CONSTRAINTS TO AGRICULTURAL DEVELOPMENT OF LARGE SCALE FARMS IN MOIBEN DIVISION, UASIN GISHU DISTRICT

B Y

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF MASTER OF ARTS (M.A.) IN URBAN AND REGIONAL PLANNING, FACULTY OF ARCHITECTURE DESIGN AND DEVELOPMENT,

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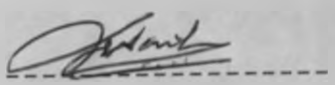
DECLARATION

This thesis is my original work and has not been presented for a degree in any other University



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This thesis has been presented for examination with my approval as University Supervisor.

DR. ELIJAH N. D. NDEGWA,
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A C K N O W L E D G E M E N T S

This thesis is a culmination in my humble judgement, of numberous sequences of learning. I recall the first in this sequence of learning as principally that which I obtained in and within the household of my parents - Wasike Wa Nalianya and Sifrosa Kuvondo. As they nourished and fostered my growth, they correspondingly expounded my scope of comprehension of the world around me. From my neighbours and friends, I learned game theories. Only then was I enabled to identify among my playmates friends "in need" and some friends "in deed". From the classrooms (1966 - 1986) I have learned and relearned things and theories some of which were already familiar to me. But I had to learn them from a scholarly perspective. It is to this particular learning that this thesis belongs. During my short period at work (1984), I learned that often theory and the world of work are indifferent to each other. It is here that I started seeing the tendential conflict between theory and practice by observing the people who have succeeded.

My expression of gratitude goes to those who taught, advised, encouraged and inspired me during the course of my graduate programme. I must single out for special thanks, Dr. Elijah N. D. Ndegwa who was my Supervisor right from the conceptualisation of the research topic up to the final writing of this thesis. His guidance, advice and interest in my work were a constant source of encouragement, especially his critical comments on the initial drafts of the thesis which helped me to crystalise my ideas. Thanks also go to Wazee William B. Saina, Hamisi and Aggrey Matanda for their assistance during the field research in Moiben Division.

Grateful acknowledgement is also extended to Mr and Mrs Francis Simiyu Wanyama, Patrick Sirengo Khaemba and all my colleagues in the final year for the constant encouragement during the writing phase of this thesis.

The typing of this thesis was done with a lot of diligence by Wangui Kago and Lucy Kinyua. To them, I am grateful. I am equally appreciative of the access granted me to reading materials at various libraries. I am very grateful to the Kenya Government for funding my graduate programme.

A B S T R A C T

During the last few decades many of the third World Countries Kenya included, have been involved in the development of agricultural sectors as a basic development programme, the purpose of which is directly to increase food supply through raising productivity per unit of land and increase employment potential of this sector.

In order for the above goals to be achieved, the resources: land, labour, machinery, fertilizers, improved seed etc, must be available to produce the desired commodities in the desired quantities. The prices of products and inputs must be such that collectively, farmers who individually have control of various combinations of resources, will be induced to produce sufficient output to meet national requirements. Without adequate infrastructure such as availability of farm inputs at the righttime, marketing channels, processing and storage facilities, farmer training, veterinary work, credit provision etc, bottlenecks arise which curtail the growth of agricultural output per unit of land.

In Kenya, we have a dualistic structure of agriculture: small scale and large scale farms. At the national policy level as shown in the Development Plans 1974 - 1978, and 1979 - 83, the Government seems to favour small scale production on the ground that productivity per unit of land is higher. Yet, the production of cereals such as maize and wheat on large scale could equally meet the objectives outlined above. The general objective of this study was to identify constraints to agricultural development of large scale farms in Moiben Division, in Uasin Gishu District, a district which has had a long history as a large scale farm mixed farming area in both pre and post independent eras of Kenya. A sample survey of 54 farmers was selected in order to examine the factors which limit agricultural production.

Analysis of the data from the survey using descriptive statistics has shown several constraints to agricultural development in the area. These include: unregistered farms which limit the use of such farms as collateral security for credit, high degree of slope which limits farm mechanization on some farms,

shortage of labour during peak demand periods, low level of farm management skills, shortage of farm machinery, low rate of fertilizer input per hectare, inadequate transportation facilities, in operative cattle dips and water projects, inadequate marketing and storage facilities, and low level of off-farm job opportunities.

These constraints are closely interrelated. Consequently, a comprehensive planning approach to their alleviation is advocated. The specific measures include: completion of land registration of unregistered farms, education of farmers on a wide range of soil conservation methods, raise the level of fertilizer input per hectare, improvement of farm management skills of farmers, speeding up processing of loan applications by lending institutions. ensuring timely availability of farm inputs and within easy reach of the farmers; introduction of tractor-hire service, upgrading grade E roads especially in peripherally located areas, increasing the storage capacities of National Cereals and Produce Board Depots at Moisbridge and Eldoret, streamlining the operation and management of water projects and cattle dips and, finally, it is recommended that consideration be given to a study of the viability of constructing a milk cooling plant within the Division.

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CHAPTER I: INTRODUCTION

This Chapter presents an overview of what the present study undertakes. It starts by briefly outlining the theoretical framework in which the study is posited and Kenyan Agricultural Policy. The second part of the chapter considers the nature, scope and limits of the problem being studied. It specifically deals with problem centred issues: ranging a general statement of the problem itself, through objectives, assumptions, operational definitions as well as scope and limitations of the study. It rounds off with an outline of the structural organisation of the thesis.

THEORETICAL FRAMEWORK

A comprehensive study of any planning problem is only possible within a specific theoretical framework. One cannot engage in a meaningful study of any planning problem without knowing its structure and a theory of that structure. It is theory which equips us with the proper tools of analysis for dissecting a given planning problem and understanding it for what it really is. Indeed, the cardinal task of scientific investigation is to disinguish between mere appearances and concrete reality. In fact, the delineation of elements of a task environment with proper tools of social inquiry is the essence of the systems approach to planning. (McLoughlin 1978, Chadwick 1976).

Our analysis throughout this study, therefore, assumes as its theoretical springboard, a systems approach view to planning. We shall attempt to utilize the basic theoretical tenets of inputs into and outputs from the farm in an effort to understand the constraints to large scale farm development in Moiben Division. The central thesis in systems analysis is that a holistic approach is cardinal in planning. This is also the methodological foundation of all social sciences. Systems analysis enables us not only to understand complex planning problems but also to influence social life, and transform it in the interest of man.

The essence, origin, development and functional role of planning can only be understood through a thorough analysis of the task environment as a whole. One cannot consider planning as a reflection of the ideal, which has nothing to do with the actual

reality. In reflecting actual reality, in reflecting a definite enterprise, or certain of its features, a planner goes further during the process of his creativity, he reproduces not simply the object but also the prospects of its development. In this sense, planning does not only reflect reality, it creates and shapes it. The adoption of a systems approach in this study is based on three grounds: it explores the organic relationships between the planning of the past and the planning of the present and the future, it affirms and explores the components of planning - its objective reflection of reality by detecting order in a reality that is apparently complicated ans spells out the function of planning in society and the obligations of the planner by specifically identifying units of analysis in their settings (Chadwick 1976, McLoughlin 1978, Hagget 1980, Coffey 1981).

As a method of planning, systems analysis is not an inherent property of planning. It entails knowing what one wants, and knowing what one wants in turn, entails identifying and specifying how one is to get what one wants. It is to this that we now turn.

THE KENYAN AGRICULTURAL POLICY FRAMEWORK

The Kenya Government's policies, goals and objectives towards the agricultural sector are explicitly spelt out in the past and current development plans. The policy goals on agriculture include: to improve and increase agricultural production through intensified use of resources, to improve distribution of rural incomes through the promotion of cash crop production, to devise methods of developing the low potential areas and to promote a more even development among different regions of the country, to improve nutrition standard in the rural areas, to increase opportunities for employment in the agricultural sector and, to attain self-sufficiency in food supply and increase agricultural exports (Development Plans 1974 - 78, 1979 - 83, 1984 -88). Within the overall strategy of promoting rural development, equitable income distribution and employment generation, the government intends to achieve an annual growth rate of 5.6% in marketed agricultural output by thc year 2000 (Sessional Paper No. 1, 1986). With respect to the distribution

of increased government expenditure between the large scale and small scale farmers, the government aims at "giving highest priority to programmes aimed at developing the small holder farming areas ..." (Development Plans 1974 - 78, 1979 - 83, Lena H. 1977,) yet, it is at the same time recognised that production of cereals: maize and wheat on a large scale may help in achieving the goal of self-sufficiency in food production.

However, the government also recognises possible limitations on rapit agricultural expansion. Thus, in its view, "The principal constraints in agriculture are knowledge, technology and credit" (Development Plans 1974 - 78, 1979 -83, 1984 - 88, etc).

THE PROBLEM

Kenyan agriculture is dualistic in nature, consisting of, on the one hand, large scale commercial farms. The duality between "small scale" and "large scale" is also described in development literature as "traditional" and "modern", "labour intensive" and "capital intensive". However, this duality is becoming more blurred as many small scale farmers increasingly aim for marketable surpluses and increasing sub-division of large scale farms in an area like Moiben Division takes place.

Agriculture has been and is s^ill the backbone of Kenya's economy. I has accounted for 30% - 40% of the Gross Domestic Product since the 1950's 85% of the population is engaged here, it accounted for well over 70% of the exports in the 1970s. (Witucki 1976). Agriculture accounted for 37.1% of the Gross Product in 1977, 34.4% in 1979, 33.4% in 1982, 31.2% in 1983 while manufacturing accounted for 13.3% and commerce 9.7%. Thus equity and growth of income in the initial stages, provision of foodstuffs, etc will depend on the development of the agricultural sector.

More concretely, the value of agriculture in the economy is exemplified by tow indicators: employment and value of production as shown in the tables below:

TABLE I AGRICULTURAL EMPLOYMENT IN KENYA - 1979 - 1980

Farm Classification	Province	Average Farm Size (Hectare)	No. of Farms	Average No. of Farm Workers per Farm	Total No. of Farm Workers	No. of Farm Workers as % Total Agricultural Employment
Small Scale	CENTRAL	2.67	329,530	2.3	757,919	22.9
	COAST	2.38	69,861	1.9	132,736	4.0
	EASTERN	2.18	353,159	2.1	741,634	22.4
	NYANZA	1.93	386,431	1.9	734,219	22.1
	RIFT VALLEY	2.98	89,823	2.4	215,575	6.5
	WESTERN	2.47	254,618	2.1	534,698	16.1
	SUB-TOTAL	2.33	1,483,422	2.1	3,115,186	93.9
Large Scale		700	3,165	63.5	200,973	6.1
	TOTALS		1,486,587		3,316,123	100.0

SOURCE: Central Bureau of Statistics (1980) and Andrew B. Trench (1981) Employment Trends in Kenya's Agriculture: Notes

TABLE II ANNUAL VALUE OF GROSS MARKETED OUTPUT FROM SMALL AND LARGE SCALE FARMS: 1964-79 IN MILLION POUNDS

	SMALL FARMS	LARGE FARMS	TOTAL	SHARE OF SMALL FARM %	SHARE OF LARGE FARM %	TOTAL %
1964	24.6	35.8	60.4	40.7	59.3	100
1965	23.8	33.3	57.2	41.6	58.4	100
1966	32.7	36.0	68.8	47.5	52.5	100
1967	34.1	32.9	66.9	51.0	49.0	100
1968	35.8	34.4	70.2	51.0	49.0	100
1969	38.3	37.9	76.2	50.3	49.7	100
1970	44.2	41.2	85.4	51.7	48.3	100
1971	44.6	42.1	86.7	51.4	48.6	100
1972	55.6	50.3	105.9	52.5	47.5	100
1973	63.3	60.0	123.3	51.3	48.7	100
1974	74.6	72.0	146.7	50.9	49.1	100
1975	75.1	73.7	148.8	50.4	49.6	100
1976	77.2	75.1	152.3	50.6	49.3	100
1977	79.3	73.1	152.4	52.0	48.0	100
1978	81.2	79.3	160.5	50.5	49.5	100
1979	82.5	80.2	162.7	50.7	49.3	100

SOURCE: Heyeretal (1976) Witucki (1976) Central Bureau of Statistics (1980)

It appears from the table above, Small Scale Agriculture dominates Kenya's agriculture in terms of farms, employment and volune of output. Table 1 shows that in 1979 of the estimated 1.5 million farms about 98.8% were classified as Small Scale and only 0.2% as Large Scale. The table also indicates that in that same year, Small Scale Agriculture also generated about 51% of the value of Gross-marketed farm output Table 2 while the Large Scale farms Sector-accounted for about 49.0%. Besides, table 1 also shows the duality in terms of average farm size: Small Scale with 2.33 hectares while Large Scale with 700 hectares. Although the Large Scale farm sector has large parcels of land on average, the relative share of small scale farms in gross marketed output has grown steadily in the last two decades. Factors leading to the low level of productivity in the large scale farm sector form the focus of this study.

To achieve the agricultural policy goals outlined above, the resources: Land, Labour, Animals, Machinery, Fertilisers, Technical Knowhow, etc. must be available to produce the commodities in the desired quantities. In addition, there should be price incentives and appropriate infrastructure to stimulate agricultural production in a given locality. An efficient production oriented policy towards agricultural development consists of three lements: Land Tenure and how it regulates the access to and distribution of land as a major resources for production; Land utilization which deals with the increase of productivity of land to ensure efficient output of necessities and adequate income for farmers and market and price incentives to encourage agricultural development (Sessional Paper No. 4 of 1980 P. 27, Sessional Paper No. 4 of 1981 and Sessional Paper No. 1 of 1986).

Experience in Kenya over time, has shown that although these resources may be available in a given locality, they are not being utilized to the expected levels (Large Scale Farm Sector Survey 1977, German Agricultural Team 1972, 1983, Metson 1978, Allan, 1971). For example Metson's study of Nandi District has shown that while farmers ought to produce 66 ninety kilogramme bags of maize per hectare, most of them had an average ranging from 29 to 51 bags

of maize per hectare. Focussing on a sample of 54 large scale mixed farms, this study attempts to find out the constraints to large scale agricultural development in Moiben Division. The study thus seeks an answer the questions: What are the constaints to Agricultural Development in Moiben Division? What are the possible planning solutions to the constraints identified?

STUDY JUSTIFICATION AND RELEVANCE:

More intensive and efficient use of land is expected to be achieved through amongst others; use of higher levels of purchased inputs especially fertilisers, introduction of soil and water conservation programmes, transfer of new technologies such as new seed varieties, new ways of husbandry farmers, and efficient procurements of farm inputs through the provision of physical facilities like rural access roads, rural market centres and markets (Development Plans 1979 - 83, 1984 - 1988).

Previous studies concerned with factors influencing agricultural utilization and productivity in Kenya have come to the general conclusion that climate, soil properties, cultural practices and socio-economic contraints such as labour, markets, farm size etc, influence levels of resources utilization (Ferarn 1961 30 - 43), Odingo R. S. 1963, 37 - 44, Allan A. Y. 1971, 41 - 63, Gerhart D. J. 1974 76 - 86, Lerna 1977 Metson 1978, Alila 1978). Although most of these studies had addressed themselves to the small scale sector, it is possible that some of these factors affect the development of large scale farms to which our study is focussed.

Within Moiben Division, not all the above factors are major determinants of resource utilization. While climate conditions help to explain the suitability of the area for wheat, maize and dairy farming, it does not help to explain other factors affecting agricultural development in the area. The varied nature of maize, wheat and milk production in the Division, one of the principal wheat maize and milk producing areas in Kenya, necessitates an attempt to find out the causative factors.

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Although recognised as an important agricultural area in the country, Moiben Division has not been subjected to a systematic study. The area is a long-standing mixed large scale farming area and hence provides an opportunity to shed some light on constraining factors to resources' development. Moiben is an appropriate choice as a case study of constraints to agricultural development engendered among other things by the past development trends and anticipating the effects of current regional development strategies. The findings that will emerge from this study will ideally complement earlier resource use studies. The emergent comprehensive picture of resource utilization would open avenues for more scientific analysis of phoenomenon, for instance, a meaningful model of land use. Moiben was chosen because of the author's familiarity with it, coupled with the logistic reason of access, it forms an administrative unit which in essence, facilitates one's analysis such that identifying what is internal and external becomes easier.

THE STUDY OBJECTIVES:

(a) To indicate the agriculural resource base of Moiben Division.

(b) To identify the constraining factors which hinder optimum utilization of agricultural resources.

(c) To propose some strategies for overcoming the identified constraints.

THE STUDY ASSUMPTIONS:

(a) The overriding assumptions in this study is that despite the relative abundance of agricultural land and animal resources available to large scale farmers in Moiben Division, vis-a-vis other areas in the country where small scale farming predominates, the larges scale farms are underutilised.

(b) That resource development would be greatly improved if the constraining factors in the division are removed. This will help in translating national policy issues into reality.

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OPERATIONAL DEFINITIONS:

In this study unless the contrary is stated otherwise, the words; larges scale farm, crop yield, farming system or enterprise, optimum farming systen resources, and management, will have connotations as below:-

(a) Large Scale Farm:

An objective definition of a large scale farm is still questionable. Problems arise with the standard scale to use; whether amount of hectarage, labour employed, capital utilization, output ect. In fact what is regarded as a large scale farm in Kenya may be regarded as a small scale in another country. A large scale farm will be defined in this study as a farm of size over 12 hectares of Arable land (CB. S 1978, 1980, ect). It is a farm which under the given agro-ecological conditions can afford to invest in the elements of modern production technology particularly fertilisers, improved tools and machines (Kenya colony 1962, Large scale farm sector survey 1977, Enyi and Kuyembeh 1980). Although this definition is likely to plunge is into further problems of subjectivity, it serves as a yardstick in the present study where all the large scale farms fall within the foregoing classification.

(b) Crop yield:

This embraces biological and economical yields in terms of output per unit area of land. (Brown 1970, Jackson 1970, Dokin 1977). The focus is on economic yield per unit area of land.

(c) Farmining Enterprise:

This connotes a piece of land on which crops and animals are produced and on which there is or are a single group of person(s) in charge of important farming decisions such as whether or not to introduce a cash crop, or whether to hire farm labour, use heavy harrowing etc. decisions which can be made in advance and which involve out of the ordinary

(d) Resources:

These are phenomena which contract or expand in response to types of human effort and behaviour. They are reflections of human spatial appraisal which is related to some production function designed to attain some material wants by an individual or a social group (Zimmermann 1956, 1964). In this study, they embrace land, water, forestry, livestock, labour, knowledge, money and machines.

(e) Management:

It is the co-ordination of all resources through the pocesses of planning organising, leading, and controlling in order to obtain stated objectives.

SCOPE AND LIMITS OF THE STUDY:

A complete study of the agricultural resources can only be undertaken by a large research team. Hence the scope of this study has been limited by the amount of time and resources available to a selected sample of 54 farmers in Moiben Division. Besides, the problem studied brings the study within the threshhold of other disciplines with which the researcher is unfamiliar. For example, it borders on economics, sociology, management etc. among social sciences as well as agriculture. However, this should not be lamented over, since planning by its very nature is interdisciplinary. In addition, it presents an opportunity for shared knowledge and making contribution to the ever expanding stock of resource utilization studies. It is hoped that the research will serve as a pilot study for extensive studies at the district level. If the study arouses further interest, it will have gone along way in aungmenting our knowledge of resource use in the area.

STRUCTURAL ORGANIZATION OF THE THESIS:

The thesis consists of six chapters. Chapter I delineates the study problem, objectives and assumptions. Chapter II provides an outline of the physical and human backgroud of Moiben Division, the study area.

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Chapter III is concerned with the literature review. It discusses in a chronological sequence the relevant studies that have analysed factors affecting agricultural development in general and Kenya in particular. Chapter IV describes the methodology used in our study of Moiben and techniques of data collection and analysis. The findings and results of the survey are discussed in Chapter V. A synthesis of major conclusions and recommendations for planning agricultural development are presented in Chapter VI.

CHAPTER II: THE STUDY AREA

In the previous chapter, the study problem has been delineated. This chapter deals with the environmnetal background to the study area in Rift Valley. The background is instructive not only for depicting physical and human attributes of environment thereby understanding its nature, endowments and constraints but also for appreciating the process or factors that affect agricultural development in Moiben Division. In order to have insights into Moiben Division, it is necessary to portray the environmental background of Uasin Gishu District of which it (Moiben Division) is only a small but distinctive part. Uasin Gishu District has three administrative Divisions: Northern (Moiben), Central (Municipality) and Southern Division.

PHYSICAL AND HUMAN BACKGROUND OF UASIN GISHU DISTRICT: A LARGE SCALE FARMING DISTRICT.

The salient features of the physical environment of Uasin Gishu District that require explication are:- physiographic framework, drainage system, pedological conditions, climatic regime and vegeration and ecological conditions. All these factors severally and jointly affect agricultural development.

