local govt institutions	29.0	2.7
KCC	15.0	1.4
Itinerant traders	14.0	1.3
Total	1066.1	100.0

Source: Survey Results, 1991.

The dominance of the PRODUCER - CONSUMER marketing channel is demonstrated. About 54.6% of the total milk marketed went through this channel, while about 30.4% went through the PRODUCER - CATERING/GOVERNMENT INSTITUTIONS - CONSUMER channel. It can therefore be inferred that 85% of the total volume of milk marketed daily went directly to the consumers, both individual and institutional (hotels/restaurants/government institutions). This is so because local sales are more remunerative to producers: such sales involve lower marketing costs than the sales of milk elsewhere. Based on an argument by Mbogoh (1984) that the KCC milk intake, especially

from small-scale producers, heavily reflects the surplus of production after the local demand for milk has been satisfied, milk production in the study area can be said to be low. Since only about 1.4% of the marketed milk went through the KCC, the unregulated (informal) channel is clearly the main outlet for Kilifi District's marketed milk. Figure 4.2 gives a schematic representation of milk marketing channels by percentage volume of liquid milk sold in Kilifi District. The results in Figure 4.2 are comparable to those in Figure 4.1 in terms of importance of alternative marketing channels by both percentage volume of milk sold and percentage of sample farmers using a particular channel respectively.

Figure 4.2: Alternative Marketing Channels by Percentage
Volume of Liquid Milk Sold in Kilifi District
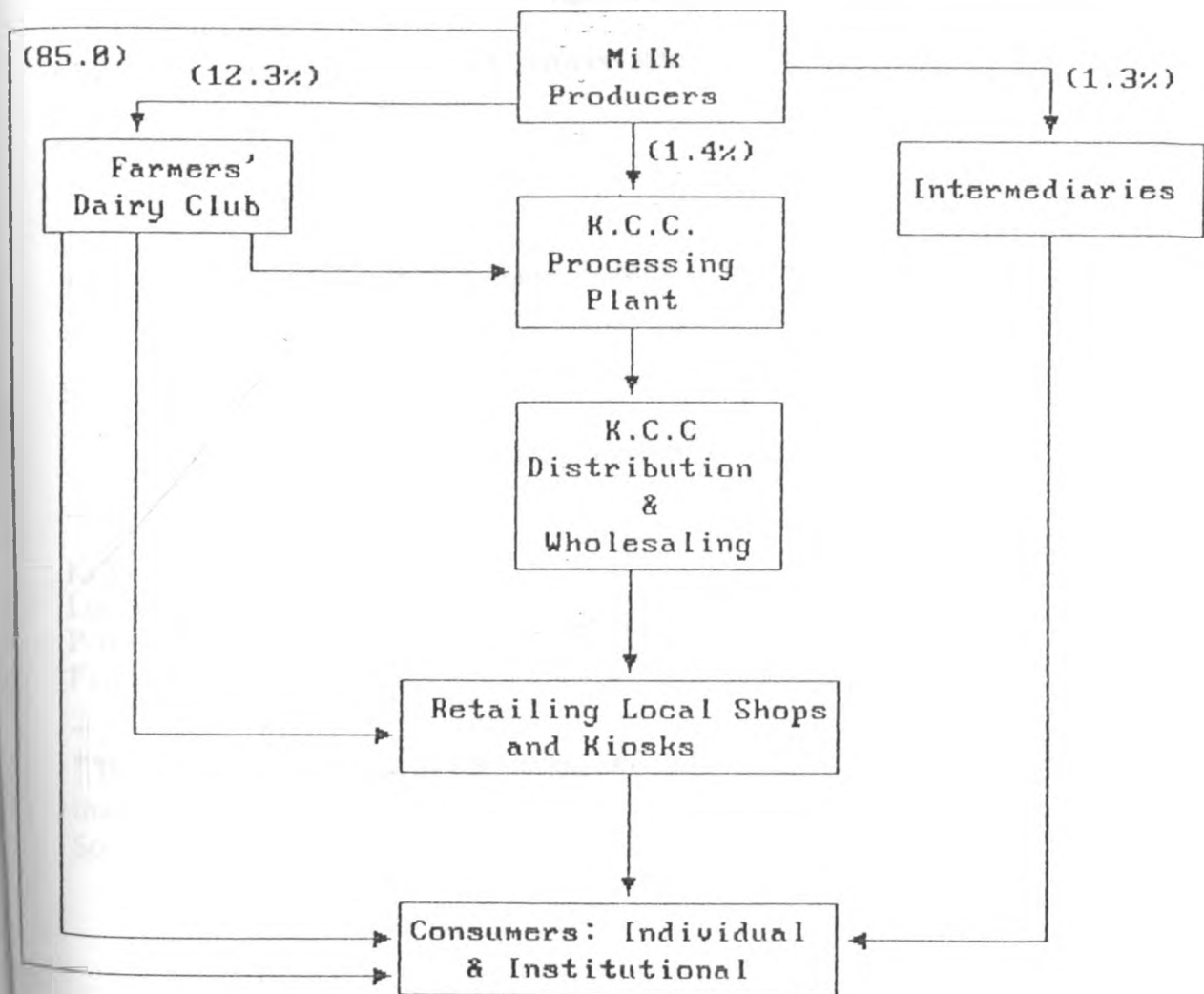
Source: Author's Investigation, 1991.

4.1.9 Institutional Milk Marketing: Sources of Supplies, Purchase Arrangements and Distribution

Table 4.16 presents the major sources of milk supplies to institutions. The Table demonstrates that the KCC is the major supplier of milk. It supplies to 79% of the institutions interviewed. This is followed by local producers (42%), a private processor (Kilifi Plantation) (14%) and the farmers' dairy club (4%). Each institution had more than one source of its supplies. The KCC covers more institutions than all the other sources combined.