THE PHYSICAL BACKGROUND: AN OVERVIEW

Uasin Gishu District lies on the Uasin Gishu Plateau. It extends north about 224 kilometres from the equator and west some 96 kilometres from its eastern Kerio Valley boundary. Service centres in the districts include: Eldoret, the only principal town and district headquarter, Turbo, Moiben and Kipkabus rural centres. To the north, we have Cherangani Hills rising to about 3,000 metres above sea level. High grassland covers the plateau which slopes from 2,500 metres to 2,600 metres in its eastern portions to 1,810 metres in the west (see Map No. 4).

Escarpments surround this plateau on all but the extreme western boundaries. To the south, the plateau continues for some distance into Nandi District but gradually gives way to hither to forested country and eventually to escarpments which drop 500 metres to just above 600 metres on both the western

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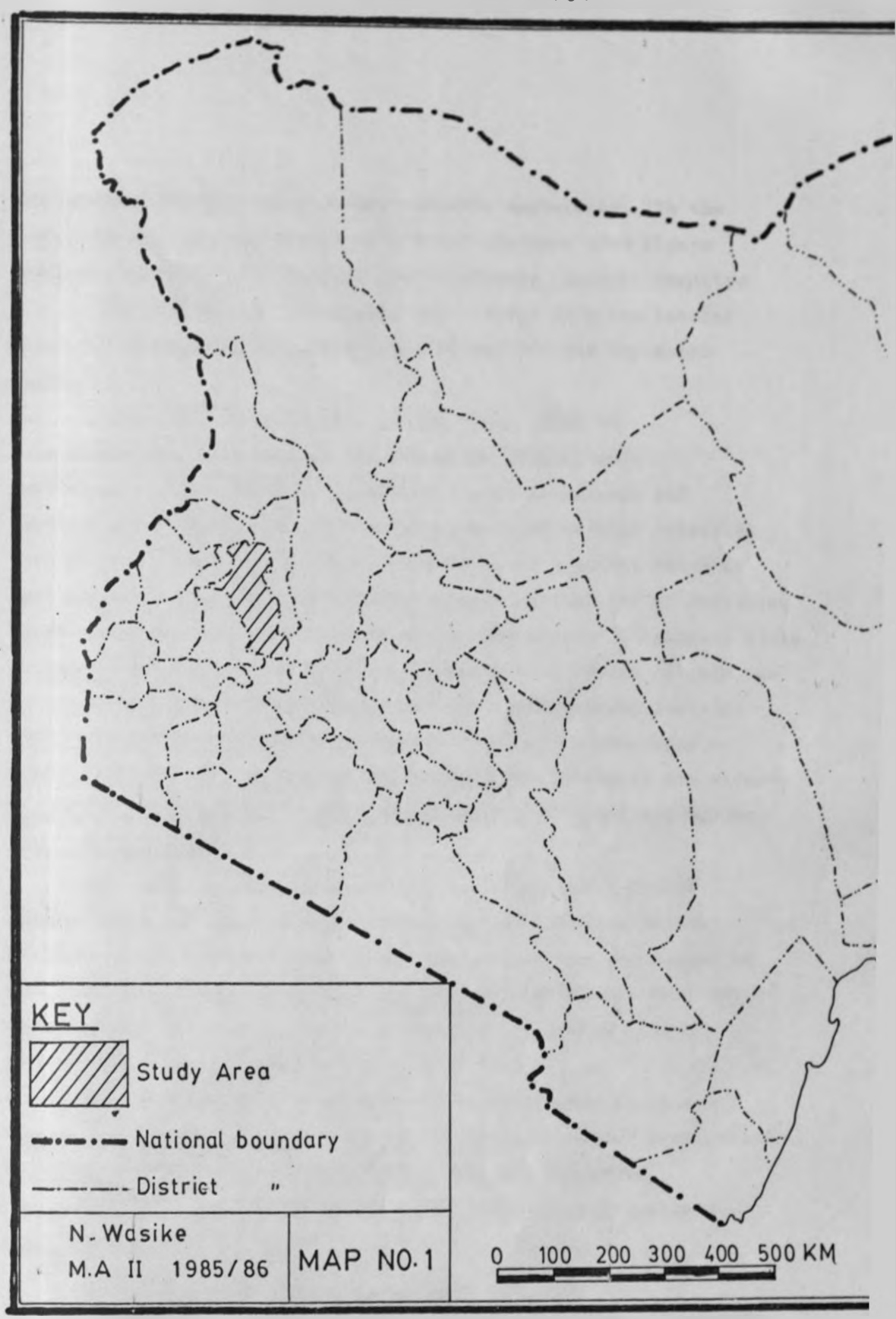
KENYA: UASIN GISHU DISTRICT



and Southern borders to the Lake Victoria depression. To the east, the plateau continues for a short distance into Elgeyo Marakwet District and rises to the relatively, heavily forested rim of the rift valley escarpment which drops in a few lateral miles to 700 metres above sea level in the hot and dry Kerio Valley.

Uasin Gishu is generally narrow, only about 16 kilometres over most of its 160 kilometre length, only broadening in the north to include the high grasslands and forests of Cherangani Hills. It is classified as high potential agricultural land. It receives over 750mm of rainfall annually and generally closer to 1000mm with a good reliability of receiving these amounts of rainfall in six out of ten years, Cherangani Hills to the north-west of the district, receive over 1500mm of rain due to their attitude. The southern portion towards Nandi District also receives about 1500mm of rainfall due to its proximity to Lake Victoria. The period October through March though not without some rain is generally a drier period (Low D.A. Ojany and Ogendo 1973, Mbwagwa 1978).

The district has soils of high fertility soils around Eldoret Town and most of Moiben Division, and pockets of low fertile soils characterised by waterlogging to the south-east of Eldoret Town. Some of the serious limitations on soil include: steep slopes and shallow soils to the east of Moiben Centre (Schmidt and Jaetzold 1983)

The district is drained to the north by River Nzoia and little Nzoia, Sergoit Rivers, in the midpart by Sosian River which straddles Eldoret Town and by Nureri, Masaba, Endaragua , Kipkurere rivers to the south (Rop 1981, Schmidt and Jaetzold 1983 (see Map No. 4).

THE HUMAN BACKGROUND.

In 1962, the district had a population of 92,000 people, 300,766 people in 1979 and 408,687 people in 1985; (CBS 1983). This shows an annual growth rate of about 5.8% between 1979 and 1985. Eldoret Town had 8,193 people in 1948; 19,605 people in 1969 and 50,503 people in 1979. This gives an annual intercensal

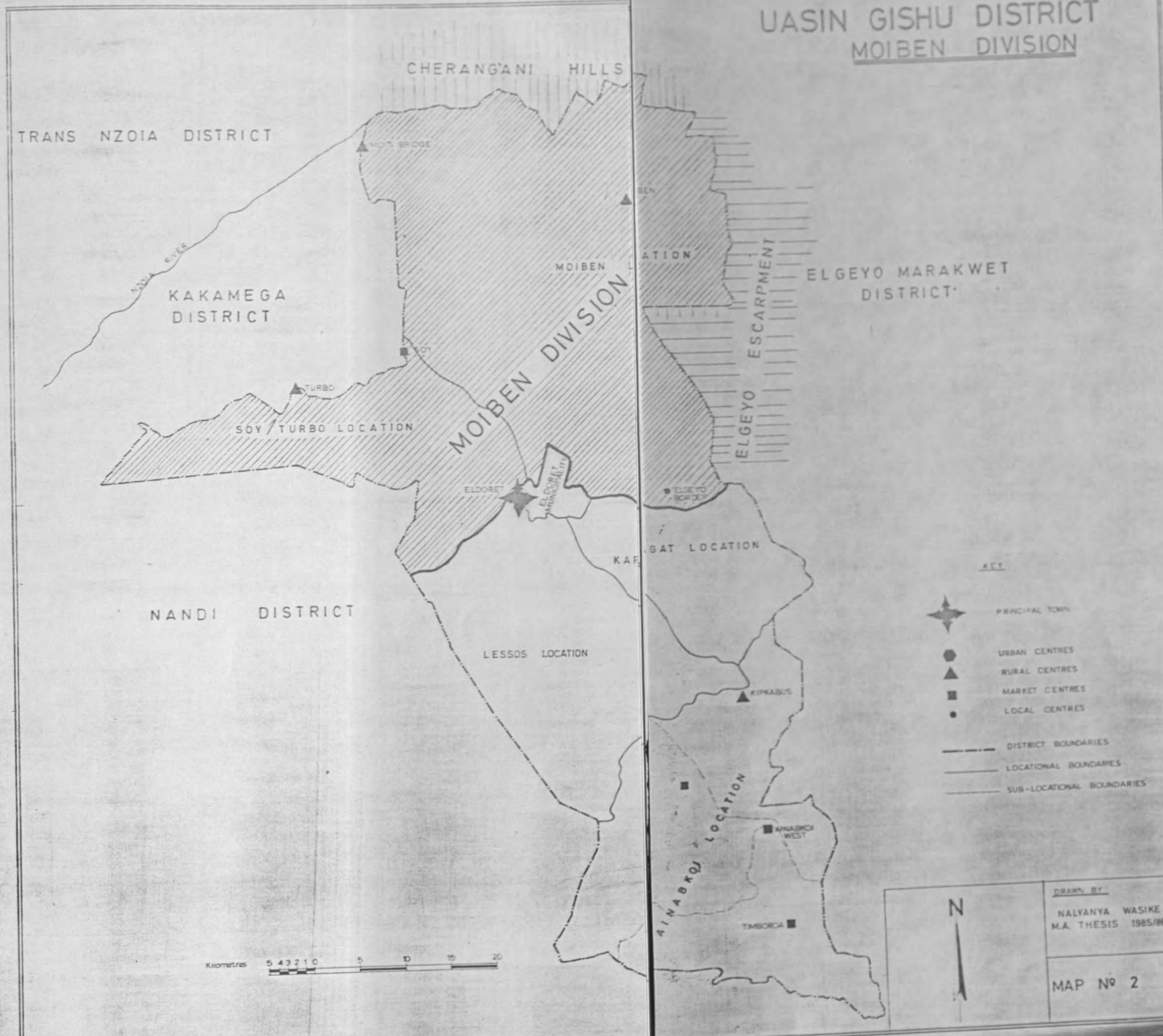
growth rates of 9.9% between 1948 and 1962 and 15.7% between 1969 and 1979. This population change has implications on agricultural development to meet the food requirements, the provision of social infrastructure, land/man ratio, etc. It must be noted, however, that densities at the district level mask differentials at the divisional and locational levels more so in Uasin Gishu District.

Culturally, there are several linguistc groups resident in the district. The Kalenjin, Kikuyu, and Luo. The cultural landscape of the district has consistently been influenced by environmental processes over time (Sawer 1956, Warren 1970). The emergence and subsequent growth of Eldoret Town is a function of both wheat and maize industries in Uasin Gishu for which it serves as a principal market centre. (Mbwagwa 1978, Obudho 1979, Rop 1981). While the rural environs of Eldoret Town depict for most of the year, an agricultural landscape, the urban area depicts a morphological structure typical of any town. It is the infrastructure of both maize and wheat and livestock in the rural setting that sustains the socio-economic wellbing of inhabitants in Uasin Gishu and not those of the town where commercial-cum-industrial activities are more pronounced (Ogendo 1972, Mwagwa 1978).

MOIBEN DIVISION IN UASIN GISHU DISTRICT

In the previous section, a broad overview of the district has been provided. This section specifically attempts to describe the location of Moiben Division, with emphasis on its physical characteristics, the geology, soils, climate, ecology, human background and infrastructure.

Moiben Division lies on the Uasin Gishu plateau of Uasin Gishu District. The plateau is bounded by latitudes 0°30'N and 1°0'N and longitudes 35°100'E and 35°30'E. The Leseru-Kitale railway line, a branch line from the main Nirobi-Kampala railway line, straddles the area. The main Eldoret/Kitale tarmac road (B1) also straddles the area. The Eldoret/Bungoma truck road (A104) straddles the south western tip of the Division. Moiben Division is bordered to the south by Eldoret Municipality and to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MOIBEN DIVISION
CHERANG'ANI HILLS
TRANS NZOIA DISTRICT
MOI'S BRIDGE
KAKAMEGA DISTRICT
MOIBEN DIVISION
ELGEYO ESCARPMENT
ELGEYO MARAKWET DISTRICT
SOY
TURBO
SOY/TURBO LOCATION
ELDORET
ELDORET MUNICIPALITY
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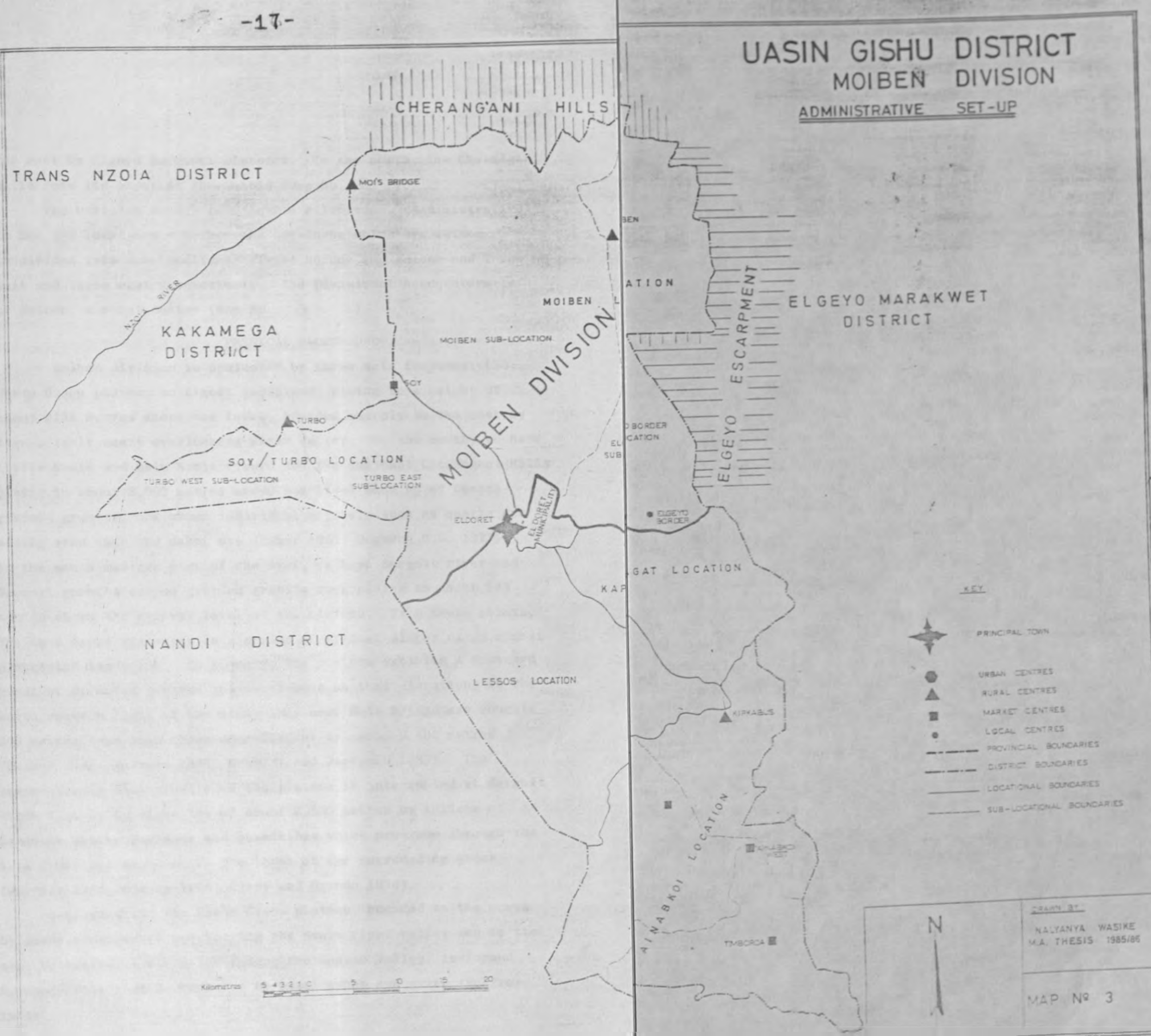
MAP Nº 2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MOIBEN DIVISION
ADMINISTRATIVE SET-UP
CHERANG'ANI HILLS
TRANS NZOIA DISTRICT
MOI'S BRIDGE
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MOIBEN SUB-LOCATION
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SOY/TURBO LOCATION
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MAP Nº 3

the east by Elgeyo Marakwet District. To the north, the Cherangani Hills form its physical threshhold (Map No. 2).

The Division covers 1910 square kilometres. Administratively, it has two locations - Moiben and Soy-Turbo which are futher subdivided into sub-locations: Elgeyo border and Moiben and Turbo west and Turbo east respectively. The Divisional headquaters is at Moiben; a rural centre (Map No. 3).

PHYSICAL BACKGROUND

Moiben Division is dominated by three main features: the Uasin Gishu plateau an almost tableland, rising to a height of about 2134 metres above sea level, bounded sharply to the east by Elgeyo fault scarp overlooking Kerio Valley. To the north, we have little Nzoia and main Nzoia rivers and the dominant Cherangani Hills rising to about 3,000 metres above sea level made up of coarse grained granite rock whose individual crystals such as quartz are easily seen with the naked eye (Baker 1964, Ongweny G.S. 1973). To the south eastern part of the area, we have Sergoit river and Sergoit rock, a coarse grained granite rock rising to about 183 metres above the general level of the plateau. From these points, the land drops westwards in a series of gradual slopes of an almost plateauish landscape. In summary, the plateau exhibits a downward gradient directed towards the north-west so that elevations at the north western limit of the study area near Mois bridge are roughly 300 metres less than those near Eldoret at about 2,400 metres (Ominde 1968, Mbwagwa 1978, Schmidt and Jaetzold 1983). The comparatively flat profile of the plateau is interrupted at Sergoit which lies at an elevation of about 2,500 metres by inliers of basement system gneisses and quartzites which protrude through the lava flows and stand above the level of the surrounding areas (Pulfrey 1954, Ojwang 1966, Ojany and Ogendo 1973).

Geologically, the Uasin Gishu plateau, bounded to the north by steep escarpments overlooking the Nzoia river valley and to the west by smaller escarpments facing the Sosian Valley, is formed by phonolitic lava accompanied by basal types and grits (Pulfrey 1954).

Crystalline rocks of the basement system dominate the Uasin Gishu lavas and also seen over areas beyond it. The basement system rocks found here may be divided into two regional groups: a series of well differentiated superncumber folded metamorphosed sediments of marginal geosynclinal facies occupying the elevated Cherangani region and the Ziwa and Matunda environs and, the granite migmatite foundation underlying the less elevated country around Turbo and its environs. The rocks in this area form part of the Turbo-Kitale group of volcanoes which are in turn, the western most representative of the Turoka group. This is a group which, according to geochronological succession belongs to the basement system and tertiary lava tuffs (Ongweny and Hove 1973).

The topographical nature, the geological background, living organisms, time in years and susceptibility of the rock material to the weathering process have dynamically shaped the soil pattern in the area. Generally, most of Moiben Division is characterised by low soil fertility subject to local differences. The basement system is overlaid with rich volcanic soil in the north around Segero and Moisbridge spreading into the Trans Nzoia and also in the eastern part around Moiben rural centre and environs. The area around Moiben Centre has well drained, extremely deep dark reddish brown, friable clay with humic top soil. To the north eastern part of Moiben Centre, we have well drained, deep, strong brown to reddish yellow, very frable, sandy clay loam to sandy clay underlain by granite and quartz. Besides, on the bottom lands in the area, we have soils developed on infill from intermediate igneous rocks. These are poorly drained, moderately deep, dark grey to grey, mottled firm clay with humic topsoil covering Ziwa, Moisbridge and Matunda and their respective environs. Apart from this, we have soils on plateaus and high level structural plains underlain by igneous intermediate rocks. They are well drained, moderately deep, dark red, friable clays found in parts of Soy/Turbo locations. In summary, the soils derived from the volcanic ash are well drained and have moderate to high agricultural potential (Odingo R.S. 1963, Allan A.Y. 1971, Gerhart 1974, Republic of Kenya 1982, Jaetzold and Schmidt 1983).

Serious limitations about soils in the area include: steep slopes unsuitable for cultivation on the slopes of Cherangani Hills and shallow soils in parts of Soy/Turbo location. Alluvial soils, often of black cotton type, are poorly structured. These soils have a low organic content, tend to be acid and usually have more or less impleded drainage with the result that their agricultural potential is limited.

Most of these soils are generally used for livestock in the division. (Map No. 5).

CLIMATE AND ECOLOGY:

Though found within one degree of the equator, daily temperature are fairly equal throughout the year since much of the area stands at an altitude of more thatn 2,000 metres above sea level. Eldoret at an altitude of 2,073 metres above sea level, and with a rainfall range of 900-1100 mm, typifies the rainfall regime over Moiben Division. The rainfall distribution during the year is bimodal with a first peak in April and a second one in August. Whereas December, January and February are the driest months. The probability of this region receiving less than 750 mm of rainfall is between 0-10% (Allan A. Y. 1971, Gerhart D. J. 1974, Jaetzold and Schmidt 1983). Rainfall in the area increases with altitude on the Cherangani/Elgeyo Marakwet highlands to the north east and Mt. Elgon to the west. Both rainfall probability and reliability are consistent with mean annual totals; the higher the latter. the greater probability as well as the reliability of rainfall occurence. The table below shows data for two stations.

UASIN GISHU DISTRICT
MOIBEN DIVISION
TYPES OF SOILS

TRANS NZOIA DISTRICT

CHERANG'ANI HILLS

MOI'S BRIDGE

Little Nzoia River

NZOIA RIVER

KAKAMEGA DISTRICT

Kipsaos river

SOY Sergoit river

TURBO

KAIMOSI

MOIBEN DIVISION

ELDORET

ELDORET MUNICIPALITY

KAPSAGAT LOCATION

NANDI DISTRICT

LESSOS LOCATION

ELGEYO ESCARPMENT

ELGEYO MARAKWET DISTRICT

ELGEYO MARKET

KIPKABUS

AINABKOI LOCATION

AINABKOI WEST

TARAKWA

Kilometres 5 4 3 2 1 0 5 10 15 20

KEY

- PRINCIPAL TOWN
- URBAN CENTRES
- RURAL CENTRES
- MARKET CENTRES
- LOCAL CENTRES
- DISTRICT BOUNDARIES
- LOCATIONAL BOUNDARIES
- SUB-LOCATIONAL BOUNDARIES
- BASEMENT SYSTEMS
- LOWER PLATEAU
- UPPER PLATEAU

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MAP Nº 5

UASIN GISHU DISTRICT
MOIBEN DIVISION
TOPOGRAPHY AND DRAINAGE

CHERANG'ANI HILLS

TRANS NZOIA DISTRICT

MOI'S BRIDGE

40" RAINFALL

NZOIA RIVER

KAKAMEGA DISTRICT

SOY

TURBO

MOIBEN DIVISION

ELDORET

ELDORET MUNICIPALITY

KAP

NANDI DISTRICT

LESSOS LOCATION

ELGEYO ESCARPMENT

ELGEYO MARAKWET DISTRICT

ELGEYO

AGAT LOCATION

KIPKABUS

AINABKOI LOCATION

AINABKOI WEST

TIMBORGA

Kilometres 5 4 3 2 1 0 5 10 15 20

KEY

PRINCIPAL TOWN

URBAN CENTRES

RURAL CENTRES

MARKET CENTRES

LOCAL CENTRES

DISTRICT BOUNDARIES

LOCATIONAL BOUNDARIES

SUB-LOCATIONAL BOUNDARIES

N

DRAWN BY:

NALYANYA WASIKE
M.A THESIS 1985/86

MAP Nº 4

TABLE 3 RAINFALL DATA FROM KIPSOMBA AND KENLEY FARM IN MOIBEN DIVISION

NAME OF STATION AND ALTITUDE	YEARS OF RECORD	ANNUAL RAINFALL IN MM.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.
SOY, KIPSOMBA 1951 METRES	53	1052	22	38	58	123	145	109	166	175	87	48	50	32
		60% 940	30	12	42	94	115	99	126	157	75	34	15	16
MOIBEN, KENLEY FARM 2134 METRES	25	970	21	33	59	123	133	75	114	147	62	56	104	42
		60% 870	6	6	38	102	103	64	95	132	39	36	31	20

NOTE: These figures of rainfall reliability should be exceeded normally in 6 out of 10 years.

SOURCE: Jaetzold and Schmidt: Farm Management Handbook Vol. II Pg 154 - 155
1983

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The table above showing rainfall data from two representative stations in the division (and the corresponding 60% reliability) shows the suitability of the area for the practice of maize, wheat and livestock farming (Allan A. Y. 1971, Gerhart 1974).

Within Moiben Division, there is little variation in temperature. Monthly mean maxima ranges between 23°C and 29°C, minima between 10°C and 23°C and diurnal range between 12°C and 17°C.

THE ECOLOGY

The agro-climate zone of Moiben Division can be best appreciated in the context of Uasin Gishu District and Western Kenya (Allan A.Y. 1971, Okalo 1974, Kenya Republic of 1979, Gerhart D.J. 1974, Schmidt 1983). This is an area of relative internally homogeneous with respect to the suitability of maize and wheat technologies. Uasin Gishu District falls in agro-climatic Zone II, a portion of the region receiving well over 1,500mm of rainfall per year. Ecological and soil characteristics of the area render it suitable for maize, wheat, barley, cultivation and livestock rearing (see Map No. 6).

The climate environment induces the growth of a tree savannah over much of the division, but with agricultural development, over time, the bush has been progressively cleared and land placed under the plough so that the original character of the area can only be seen outside the arable areas especially on highlands like Cherangani. It appears from these areas and from the accounts of the first settlers to arrive in this part of Kenya that much of Uasin Gishu plateau was formerly open grassland with isolated tree growth. The low country of the Nzoia, Moiben and Sosian Valleys supported a denser thorn bush with strips of decidous and ever green forest near to the water courses(Cecil Hoey 1955, Low D.A. 1963, 63-74, Warren E. 1970).

THE HUMAN BACKGROUND

The population pattern of Moiben Division and Uasin Gishu District at large, is influenced by the major physical diversities of the area discussed in the preceeding section.

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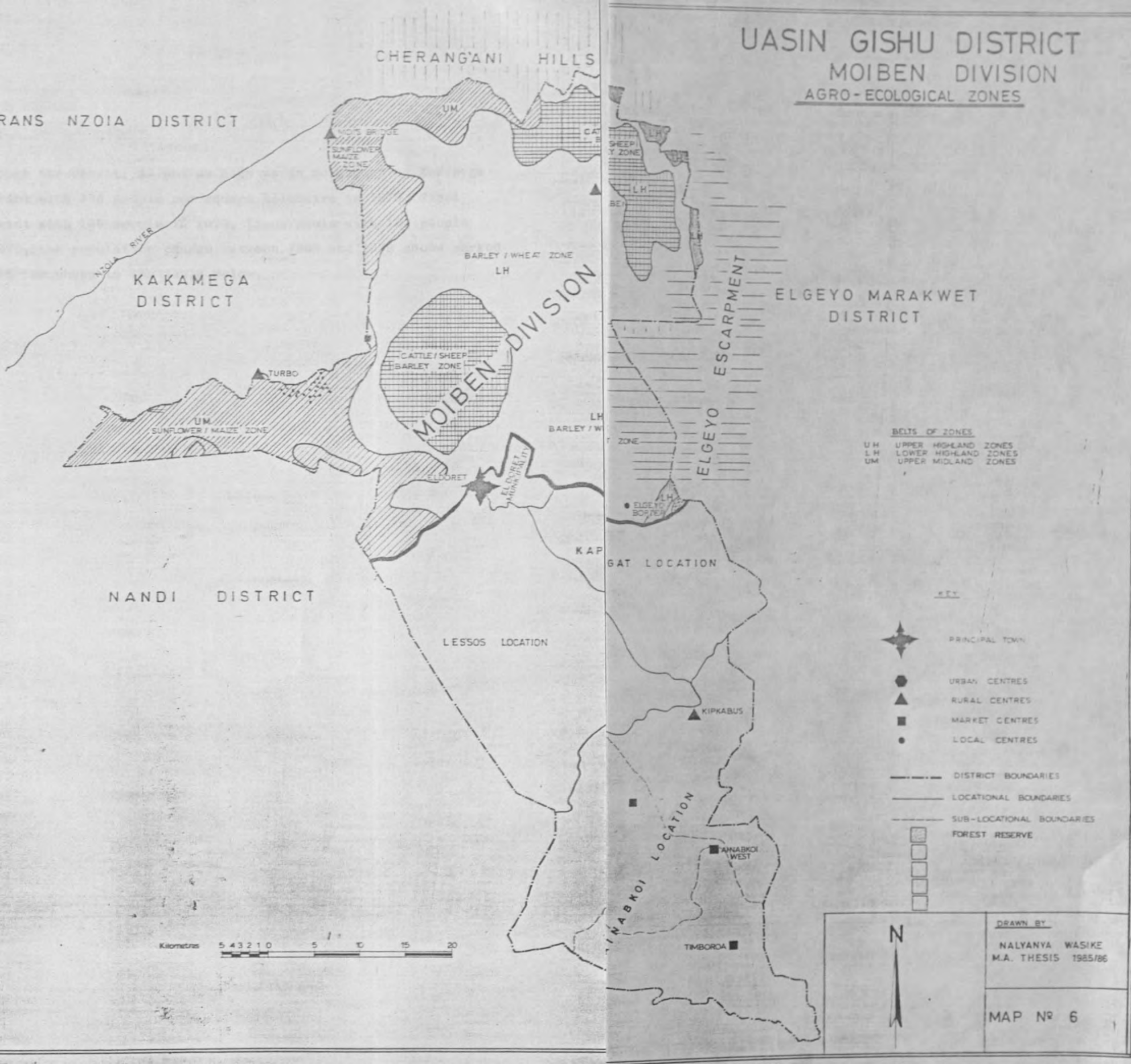
UASIN GISHU DISTRICT
MOIBEN DIVISION
AGRO-ECOLOGICAL ZONES
CHERANG'ANI HILLS
TRANS NZOIA DISTRICT
NZOIA RIVER
KAKAMEGA DISTRICT
MOIS BRIDGE
SUNFLOWER MAIZE ZONE
UM
BARLEY / WHEAT ZONE
LH
MOIBEN DIVISION
CATTLE / SHEEP BARLEY ZONE
TURBO
UM SUNFLOWER / MAIZE ZONE
ELDORET
ELDORET MUNICIPALITY
NANDI DISTRICT
LESSOS LOCATION
KAPGAT LOCATION
ELGEYO ESCARPMENT
ELGEYO MARAKWET DISTRICT
ELGEYO BORDER
BELTS OF ZONES
UH UPPER HIGHLAND ZONES
LH LOWER HIGHLAND ZONES
UM UPPER MIDLAND ZONES
PRINCIPAL TOWN
URBAN CENTRES
RURAL CENTRES
MARKET CENTRES
LOCAL CENTRES
DISTRICT BOUNDARIES
LOCATIONAL BOUNDARIES
SUB-LOCATIONAL BOUNDARIES
FOREST RESERVE
KIPKABUS
KAPNABKOI LOCATION
KAPNABKOI WEST
TIMBORDA
Kilometres 5 4 3 2 1 0 5 10 15 20
N
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M.A. THESIS 1985/86
MAP Nº 6

Although the density is not as high as in neighbouring Kakamega District with 294 people per square kilometre in 1979, Nandi District with 109 people in 1979, Trans Nzoia with 124 people in 1979, the population change between 1969 and 1979 shows marked growth as shown in the table below.

(A) UASIN GISHU DISTRICT TABLE 4

Year	Area in Sq. Km.	Total Population	Density
1979	3,799	300,766	79
1980	"	324,365	85
1981	"	339,705	89
1982	"	355,744	93
1983	"	372,545	98
1984	"	390,161	102
1985	"	408,687	107
1986	"	428,095	112
1987	"	448,479	118
1988	"	469,893	123

(B) MOIBEN DIVISION TABLE 5

Year	Area in Sq. Km.	Total Population	Density
1979	1,910	128,147	67
1980	"	138,180	72
1981	"	144,714	75
1982	"	151,547	79
1983	"	158,704	83
1984	"	166,209	87
1985	"	174,101	91
1986	"	182,368	95
1987	"	191,052	100
1988	"	200,174	104

POPULATION BY LOCATION IN MOIBEN DIVISION TABLE 6

Location	Male	Female	Total Population	Area in Sq. Km.	Density/ Sq. Km.
Moiben	48179	48127	96306	1529	162
Soy/Turbo	15881	15960	31841	381	83
Division Total	64060	64087	128147	1910	67

SOURCE: Population Projections for Kenya 1980 - 200 CBS, M E P D Nairobi, March 1983 and Kenya Population Census 1979 Vol. I

The difference in densities between Uasin Gishu on the one hand and Kakamega and Nandi Distircts on the other is perhaps due to the former having been a scheduled area while the latter were African reserves (Sorrenson, 1954, Ominde 1968), etc. The densities in the table above tend to mask rural differentials in the district and the division. Due to increasing movement of population into the area and land sub-division over time, the population has increased overtime (Ominde 1968, 1979).

There is a marked ethnic heterogeneity in Moiben with Kalenjin (Nandi, Elgeyo, Kipsigis) as the majority. There has been an influx of Luhya, Kikuyu, Luo etc. as landowners over time. Although pastoralists in origin (Ogot B.A. 1967, Kipkorir B. 1979, Warren E.C. 1970, Low D. 1963), the Kalenjin, living in the area, have readily taken to agriculture. Milk, however, remains an important part of Kalenjin diets (Gerhart D. J. 1974, Metson J.E. 1978, Ruigu, 1978 etc).

Amongst the Kalenjin tribes land was originally held in common and could not be sold. Devleopments over time in Kenya (Sorrenson 1954, Odingo 1963, Okoth-Ogendo 1978, Kenya Govenrment 1978) have led to land being adjudicated, registered and transferred as private land. Most of the land in Moiben Division is privately owned.

ECONOMIC INFRASTRUCTURE

Roads

Moiben Division is connected with other areas by both asphalt and murram roads. Within the divisions, the road connections are as in the table below:

TABLE 7 Road Network in Moiben Division

Category of Road	From	To	Distance Covered in Kilometres
A104	Eldoret	Turbo	38
B2	Nine Miles	Moisbridge	32
C50	Elgeyo Border	Matunda	62
C51	Eldoret	Kopkei	18
C48	Moiben	Segero	15
D328	Ziwa	Segero	10
D329	Soy	Eldoret	30
D288	Kipkarren	Tapsagoi	12
C37	Turbo	Tapsagoi	10
E323	Soy	Moiben	37
TOTAL			261

With an area of 1910 square kilometres, Moiben Division has a road density of 0.13 kilometres of road per square kilometre. Of significance however, is the fact that some of the class D and E roads are not well maintained especially in areas like Segero, and parts of Elgeyo border. Consequently, Segero and areas on the Elgeyo border are not well integrated into the road network of the division. There is no organised bus transport except for a few irregular matatus. The road network is the major interface in procurement of farm inputs and sale of farmers' produce in turn. It is augmented by the railway line with a sub-station near Soy local centre. The above text is summarised in Map No

Agriculture Marketing

Moiben Division has three rural centres: Moiben, Turbo and Moisbridge, one market centre (Soy) and seven local centres:

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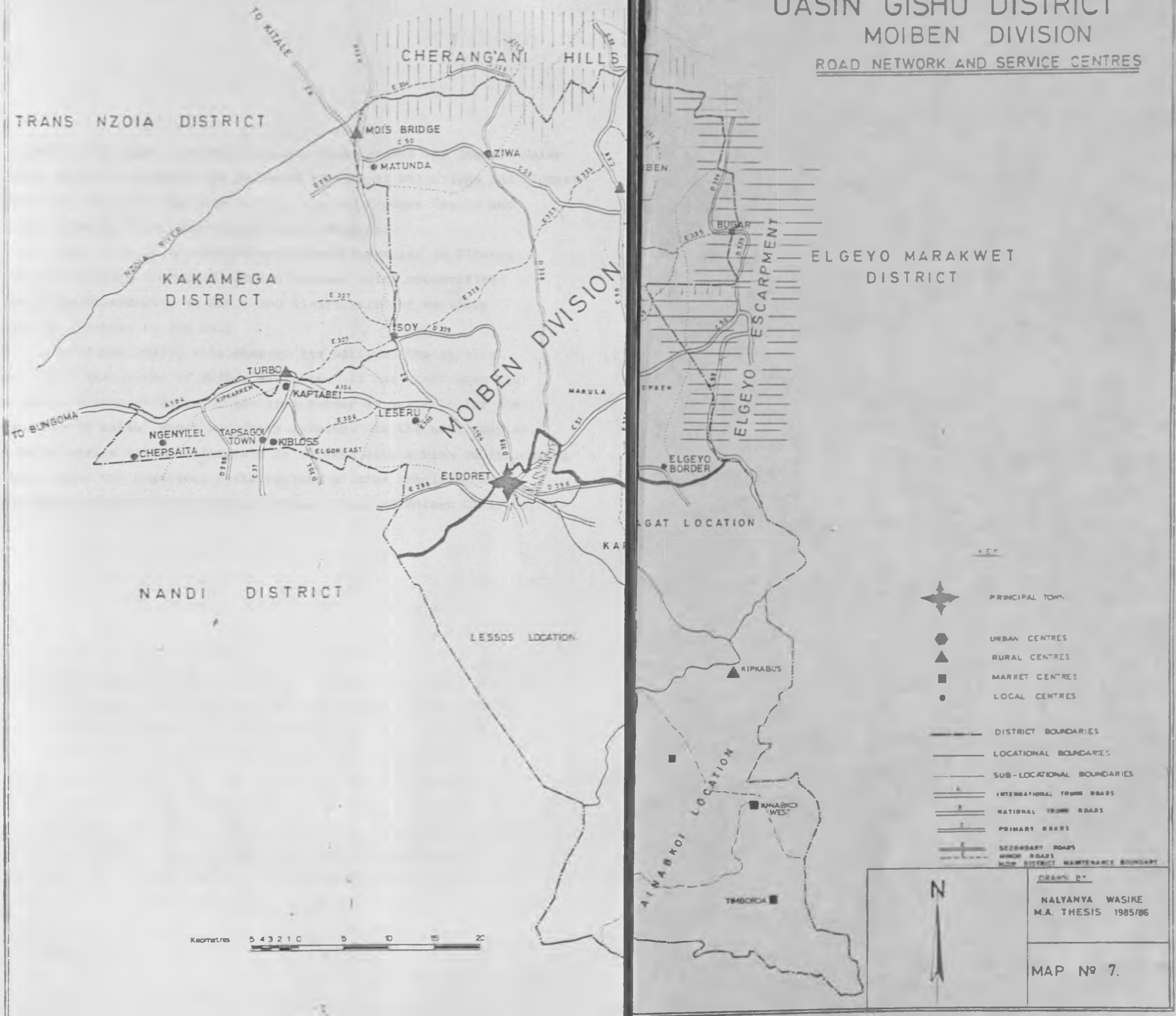
UASIN GISHU DISTRICT
MOIBEN DIVISION
ROAD NETWORK AND SERVICE CENTRES



Chepsaita, Tapsagoi, Leseru, Matunda, Ziwa, Segero and Bugar. Maize wheat and milk products are marketed locally at Moisbridge and Eldoret where we have both the National Cereals and Produce Depots and Kenya Grain Growers Cooperative Unions Branches.

Milk is sold to Kenya Cooperative Creameries in Eldoret town via private transport contractors and dairy cooperative societies or directly to KCC. The distribution of services centres is shown on Map No.7

Retrospectively, this chapter has outlined the physical and human background of Moiben Division. It has indicated that climatic characteristics of the area render it suitable for the practice of maize, wheat and dairy farming. In the next chapter, a brief review of the literature is offered with a view to indicating inter alia, the pracitcal contributions of othe scholars, as linchpins on which to contextualise our study of Moiben Division.

CHAPTER III: LITERATURE REVIEW

This Chapter is devoted to a critical review of the relevant literature pertaining to Agricultural Development and the factors involved. The aim is neither to pinpoint a panacea, a shortcut to efficient resource utilization nor to advocate any one single approach. The problem of Agricultural Resource Development and the constraining factors associated with it is much more complex for that. It is an example of what can be called a "system" problem; one with multiple complimentaries, with many facets, essential prerequisites and sequences and many feedbacks. Past researches are reviewed partly in the context of their relevance to Moiben Division and partly for providing guidelines on possible and future strageties for resources development and understanding of the processes which, concurrently, lead to the varied resource utilization pattern in Kenya.

Glover (1948, 1953, 1957), basing his argument on research carried out at Muguga, came to the conclusion that methods of land preparation, crop husbandry, availability of farm inputs, timeliness in planting, marketing infrastructure, etc. jointly and severally influence the production of agricultural products in a given area.

Norman (1952) in a study of the Hausa farmers in Northern Nigeria indicates that allocating farm resources optimally increased income by 9% beyond existing levels. He notes that the amount of labour a farmer could contribute or hire during the peak labour demand season was an important constraint in increasing farm production. He notes that farm labour during the peak season boosted farm income by 28% ceteris paribus.

Schultz (1956) in a classic book on traditional agriculture, argues that when farmers are limited to traditional factors of production, they reach a point after which they make little or no contribution to economic growth. Small Scale farmers already allocate their resources optimally as opposed to some large scale farmers.