Table 4.16: Major Sources of Supplies of Milk to Institutions in the Study Area

Source	Percentage of Institutions Receiving Portion of Their Supplies From Respective Sources**
KCC	79
Local Producer	42
Private Processor	14
Farmers dairy club	4

**Percentages do not add to 100 because most institutions received their supplies from more than one source.
Source: Author's Work, 1991.

An analysis of the types of the dairy products handled by all the institutions interviewed is given in Table 4.17. This analysis helps to reveal which types of products were most frequently used.

Table 4.17: Importance of Different Types of Milk Products Supplied to Sample Institutions

Milk Type	Percentage of Institutions Supplied[**]
KCC UHT	72
Fresh Whole milk	37
Kilifi Pasteurized milk	22
KCC Pasteurized milk	11
KCC fermented milk (mala)	3

[**]Percentages do not add up to 100 because most Institutions used more than one type.
Source: Survey Results, 1991.

From Table 4.17, the KCC Ultra Heat Treated (UHT) milk , Fresh whole milk, and Kilifi pasteurized milk were the major types of milk consumed by the institutions during the survey period.

Fifty nine percent of the sample institutions were found to have written contractual agreements with their suppliers, 13% had verbal arrangements only, and 28% did not have any form of arrangement. These forms of tying devices are indicative of the existence of some degree of vertical integration in the dairy industry in Kilifi District. From an economic standpoint, tying devices are typically undesirable because they are usually an attempt to foreclose a portion of the market from competition (Koch, 1974).

4.1.10   Producer Prices Received by Farmers From Different Market Outlets

In a well functioning marketing system, producers are free to market their products through the outlets of their own choice. The decision to market a given product such as fresh milk through a particular outlet is a function of producer price, transfer costs, risks to be borne and the promptness of payment, among other factors. Given that alternative

marketing channels exist and, assuming that the producers are rational, a dairy farmer will dispose of his milk to the highest paying buyer (market outlet). Table 4.18 shows the average, minimum and maximum prices received by the sample farmers from the alternative market outlets.

Table 4.18: Milk Prices Received by Sample Farmers According to Market Outlets

Type of marketing outlet	Mean price (Kshs/litre)	Maximum price (Kshs/litre)	Minimum price (Kshs/litre)
Local govt institutions	7.67	8.00	7.00
Hotels/Restaurants	7.10	8.00	6.00
Individual consumers	6.67	8.00	4.00
Itinerant traders	6.00	6.00	6.00
KCC	4.30	4.30	4.30
Farmers' Dairy Club	4.53	5.60	3.00

Source: Survey Results, 1991.

The mean price received by the sample farmers during the survey period was Kshs. 6.60 per litre, with a range of Kshs. 3.00 per litre to Kshs 8.00 per litre. Table 4.16 generally shows that the prices received from local sales are higher when compared to those received from the farmers' dairy club, the KCC or the intermediaries. Government institutions had the highest average price of Kshs. 7.67 per litre, followed by the hotels which offered Kshs. 7.10 per litre. If individual and institutional consumers, such as schools and hotels, are combined to constitute the PRODUCER - CONSUMER channel, the mean price for this channel would be Kshs. 7.12 per litre. The average price received by the producers from the PRODUCER - CONSUMER channel would thus be the highest among the channels identified. Some farmers were able to obtain as high as Kshs. 8.00 per litre from this

channel. It appears, however, that some farmers (1%) preferred to sell their milk through the KCC outlet despite the fact that it offered the lowest producer price. Reason for selling milk to the KCC is that this outlet is able to assure a ready market for milk. The low patronage by milk producers of the KCC outlet suggests that the local milk demand outstrips supply. The proximity of the KCC outlet was also cited as a reason for selling milk to that outlet.

4.1.11 Market Performance

This section on market performance examines the relative efficiency of the dairy market outlets in Kilifi District. Marketing efficiency is emphasized as one of the important measures of marketing performance (Chabari, 1986). For purposes of this study, efficiency indicators are estimated using producer price as the starting point. It is assumed that the objective of the milk marketing system is to provide the highest net prices to producers. In the context of this study, a marketing channel is deemed to be relatively more efficient if it provides a higher net price, that is, the producer price less the transfer cost. Transfer cost consists of terminal costs, such as handling, packaging plus transportation cost. In this study, however, attempts to generate data related to costs of packaging and handling failed because milk was packaged in bottles and milk cans provided by the buyers. The costs related to handling and packaging were thus assumed to be zero. Storage costs were also assumed to be negligible or zero because milk was sold fresh immediately after milking. It was therefore deemed appropriate to use only transportation cost to represent the marketing cost in the evaluation of relative efficiency. Marketing losses due to milk spoilage while still on the farm or in the process of delivery could also add to the marketing cost. In this study, however, no milk spoilage cases were reported.

4.1.11.2 Marketing Costs

The distance that each farmer has to ship his products, the mode of transport and the condition of the transportation infrastructure, affect the magnitude of the marketing costs incurred by the farmers. Table 4.19 shows the distance to the market covered by the sample farmers during the survey period.

Table 4.19: Distribution of Sample Farmers According to Distance to Markets

Distance category (km)	Number of farmers	Sample percentage	Cumulative percentage
0	23	32.9	32.9
>0 - 2	18	25.7	58.6
>2 - 6	16	22.9	81.4
over 6	13	18.6	100.0
Total	70*	100.0	____

*32 farmers did not sell any milk during the survey period.
   Source: Survey Results, 1991.

The mean distance covered by the sample farmers was 4.35 km, from the farm to the point of first sale, the range being from zero to 33 km. Table 4.19 shows that about 33% of the sample farmers sold their milk at the farm gate, while about 26% covered distances greater than 0 to 2 km, about 23% covered distances greater than 2 to 6 km and only about 19% covered distances greater than 6 km. In situations where the distances to be covered are long, the farmers might be constrained from selling their milk by such distances so that only the "morning milk" is sold. The issue of the distance to the market was, however, not

a big problem as most farmers (81%) sold their milk within relatively short distances, ranging from zero to six Kilometres. The mode of transport used by the sample farmers is shown in Table 4.20.

Table 4.20: Mode of Transport Used by Sample Farmers

Mode of Transport	Number of Responses	Percentage of Total	Cumulative percentage
Trekked on foot	24	43.6	43.6
Bicycle	15	27.3	70.9
Public means	13	23.6	94.5
Personal car	2	3.6	98.1
Motor Cycle	1	1.8	100.0
Total	55*	100.0	_____

*Of the remaining 47 farmers, 23 sold milk at the farm gate, 12 did not produce any milk and the other 12 consumed all their milk.

Source: Survey Results, 1991.

The results in Table 4.20 show that about 44% of the producers mainly trekked when delivering milk to the sales points, while about 27% used bicycles, 24% public transport, 4% their personal cars and only 2% used motor cycles.

The approximate costs of transporting milk to the various market outlets are shown in Table 4.21. These costs were obtained by asking the respondents to estimate how much they paid in delivering their milk to the respective outlets per day. The transportation costs for the respective market outlets were then divided by the quantity of milk sold in litres that

went through those outlets in order to obtain the transportation cost per litre of milk sold.

This transportation cost per litre is what is being referred to as the unit marketing cost. Table

4.21 shows the transport costs per litre according to the market outlets.

Table 4.21: Transport Costs per Litre According to the Market Outlets

Market outlets	Transportation cost (Kshs.) per day	Quantity of of milk sold	Transportation cost per litre (unit cost)
Individual consumers	148	581.8	0.25
Hotel/ Restaurant	54	295.3	0.18
Farmers Dairy Club	34	131.0	0.26
KCC	15	15.0	1.00
Local govt Institution	00	29.0	0.00
Itinerant traders	00	14.0	0.00

Source: Author's Calculations, 1991.

Table 4.21 shows that the estimated average costs of transportation were:

i) Kshs. 0.25 per litre of milk sold through the PRODUCER -CONSUMER channel;

ii) Kshs 1.00 per litre of milk sold through the PRODUCER - KCC - CONSUMER channel;

iii) Kshs. 0.18 per litre of milk sold through the PRODUCER -CATERING INSTITUTION -

 CONSUMER channel; and

iv) Kshs. 0.26 per litre of milk sold through the PRODUCER - FARMERS' DAIRY CLUB

- CONSUMER channel.

The high transportation cost per litre of milk sold for farmers who delivered their milk

to KCC was due to the distance covered in doing so and at the same time delivering small

quantities of milk. Some of the sample farmers who sold their milk through the PRODUCER - GOVERNMENT INSTITUTIONS - CONSUMER channel and the PRODUCER - ITINERANT TRADER- CONSUMER channel either did so at the farm gate or trekked to the consumers' premises. Some researchers have used the opportunity cost of earnings foregone to put a value on time spent on trekking (Hanley, 1990), assuming that this represents the opportunity cost of time. Others have distinguished between those giving up earnings and those not. However, in the present study farmers did not give up any earnings and therefore the opportunity cost of trekking was taken to be zero.

The efficiency of the fresh milk sales through the alternative marketing channels was estimated by using the mean producer price per channel and the unit marketing cost. The difference between these two parameters, that is, the net price, was used to judge the relative efficiency of the different marketing channels (Table 4.22).

Table 4.22: Unit price, Unit cost and Net Price by Market outlet

Market outlet	Mean Price (kshs/litre)	Unit cost (kshs/litre)	Net price (Kshs/litre)
Government Institutions	7.67	0.00	7.67
Hotel/ Restaurants	7.10	0.18	6.92
Individual Consumers	6.67	0.25	6.42
Itinerant Traders	6.00	0.00	6.00
Farmers' Dairy Club	4.53	0.26	4.27
KCC	4.30	1.00	3.30

Source: Author's Calculation, 1991.

Table 4.22 shows that selling directly to government institutions was the most relatively efficient outlet because it yielded the highest net price, and this was followed by the hotels/restaurants and individual consumers. The least relatively efficient outlet by this criterion was the KCC outlet. However, it must be noted that only about 1% of the sample farmers used the KCC outlet. Generally, the PRODUCER - CONSUMER channel, covering both the institutional and the individual consumers, was the most efficient, yielding an average net price to producers of @ Kshs. 7.00 per litre as compared to itinerant traders @ Kshs. 6.00 per litre, the Farmers' Dairy Club @ Kshs. 4.27 per litre, and the KCC @ Kshs. 3.30 per litre.

4.1.12 Capital Requirement

The role of credit in modern farming has been emphasized by a number of studies. Pischke (1974), Kayondo (1975) and Muthee (1975) (as cited by Iyadema, 1988) have stressed that credit is an essential ingredient in agricultural development, particularly for small-scale farmers. Indeed, availability of credit to farmers can enable them to afford increased use of agricultural inputs and thereby realize higher yields. Credit to marketing agencies can improve their efficiency both in procurement and distribution (Iyadema, 1988). According to the survey results, most farmers (62%) did not receive or use credit. Those who received or used credit claimed that what they got was not sufficient to finance their dairy enterprise. About 97% of the farmers who used credit obtained it from a government parastatal, the Agricultural Finance Corporation (AFC). This credit was given mainly in kind. Only about 3% of the sample farmers obtained credit from a commercial bank. The main reason cited for not obtaining commercial credit was lack of collateral. Many financial institutions request for land title deeds as collateral, land being the most tangible resource

in the agricultural sector. About 48% of the sample farmers lacked title deeds to their homestead plots (refer to Table 4.5). Another reason cited by sample farmers was lack of awareness on the benefits that can accrue from the use of credit. Therefore, it can be said that access to capital is a limitation to dairy farming in Kilifi District given that the dairy enterprise requires a heavy capital input. Thus, capital requirement could be a barrier to entry into dairy farming.