Investment into human and material capital may raise productivity of agricultural sector in the long run. Heady (1961) in his study of economics of agricultural production and resource use notes that the major societal concern will remain outstandingly that of gearing food output and resource employment of agriculture to economic growth goals. He contends that milk production demands complex marketing procedure with daily collections followed by cooling and pasteurisation prior to distribution to the consumers. Infrastructure in a given area should be linked to output.

Odingo R.S. (1963) in his study of geographical aspects of agricultural development in the Kenya highlands came to the conclusion that physiographic nature of land, soil fertility, climatic variations, farm practices, input availability and marketing etc. were factors influencing the pace and rate of agricultural development in the region.

Masao Yoshida (1966) and Commission of Inquiry (1966) in their studies on maize and wheat in Kenya came to the conclusion that variation in weather cycle, altitudinal suitability, decisions in marketing and reduced freight charges with the building of railway were, in a historical perspective, factors responsible for varied pace and rate of production.

Waler and Martin (1966) contend, eventually a model must be selected which starts from where farmers are, in terms of resources, incomes and goals and carries the analysis to the point of estimating where they can, should or will go.

Olsen, M (1968) contends centralized decision-making fosters overall communication, coordination, control and planning and permits organizational members to hold together and work toward attainment of goals. Functional rather than normative integration is emphasized. However, he notes that increased centralization stifles initiative and creativity of lower cadre personnel resulting in organizational rigidity; such that an organization becomes incapable of continually and flexibly adjusting to changing internal and external environments.

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Owako F.N. (1969), and Engel (1983) in their studies of agrarian problems of Machakos District, contend that physical and human background, land utilization pattern and related constraints pertaining to transportation, marketing, innovation diffusion, etc. dynamically affect the pace of agricultural development in the District. Theirs, however, were the smallholders, unlike the current one on large scale farmers.

Etherington D.M. (1969) in his study of large scale plantation agriculture contends that access to capital in form of machines, housing presence of high cadre of management, transportation network to handle perishable products and implementation of latest research findings were factors influencing resource utilization in a given area.

Oyenuga Victor Adenuga (1969) in his study of the agricultural sector in Nigeria contends that development of both crop and animal industries, design, production and distribution of implements and machinery to supplement use of human labour, creation of sound research institutions and consolidation of existing ones, development of extension services, and a sound, efficient agricultural education; development of water system, good storage and marketing system, introduction of a soundly based and efficiently operated credit systems, farmers' cooperative societies, and industries to produce farm inputs are factors which, severally and jointly affect the pace and rate of agricultural resource utilization in a given country. His study, however, had a heavy leaning towards human factors than the physical factors. We attempt to marry the two in our study.

Nyakaana L.M.A. (1970) in his study of agricultural and economic development in Uganda notes that both internal proximate factors influence decision making at the farm level. The former include:- technological innovations, managerial knowhow, innovativeness and use of capital land and labour while the latter include:- agricultural research, extension and education, institutional arrangements in marketing and credit plus government policies and commitments to agricultural development.

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He contends that, environment, land availability and tenurial system, husbandry practices, social and education attributes, national agricultural policies, all dynamically shape the pace and rate of agricultural resource development in a given area. He advances the case for large scale agriculture on seven grounds:- it is an avenue for developing export trade; permits better supervision and control of the products; facilitates orderly planting through systematic use of fertilizers; allows for economies of scale in transport and regularity of input supply; justifies use of specialized equipment like tractors; employers of many people and use of byproducts is facilitated. He notes that planning for agriculture helps in identifying the interplay of factors and attracts supply of scarce resources and, encourages greater release of energies. He argues that a plan should be disaggregated to adjust to local environmental conditions of fertility, climate, infrastructure and availability of processing and marketing facilities with due regard to resource endowment, product mix (both actual and potential) of the area, in the context of the national planning procedures.

Allan Y Allan (1971) in his study of agronomic factors affecting maize yeilds in Western Kenya, noted that soil erosion, water-logging, temperatures and rainfall variations, day length, radiation, insect damage, method of land preparation, availability of inputs, timeliness in credit provision and planting, plant population per hectare, severally and in combination affect the resource utilization and productivity in a given ecological setting.

Vail D.J. (1971) in his study of innovation adoption as a stimulus to agricultural development in Teso, Uganda, contends that research findings and their dissemination, agricultural extension system, input supply, farm produce marketing, transport network, perceived benefits by farmers, coercion, etc. severally and jointly influence the rate and pace of resource utilization in a given setting both in the short and long run.

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Mosher A.T. (1972) in his study of stimulants to agricultural development notes that market availability, technological package need and adoption, input availability in time, production incentives and adequate transportation network are all essential to agricultural development. He contends also that farmer's educational background and experience, extension advice, production credit and national policies, planning and cooperatives are accelerators which may or may not be essential in a given area.

F.F. Hill and Lowell S. Hardin (1973) in their review of the green revolution in Asia contend that a well adapted production technology, adequate water supply, input availability, favourable product price relationships, government commitment and leadership are key factors in those situations where the green revolution has been most successful. Their observations appear to apply to the diffusion of hybrid maize in Kenya in the 1960s.

Moock P.R. (1973) in his study of maize production in Vihiga Division,contends that decision making is crucial to farm productivity. This depends on farm head/owner or farm manager and their respective perceptions of allocative and economic efficiencies. He notes that a labourer's 'embodied' technology will embrace:- educational level attained, type of agricultural training, work experience, etc. Using correlation and regression methods for analysis, Moock found out all these attributes influence decisions pertaining to:- how and when to use which inputs; nature of seedbed, when to plant, what spacing to follow in planting, soil conservation measures, which, in turn, have a bearing on land productivity and yield per unit area.

Price J.L. (1973, 1976) notes that all activities of a formal organization ranging from the setting of goals, allocation of scarce resources, research and training, etc, necessitate decisions to made about them. There is need for a link between thinking and doing, between reflection and action. The farming community and even individuals similarly make decisions about their various farming activities such as time of planting, seedbed preparation methods, etc.

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Anthonio Q.B.O. (1973) in his study on the dynamics of decision making and policy formulation for agricultural improvement in low income countries contends that although knowledge of the decision making processes helps to remove bottlenecks, to reduce persistent production constraints and to expedite sustained overall agricultural improvement. Motivation of agricultural improvement has to start with improving the nature of decision making not only on the farm but in all areas affecting the progress of agriculture. Indeed, he argues, in Africa, capacity or skill in farm organization restricts the progress of agriculture.

The Wabuge Commission (1973) in its thorough investigative study into fluctuations in maize production in Kenya, noted that:- inadequate research and extension services, difficulties in obtaining inputs, high input price, poor servicing facilities for farm machinery, difficulties in obtaining spare parts, high cost of spare parts, lack of access to machinery in small farm arcas, difficulties in obtaining credit at right moments, lack of labour for weeding and harvesting, poor access roads especially during wet seasons, inefficiencies in the marketing system, low crop prices for maize versus other cereals, lack of storage facilities and pests and diseases were explanatory factors for the trend in maize production.

Gerhart D.J. (1974) in his study of hybrid maize diffusion in Western Kenya, using correlational and regressional analyses contends that, planting breeding research, agronomic research, seed production and its distribution, fertilizer provision and pesticides, education and training of local research and extension staff, a vigorous extension programme, adequate credit facilities, a good transport network, marketing organization with fair prices, storage facilities (their capacity and adequacy) and official government support are, jointly explanatory factors for successful diffusion of the crop in Western Kenya.

Evenson R. E. (1975) in his study of agricultural research and productivity notes that increased productivity depends on increased use of resources: land, fertilizer, water machinery.

He points out that output will rise due to improved quality of factors of production, better knowledge, better infrastructure, institutional arrangements, etc. Agricultural production embraces two processes:- biological and mechanical. Inputs into biological process include:- seeds, fertilizers, water, correct choice of methods, timing, etc. while the mechanical process include:- labour and machinery. It is the sound and rationalized combination of the two that facilitates agricultural productivity.

Muketha J.K. (1976) in his study of labour and capital substitutability in large scale farms, contends that tractors, combine harvestors and planters are necessary to solve labour bottleneck in this sector. He notes that with mechanization, more land is brought under cultivation but, cautions that mechanization should not be introduced haphazardly.

Lema H. (1977) in her study of comparative agricultural development strategies in Kenya and Tanzania, using a reflective, descriptive and prescriptive analysis, notes that institutional building related to agricultural research, rural education and farmer training, programmes of investiment in infrastructure including irrigation, rural roads, healthcentres, water, etc. improvement of produce marketing and distribution of inputs, credit policies related to producer prices and land tenure are factors influencing farmer's productivity. On large scale farms in Kenya, she observes that lack of large scale farming knowledge especially amongst the new settlers, lack of farm plans and budgets, little extension coverage, lack of working capital for day to day operations jointly affect resource utilization.

Byerlee and Eicher (1977) noted that labour use in African agriculture is highly seasonal due to rainfall patterns. There are periods of labour bottlenecks and periods of slack labour. Introducing complementary enterprises that utilize labour during the slack periods increases incomes and employment. Indeed, Okurume's study (1970) of cocoa production in Nigeria, Collison's study (1973) of tobacco production in Tanzania and Nalyanya's (1985) of Kipsomba, are examples of evidence that utilization of farm labour during slack periods for cash crop production increases

Leonard D.K. (1971, 1973, 1974, 1977) in his study of organizational theory and agricultural practice in Kenya notes that extension services are skewed in favour of the more progressive and wealthier farmers. He contends that disatisfaction with pays and hours of work, frequent staff transfers, inadequate job training due to lack of materials for demonstration, transport, etc. were factors which militated against the efficiency of extension staff.

Rukandema F.N. (1977) in his study of resource availability, utilization and productivity in Kakamega District with special reference to Muyenga (Butere) and Shikoli (Ikolomani) locations using correlational and regression analysis contends that rudimentary level of technology, low labour productivity, low plant population per acre, diminishing land per individual and delay in harvesting leading to crop rotting, jointly affect resource utilization and productivity in the area. He notes the untapped potential in the district for tea, coffee, bananas, potatoes and poultry keeping.

Metson J.A. (1978) in her study of maize and dairy farming in Nandi based on sample of 62 farmers and using correlational, regressional and linear programming methods of analysis notes that:- location, climate, soil types, vegetation, population change, and land tenure in combination, affect or influence (the distinction between and reasons for) rainfed agricultural development in different areas of a given region or nation. Besides, she contends that prices of inputs, farm sizes, family and hired labour, innovations and their adoption, diseases and their control, credit facilities; their availability and timing, marketing farmers' perception of problems, farmers' education and training, reinforce the above physical factors to affect the pace of agricultural activity. In terms of harnessing resources to raise productivity, Metson notes that advanced technologies, new hybrid varieties, high fertilizer application, tractor ploughing and planting often require a larger capital input hence an incrementalist strategy in their adoption in necessary.

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Focussing on the large scale farming sector, she contends that shortage of capital, shortage of water, cost/shortage of fertilizer, cost/shortage of labour, cost/shortage of machinery, poor marketing facilities, shortage of tractors, cost/shortage of land are factors which, in combination may affect farming in a given area.

Okoth-Ogendo (1978) in his study of the political economy of land law, notes that the land tenure system, farmer's knowledge and training, working capital, and budgeting, daily job routine and time apportionment all, overtime, affect the pace of land use in a given setting.

Mwangi W. M. (1978) in his study of farm level derived demand responses for fertilizer in Kenya based on a detailed survey of Central Province notes that use of fertilizer leads to increase in agricultural output. He notes however, that net farm income is influenced by product prices and capital to a much greater extent than it was by fertilizer prices. He contends that lack of funds, lack of fertilizer supplies, at the needed time, high transport costs, lack of fertilizer credit, low level of literacy all constraint the use of fertilizer. He advances the view that fertilizers are a prime mover of agricultural development but notes that consumption of fertilizer is affected by:- prices paid for products to pay for fertilizers, response of different crops to different fertilizers such as sugar and maize, farmers' awareness of these factors, applications of recommended fertilizer level, etc, and credit availability.

Ruigu G. M. (1978) in his study of the Kenyan milk subsystem contends that agricultural extension, training and research findings and dissemination, credit provision, input supply programmes, and adjudication and registration, disease control, cooperative marketing, etc. all affect the dairy industry in Kenya. He observes that decisions making structure in dairy industry in Kenya is highly centralized with production and management handled by Kenya Cooperative Creameries. It is characterised by seasonality in production and spatial variation in pricing.

An improvement strategy in milk production involves health and diseases control, management, foods, pasture improvements and credit and extension.

Feldmann (1979) has categorised factors affecting decision making at the farm level into three broad areas:- (a) those which the farmer has managerial control over; goals and objectives; incomes, security, work, etc. farm resource levels: land, labour, capital, skills, etc; (b) those outside the farmers control: natural conditions; climate, soils, topography, socio-economic access to markets, prices, tenure systems, and socio-cultural-political obligation network, social responsibility. He notes that these factors interract to create a complex of decision environment within which the farmer makes his rational choices of crops, varieties, inputs, timing of operations; in fact, his survival algorithm .

Nsereko J. (1980) in his (reflective, descriptive and prescriptive) study of Uganda's agricultural sector contends that maximization of resource use in a given setting is achieved through:- improvement of transport and communications, rise in production, productivity and efficiency in resource utilization, clearcut marketing channels to the farmers and better land use system that is conducive to capital formation and agricultural development; farmer's training, experience and awareness.

Chitere P.O. (1980) in his study of decentralization of decision making processes and their implications for implementation of crops improvement programme, in Lugari and Ikolomani Divisions notes that where farmers are exposed to knowledge about improved farming and they think, talk, read, work, and act on information received, productivity is usually higher. Capacity of extension, including/comprising of density of staffings, occupational competence, transportation arrangements affect innovation diffusion. He contends that intensification of husbandry methods could lead to high farm productivity.

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Mukhebi A.W. (1981) in his study of income generation in Kenyan small scale agriculture, based on a survey of farmers in Machakos District notes that the population/land ratio affects gross production and productivity. He points out that average income tends to decrease as the size of land per individual falls. With a decrease in land/population ratio, the rate of employment from agriculture will decrease leading to increased under-employment and calling for increased off-farm employment. Continuous decline in land base per worker leads to poverty of those affected.

Misiko P.A.M. (1976 and 1981) in his studies on agricultural innovation diffusion in Bungoma District notes that: research and findings and their dissemination, agricultural extension system, input supply, farm produce marketing channels, incentive goods such as prices, are all stimulative functions in innovation diffusion. While, long distances to the market, poo. means of transporting produce, marketing dates vis-a-vis harvesting dates, quantitative limitations to local marketing capacity, poor network linking local tometropolitan markets, poor communication channels are disincentives to innovation adoption.

GOK (1981) in its Sessional Paper No. 4 on food policy notes that application of new technology in agriculture from outside and that developed locally at the thirty research stations in major farming areas should help to stimulate food crop production to meet the demands of the ever increasing population.

Ouma W.O. (1981) notes that absence of sufficient flow of information causes serious delays in decision making and hence implementation at all levels of the organisation. There is need for researchers, administrators, extension officers and farmers to interract continuously with intent to think, talk, read, look and act on information gathered to facilitate resource utilization.

Tabaro K.G.B. (1980) in his study of factors affecting resource utilization in Karagwe District, Tanzania, notes that poor transportation facilities and services, inadequate marketing facilities, low level of skills and technology, low level of industrialization and peripheral location of the area, all in

combination, led to low level of resource utilization and productivity. He advocates an integrated spatial framework for the removal of those constraints.

The literature cited above has isolated well over thirty factors that affect agricultural development. This list of factors is more than can be adequately handled in this research. Consequently and for the sake of clarity, brevity and convenience, these factors may not be grouped into four broad categories:- land, labour, capital and infrastructural factors. Land related factors include:- nature of the terrain, tenure system, its potential crop yield per acre, while capital related factors include:- physical inputs into the farm such as improved seed, fertilizer and their timely availability, farm machinery like tractors and planters; labour related factors include:- type of labour, its availability by seasons, farmer's level of education and migration. Infrastructure related factors include: depots and their storage capacities. This constitutes the output side of the farm operation. This categorisation is used in a subsequent chapter to examine constraints to agriculture in Moiben Division. In the next chapter, the research methodology adopted in this study is outlined.

CHAPTER IV - METHODOLOGY

The previous three chapters have illuminated the background to both the problem under study and its scope, the study area and presented a brief literature review. In Chapter III, the factors affecting agricultural development and the methodologies used to identify these factors were derived from the literature review. The present chapter analyses and rationalises methodology considered appropriate in this study for data collection, analysis, interpretation and presentation of results and outlines some limitations of the techniques.

RATIONALE FOR THE METHODOLOGY USED

The farm is regarded as the focal unit in this investigation. Heller (1964), and Kenshall (1978) have suggested that the farm may be used to study variations in agricultural activity and to show the influence of physical and human factors on the sector. Investigations at the farm level have particular merit because farmers do not evaluate environmental resources in isolation from production units.

A number of studies (researchers) such as Odingo (1963), Owako (1969), Lema (1977), Nsereko (1980) have used the field survey technique to analyse the constraints to agricultural development in the context of physical and human factors. Others such as Nyakaana's (1970) study of Uganda, Moock's (1973) study of Vihiga, Gerhart's (1974) study of Western Kenya, Vail's (1971) study of Teso District in Uganda, Lowell's (1973) study of selected Asian countries, Rukandema's (1977) study of Kakamega and Metson's (1978) study of Nandi District reviewed above, have used both the practical field survey and participant observation techniques in gathering data to explain factors affecting agricultural development. It is argued in all the above studies that farm surveys yield more realistic data than experimental stations' findings because the former are representatives of actual farm conditions. Indeed, Allan (1971) and Misiko (1976) in their studies of Trans Nzoia and Bungoma Districts respectively, contend that conducting a problem oriented research in the environment of farmers further broadens the researcher's experience and understanding of the real problems and characteristics of the farming systems.

Mukhebi's (1981) study of Mbiuni Location in Machakos District

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and Metson's (1978) study of Nandi District concurred on the premise that a study of specimen (representative farms) is essential in understanding the interrelationships between agricultural land use pattern and the farmer's resources, decisions, abilities, and adaptation to changes in technology and price levels. Therefore, the concept of representative farms would be relevant in studying constraints to agricultural development in large scale.

The studies that used both the field survey and participant observations as indicated above were spread over a year in their data gathering phase. These researchers were able to gather large stocks of data which required the use of predictive techniques such as linear programming and multiple regressions to isolate the factors affecting agricultural development and their interrelationsips. Due to constraints of time and funds, this study uses the farm survey method of gathering data along the lines of Rukandema (1977), Metson (1978) and Vail (1971) who adopted a systems approach.

A system as noted in chapter one above, consists of parts of elements, the relationship between them and the process of interraction on which that system rests. (McLoughlin, 1978, Haggett, 1980 and Coffey, 1981). The systems approach and its many variants are useful as analytical frameworks which facilitate the detection of order in a reality that is apparently complicated. Moereover, it encourages the anlysis of units within their own settings and emphasises their interractions with other units within the system. There is reasonable expectation that when questions are posed within a systems framework, they lead progressively and cummulatively to an understanding of the system as a whole (Chadwick 1976, McLoughlin 1978).

Although the systems approach has been widely used in typological classification of agriculture (Harries 1969, Kostrowicki 1970, Vanzetti 1972, Lowell 1973, etc.), it has not been used in the context of identifying constraints to large scale farming enterprise, certainly not in Moiben Division. A large scale mixed farming system of maize, wheat and livestock consists of a set of interracting resources: water, forestry, livestock with land as the base. These resources are functionally related to the natural and economic

environment in a given area (see Figure I). A systems approach permits the emphasis on more significant elements in a given type of agriculture on which a detailed analysis can be concentrated. The schematic diagram (Figure 2) shows that a mixed farming type of agriculture is linked in a complex feed system composed of agronomic practices, physical and socio-economic environments. Although more attention is paid to soil properties, agronomic and socio-economic factors, this diagram shows that they are closely intertwined and jointly affect the practice of agriculture in a given setting. Accordingly, these factors are capable of having independent effects on maize, wheat and milk production.

Without energy and material supplies such as fertiliser and seed inputs, large scale mixed farming systems would be seriously strained with serious consequences on yields (outputs). Figure 2 shows the flows of energy and flows of information arising from the farmer's assessment of capital and technological constraints, economic and locational constraints some of which affect the supply of variable inputs such as seeds, fertilisers and insecticides. This type of path-analytic framework does not imply causality but a chain of interrelated mutually reinforcing processes. In such a system, it is often the farmer who decides on what, how, when, where and what types and quantities of inputs to use as shown in the studies by Price (1967), Moock (1973), Anthonio (1973), Lowell (1973) and Chitere (1980) reviewed above.

RESEARCH DESIGN

In order to identify factors affecting agricultural development in Moiben, it was deemed necessary to select a sampling technique that would enable a representative sample to be drawn from a wide cross-section of farmers.