4.1.13 Problems Affecting Dairy Production and Marketing in Kilifi District

The producers were asked to describe what problems they faced in their dairy enterprise. Many producers listed more than one answer, although some did not indicate any problem. These responses are divided into two categories, viz. milk production constraints and milk marketing constraints, and are tabulated in Tables 4.23 and 4.24 respectively. This information is necessary in order to list the constraints according to the frequency with which they occurred among the sample farmers. Table 4.23 shows the milk production constraints in Kilifi District.

Table 4.23: Milk Production Constraints in Kilifi District

Problem	Number of responses[*]	Percentage of responses
-High cattle disease incidence	26	30.6
-Lack of feeds	14	16.5
-Lack of credit scheme	10	11.8
-Seasonal lack of water	7	8.2
-Ineffective Animal Health, Artificial Insemination and Extension services	3	3.5
-Lack of knowledge on how to conserve fodder and farm by-products	2	2.4
-Farmers lack of knowledge on how best to operate zero-grazing units	2	2.4
-Lack of breeding stock	1	1.2
-Lack of fodder planting material	1	1.2

[*] Some farmers gave more than one problem.
Source: Survey Results, 1991.

Table 4.23 shows that cattle diseases, lack of animal feeds, lack of credit scheme for dairy enterprise and seasonal lack of water (for both irrigation and animals) were the most commonly mentioned milk production constraints. These constraints have thus limited the expansion of the dairy industry in Kilifi District.

Cattle diseases, especially those of East Coast Fever (Theileriosis) and Nagana (Trypanosomiasis) have been common problems (Thorpe, 1990). Such diseases become a major worry for every farmer who depends on dairy enterprise for income. Therefore, it would be very difficult to encourage increased milk output to overcome the unsatisfied demand without first taking measures to reduce or eliminate the high incidence of cattle diseases. Most of the dips in'the study area do not operate. There are, however, some

efforts being made by the International Livestock Centre for Africa (ILCA) in controlling these diseases.

Credit was not found to be easily available. Thus, the farmers may lack funds to purchase enough of the inputs in a dairy enterprise. Since dairy cattle require concentrates to realize their genetic potential, a limitation of credit can preclude maximized output.

On the marketing side, poor infrastructure, absence of an organized milk market and seasonally low producer prices for milk relative to production costs were the common problems cited by the farmers. These are shown in Table 4.24.

Table 4.24:   Milk Marketing Constraints in Kilifi District

Problem	Number of farmers*	Percentage of farmers
Poor infrastructure	20	23.5
-Absence of organized milk market	15	17.6
-Seasonally low milk prices	1	1.2

* Some farmers gave more than one problem
Source: Survey Results, 1991.

Poor infrastructure, mainly poor access roads, are a disincentive to milk producers. Some access roads in the producing zones were not only rough but inaccessible during the wet season. In such cases, the means of transport was also scanty and expensive. Milk, probably the most perishable of all major agricultural products, presents some unique marketing problems. It must

be sold immediately after milking, especially if cooling facilities are not available. Hence, the producers should have free access to the markets during all seasons.

Milk producers in Kilifi District also expressed concern about the lack of organized markets, as reflected in the lack of a suitable network of marketing channels that are as near as possible to the farmers.

4.1.14 Farmers' Suggestions on What Should be Improved

Table 4.25 lists the suggestions made by the sample farmers on how the government can assist them in alleviating their problems.

Table 4.25: Farmers' Suggestions on How to Alleviate Their Problems

Suggestion	Number of responses*	Percentage of Total
-Better Access to Credit	25	28.7
-Improve on Transport Infrastructure	14	16.1
-Improve on Veterinary Services	14	16.1
-Development of appropriate extension package to meet changes in production pattern	14	16.1
-Formation of Producer Cooperative Society	6	6.9
-Improved Access to Water	6	6.9
-Improve on Inputs Supply to Farmers	4	4.6
-Establish Locational-based producer price and dry season premiums	4	4.6

*Some farmers gave more than one suggestion
Source: Survey Results, 1991.

The suggestions given in Table 4.25 are aimed at achieving the following objectives:-

a) Making capital accessible through the provision of credit facilities;

b) Facilitating transportation of milk by improving the transport infrastructural facilities by way

of opening up new access roads and repairing those in bad condition;

c) Improvement of the inputs supply to the farmers; and

d) Providing the farmers with the knowledge on modern ways of dairy farming.

4.1.15 Problems Faced by Institutions in the Procurement of Milk

Table 4.26 gives the problems that face institutions in the procurement of milk.

Table 4.26: Problems Faced by Institutions When Procuring Milk

Problem	Number of institutions*	Percentage of institutions
Shortage of Milk	30	39.4
-Unreliable supply	12	15.7
-Poor transport infrastructure that leads to delays in delivery	8	10.5
-Spoilage for KCC milk	7	9.2
-High price fluctuation in the informal sector	1	1.3

*Some institutions did not mention any problem
Source: Survey Results, 1991.

Table 4.26 demonstrates that the major problems facing the institutions when procuring milk are its shortage and irregular/unreliable supplies. The milk shortages mentioned are likely to be the main driving force behind the high prices in the informal sector. Among the other problems, the spoilage of the KCC milk and price fluctuations in the informal sector are also important.

4.1.16 Suggestions by Institutions on How the Government Could Help Alleviate Their Problems

Table 4.27 records the suggestions made by the institutions as to how the government could assist them in alleviating their problems.

Table 4.27: Institutions' Suggestions on How Government Could Assist in Alleviating Their Problems

Suggestions	Number of institutions	Percentage of Institutions[*]
-Improvement of general infrastructure	14	18.4
-Encourage more farmers to produce milk	11	14.4
-License producer retailers and processors to sell milk in Urban areas	3	3.9
-Improvement of hygiene of locally produced milk	2	2.6
-Avail powdered milk, especially during dry season	2	2.6

[*]some institutions had no suggestion.
Source: Survey Results, 1991.

4.2 Results of the Regression Analysis

This section presents and discusses the results of the estimation of the linear multivariate regression model of the form:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3,$$

as presented and discussed in section 3.5.2.

Table 4.28 provides the regression results in the form of the estimated beta coefficients and associated standard errors as well as the t^* values. Unless otherwise stated, subsequent discussions are based on the results as shown in the Table. Some of the hypotheses stated in section 1.8 are tested on the basis of these regression results.

Table 4.28: Results of the Regression Analysis

Variable Name and Constant		Regression Coefficient	Standard Error of Coefficient	t^* Value
Constant	(a)	-2.23	1.36	-1.64
-Market price for milk	(X_1)	1.07	0.17	6.19
-Number of lactating animals	(X_2)	0.73	0.34	2.18
-Household size	(X_3)	0.15	0.09	1.59

R^2	0.42
F (d.f)	20.93 (3,86)
Number of observations	90
Level of significance	5%

Source: Survey Results, 1991.

The estimated equation for the determinants of the amount of milk offered to th[e]

by the farmers is thus given by:

$$Y = -2.23 + 1.07X_1 + 0.73X_2 + 0.15 X_3$$

where:

Y is the amount of milk actually marketed.

X_1 through X_3 are as defined in Table 4.28.

The results reveal that the regression coefficients for market price and the nu[mber of]

lactating animals were statistically significant at the 5% level. The regression coeffic[ient for]

household size was, however, insignificant at the same level. The value of the coeff[icient of]

multiple determination (R^2) is 0.42. The higher the R^2 value, the better the "goodness [of fit" of]

the regression line for the sample observations. The fitted equation therefore explai[ns]

about 42 percent of the variation in the amount of milk actually sold. The quantity [of milk]

marketed is thus also influenced by some other factors since only 42 percent is explain[ed by the]

number of lactating animals, average market price for milk and the household size.

The F-statistic has a value of 127.67. Comparing the calculated value of the F-statisti[c]
the tabulated F-value of 3.95 at the 5% level of significance, it is clear that the regres[sion]
equation as specified is statistically significant. Hence, the null hypothesis that all the regres[sion]
coefficients are zero is rejected, and that the model used here has some explanatory powe[r in]
determining the factors affecting the quantity of milk marketed.

The regression results indicated that the coefficient of the number of lactating anima[ls is]
positive and significant at the 5% level. The implication is that the larger the numbe[r of]
lactating animals, the larger the proportion of milk produced that goes to the market, *ce[teris]
paribus*, suggesting that an increase in the number of lactating animals would lead to an incr[ease]
in the amount of milk sold.

The regression coefficient for the average market price for milk was found to be pos[itive]
and significant at the 5% level. This implies that if the producer price for milk increases, th[ere]
would be an increase in the amount of milk that is supplied to the market. This result conf[irms]
what other workers have found: that milk producers are responsive to the level of prod[ucer]
price, and that low levels of milk supplies to official markets may be associated with [the]
unrealistically low levels of the price fixed by the government (Mbogoh, 1984).

The coefficient for the variable on household size was insignificant at the 5% level. T[he]
household size bears no relationship with the amount of milk sold. Theoretically, one w[ould]
expect an inverse relationship between household size and the quantity of milk s[old]

Chaturvedi (1959) distinguishes a marketable surplus of developed economies as "real" marketable surplus since it represents the excess of producer needs and describes that of poor agricultural economies as "forced" marketed surplus since it represents the surplus that is created compulsorily out of the given produce in order to meet other pressing needs. The description of marketed surplus from poor agricultural economies by Chaturvedi (1959) as being "forced" could probably explain the non-significance of the household size as a variable that can explain marketed milk production. The reason is that the amount of milk retained for household consumption was too small and almost uniform, yet household size varied greatly among the farm families. As such, household size did not significantly influence the marketed milk production in Kilifi District.

4.3 Hypotheses Testing

Three hypotheses as stated in section 1.7 were tested in this study. Hypothesis (ii) was tested on the basis of the results of regression analysis. A two-tail t-test was performed. The tabulated t-value of 2.00 at 5% level of significance under the specified degrees of freedom was compared with the calculated t^* ratios in Table 4.28.

The first hypothesis stated that "the unregulated informal market does not constitute the major outlet for the marketed milk that is produced in Kilifi District". In the context of this study, the term "major" is justifiably taken to imply anything above 50% of the marketed milk output. The results of the study show that about 54.6% of the marketed milk went to individual consumers, while about 30.4% went to the institutional consumers. These two outlets constitute

the unregulated market outlets. Only about 1.4% of the marketed milk went through the KCC outlet, which constitutes the regulated market. In volume terms, therefore, the results show the dominance of the direct PRODUCER - CONSUMER marketing channel. Since about 85% of the marketed milk went through this unregulated milk market, the hypothesis "that the unregulated informal market does not constitute the major outlet for marketed milk that is produced in Kilifi District" is rejected.

The second hypothesis stated that "the quantity of marketed milk bears no relationship with the average market producer price for milk". The regression results show the effect of price on the quantity of marketed milk to be positive and statistically significant at the 5% level. Thus, the hypothesis that "the quantity of marketed milk bears no relationship with the average market producer price for milk" is also rejected. Since the coefficient is 1.07, it means that an additional Kenya shilling increase in the market price for milk will induce an additional 1.07 litres of milk sales per day. These results are consistent with *apriori* expectations.

The third hypothesis stated that "the unregulated market does not yield the highest net producer price per litre of milk sold when compared with that for the regulated market". The results show that, generally, the prices received from local sales which constitute the unregulated market are higher than those received from the farmers' dairy club, the KCC or the intermediaries. Institutional consumers offered the highest average net price. Local government institutions offered kshs. 7.67 per litre, followed by the hotels which offered kshs. 6.92 per litre, while individual consumers offered kshs. 6.42 per litre. The KCC outlet constitutes the regulated

market in Kenya. When the general PRODUCER - CONSUMER channel was considered, the mean net price for this channel was Kshs. 7.00 per litre. On the basis of these results, the null hypothesis that "the unregulated market does not yield the highest net producer price per litre of milk sold when compared with that for the regulated market" is rejected. This implies that the unregulated market does yield the highest net producer price per litre of milk sold when compared with that for the regulated market.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS, RECOMMENDATIONS AND POLICY IMPLICATIONS

This chapter summarizes the objectives, hypotheses, results and conclusions of this study. Policy implications based on the inferences and information contained in this study are also presented.