The sampling methodology was in two stages. The first was a real unit sampling that demarcated Moiben Division. The Division was further demarcated into its two locations: Moiben and Soy/Turbo. The second stage consisted of designing a farmer sampling frame to help in selecting farmers to be interviewed. The Central Bureau of Statistics stratified sample frame was adopted after discussion with agricultural officers at the divisional level. The sample frame gave a total of 524 farms in the operational definition of a large scale

FIGURE 1 A CONCEPTUAL FRAMEWORK OF LAND-USE IN MOIBEN DIVISION

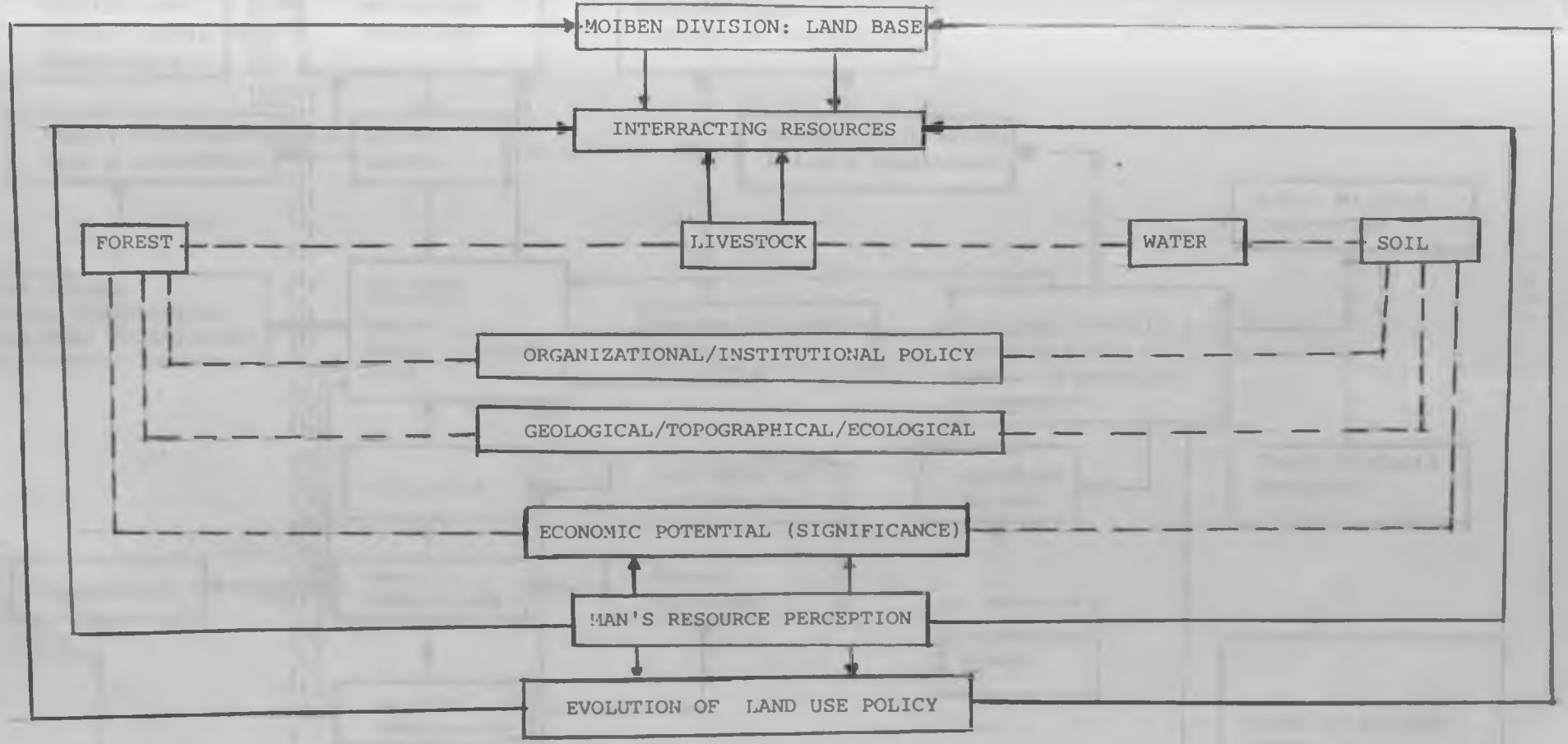


FIG. 2 A CONCEPTUAL MODEL OF A LARGE SCALE MIXED FARMING SYSTEM IN MOIBEN

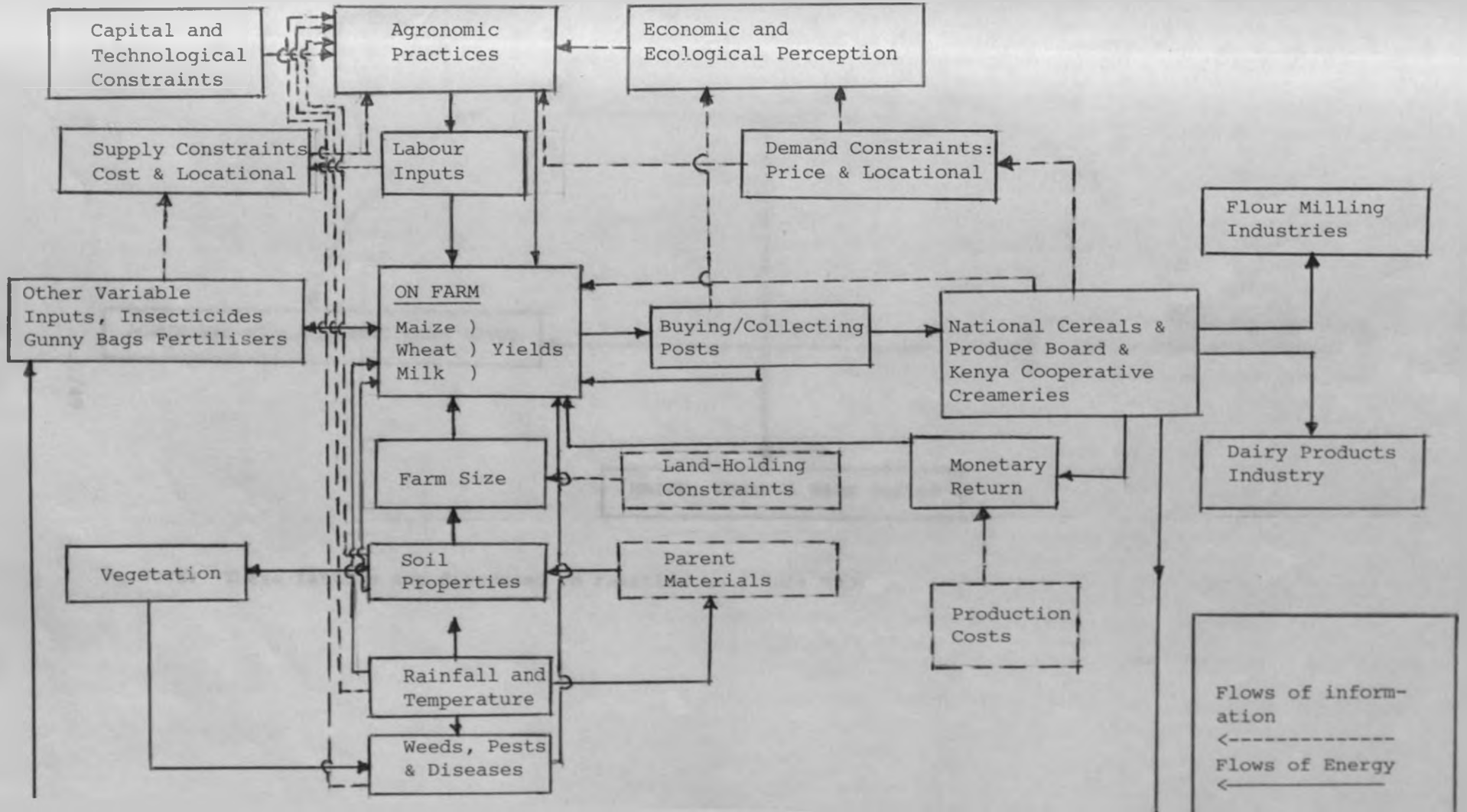
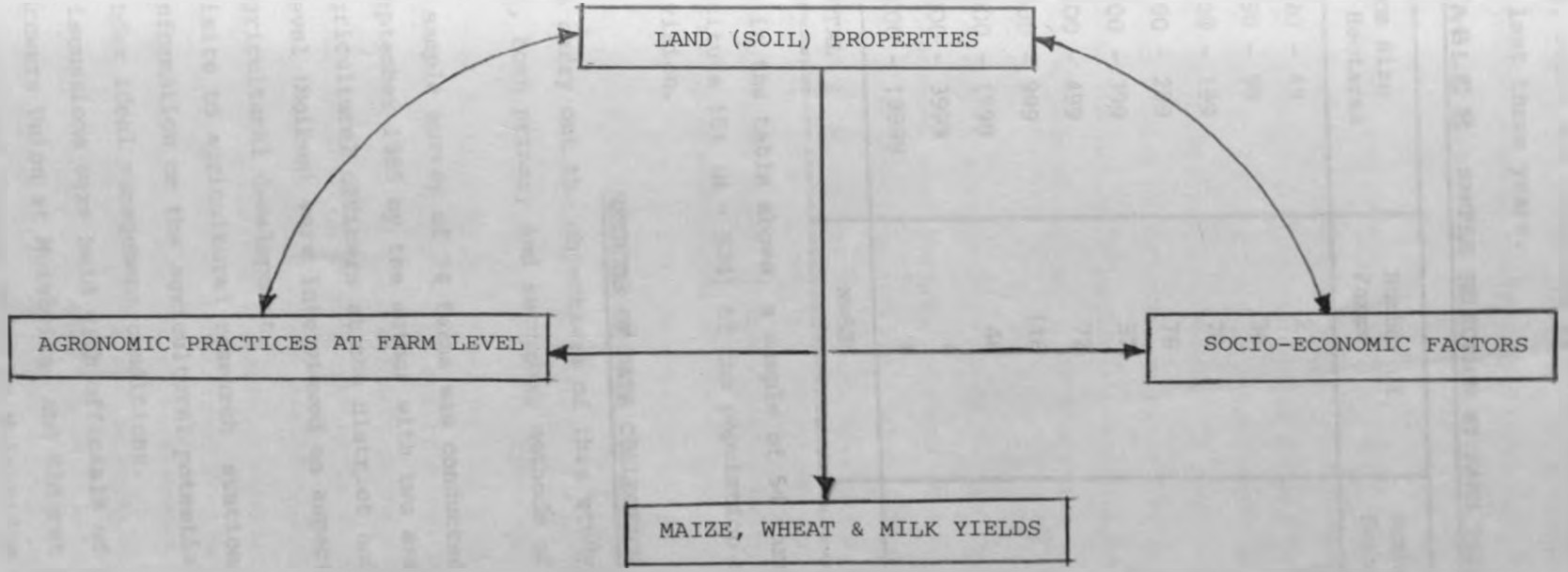


FIG. 3 A SIMPLIFIED MODEL OF FACTORS AFFECTING AGRICULTURAL DEVELOPMENT IN MOIBEN DIVISION



NOTE: These factors are discussed in relation to figure Two.

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scale farm given in Chapter I. Besides, farms selected were those where wheat, maize and livestock farming activities had been practised during the last three years.

TABLE 8 SAMPLE SELECTION BY FARM SIZE

Farm Size in Hectares	Number of Farms	Number of Farms Selected
20 - 49	23	2
50 - 99	36	4
100 - 199	72	4
200 - 299	78	6
300 - 399	57	10
400 - 499	72	4
500 - 999	116	14
1000 - 1999	46	4
2000 - 3999	4	2
4000 - 19999	8	4
TOTAL	N=524	54 (10%)

As shown in the table above, a sample of 54 farmers were selected. This constitute 10% (N = 524) of the population of large scale farms in the division.

METHODS OF DATA COLLECTION

To carry out the objectives of this study, outlined in Chapter I, both primary and secondary methods of data collection were used.

1) A sample survey of 54 farms was conducted in August and September 1985 by the author with two assistants.
2) Agricultural officers at the district and divisional level (Moiben) were interviewed on aspects of agricultural development.
3) Visits to agricultural research stations to collect information on the agricultural potential of the region under ideal management conditions.
4) Discussions were held with officials of Kenya Grain Growers Union at Moisbridge and Eldoret and National Cereals and Produce Board at Moisbridge and Eldoret

depots on aspects of provision of farm inputs and purchase of farm produce. In addition, milk transport agents, dairy cooperative officials and officials of the Kenya Cooperative Creameries were interviewed.

The questionnaire administered to farmers covered both agronomic and socio-economic aspects: land preparation, sources of farm inputs, transportation, marketing facilities. In addition, data on farmers overall indications of constraints to agricultural development in Moiben was collected. In most cases, farmers' recall was the major source of information since few farmers keep records. Besides this, the author's personal observations in the field were used to gather data on aspects like the state of roads, distribution of markets, etc.

As a sample survey, this study relies mainly on data collected through interviews with farmers as noted above. However, this source of data had to be supplemented with others notably documentary evidence from such sources as agricultural information centre, Nairobi, earlier farm surveys in the region and the broad spectrum of literature reviewed above. Consequently, unless stated or the source acknowledged in apprehension, all data used in the study emanate from the field survey and have to be interpreted in the light of their nature and possible limitations as noted above.

METHODS OF DATA ANALYSIS AND PRESENTATION

Descriptive method of analysis based on questionnaire responses has been used in this study. The focus in the analysis is on identification of constraints to agricultural production on both the input and output side of the farm enterprise: availability of farm inputs, rates of fertiliser and seed application, availability of machinery (capital) labour, land, credit and on the output side focus is on adequacy of marketing channels, transportation system, storage facilities, payments for milk delivered to Kenya Cooperative Creameries and cereals (maize and wheat) delivered to National Cereals and Produce Board. Descriptive statistics have been used to present findings using percentages, charts with relevant written texts.

In the next chapter, discussion is focussed on factors

affecting maize, wheat and milk production in Moiben Division. For clarity, brevity and convenience, a brief description of the production conditions for each activity is given to and summed with its structure in the Kenyan context. The research findings in this respect are expected to be of particular value in indicating action programmes and strategies which could be adopted by farmers if high levels of production are to be realised or if the full potential of this area were to be realised.

CHAPTER V: DATA ANALYSIS AND FINDINGS

The background to this study has been presented in the first four opening chapters which considered its frame of reference, reviewed relevant literature to the study and explained the methodological framework. This chapter explains the factors affecting agricultural development in Moiben Division. Basically, it falls into three parts:- the first one gives an overview of the production conditions and structures for maize, wheat and dairy farming in the Kenyan context. This serves as a spring board for the second part which focusses on the constraints identified in an analysis of data procured from the field and compared to ideal production figures. As noted at the end of chapter III, land, capital, labour and infrastructure are used as the main parameters. The third part is a summary of the preceeding sections.

MAIZE FARMING ENTERPRISE IN MOIBEN

Maize Production Conditions

Maize grows in the equatorial region and in the tropics and even in the warm temperate zones between 35°N and 35°S of the equator. The origin, spread and development of maize production in Kenya has been well documented (Troup Report 1953, Allan A Y 1971, Moock 1973, Gerhart 1974) and as such need not detain us here. At present, maize is the basic dietary staple for most Kenyans. It is consumed either as whole maize, maize on the cob and maize flour or posho.

On average, maize requires a minimum rainfall of 750mm well distributed throughout the year, but optimum rainfall requirement is 1000mm if satisfactory growth and yield are to be realised. Most maize growing areas in Kenya have variable and deficient rainfall distribution which, quite often results in poor yields. Altitude and its moderating influence on temperature has significant impact upon the duration of maize maturity and subsequent length of crop cycle. In Kenya, maize is grown from a few metres above sea level in the Coast Province up to an altitude of 2000 metres above sea level in Nyanza, Western and parts of Rift Valley (Uasin Gishu, Nandi, Trans Nzoia, etc) Provinces. The typical maize maturity

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period ranges from six to nine months from the time of planting.

Soil type affects maize growth and yields. The soils in Uasin Gishu, as shown in Chapter II above, are dark-reddish brown clays of volcanic origin, friable in texture and high in inherent fertility but require nitrogen and phosphate supplementation to increase crop yields. The water retention capacity is reasonably high, which makes the soils difficult to work in wet conditions while in dry weather they are hard to break. This necessitates the use of heavy machinery during land preparation. It is, however, generally recognised that maize tolerates a wide variety of soil conditions, but for good yields, free drainage and sufficient supply of soil nutrients are necessary (Allan A Y 1971, Okallo 1974, Gerhart 1974).

Apart from the geo-physical environmental factors mentioned above, maize needs careful attention by the farmer if economic yields are to be realised. A small amount of moisture is needed in its early stages of growth, when the growing point is still below the surface of the ground, and then considerable moisture in the later stages when it is taselling and filling out the cob. Maize should be planted early before the onset of rains. Planting after the rains have started means that the plant starts off in very wet, cold, poorly aerated soil and then may suffer later from water shortages when the rains are tailing off. Land preparation involves opening up the soil by deep ploughing and one round of light ploughing with harrowing done to ensure a suitable soil tilth. Conventional wheel tractors with disc, chisel ploughs and harrows are used in Moiben. Maize seed is procured from Kenya Seed Company and planted using planters and spaced 0.76 metres to 0.91 metres in between rows.

Maize requires nintrogenous, phospatic and potassic fertilizers. However, in Kenya, phosphate remains the most important fertilizer (Allan A Y 1971, 1974, 1975). A rate of about 168 kilogrammes of Diammonium Phosphate per hectare at planting time is considered an ideal application rate.

For good yields, maize yields should be kept weed-free throughout the crop life. Hand-weeding is used in most maize growing areas although large scale farms use herbicides and mechanized spraying to

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control weeds. Weeding frequency depends upon climate but one to two weedings before crop maturity is considered optimal. Early weeding within four weeks of planting increases yields while late weeding reduces them (Allan A Y 1971, Moock 1973).

Harvesting is done when maize is considered mature and millable. In most areas of Kenya, maize is harvested by hand although on some large farms and plantations in Moiben Division, harvesting is done by combine harvesters. Maize should be harvested once it reaches physiological maturity with a moisture content of less than 15%. Yield levels often drop with continuous planting on the same field and this explains the common low yields in most areas where little or no crop rotation is practised.

The schematic diagram (figure IV) shows the maize industry structure in Kenya. It indicates the flow of basic inputs into the farm operation such as recommendations, capital inputs, fertilizer, seed, credit, labour and the flow of outputs to various markets for home consumption and milling. The structure at the national level has been disaggregated to zero in Moiben in our subsequent discussion of this activity using the parameters of land, labour, capital and infrastructure outlined above.

Wheat Production Conditions

Wheat has been grown in Kenya for well over eighty years (Ogemma and Cormack 1980). The proportion of wheat in the diet of most Kenyans has been rising steadily. While leavened bread is quite popular, unleavened bread, or Chapati is widely consumed in urban areas. Currently, Kenya is dependent upon foreign sources for 33 - 40% of domestic needs (Sessional Paper No. 1 1986). Analysis shows that under small farm conditions maize production for subsistence has substantial comparative advantage over wheat (Mulamula, Harder, Paulsenn 1976, 1977, 1978).

Wheat production is highly mechanized. Indeed, studies by Maitha (1976) and Muketha (1976) and Etherington (1969) reviewed in chapter three above contend that wheat should be produced on large scale where returns to investment may justify investment in capital.