5.1 Summary

The dairy industry has a vital role to play in the development and growth of Kenya's economy. The overall thrust of Kenya's agricultural policy is to achieve food self-sufficiency, with surplus stocks for strategic reserves and export. With reference to milk production, the Kenya government's policy, therefore, aims to increase milk production so as to meet increasing national demand resulting from population growth and increases in disposable income. Improving the profitability of dairy farming relative to the other agricultural activities would be expected to be instrumental in making dairy farming attractive. Hence, any efforts to improve dairy production should be accompanied by improvements in the marketing system in order to ensure that: (i) there are sufficient outlets to cater for increased output of dairy products; (ii) the marketing system provides the right incentives to producers in order that they provide the goods and services that are required by the consumers at acceptable prices.   In   Kilifi District, the milk marketing system has been criticized as being ineffective in linking supply with demand, thus dampening the possibility of alleviating the region's large milk deficit. The fact

that the milk production and marketing system in Kilifi District has not been studied in detail limits information that can lead to finding ways and means of resolving this problem. To address these problems, the present study set out to:

i)   identify the factors that constrain the coast dairy industry at production and marketing levels, and to suggest appropriate strategies to overcome them;

ii)   determine the various factors that influence marketed milk output in Kilifi District;

iii)   identify and describe the marketing channels for milk in Kilifi District;

iv)   compare the efficiency of different market outlets and channels in terms of net prices as a measure of market performance between the regulated and unregulated milk markets.

Three hypotheses were tested. These stated that:

i)   the unregulated "informal" milk market does not constitute the major outlet for the marketed milk that is produced in Kilifi District;

ii)   the quantity of milk marketed bears no relationship with the market price for milk;

iii)   the unregulated market does not yield the highest net producer price per litre of milk sold when compared with that of the regulated market.

To meet the study objectives, data were collected using a set of structured questionnaires at two levels. First, 102 farmers were selected at random, 51 of whom were registered as

members with NDDP. The other 51 were non-NDDP members. These farmers were intervi

to provide information on socio-economic characteristics, milk production and marketing a

as the associated farming activities. Also sought was information on the mode of transpor

transportation costs to the market, markets of first sale, other variable costs related t

process of marketing and problems encountered in production and marketing of

Secondly, institutional milk consumers (such as hotels and retail shops) were interview

provide information regarding the types of dairy products purchased, sources of supply of va

dairy products and problems encountered in procuring these products. Data collection

conducted during the period from May through July 1991. The analysis of the data was ca

out using descriptive statistics and regression analysis.

The study revealed that fodder production was practised by 80% of the farmers intervie

Napier grass was the main type of fodder crop. The other type of fodder crop growr

Leucaena leucocephala.

About 50% of the animals kept by sample farmers were of improved type, while the

were of the local zebu type. The percentage of the farmers who had improved dairy an

only was about 55%. About 62% of the lactating animals were of the improved type. Milk

per improved animal was about 8 litres per day while that of an indigenous zebu cow was a

1 litre per day. Of the total daily milk production, about 21% went towards house

consumption, 73% was sold, 5% went towards calf-feeding and about 1% was processed, m

into fermented milk, all of which was for home consumption. The only dairy produc

thus marketed by dairy farmers was fresh whole milk.

Milk was marketed through both the formal and the informal market outlets, the

milk channel being the PRODUCER - CONSUMER one. About 85% of the total

the milk that was produced daily went through this channel. The main reasons giv

farmers for preferring to sell their milk through the informal rather than the form

outlets were the higher milk prices and prompt payments. However, a limited n

farmers preferred to sell their milk through the KCC outlet even though it offered

producer price. The main reason for selling milk to the KCC is that this channel

assure a ready market for milk and also due to its proximity.

The results of the study also show that small-scale farmers use public transport (

bicycles (27%) to transport their milk. However, trekking was the most common

transport used, accounting for 44% of the sample farmers.

The test of efficiency of different marketing channels, based on the highest net

price, revealed that the selling of milk directly to government institutions was the most

efficient, followed by sales to hotels and individual consumers. The least relativel

channel according to the criterion chosen, was the KCC outlet. However, it must be

less than 4% of the sample farmers sold milk to government institutions and/or t

Generally, the PRODUCER - CONSUMER channel was the most relatively efficien

a net producer price of @ Kshs. 7.00 per litre, as compared to that for itinerant trade

6.00, and that for farmers' dairy club @ Kshs. 4.27 per litre, and that for the KCC @

per litre.

About 38% of the farmers in the study area were found to have acquired s

even though they claimed it was not sufficient to finance their dairy enterprises.

mainly given in kind. About 97% of the farmers who had acquired some credit

from the AFC, and only about 3% had acquired some credit from a commercial ba

The farmers cited various constraints they face in their dairy enterprise. These

could be divided into production and marketing problems. The most important

problems cited by the farmers were:

 i)   cattle disease outbreaks, especially those of East Coast Fever (*Theil*

         Nagana (*Trypanosomiasis*);

 ii)   lack of animal feeds;

 iii)   lack of a credit scheme for dairy enterprise; and

 iv)   lack of water for animals and irrigation.

The marketing problems cited were:

 i)   poor infrastructure, with respect to access roads;

 ii)   lack of organized milk markets;

 iii)   seasonally low producer prices for milk relative to production costs.

On the institutional side, the KCC was found to be the major supplier of milk, sup[plying]
79% of the institutions interviewed. The other important milk suppliers to inst[itutional]
consumers were the local producers (42%), private processors (14%) and the farmers' d[airy]
(4%). The principal type of milk supplied to the institutions was the KCC UHT. Ab[out]
of the institutions received this type of milk. Others, in order of importance, were: fres[h]
milk (37%), Kilifi pasteurized milk (22%), the KCC pasteurized milk (11%), and t[he]
fermented milk (3%).