On average, wheat requires a minimum of about 500mm of rainfall distributed throughout the growing season, but optimum

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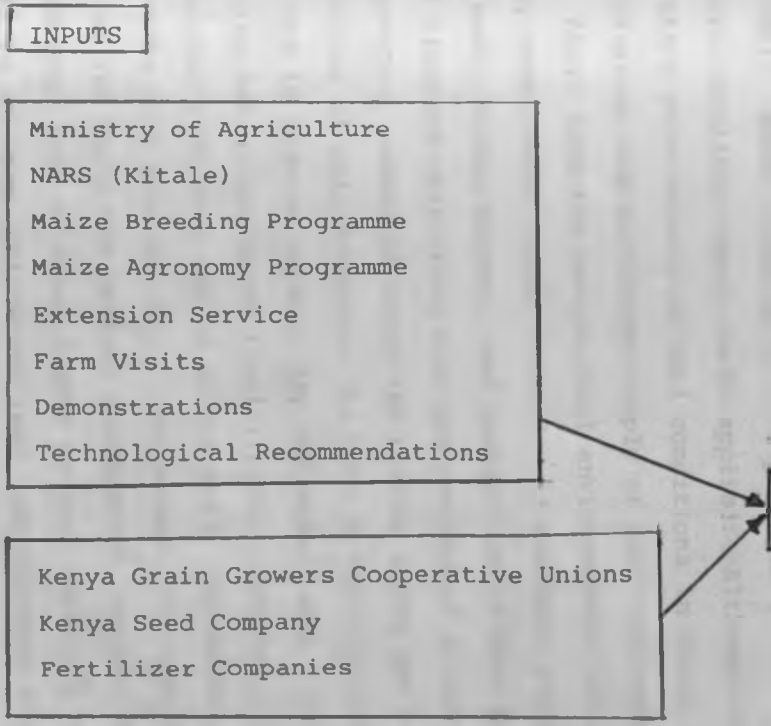
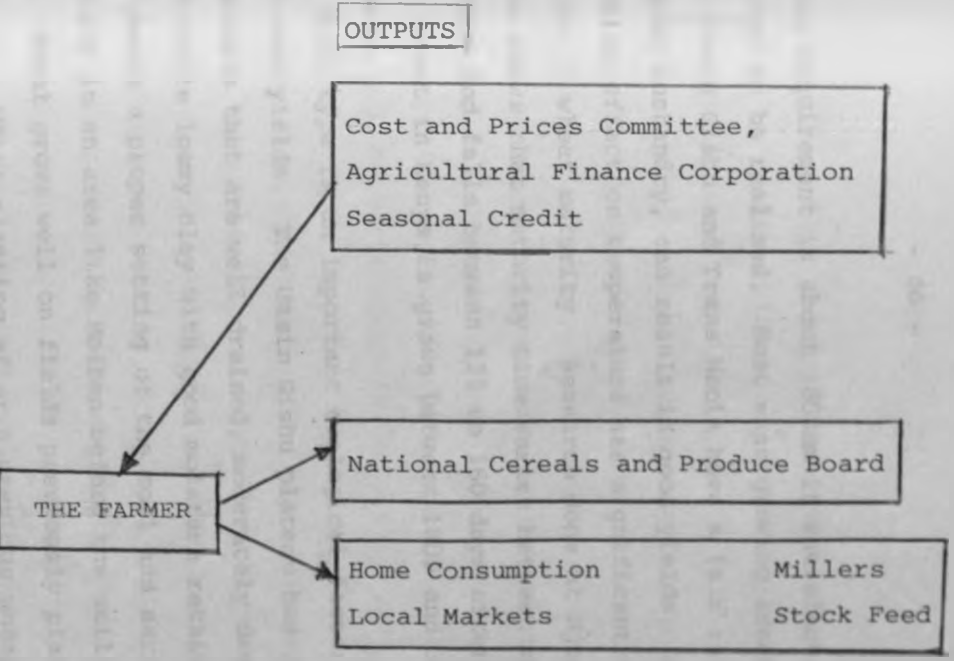
Figure IV: MAIZE INDUSTRY STRUCTURE IN KENYA



SOURCE: Ministry of Agriculture


OUTPUTS
Cost and Prices Committee,
Agricultural Finance Corporation
Seasonal Credit
THE FARMER
National Cereals and Produce Board
Home Consumption
Local Markets
Millers
Stock Feed

rainfall requirement is about 800mm if satisfactory growth and yield are to be realised. Most wheat growing areas in Kenya such as Narok, Uasin Gishu and Trans Nzoia have a fair rainfall regime which, with good husbandry, can result in good yields. Altitude with its moderating effect on temperature has significant impact upon the duration of wheat maturity. Research done at Njoro wheat breeding station shows that maturity time varies between the various wheat varieties and falls between 125 to 160 days after planting. Like maize, wheat in Kenya is grown between 1800 and 3000 metres above sea level.

Soil type is an important ecological factor affecting wheat growth and yields. The Uasin Gishu plateau has ferrasols developed on plateaus that are well drained, moderately deep to deep, dark red, friable loamy clay with good moisture retaining capacity. Wheat needs a proper setting of the soil and early ploughing is essential in an area like Moiben before the soil becomes hard to work. Wheat grows well on fields previously planted with maize and sunflower. Wheat planting after a previous wheat crop is permissible but more fertilizer needs to be applied. Although wheat may tolerate a wide variety of soil conditions in Kenya, for good yields free drainage and sufficient supply of soil nutrients are necessary.

Apart from the geo-physical environmental factors mentioned above, wheat needs proper husbandry if economic yields are to be realized. Within Moiben, land preparation is done by conventional wheel tractors with light disc and mouldboard ploughs. The size of the tractor, number of hours the tractor works per year and the conditions of soil determine the rate at which ploughing may be done. The crop is planted between May and August and, like maize, early planting has a bearing on final yields. Planting is purely mechanized with seed drills as the major implements. A seed rate of 100 Kg/ha with spacing of 17.5 cm between the rows and a fertilizer rate of 168 Kg/ha are optimal recommended levels. It is also recommended that a farmer plants several varieties to guard against the risks of stem, yellow and leaf rust diseases which affect the crop (Ogemma 1976, 1977, 1978). The time of planting should coincide with suitable rain conditions of proper wheat establishment is to be secured.

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Like maize, wheat requires phosphatic nitrogeneous fertilizers for growth. In Moiben Division, Diammonium Phosphate is the most suitable fertilizer.

For good yields, wheat fields should be kept weed-free throughout the crop life. Broad leaved weeds are best controlled when the wheat is one to two leaf stage. A higher rate of chemical application is applied once the weeds are larger. Spraying should be done when the crop is 4 to 6 leaf stage. The recommended rate of herbicides application is 110-200 litres/hectare. Higher rates should be applied where there is dense weed growth to ensure better spray coverage.

Harvesting is done when wheat is considered mature and millable. Mechanical combine harvester is highly recommended. The average cost of harvesting per hectare is about one hundred and eighty shillings. The maximum moisture content for sale is 12.5%. Storage facilities should be rodent, bird and weather proof. Weevil control is essential since the crop is highly susceptible to weevil damage. An application of Malathion powder will guard against this.

The National Cereals and Produce Board handles marketing of both wheat and maize. There are depots at Moisbridge and Eldoret catering for Moiben Division.

The schematic diagram (Figure V) shows the structure of wheat industry in Kenya. Like for the case of maize above, this structure is disaggregated to Moiben Division to identify factors affecting agricultural development.

Dairy Industry

Prior to independence in Kenya in 1963, dairying was confined to high potential areas in Central Province and parts of Rift Valley especially in Trans Nzoia and Uasin Gishu Districts. It was then wholly or mostly practised on large scale farms. In the post-independent period, the industry is engaged in by both small and large scale farmers (Ruigu 1978, Mbogoh 1982).

Increased milk production is dependent on improved production facilities on the farms. At the same time, it is also dependent on improved marketing outlets and facilities. Unless the milk finds a

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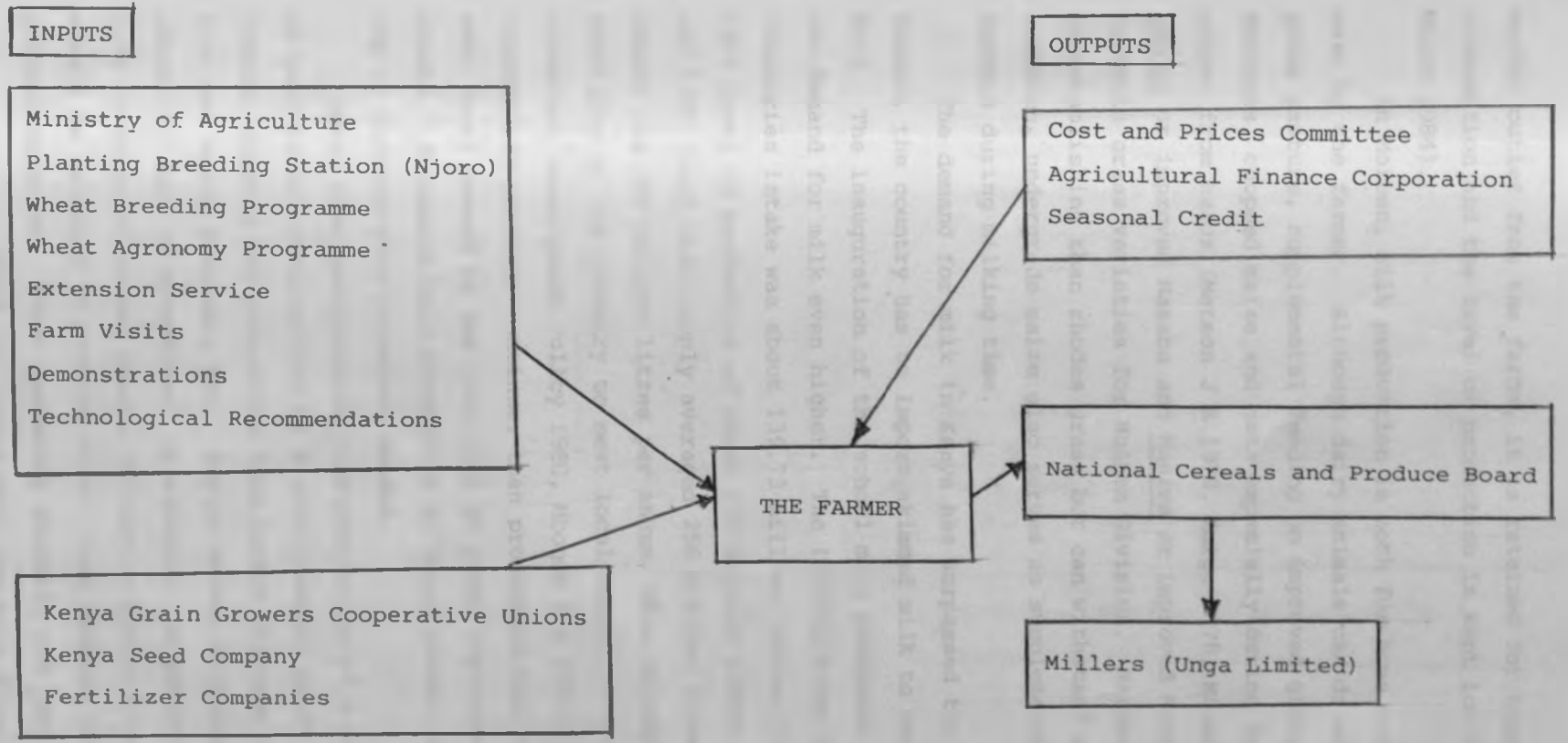
Figure V: WHEAT INDUSTRY STRUCTURE IN KENYA



SOURCE: Ministry of Agriculture

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market outlet from the farms, it is retained for household consumption and the level of production is kept low (Ruigu 1978, Minae 1984).

In Moiben, milk production is both for home consumption and for sale by the farmer. Although dairy animals can do well on natural grass pasture, supplemental feeding on improved grass pastures, bran, molasses, chopped maize and oats especially during dry weather raises output from herds (Metson J E 1978, Ruigu 1978, Minae 1984). Boma Rhodes or improved Masaba and Nasiwa or improved Nandi Setaria are suitable grass varieties for Moiben Division. Nasiwa grass is slow in establishing than rhodes grass but can withstand waterlogging. In addition, undergrade maize also serves as supplemental feed to dairy animals during milking time.

The demand for milk in Kenya has surpassed the supply such that todate, the country has to import skimmed milk to cater for the short-fall. The inauguration of the school milk programme in 1979, raised the demand for milk even higher. The 1979/80 Kenya Cooperative Creameries intake was about 139.73 million litres; 11% lower than the 1978 level of production of about 157 million litres. Between 1980 and 1985 local milk supply averaged 256 million litres while the demand was 350 million litres per annum, thus re-eimphasizing the inability of the industry to meet local demand (Economic Survey 1985, Livestock Development Policy 1980, Mbogoh S G 1982). If present consumption patterns continue, then production will have to double to meet local demand by the year 2000 AD given the current population growth. Increased milk production by dairy farmers will go along way in meeting this increased demand.

Apart from geo-physical characteristics of a given area, such as good soils, availability of drinking water, dairy animals need regular dipping and protection from cattle diseases like tickbone, foot and mouth diseases, etc. Within Moiben Division, there are about 214 dips in operation. In addition the marketing infrastructure in terms of access roads, collection points, transport vehicles should be arranged to provide a fair link between the farm and processing plant. Three marketing channels are open for large scale milk producers. They can either sell the milk directly from the farm

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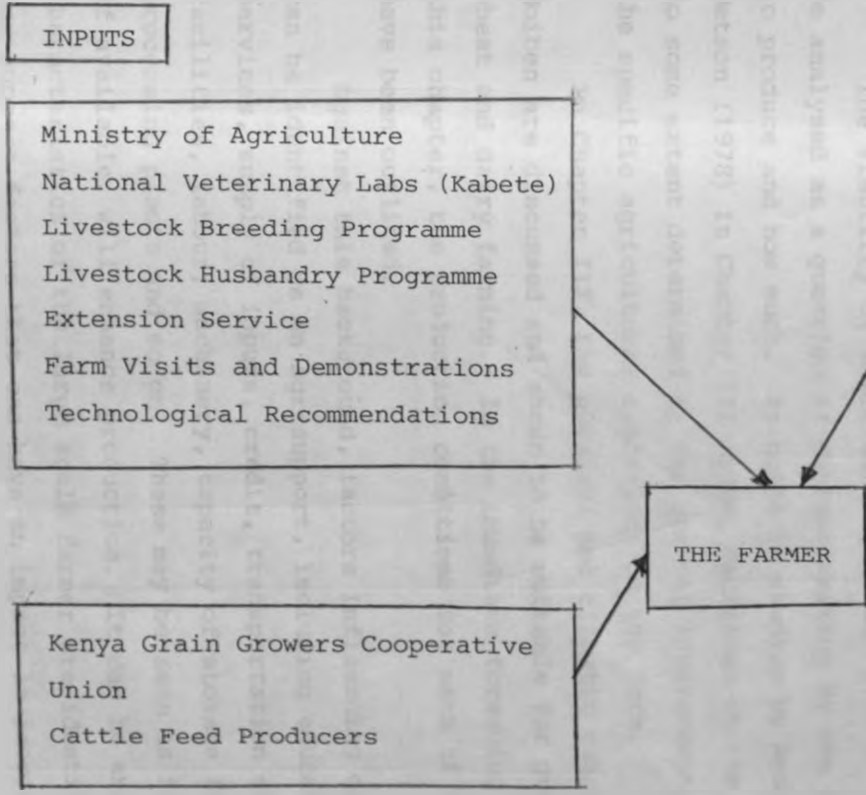
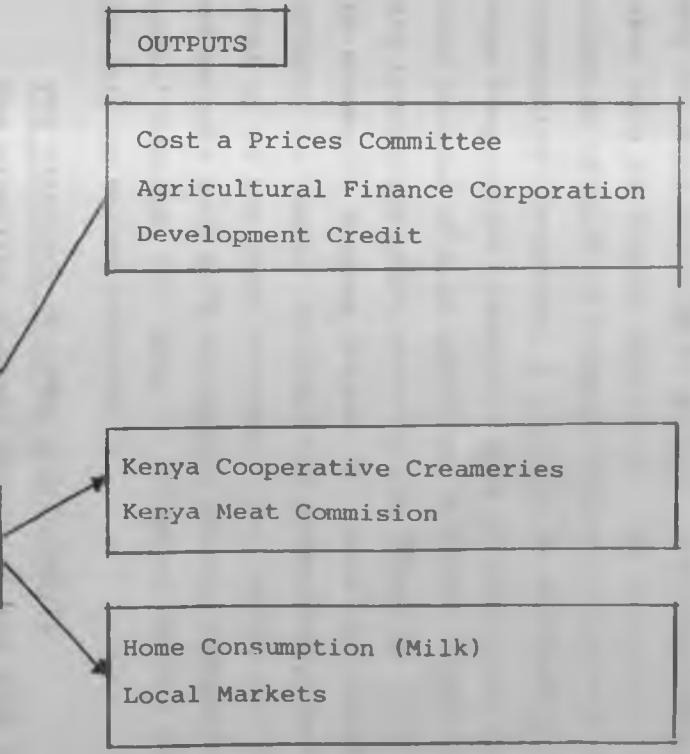
Figure VI: DAIRY INDUSTRY STRUCTURE IN KENYA




OUTPUTS
Cost a Prices Committee
Agricultural Finance Corporation
Development Credit
Kenya Cooperative Creameries
Kenya Meat Commision
Home Consumption (Milk)
Local Markets

to the neighbours and other local buyers like hotels and shops. They can send the milk to a local dairy cooperative society that takes care of further marketing. The processing, packing and marketing of milk in Kenya is nationally catered for by the Kenya Cooperative Creameries; a countrywide cooperative organisation The Kenya Cooperative Creameries buys directly from farmers and is the third channel of milk marketing in Kenya. There is a Kenya Cooperative Creameries plant catering for Moiben Division in Eldoret town. The schematic diagram (Figure VI) shows the structure of the dairy industry in Kenya. It shows the production process from the farm level up to the final consumer. The inputs into the farm operation and outputs such milk collection points, transportation, processing plants' capacity will help in isolating factors that affect the dairy industry in Moiben Division.

THE VIABILITY OF LARGE SCALE FARMING

The viability of mixed farming at the farm level in Moiben can be analysed as a question of decision-making by the farmer as to what to produce and how much. As noted in studies by Nyakaana (1970) and Metson (1978) in Chapter III above, decisions at the farm level are to some extent determined by the general environmental factors and the specific agricultural conditions on the farm.

In Chapter II*I*, the physical and climatic characteristics of Moiben are discussed and shown to be suitable for practice of maize, wheat and dairy farming. In the immediate foregoing discussion in this chapter, the production conditions for each of these activities have been outlined.

Against this background, factors influencing decision-making can be identified as an agrisupport, including education, extension services, supply of inputs, credit, transportation system, marketing facilities, labour, machinery, capacity of storage facilities and processing plants and so on. These may be seen as incentives which, if available, will enhance production. It can be argued that if the characteristics of the large scale farmer are identified, then the agrisupport factors that can have an impact in increasing levels of production can be determined.

In the following section, the survey data is analysed in

relation to some aspects described above to show the problems and constraints experienced by farmers in Moiben Division.

TABLE 9 AGE STRUCTURE OF THE RESPONDENTS

Age-group	Number	Percentage
20-29	7	13.1
30-39	9	16.6
40-49	10	18.5
50-59	22	40.7
60-69	6	11.1
70+	-	-
TOTAL	54	100

SOURCE: Field Survey 1985

The highest number of respondents is concentrated between the ages 50-59. This is followed by those between ages 40-49. The explanation to this is that people below these ages are young and many of them prefer other kinds of jobs in urban areas (Rempel 1978, Moock 1973). They may engage in farming only as a part-time activity. Those in the age-group of 50-59 are mainly those who bought out the former white settlers during the land transfer programme in 1960s after independence. The group in the 20-29 age bracket are fulltime farm managers.

RESPONDENTS LEVEL OF EDUCATION

A discussion of farmer's level and type of education is an attempt to capture that generally elusive variable termed management. Education is defined narrowly here as formal schooling. Theoretically education should widen one's horizons, enable one to acquire knowledge and new ideas from various sources and in some cases facilitate the acquisition of new skills. On this reasoning, a farmer with some education especially agriculture training, should be more productive than his illiterate neighbour. The table below summarises the respondents' levels of education.

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TABLE 10 RESPONDENT LEVEL OF EDUCATION

Level of Education Attained	Number of Farmers	Total %
Primary	33	61.2
Secondary	15	27.7
College (Agriculture Training)	6	11.1
TOTALS	54	100

SOURCE: Field Survey 1985

33 (61.2%) of the respondents had attained primary level of education. This varied from two to six years of primary education. 15 (27.7%) of the respondents had attained two to four years of secondary school education. Besides, 6 (11.1%) of the respondents had attained college level of training in agriculture. An analysis of output per hectare for maize showed that those with agriculture training achieved an average of 51 ninety kilogramme bags per hectare while those without had an average of 46 ninety kilogramme bags per hectare. The corresponding figures for wheat were 27 and 21 ninety kilogramme bags respectively.

TABLE 11 DECISION MAKING STRUCTURE

An analysis of the decision making structure on the farms surveyed shows that key decisions pertaining to day to day operations are made by 43 farmers who accounted for nearly 80% of the total number of respondents while the rest 11 accounting for about 20% were either farm managers or their assistants. An analysis of levels of production showed that on average, farms headed by trained farm managers recorded higher output per hectare than those headed by owners who had no agricultural training. This is summarised in the table below.

Decision Maker	Number of Farms	Average Maize Yield 90Kg/Ha	Average Wheat Yield 90Kg/Ha
Farm Owner	43	49	19
Farm Manager	11	53	21

SOURCE: Field Survey 1985

Thus viewed against the ideal levels of 66 ninety kilogramme bags per hectare for maize and 26 ninety kilogramme bags for wheat, it appears that on those farms where trained farm managers were key decision makers higher levels of production were recorded.

LAND

As noted in Chapter II above, land is the basic factor of agricultural production in Moiben Division. It is used to reduce all the other physical inputs to a per hectare basis to consider the yields of maize and wheat per hectare. Moiben Division accounts for nearly 50% of total agricultural land in Uasin Gishu District. It also accounts for 45% of total rural area and 37% of the total rural population of Uasin Gishu District. The average land size per household is 6.95 hectares as shown in the table below.