Institutional consumers had tying purchase arrangements with the various sources
supply. About 59% of the sample institutions had written contractual arrangements, wh[ile]
had verbal arrangements with their suppliers. Only about 28% did not have any
contractual arrangement with their sources.

The most critical marketing problems cited by the institutional consumers were:

i)   shortages of milk;

ii)   unreliable supply;

iii)   poor transport facilities;

iv)   spoilage for KCC milk; and

v)   high price fluctuations in the informal sector.

The results of the regression analysis show that, of the variables tested, the nu[mber]
lactating animals and the average market producer price for milk are important deter[minants]

...milk marketed. These two factors were positive and significant at 5% level.

...s was found to be insignificant at the 5% level.

...clusions are drawn from analysis and results. Recommendations and policy

...this study are then made also on the basis of the analysis and results.

...of caution is necessary when drawing general policy inferences from such a

...dy was carried out in a region where commercially oriented milk production

...Secondly, the socio-economic, cultural and physical environment of the study

...from other areas of Kenya. In view of these facts, it may not be appropriate to

...sults for all the dairy farmers in the country, except for those ones who operate

...environment.

...qualifications, the inferences made hereafter appeared plausible:

...ic potential of the dairy animals in the study area appears to be one of the

...ns to increased milk production in Kilifi District. The percentage of improved dairy

...in the study area was found to be 50% of the total cattle population in the sample;

...re exists a considerable unexploited potential for raising milk output in the area

...the upgrading of the indigenous stock or through direct purchases of improved

(ii)   informal marketing channels dominate the Kilifi dairy market, with about 85% of the total daily milk production going to local consumers, and the local sales being more remunerative to producers because of higher net prices; the producer prices in the informal markets were found to be generally higher than those in the formal market;

(iii) rural markets are dominated by the sales of small quantities of fresh whole milk moving within relatively short distances, and very often directly exchanged between the producer and the consumer; the KCC milk intake   from the study area was found to be low, with less than 1% of the sample farmers selling their milk to the KCC, yet the KCC is the major supplier of milk in Kilifi District, supplying to about 79% of the institutional consumers interviewed; therefore, it can be concluded that a large proportion of the milk sold by the KCC in Coast Province originates from outside the province, and this is also easily substantiated by government statistics (Ministry of Livestock Development, 1991);

(iv)   use of credit to finance the dairy enterprise in the study area was found to be low. Only about 38% of the farmers interviewed used the existing credit facilities. This was because of collateral requirement by the financial institutions, and many farmers lacked such collateral. Access to credit for investment and initial capital requirement, therefore, was found to be a barrier to entry into dairy farming by smallholders;

(v)   there exists some form of vertical integration in the dairy industry in Kilifi District, since the study found that there were tying purchase arrangements in the Kilifi District dairy industry;

(vi)   the prices that the farmers receive and the number of lactating animals on the farm were found to be important determinants of the quantity of marketed milk so that favourable producer prices could be a crucial factor if the milk marketing system is to be expected to guarantee regular and sustainable supplies;

(vii)   lastly, the farmers were facing a myriad of problems that preclude efficient functioning of the dairy industry, most of these being not of their own making and thus needing urgent attention from government and other bodies in the dairy industry if dairy production is to be stepped up in order to rectify the imbalances in supply and demand.

5.3   Recommendations and Policy Implications

Based on the study results, various recommendations for policy action can be proposed. Since the genetic potential of the dairy animals was suspected to be a limitation to increased milk production, there is need for genetic improvement of the local indigenous stock. This can be achieved by upgrading dairy cattle through the use of artificial insemination, which is a low-cost though long-term process. An alternative would be to encourage direct purchases of improved stock. The latter alternative should be coupled with the setting up of multiplication farms for increased stock availability.

Increased availability of and smallholder access to rural finance and credit, coupled with a more efficient credit delivery system and higher recovery rates of credit from both public and commercial sources, would be necessary. Credit is needed for the purchase of inputs that can

boost the farmers' dairy output. Of course, strict supervision is necessary to ascertain that such credit is used for the intended purposes. Credit should preferably be in kind. Related to the availability of credit, land demarcation needs to be expedited in order that the farmers can get and use their land title deeds as collateral for getting loans in order to secure investment capital for their dairy operations.

A veterinary service and a prophylactic drug supply system are essential in controlling disease problems in improved dairy animals because of their susceptibility to endemic diseases. Veterinary services should, therefore, be provided by the government, under a system of cost recovery or by the farmers' co-operative society. This is in view of cattle diseases, especially those of **Theileriosis** and **Trypanosomiasis**, being endemic in the area.

Small scale farmers could join together in cooperatives and pool their produce for further marketing and, thereby increase their bargaining power. This is in view of the dominance of informal market outlets in Kilifi District. Transportation could also be organized through the cooperatives. Empirical observations suggest that the large milk outlets (such as tourist hotels) prefer large quantities of milk and milk products on a continuous basis. The small scale farmers can only supply such outlets by pooling their produce through a cooperative. However, such cooperatives need effective and efficient management, while the farmers must produce enough milk to sustain such cooperatives. Therefore, it is suggested that reorganization of the milk marketing system through the establishment of the farmers' dairy cooperative societies may help to improve the efficiency of milk marketing.

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Efforts need to be intensified to improve the state of rural roads by making them all-weath[er]
roads. This could be done at least by putting gravel on roads if tarmac is considered
expensive. Transportation of milk, animal feeds and movement of A.I. services would beco[me]
easier. Transportation costs are also likely to be reduced.