TABLE 12

Location/ Division	Area in Km^2	Agricultural Land in Km^2	No. of Households	Land Per Households
Moiben	1529	1376	16915	8.11
Turbo/Soy	381	343	5020	5.79
TOTALS	1910	1719	22835	6.95

SOURCE: Jaetzold (1983)

The climatic and ecological conditions of Moiben are suitable for the practice of maize, wheat and dairy farming as shown in Chapter II. Land suitability is thus not a major constraint. However, viewed against the current rate of population as shown in Chapter II above, and the related land demands, land is a diminishing resource in Moiben. The reduction in land size per individual is mainly due to subdivision especially in Matunda and Ziwa areas. While the intensity of land utilization is high on subdivided farms, it is uneconomical to use machines which are essential farm implements in this area on such small parcels of land especially where wheat is grown.

Land preparation is often delayed especially during the dry season when it is hard to break. Consequently, land preparation is delayed and has effects on time of planting and weeding, which in turn, have an effect on ultimate yields. 20 (38.8%) of the farmers

noted that the steep slope on Cherangani Hills posed a constraint to mechanical ploughing by tractor. However, slope areas of the division such as Cherangani are more suitable for dairy farming

Apart from this, the topographic characteristics of surveyed farms render some of them highly susceptible to soil degradation through erosion.

TABLE 13 TOPOGRAPHIC CHARACTERISTICS OF SURVEYED FARMS

Topographic Characteristics	Number of Farms in Moiben Location	Number of Farms in Soy Location	Total	%
Flat	13	11	24	44.44
Slightly Steep	5	9	14	22.92
Steep	9	7	16	29.62
TOTAL	27	27	54	100.0

SOURCE: Field Survey 1985

The farms categorised as having steep slope are located in the environments of Cherangani Hills and Turbo area where gradient is between 40°-50°. The steep slope is not only difficult to work using machinery such as tractors but also susceptible to erosion when used without attendant conservation measures. Indeed areas around Turbo rural centre in Soy/Turbo location are also susceptible to gully erosion during heavy down-pours of April and August.

The solution to soil erosion lies in practising of soil conservation through terracing, tree planting, etc. Data gathered in the field on this aspect is summarised in the table below.

TABLE 14 TERRACING ACTIVITIES ON THE SURVEYED FARMS

Farms Terraced	Moiben Location Farms %	Soy/Turbo Farms %	Total	%
Partly	11 (40.74)	9 (33.33)	20	37.04
Completely	7 (25.92)	8 (29.63)	15	27.78
Not at all	9 (33.33)	10 (37.04)	19	35.18
TOTALS	27 (100)	27 (100)	54	100

SOURCE: Field Survey 1985

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It appears from the table above that 15 (27.0%) are terraced while 20 (37.0%) are partly terraced and 19 (35.0%) are not terraced at all. 10 of the 19 farms that are not terraced are in Moiben along the Elgeyo border escarpment while 9 of them are in Soy/Turbo location in Chepsaita and Tapsagoi areas. The increasing pressure on land by human being and livestock already noted above, renders the area highly susceptible to erosion. Although data has not been gathered to show the influence of soil erosion on productivity it may be observed that increased soil erosion over time, lowers the productivity of land. Indeed, studies by Allan (1971) in the region showed that erosion and absence of concomitant soil conservation measures partly affected agricultural productivity. In addition, Metson's study (1978) of Nandi District and Rukandema's study (1977) of Kakamega District all reviewed in Chapter III above, came to the conclusion that land terrain, tenure system and susceptibility to being tilled easily over the seasons affect the agricultural productivity.

LABOUR

The growing of wheat and maize in conjunction with dairying leads to a very uneven demand for labour throughout the year. The interviews on labour show that family labour including school children on part-time was augmented by casual labour which came mainly from neighbouring Kakamega and Elgeyo Marakwet Districts. As the maize hectarage increases, there is a corresponding increase in the derived demand for labour. In Moiben, because tractor ploughing dominates hand planting among large scale farms, less casual labour would be required for this stage of maize cultivation but weeding and harvesting would require increased labour. 29 (53.0%) of the farmers noted that labour shortage was a constraint during harvesting. Wheat farming is purely mechanized for ploughing, planting and harvesting. Weeding of wheat is done by either tractor spraying or human labour; which calls for increased use of labour.

Each maize activity contains the labour requirements, measured in mandays. A manday is a unit of labour measurement equivalent to a full day's work of eight hours by an adult equivalent (those in the age-bracket of 15 - 49 years old). The number of manhours of

family, non-paid, communal and hired labour employed in maize cultivation was sought from respondents together with dates when each task started and ended. Although the records were incomplete, the labour requirements per hectare for maize were calculated and approximate dates for each task determined.

TABLE 15 LABOUR ACTIVITIES AND REQUIREMENTS

Maize Task	Manhours Per Ha.	Period
Ploughing with Tractor	2 - 3	January - March
Planting with Tractor	3 - 4	March - April
Weeding with Tractor	212	May - June
Harvesting by Hand	218	November - December

SOURCE: Field Survey 1985

The above data are approximations since from the sample survey, size of acreage planted, is varied amongst farm sizes and determines the amount of manhours that will be required. From the table above, it appears that periods of weeding and harvesting require large amounts of labour in manhours. 47 (87.3%) of the farmers indicated that these are periods of acute labour shortages. Weeding as shown by Allan (1971), Metson (1978), Rukandema (1977) studies reviewed above, is a critical factor in determining yields. Consequently, delay in weeding due to labour shortage, was indicated as affecting productivity at the farm level. Unlike maize, wheat cultivation is purely mechanized, with mandays equivalent to those for maize during ploughing and planting. However, the capital input for wheat in the form of tractor and chemical spraying for weeding leads to increased costs to the farmer.

While the majority of children aged 8 - 15 years attend school, they provide labour on the farm before and after school hours, mainly working with the livestock on routine daily tasks such as moving the herd to fresh grazing, diriving the herd to water, bringing in the cows for milking, etc. Besides, the planting and harvesting of maize coincides with school holidays (April and December respectively) and older children also assist in these tasks.

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Despite this, labour shortage is still a problem amongst the Moiben farmers and more so during weeding and harvesting seasons for maize. Although the supply of farm labour can be augmented by hiring temporary labour (adults) it appears that demand for labour during weeding and harvesting surpasses supply.

In the calendar periods when labour is not required for maize (July and November) there is little likelihood of labour shortage, re-emphasizing the seasonality of labour demand peaks.

In the dairy industry, each cow/calf activity for mature grade, upgrade and local stock has labour requirements for feeding and milking which are approximately uniform throughout the year. Interviews with 49 (90%) of the farmers shows that the time and labour required for most all-herd practices was the same irrespective of the size of the herd.

There are several problems associated with the influx of casual labour for short periods as noted above. When viewed from a national level, it may be unacceptable to encourage a farming system which requires high casual labour inputs for only very limited short periods if no employment is available for the rest of the year (Development Plans 1974-78, 1979-83). If the neighbouring farming systems periods of slack labour demand coincide with peak labour demands in Moiben Division, this would harmonise the irregular labour requirements of the two systems but this is unlikely given the similarity in the timing of the rains in the region. It appears the employment absorption capacity of these enterprises has not grown in line with labour force in the region.

It is beyond the scope of this study to estimate the potential supply of casual labour. In the survey, 47 (87.0%) of the farmers interviewed showed there was a shortage of labour. If labour shortage becomes acute, mechanization of weeding, harvesting and shelling of maize is likely to occur as in the case of wheat. However, such a decision depends on the ability of the farmer to get the necessary capital required in form of tractors.

Apart from the issue of supply of casual labour in Moiben, Kenya's policy makers and planners must consider the possible conflict between the expansion of output and growth in rural employment. In adopting capital-intensive technology as was observed on 9 (16%) of

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the farms, surveyed, output may be expanded rapidly but the volume of total employment generated does not necessarily increase at the same rate.

CAPITAL

The term capital as used in this study includes farm machinery, planting material, fertilisers, improved seed and money; liquid or circulating capital. The amount of capital available to the farmer determines how he can finance ploughing, planting, weeding, maintenance of livestock, hiring of permanent and casual labour between January and December in a year. In addition, it enables the farmer to purchase additional stock such as tractors and meet all his expenses like marketing of his produce. Generation of capital is, in turn, linked to how successful a farmer works on his farm.

The ownership pattern of farm machinery in the table below shows the extent of farm capitalisation on the surveyed farms.

TABLE 16 OWNERSHIP OF FARM IMPLEMENTS

Implement	Number of Farmers	% of Total N=54
Tractor/Plough	33	61.11
Planter	29	53.70
Sprayer	49	90.74
Combine Harvester	23	42.59

SOURCE: Field Survey 1985

It is beyond the scope of this study to estimate the efficiency of utilization of farm machinery listed in the table above. Suffice it to say that the types of machines listed above are the most prevalent forms of mechanical aids to labour in Moiben Division. It appears from the table above that 33 (61.1%) farmers owned both the tractor and plough while 29 (53.7%) of the farmers owned planters. 23 (42.5%) of the farmers owned combine harvestors. Besides, 17 (31.48%) of the farmers interviewed owned all the implements listed above in sound working conditions. On the other hand, 26 (48.19%) of the farmers interviewed indicated ownership of tractors, ploughs, and planters but these were not operating due to shortage or cost of spare parts.

The pattern of farm implements ownership above has effects on

the sequence of farm operations. Apart from the 17 farmers who owned all the listed implements, the rest resort to hiring during ploughing weeding, planting and harvesting. Consequently, delays are experienced in the performance of important tasks such as timely planting, weeding and harvesting. As noted in the opening remarks in this chapter on production conditions for maize and wheat, delayed planting affects farm yields.

Considering the various determinants of technology such as improved seed/breeds varieties, use of fertiliser and chemicals and timeliness of planting, it has to be noted that use of improved genetic material is fairly wide spread for cereals and dairy cattle in Moiben. 100% (54) of the respondents used recommended seed for maize and wheat and fertilisers. However, nutritional standards for both crops (wheat and maize) that is fertiliser application and livestock (concentrates feeding) vary greatly and are often not satisfactory. The table below shows the recommended optimum fertiliser rates for maximum yields under varied agronomic practices.

TABLE 17 EXPECTED HYBRID MAIZE YIELDS

Maize Activity	Yield per Ha. (90 Kg. Bags)
a) Tractor Ploughing and Planting	
Early planting	
High fertiliser level (168 Kg)	66
Medium fertiliser level (125 Kg)	58
Low fertiliser level (100 Kg)	51
Late planting	
High fertiliser level (168 Kg)	44
Medium fertiliser level (125 Kg)	39
Low fertiliser level (100 Kg)	29
b) Tractor Ploughing and Hand Planting	
Early planting	
High fertiliser level	49
Medium fertiliser level	42
Low fertiliser level	34

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Late planting	
High fertiliser level	42
Medium fertiliser level	37
Low fertiliser level	27

SOURCE: National Agriculture Research Station, Kitale

TABLE 18 EXPECTED WHEAT YIELDS

Wheat Activity	Yield per Ha. (90 Kg Bags)
Tractor Ploughing and Planting	
Early planting	
High fertiliser level (168 Kg)	28
Medium fertiliser level (125 Kg)	22
Low fertiliser level (100 Kg)	17
Late planting	
High fertiliser level (168 Kg)	24
Medium fertiliser level (125 Kg)	19
Low fertiliser level (100 Kg)	13

SOURCE: National Agricultural Research Station, Kitale

Against these ideal levels of yields per hectare, data from the survey is presented below, with categories of fertiliser input per hectare and corresponding average yields.

TABLE 19 MAIZE YIELDS ON SURVEYED FARMS

Number of Farmers	Range of Fertiliser Input in Kgs/Ha.	Average Yields in 90 Kg Bags/Ha.
17	150 - 155	51
23	125 - 145	47
14	100 - 125	41

SOURCE: Field Survey 1985

TABLE 20 WHEAT YIELDS ON SURVEYED FARMS

Number of Farmers	Range of Fertiliser Input in Kgs/Ha.	Average Yields in 90 Kg Bags/Ha.
13	150 - 155	25
29	125 - 145	18
12	100 - 125	12

SOURCE: Field Survey 1985

It appears from the data on ideal levels of output above that the three factors influencing maize yields in this region are date of planting, rate of fertiliser input per hectare and method of planting. For tractor planting, the differences between early planting and late planting with the same level of fertiliser are up to 19 bags (90 Kg each) per hectare. While the difference in yields between tractor and hand planting with the same amount of fertiliser and date of planting is approximately 15 bags per hectare. With identical planting methods and dates of planting, the maize obtained from a high level of fertiliser application is approximately 15 bags per hectare, greater than for a low level of fertiliser. Viewed against the actual production figures from the field survey for both maize and wheat, it appears that 17 (31.4%) of the farmers had an average yield of 51 bags per hectare; with a range of fertiliser application between 150 - 155 kilogrammes per hectare. This is less than the expected figure of 66 bags per hectare.

Consequently, the highest recorded level of wheat produced per hectare is 25 bags as against the expected 28 bags per hectare. Timely availability of farm inputs, and availability of planters are some of the factors that had to delay in planting as noted above.

In order to increase milk production, a Moiben farmer has the following options;

a) If capital is available and there is sufficient grazing, he can purchase extra milking cows.

b) He can sell male stock or immature female stock to release grazing and purchase extra milking cows.

c) He can transfer extra milk cows to a higher maize ration, if they are not already on higher ration thereby increasing their individual milk yields and/or

d) He can wait until the number of mature cows increases by the natural breeding process.

However, the cultural attachment of Moiben farmers towards cattle as a measure of wealth is such that sale of cattle can only be considered as a last resort.

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Because of lack of or poor record keeping by farmers on dairy production and the seasonality of milk production, it was not possible to establish an average yield of milk in litres per cow. However, the question about problems on dairy milk production was left open ("what problems do you experience in dairy farming?") and the answers show which problems were mentioned. This is summarised in the table below:

TABLE 21 CONSTRAINTS TO DAIRY HUSBANDRY

Problem	Number of Farmers Affected	%
Tickbone Disease	33	61.1
Water Shortage in Dry Season	36	67.0
Feeding in Dry Season	29	53.0
Dipping and Veterinary Services	28	51
Lack of Management Skills	26	48.1
Marketing	21	38.8

SOURCE: Field Survey 1985

It appears from the table above that tickbone diseases and water shortage during the dry season are major constraints to dairy farming. It is not possible from the data gathered to establish levels and frequency of other diseases that may affect dairy industry in Moiben. Field data showed that, tickbone dieseas, cost of feeding in the dry season, inoperative dips, lack of management skills and marketing were mentioned as problems affecting dairy farming in Moiben area.

ACCESS TO CREDIT

45 (85.0%) of the respondents indicated that they were loanees of Agricultural Finance Corporation (AFC), an agricultural lending institution. AFC had offered these farmers Seasonal Crop Credit for both wheat and maize. The change in policy by this lending institution requiring title deeds to be given as a pre-requisite to get a loan means that those farmers who have not yet got title deeds will not be eligible to benefit from this facility.

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INFRASTRUCTURE

As used in this study, infrastructure embraces roads, railways, research and extension and marketing. Interviews with respondents and officials in charge of transportation showed that while Soy, Turbo and Moibsbridge areas in the division are fairly well served by road, others like Segero, Kopkei, Marula and Sirikwa are not well served. 37 (68.5%) of the respondents indicated the impassability of minor roads (Grade E) during rainy seasons was a limitation to movement of farm produce especially milk to the collection points. Consequently, given the perishability of milk, a lot of it is waster. Conversely, the rugged nature of road on the slopes of Cherangani Hills and low frequency of road maintenance have compounded this problem. The state of roads during the rain season also affects the movement of inputs from centres like Moisbridge and Eldoret town to the farmers. 29 (53.7%) of the respondents mentioned shortage of vehicles especially during harvesting period to transport maize and wheat produce to both Eldoret and Moisbridge depots.

The centres for maize and wheat marketing are at Moisbridge and Eldoret, both managed by the National Cereals and Produce Board. Milk is marketed to the Kenya Cooperative Creameries plant at Eldoret by all the farmers via dairy cooperative societies or contractors.

Produce movement restrictions (permits) instituted by National Cereals and Produce Board (1984, 1985) lead to farmers incurring high marketing costs. During bumper harvests of maize and wheat, the storage capacity of about 500,000 bags at Moisbridge and about 950,000 bags at Eldoret are usually surpassed by the supply of farm produce. During such periods, farmers' produce stands the risk of waste through rotting and there is delay in payment to farmers as indicated by 31 (57.4%) of the respondents. The storage problem is compounded by the fact that these depots also cater for parts of Nandi, Trans Nzoia and Kakamega Districts.

Milk marketing in the Division is affected by supply surpassing capacity of the Kenya Cooperative Creameries plant at

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Eldoret especially during May to August. 43 (79.6%) of the farmers interviewed noted excessive losses during this period when milk goes bad. The Eldoret plant also caters for parts of Nandi District. The inability of Kenya Cooperative Creameries to cope with milk supply is a national problem. As observed by the Minister for Agriculture recently (Daily Nation 7th June, 1986).

Besides, water supply during the dry season affects the practice of agriculture. Soy/Turbo location is served by five water supply projects, three of them run on harambee basis while two are run by the Ministry of Water Development. Moiben Location is served by one water supply project at Moisbridge. Water projects run on harambee projects experience management and maintenance problems. Soy Location has 31 cattle dips, while Moiben has 89 cattle dips. 21 (67%) of those in Soy are inoperative, while 69 (73%) of those in Moiben experience problems of poor management, closely linked to this, is a high incidence of tickborne disease as already noted above.

Stimulation of technical efficiency at the farm level through agricultural extension advice and intensification of artificial insemination is affected by lack of enough transport for extension officers, a factor noted by Leonard (1973) and Lema (1977). Besides, traditional attitudes of some farmers towards artificial insemination hinders the adoption of such advice.

Thus, to summarise; (a) agricultural resources use in Moiben Division is largely influenced by monthly distribution of rainfall. Besides, labour requirements are characterised by peak demand during weeding and harvesting and low demand during other periods of the year; (b) the land base is suitable for the practice of agriculture although the slopes of Cherangani Hills restrict mechanization; (c) unlike small scale farming areas where the most labour demanding operation is seedbed preparation, as shown by Rukandema's (1977) study of Kakamega District, in large scale farming areas, the most labour demanding operations are weeding and harvesting. Land preparation is done by tractors; (d) the use of modern material inputs such as fertilisers, improved seed is widespread on the surveyed farms. However, the rates of application

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of these inputs are varied amongst farmers. Consequently the average outputs for both wheat and maize are lower compared to the expected ideal levels of output; (e) most of the farmers have to hire farm machinery to practice agriculture which often results in delay; (f) tickbone diseases, water shortage in dry season, feeding in dry season, dipping and veterinary services, lack of management and marketing have been noted as problems affecting the dairy industry.

In the next chapter, a synthesis of this study will be provided, along with policy implications and specific recommendations.

CHAPTER VI: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The first four chapters spelt out the problem under investigation and Kenya's agricultural policy, described the physical and human background of the study area, reviewed the relevant literature and outlined the methodology used in this study. Chapter five was devoted to an analysis of field data. As a conclusion to this study, the present chapter is a synthesis of the study. It focusses on four main issues: it echoes the major findings by synthesising the salient features of the preceeding chapters, it draws some general conclusions to the study by placing emphasis on substantive issues already discussed elsewhere as corroborative evidence, it makes some recommendations that are pertinent to government policy on large scale farming and finally, it highlights areas for further research.

SYNTHESIS OF MAJOR FINDINGS

The general objective of this study was to identify factors affecting agricultural development of large scale farms using data from Moiben Division of Uasin Gishu District. The specific objectives were:-

(a) To indicate the suitability of the area for the practice of maize, wheat and dairy farming.

(b) To identify the constraints to agricultural development of large scale farms in the Division, and

(c) To offer suggestions for solving the problems identified.

In response to these objectives, the study was posited within a systems approach to planning as the basic theoretical framework This is discussed in Chapter I where it is emphasized that the systems approach helps in detecting order in a reality that is apparently complicated. It is noted that by tracing the flow of inputs into and outputs from the farm enterprise, we can isolate the constraining factors to agricultural development. In Chapter II, a discussion of physical and human background of the study area, soil characteristics of Moiben Division render it suitable for the practice of maize, wheat, sunflower and dairy farming. It was found out that the area lies in Agro-ecological Zone III which is

identified as high potential agricultural land. In addition, the high rainfall pattern in Moiben and the low variability of rainfall during the early growing period indicates that uncertainty of yields due to insufficient rainfall is not a major constraint. Besides, there are no records of excessive rain creating problems. Moiben and indeed Uasin Gishu District, has had a long history as a large scale farming area and as such this renders it suitable for this study. In Chapter III, a broad spectrum of literature has been reviewed to isolate factors affecting agricultural development. Over thirty factors are identified as affecting agricultural development. Within the scope and limits of this study, the factors are categorised into four broad areas: land related, labour related, capital related and infrastructure related factors as a framework for analysis in Chapter V. In Chapter IV, the methodology adopted in this study is outlined. It is particularly noted that the farm may be used as a unit of investigation in trying to identify factors that affect agricultural development in line with the systems concept outlined in Chapter I. In particular, conceptual models for the mixed farming system in Moiben are presented to show the inputs into and outputs from the farm to serve as the framework for analysis. On the basis of the assumption that there is homogeneity in resource availability and use in rural Moiben, a sample of 54 farmers were selected. Although sample sizes had to be severely restricted because of cost and time limitations, it is believed that the findings from the sampled farms approximate the general conditions prevailing in rural Moiben.

Factors affecting agricultural development are analysed in Chapter V. On the land related constraints, it was found out that although ideally a hectare of land should yield an average output of 66 ninety kilogramme bags of maize per hectare and 27 bags of wheat per hectare, the average yields for the farms surveyed were 51 bags of maize and 24 bags of wheat per hectare for the two crops. It was found that degree of slope, particularly land over 40° in Cherangani and Tapsagoi areas limits farm mechanization and encourages soil erosion where land was not terraced. Although not an immediate problem, soil erosion on a number of farms surveyed, unless checked, will lead to deterioration of soil. Field data showed that on 19

(33%) of the farms surveyed, terracing as a measure against soil erosion was not practised. Although a relationship has not been established to show the effect of soil erosion on productivity, it may be noted here that increased soil erosion over time, will lower the productivity of land. In fact studies by Allan (1971) in Trans Nzoia, Metson (1978) in Nandi came to the conclusions that increased soil erosion and absence of concomitant soil conservation leads to lowering of soil fertility which in turn affects agricultural output. Another finding of this study was that not all the farms had been registered. Consequently, the owners of unregistered farms cannot pledge them as collateral security for credit from lending institutions.

It was also noted from the survey that land preparation is constrained during the dry season when the soil is hard to break especially among farmers who lacked tractors. Consequently, several of these farmers experienced delays in land preparation. It was noted from the field survey that delays in land preparation lead to late planting. As noted in studies by Allan (1971) and Okalo (1974) in Chapter III, late planting affects the ultimate yield of maize per hectare. This finding is also corroborated by Metson's (1978) study of Nandi District, Rukandema's (1977) study of Kakamega District, Nsereko's (1980) study of Uganda which were reviewed in Chapter III above.

It was found out that although Moiben has had a long history of large scale farming, the land holding per individual in hectarage is declining. This is mainly due to population increase as shown in Chapter II above and the related land demand leading to subdivision especially in Matunda, Ziwa and Moisbridge areas. Although the intensity of land utilization was observed to be high on subdivided farms, it is noted that it is uneconomical to use machines on such small parcels of land especially where wheat is grown. Indeed Muketha's (1976) study of labour and capital substitutability in mechanized farming and Oyenga's (1969) study of plantation agriculture reviewed in Chapter III above, corroborate this fact. As observed in Chapter V in a discussion of wheat enterprise, Kenya's production does not meet current demand. The issue to be addressed

is whether subdivision should be encouraged in an area such as Moiben which is suitable for the production of wheat on a large scale farm.

In addition, the range of farm sizes per household varies between Moiben location (8.11) and Soy/Turbo location (5.79) hectares respectively. Consequently, strategies for expanded agricultural output on a large scale, should of necessity, take this into consideration.

An analysis of labour demand patterns showed that labour requirements are characterised by peak demand during weeding and low demand during other periods of the year. The supply, however, does not match demand during maize weeding and harvesting periods. Since weeding is a crucial factor in the practice of maize and wheat farming and since weeds affect ultimate crop yields and as it has been noted that labour shortage is a constraint in this area, labour shortage is considered an important factor in explaining low yields on some farms. Indeed studies by Allan (1971) in Trans Nzoia, Rukandema (1977) in Kakamega, Moock (1973) in Vihiga and Metson (1978) in Nandi reviewed in Chapter III came to a similar conclusion that labour shortage affects levels of productivity. It was also found out that demand for labour is highly seasonal; the low labour demand period being during July and November. Thus the viability of this farming system to generate fulltime employment opportunities as is the policy of Kenya Government on agriculture indicated in Chapter I above, tends to be limited. Besides, the shortage of labour, is compounded by off-farm employment opportunities in the urban centres such as Eldoret and Kitale in the region and even beyond. Field data showed that fulltime farming is engaged in by 22 (40%) of respondents in the age-group of 50-59 years old. Those below this age-group prefer off-farm employment in urban areas and engage in farming as a part-time activity. Indeed studies by Rempel (1978) on labour migration in Kenya have shown that the most economically active groups drift to urban areas in search of white collar jobs. Besides, the shortage of agricultural labour in Kenya has been noted in a series of development plans (1974 - 78, 1979 - 83) and Sessional Papers on unemployment in Kenya. It was found that unlike the small scale farm where family labour may be sufficient to

carry out all the operations, large scale farming has to be augmented by hiring of additional labour.

An analysis of field data on decision making structure showed that major decisions which farmers in Moiben have to make fall into five general categores: (a) input decisions which relate to factor combinations such as amount of land to put under wheat, maize and livestock grazing, the amount of labour to higher, and the amount of capital in form of machines, fertilizers use; (b) Moiben's environment is suitable for the practice of large scale mixed farming and hence the farmer has to decide on the best combination so as to maximize his output; (c) the production technology used on the farm depends on the crop under production. Wheat production for example is highly mechanized. The choice of production technique depends on cost considerations, interest of good husbandry and the farmer's capacity; (d) investment decisions such as acquisition and use of durable factors like tractors and planters and (e) trading decisions which relate to questions of what to buy or sell, when, where and how to transport farm proceeds to the markets. These decisions are closely interrelated in the practice of mixed farming which obtains in Moiben. Further analysis showed that on farms where the key decisionmaker was a manager with agricultural training, proper husbandry methods were effected resulting in higher yields of maize and wheat per hectare, while on those farms where managers had no agricultural training, decisions tended to be made on an ad hoc basis resulting in lower levels of production. This finding appears to concur with Moock's (1973) study of Vihiga, Chitere's (1980) study of Kakamega, Okurume's (1956) study of Nigeria and Anthonio's (1974) study of selected African countries reviewed in Chapter III above.

Analysis of capital utilization on the farms surveyed showed that the use of material inputs such as fertilisers and improved seed is widespread. It was, however, noted that the rates of application of fertiliser was below the recommended level of 168 kilogrammes per hectare. Consequently, the highest levels of output for maize and wheat were 51 and 24 ninety kilogramme bags per hectare as opposed to the ideal levels of 66 for maize and 27 for wheat when a rate of 168 Kg/ha is applied. It was found out that

only 17 (31%) of the respondents owned all essential farm implements in sound working conditions. The rest 37 (69%) had to hire some of the implements to carry out the farm operations such as land preparation, planting and weeding. Consequently, key operations like planting were delayed. In addition, several respondents noted shortage of spare parts and repair facilities for their farm machinery as some of the factors affecting the use of farm machinery. Wabuge's (1973) study of the maize industry in Kenya and Metson's (1978) study of Nandi District came to the conclusion that capital non-availability in time, was one of the factors that affected the practice of agriculture. Another finding of this study was that farmers accessibility to seasonal credit from Agricultural Finance Corporation may be limited due to a change in policy by the latter institution requiring title deeds from farmers. This may limit the farmers' activities on the farm since availability of credit is essential for those who may not finance their farming operations.

An analysis of the dairy industry, revealed that tickbone diesease, water shortage in dry season, dipping and veterinary services, lack of management skills, and marketing facilities affect the practice of dairying. Indeed, the inability of Kenya Cooperative Creameries limited to cope with supply of milk from farmers is a national problem and/confined to Moiben Division /not (Daily Nation of 7th June, 1986). It was noted that the capacity of Eldoret plant which caters for both Uasin Gishu and parts of Nandi District cannot cope with milk supply during the rainy season.

An analysis of the infrastructural facilities showed that areas such as Segero, Kopkei, Marula are not well served by road. Besides, the rugged nature of roads on the slopes of Cherangani Hills and the low frequency of road maintenance, compound the movement of farm inputs and farm produce more so during rainy season.

With regard to marketing, the two National Cereals and Produce Board's depots at Moisbridge and Eldoret cannot cope with demand for storage space when there are bumbper harvests for maize and wheat. This is compounded by the fact that these depots have also to cater for parts of Trans Nzoia, Kakamega, Elgeyo Marakwet and Nandi Districts. Besides, it was noted that produce movement restrictions through permits instituted by National Cereals and

Produce Board leads to farmers incurring high marketing costs. Delayed payments were reported by several farmers. This delayed payment in turn leads to delay in preparing the land for the next season and the purchase of necessary farm inputs in time which lead to delays in farm operations in the next farming season.

It was found that of the six water supply projects, three of them are run on harambee basis and experience maintenance problems. Consequently, the supply of water for dairy farming in the dry season is constrained. Besides this, as noted in Chapter V above, several dips experience management and maintenance problems.

Thus, to summarise, the foregoing discussion shows that Moiben farmers are dealing with an open system which is influenced by external and internal factors beyond their immediate control. The flow of inputs into and outputs from the farm is not a unilinear process as the conceptual land use models developed in Chapter IV may tend to depict. As noted in our introductory chapter, agriculture is a manmade institution that is affected by both physical and human factors. In the next section, recommendations towards the solution of the identified constraints are made.

POLICY RECOMMENDATIONS

Given the scope of this study in terms of both duration and coverage, one must start with a note of caution as far as making policy recommendations is concerned. The duration of the survey was about two months. It could therefore, be argued that policy recommendations based on the conclusions of this study could be valid only if those two months encompassed typical conditions in the area. There was no strong evidence to the contrary except for the drought in 1984, 1985, seems to have been a normal year for Moiben.

It can be argued that different areas in Kenya, cover a wide range of ecological conditions and farming systems. Thus findings from an analysis of a division like Moiben cannot be aggregated to the national level. However, this analysis together with those on Kenya reviewed in Chapter III above, provide information which can be of use to those who formulate policies. It will be recalled that our sample consisted of 54 farms. The question may then be asked: To what extent can inferences be drawn, on the basis of such a sample

about the conditions prevailing in the whole division? It is contended here that in so far as the selected farms are representative of other farms in the division where maize, wheat and dairy farming are practised, generalisations based on this sample are warranted. As Collinson (1972) and Cleave (1974) have argued, variation in a truly homogenous type of farming area is as great over a group of adjacent farms as throughout the whole area.

As discussed in Chapter I, agriculture is the mainstay of the Kenyan economy. Indeed the Sessional Paper No. 1 of 1986 on Economic Management for renewed growth notes "... there should be intensification of milk and maize production so that output keeps pace with rapid population growth ..." and that "... there should be increased production of wheat so that less money is spent on importing this commodity ..." (Chapter V of Sessional Paper No. 1 1986). It is the contention of this study, that large scale farms can contribute towards this goal if efforts are made to overcome the constraints identified.

With regard to land related constraints, it is recommended that land registration should be completed as soon as possible so as to enable farmers to use their land as collateral security in raising both development and seasonal crop credit loans. Furthermore, farmers should be acquainted with the whole range of soil and water conservation techniques so as to benefit from these two vital resources both in the short-run and long-run. Agencies that could implement the above proposals are: the Ministry of Lands and Settlement should complete land registration for the unregistered farms. The agricultural extension officers in the division to intensify their demonstrations to farmers methods of soil conserva-

tion especially in steep areas such as Cherangani Hills and Tapsagoi.

It is highly recommended that agricultural education to farmers on the necessity for improved methods of crop husbandry such as timely planting, adequate weeding, adequate rates of fertiliser inputs per hectare be intensified. The agricultural extension service in the Ministry may facilitate the implementation of this proposal through farm visits, and demonstrations. Furthermore, periodic short-term courses and field days should be intensified at the large-scale farmers training centre in Eldoret to help farmers to continuously improve their farm management skills. In addition, it is recommended that farmers should be encouraged to introduce complementary farm activities such as coffee farming to offer continuous agricultural employment opportunities. It is also recommended that in the long-run, efforts should be made to create more off-farm employment opportunities through the expansion of rural commerce and small-scale industrial activities. The Ministry of Commerce and Industry and Kenya Industrial Estates may facilitate the implementation of this through offering loans to traders in centres such as Moiben, Moisbridge and Matunda to expand their businesses. Along with these, agricultural education should be provided to the young generation to encourage them to practice farming as a full-time activity. The current efforts by government in introducing farming in the primary and secondary school curriculum are likely to contribute towards this re-orientation.

With regard to capital related constraints, it is recommended that the processing of application forms for both seasonal crop credit and development loans is rather slow and should be speeded up to enable farmers to purchase the necessary farm inputs in time. In this connection, financial institutions such as AFC should speed up the processing of farmers application forms for loans. Furthermore, it is recommended that capable traders in trading centres such as Moiben, Ziwa and Soy should be allowed to complement the efforts by Kenya Grain Growers Cooperative Union in the distribution of farm inputs. This is likely to facilitate timeliness in farming operations by getting the inputs nearer to the farmers at their local markets. The tractor is a basic capital input into the large scale

farm operations. However, as shown in the analysis above, several farmers do not own the tractors and have to rely on contracting from those who own the tractors. Although experience elsewhere in Africa tends to suggest that government provision of tractor-hire services is inefficient and extremely costly to the government, it is recommended that government tractor-hire services should be introduced in Moiben to augment the services offered by private contractors. This is likely to facilitate timeliness in land preparation and planting of maize and wheat. This proposal may be implemented by the farm management division of the Ministry of Agriculture in liaison with the district and division officials to map out the best strategies of effecting it in Moiben Division.

Concerning infrastructure, it is recommended that conditions of existing rural access roads especially category E roads between Bugar and Moiben rural centre and between Segero and Moisbridge should be improved and be continuously maintained. This is likely to facilitate the transportation of milk from these areas which are rather isolated from the main roads in the division. Furthermore, it is recommended that inoperative cattle dips especially those in Moiben location should be rehabilitated through introduction of sound management policies, through deploying qualified dip attendants. Closely linked to this, the management of water supply projects should be streamlined through enhancing participation of the public. These two proposals on water and cattle dips are likely to enhance dairy farming especially in the dry season and guard against the tickbone disease identified in the analysis in Chapter V.

Apart from this, it is also recommended that the current storage capacity of National Cereals and Produce Board depots at Moisbridge be raised to about 800,000 bags while that of Eldoret be raised to about 1,200,000 bags capacity. Alternatively, it is recommended that a new depot with a storage capacity of about 600,000 bags be constructed within the division. In fact the Ministry of Agriculture plans to construct a new depot at Ziwa (Daily Nation of 30th April, 1986). These measures are likely to cater for increased demand for storage facilities especially during periods of maize and wheat bumper harvests as were the cases in 1978

and 1985. It is also recommended that the Kenya Cooperative Creameries limited in liaison with farmers to consider the viability of constructing a milk cooling plant in the division to cater for increased milk supply during the rainy season. This is likely to alleviate the problem of milk going sour before it is processed at the Eldoret plant. Consequently, the farmers will be given incentives to boost their dairy production especially those in isolated areas such as Sirikwa and Segero in Moiben Division. In fact, the incapability of Kenya Cooperative Creameries to handle milk supplies to its processing plants is a national problem and not confined to Moiben alone as noted by the Minister for Agriculture recently (Daily Nation of 7th June, 1986) and already referred to in Chapter V above.

AREAS FOR FURTHER RESEARCH

Admittedly, this study has not been wholly exhaustive in analytical detail nor purely perceptive on the problem investigated. In this connection, areas that could be explored further include:-

(a) An exploration and evaluation of the relative efficiency of large scale farms in the utilization of the nation's scarce resources in cost benefit terms to determine the likely impact of sub-division in the context of government policy on large scale vis-a-vis small scale farms.

(b) The existence of large scale farms in an area such as Moiben in a situation of increasing landlessness and unemployment needs to be critically examined.

(c) Further exploration of the reasons for inoperativeness of cattle dips and water supply projects in order to find a lasting solution as a basis for dairy farming practice in the division.

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A P P E N D I X

FARMER'S/MANAGER'S QUESTIONNAIRE

1. Name/No. of the Farm .....
2. Location .....
3. Farmer's/Manager's Age ..... Sex .....
4. Level of Education Reached: Primary/Secondary/College
5. Have you Attended any Agricultural Course?

	Year	Place	Certificate	Length of Course	On the Job Experience
a)					
b)					
c)					

6. Main Occupation ..... Minor Occupation .....
7. Number of Children ..... In School .....
8. Expenditure on Education per year .....
9. Who makes the Following Decisions?

	owner	Manager	Asst. Man
a) Amount of Land for maize, wheat, pasture			
b) When and how to prepare land			
c) When and amount of inputs to purchase			
d) When to plant and what spacing to follow			
e) How much labour to hire and when			
f) Control of soil erosion			
g) How and when to weed			
h) When to calve			
i) Selling of maize and wheat and milk output			

10. What is the total area of your farm? ..... Acres/Ha.
11. Area planted in 1984 for maize ..... Acres/Ha.
12. Area planted in 1984 for wheat ..... Acres/Ha.
13. Which varieties of certified seed do you usually plant?
    Maize ..... Wheat .....
14. Where do you buy them from ..... Distance away .....

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15. When you prepare your land for planting which operations do you usually carry out?

    a) Ploughing by tractor ..... time ..... Ksh/acred

    b) Harrowing by tractor ..... time ..... Ksh/acred

16. At what spacing do you plant? a) maize .....

    b) wheat .....

17. To plant one acre of maize/wheat how many bags of seed do you need? maize ..... bags/acre, wheat ..... bags/acre

18. What types of fertiliser do you use? DAP/TSS/MAP

19. How many bags of fertiliser do you use for maize ..... bags/acre wheat ..... bags/acred?

20. Where do you get fertiliser from ..... distance ..... Kms.

21. When do you plant maize and wheat in this area?

    maize ..... Wheat .....

22. Do you have any pests or diseases in your maize and wheat? Yes/No. Which ones? .....

23. How often do you spray your maize and wheat against diseases ..... times

24. Name of Chemical used ..... amount ..... Kg/acre.

25. How many times do you weed your maize ..... times.

26. Amount of labour required for:-

Operations	Maize			Wheat		
	Number	Days	Shs/day	Number	Days	Shs/day
Preparing land	.....	....	.....	.....	....	.....
Planting	.....	....	.....	.....	....	.....
Weeding	.....	....	.....	.....	....	.....
Spraying	.....	....	.....	.....	....	.....
Harvesting	.....	....	.....	.....	....	.....
Other (specify)	.....	....	.....	.....	....	.....

27. Do you experience any labour shortage problems in carrying out these operations? Yes/No. If yes, during .....

28. What yield did you obtain from last year's crops:

    Maize ..... bags, Wheat ..... bags.

29. Do you consider this to be (a) very good (b) good (c) average

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(d) fair (e) poor (f) very poor yield?

30. What is best yield you have obtained sicne starting to plant Maize ..... bags/acre, Wheat ..... bags/acre. Which year?

31. What do you consider to be the average yield for your Maize ..... bags/acre, Wheat ..... bags/acre.

32. Where do you sell your produce ..... Distance away in kilometres .....

33. How do you transport your produce to the market? Own lorry/ tractor, hired lorry/cooperative.

34. Kindly indicate your crop yields in the table below:

Year	Crops Maize	Wheat	Total Yield in bags	Amount Sold in bags	Total income
1981					
1982					
1983					
1984					

35. What do you consider to be the major problems in growing maize and wheat on your farm? Climate, type of soil, lack of tractors, late arrival of fertiliser, lack of labour, etc.

36. LIVESTOCK

Please indicate the number of livestock owned.

Type Mature	Cows	Heifers	Calves	Bulls	Cast-rated Males
Grade					
Local					
Upgrade					

37. How many acres of grazing land do you have? ..... acres.

38. Do you graze livestock continuously on the same pasture? Yes/No

39. If no, how often do you move your cattle from one are to another? .....

40. How much concentrate do you feed in Kg./day?

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Type of Concentrate	Amount in Kg/day	Cost per Kilo.	Monthly Expenditure in Shs.
Chopped or ground maize			
Bran			
Molasses			
Fodder crop			
Wheat straw			
Salt			
Other (specify)			

41. How much milk do you get every day during a period when there is a lot of milk ..... litres/day.
42. How much milk do you get during a time when you get only a little every day? ..... litres/day
43. Where do you sell your milk ..... Distance ..... Kms.
44. How do you sell your milk? Cooperative/own transport, etc. .....
45. How much milk do you sell every month ..... litres. How much do you earn from this in Ksh.? .....
46. Have you made any of the following improvements to your farm? (1) fencing (2) water installation (3) housing
47. What in your opinion are the problems encountered by dairy farmers in this area? .....
.....
.....
.....

This was my last question. Thank you for your cooperation and information on mixed farming. I wish you much success in your enterprise.

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