Since the milk producer price was found to have a significant positive effect on the quant[ity]
of milk marketed, it is suggested that the milk producer price be region-specific (because co[sts]
of production differ) and that it be based on the quantity of milk delivered. This may fos[ter]
competition between formal and informal markets, and thereby encourage increased milk outp[ut.]
Recently, the price of fluid milk has been deregulated. The impact of that deregulation on m[ilk]
production and consumption is yet to be fully understood.

These above recommendations require concerted efforts by various government ministr[ies]
and organizations. In particular, the Ministry of Agriculture, Livestock Development a[nd]
Marketing will be instrumental in their successful implementation. Also, technical research w[ill]
have an important role to play in developing dairy production technologies which a[re]
appropriate to small scale farms in different AEZs. Local governments will have to help [in]
improving the state of existing rural roads, as well as with the construction of new ones.

5.4 Need for further research

An analysis of the impact of price deregulation on milk production and consumption (afte

the effect of deregulation has been fully realized) will be required. Such an analysis would revea

the effects of price decontrol on production and consumption of milk in Kenya in general, and

is considered important.

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Appendix I

FARM LEVEL DAIRY MARKETING SURVEY

1) Date of Interview _____

2) Name of Enumerator _____

3) District _____ 4) Division _____

5) Location _____ 6) Village _____

7) Name of Dairy Operator_____

8) Name of Farm Owner _____

 (if different from dairy owner)

9) Dairy Operators Sex _____ 10) Age _____

 11) Dairy Owner's Education Level_____

12) NDDP Farm? _____

13) What do you consider to be your main occupation?

_____

14) Total No. HH members _____

15) Farm Size Total Acres _____ or Hectares _____

16) No. Plots _____

17) Size of plot around homestead _____

18) Land Tenure _____

19) Crops _____ _____ _____

_____ _____ _____

20) Cash _____   _____

21) Fodder _____   _____

22) Crop residues Fed to Animals: _____   _____

23) Livestock Ownership

	Total Cattle	No. Zebu	No. Grade	Goats	Sheep
a) This farm					
b) Own Livestock					
c) Other's animals					
d) On Farms Elsewhere					
e) In Milk					
f) Being Milked					

24) <u>Feed Resources</u>

Purchased Feedstuffs   Source(s)

_____   _____

_____   _____

25) <u>Milk Production</u>

	Zebu	Grade
	Quantity	Quantity
Avg Production AM		

Avg Production PM   _____   _____

Total Milk Production _____   _____

26) Other Dairy Products Produced On Farm

Product	Frequency Produced	Quantity Produced
_____	_____	_____
_____	_____	_____

27) Dairy Product Disposal

	HH Consumption (Qty/ Unit)	Calves	Processed	Sold	Other
Milk:					
Production AM	_____	_____	_____	____	____
Production PM	_____	_____	_____	____	____
Other Products					
_____	_____	_____	____	___	___
_____	_____	_____	____	___	___

28) Transportation and Storage

Product	Storage (on farm)	Spoilage (%)	Storage (to mkt)	Spoilage (%)	Transport Mode	Distance (Kms)	T/port Cost-R-T
____	____	____	____	___	____	____	____
____	____	____	____	___	____	____	____

29) <u>Capital Investment</u>

Equipment	Owned/Rented/ Borrowed	Original Value	Present value Estimate
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

30)   Credit

Purpose	Amount	Loan Source
_____	_____	_____
_____	_____	_____

31) Other Variables Costs e.g. polythene bags, cups, bottles, petrol
etc.

Item	Cost
_____	_____
_____	_____
_____	_____

32)   <u>Household Income</u>

Sources of Household Income:

Source	Total Annual
_____	_____
_____	_____
_____	_____

33) How much would you estimate your household's minimum monthly income to be? No less than _____ Kshs/ month.

34) "What prevents you from marketing more milk/dairy products"?

_____

_____

35) How do you think the above problems could be solved?

_____

_____

36) Enumerators's Notes and Observations about this farm.

Appendix II

INSTITUTIONAL LEVEL-DAIRY MARKETING/CONSUMPTION SURVEY

1) Date of Interview _____

2) Name of Enumerator _____

3) District _____ 4) Division_____

5) Location _____ 6) Sub-location_____

7) Name of Institution _____

8) Type of Institution _____

9) Position of Respondent _____

10) Number of Customers served per day at present (on average)

_____

11) Dairy Products Produced

Product	Qty produced	Freq. of Prod.
_____	_____	_____
_____	_____	_____
_____	_____	_____

12) Dairy Products Purchased

Product	Qty purchased	Freq. purchased	Source	P/Unit
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

13) How are the above dairy products consumed?

Product	Consumed Fresh?	Processed into:	Ingredient in	As complement with:
_____	YES/NO	_____	_____	_____
_____	YES/NO	_____	_____	_____
_____	YES/NO	_____	_____	_____

14) Do you collect your supplies? Yes/No If Yes,

Product	Transport Mode	Distance (km)	Transport cost R/T
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

15) What type of agreement or arrangement do you have with your supplier of dairy products?

Product	Source	Nature of Contract	Contract Specifications _____
_____	_____	_____	
_____	_____	_____	_____
_____	_____	_____	_____

16) For those dairy products that are presently consumed, do you get adequat
supplies throughout the year? YES/NO

    If NO, when do you experience shortage:

Product   Period of shortage   Reason (s) for shortage

             J F Mr Ap M Je Jl Au S O N D

_____ – – – – – – – – – – – – _____

_____ – – – – – – – – – – – – _____

17) How do you store these dairy products?

    Product   Storage

    _____   _____

    _____   _____

    _____   _____

18) For the dairy products you produce, purchase and market, do yo
have any problem with spoilage, either on the premises or durin
transport? How much do you estimate your losses due to spoilage to b
regularly?

_____

19)   Are there dairy products which are currently not on the loca
market which you would like made available?

  _____   _____   _____

20) Are there dairy products which are on the market but which yo
would like to see made _more_ available?

  _____   _____   _____

21) What problems(s) do you encounter in procuring and marketing of dairy products?

_____

_____

22) How do you think the above problems could be solved?

_____

_____