

// " THE STRUCTURE AND PERFORMANCE OF KENYA'S SUGAR INDUSTRY

(With Special Emphasis on the Nyanza Sugar Belt)"

BY

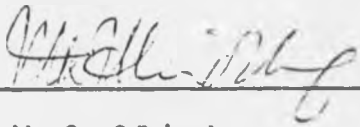
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A thesis submitted in 'part' fulfilment for the Degree of Master of Science in Agriculture in the University of Nairobi.

Nairobi 1978

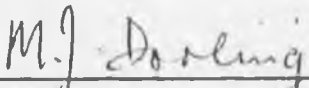
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However in conclusion, I must stress that I take full accountability for all errors and omissions that may be detected in this study.

M. O. Odhiambo.

A B S T R A C T

The study describes the organizational structure of the sugar industry in Kenya and how the existing structure affects performance at farm, factory and consumer levels. The study was conducted mainly in the Nyanza Sugar Belt and examines the problems of cane procurement and excess capacity. The analysis reveals that the excess capacity problem is a common phenomenon in virtually all the Five Sugar factories in Kenya and that this problem originates from inadequate cane supply to the factories.

At farm level, the out-growers in the Nyanza Sugar Belt are faced with many organizational, technological and socio-economic problems which result in poor performance and hence tend to kill farmers' incentives in cane production. Lack of farmer-processor integration, inadequate machinery and transport services, inadequate credit facilities, and problems of extension services and cooperative movements, are some of the factors contributing to low performance at farm levels in most of the factory zones, with the exception of Mumias.

The study concludes by recommending structural re-organization in cane production to step up cane output at farm levels, by encouraging farmers to improve their cane husbandry techniques. It is further recommended that more formal links should be set up between the factories and the farmers to ensure that the factories receive adequate cane supply, and that they in turn provide inputs or services to enable farmers to improve their yields.

## CHAPTER I

### INTRODUCTION

#### 1.1. Historical Note:

Compared to sugar industries in other parts of the world, the Kenyan sugar industry has a short history. Just about half a century ago the first centrifugal sugar factory was set up near the shores of Lake Victoria, east of Kisumu at Miwani in 1924, starting with a modest production of about 3000 metric tons per year. Hitherto, Kenya's rising demand for sugar from the increasing number of European and Asian settlers had to be met wholly by import sources.

Before 1924 sugar cane as a crop had been grown by the indigenous population for local uses such as chewing and brewing. By the close of the 19th century some Indians, who had come to Kenya as coolies and artisans during the construction of the Kenya-Uganda Railways, began establishing light commercial and industrial undertakings along the shores of Lake Victoria and the Kenyan Coast. A few of these Indians started planting some sugar cane for the production of jaggery (= "gur"), a non-centrifugal sugar known to Indians from time immemorial and whose production and end-uses as a sweetener they had had much experience with in India. The manufacture and use of jaggery soon spread to other parts of Kenya. However the jaggery sector, the pioneer in sugar manufacture in Kenya, can now only derive satisfaction from its historical status, since its present condition is in gloomy contrast to its glorious past. Jaggery production is now mainly centred in the

more remote cane growing areas where centrifugal sugar factories have not been set up (See Appendix VI).

Immediately after the Miwani factory had started production, two other centrifugal sugar factories were established at Muhoroni and at Karubi River about fifteen miles from Nairobi (3p.46). In 1927, another sugar factory was set up at Ramisi on the south east coast of Kenya near Mombasa (see Map, Fig. 1.1).

During the Second World War some of the sugar factories ran into financial difficulties culminating in the closure of the two factories at Muhoroni and Karubi. Despite increased demand for sugar in Kenya during and after the Second World War, the Kenyan sugar industry had to content itself with the two factories at Miwani and Ramisi until 1965/66 when a third factory came up again at Muhoroni. This was followed closely in 1967/68 by another factory at Chumelil, both in the Nyanza Sugar Belt, where Miwani had pioneered sugar production some 40 years earlier. In 1973 Mumias in Western Province became the latest addition to the list, now comprising of five factories in total (Fig. 1.1). At the time of writing (1977), two other factories are in advanced stages of construction, one at Nzoia in Western Province and the other at Awendo in South Nyanza, and both are expected to be in production by 1979/80. The striking feature about the new factories that have been established since 1965 is the direct government participation in terms of greater share-holding and more say within such companies. Miwani and Ramisi however are still under



FIG. 1.1 MAP SHOWING PRESENT AND PROPOSED SUGAR SCHEMES IN KENYA (1977)



private ownership (Table 5.19).

Apart from the conventional large sugar plants, plans are under way and feasibility studies are being conducted on the possibility of establishing "open pan" and "mini sugar plants", as a basis for small scale sugar production. These would be complementary rather than alternative to the large scale production units. One such factory is already set up at Kabras in Kakamega District and several are planned for the future under the auspices of the "Small Scale Sugar Production" (S.S.S.P.) project studies sponsored by the Kenya Government (Appendix V).

Thus the industry has seen considerable expansion since Kenya gained political independence in 1963. However, despite the increase in the number of sugar plants and subsequent increase in domestic production, Kenya has remained a net importer of sugar up to the present moment. The trend and development of domestic production can be seen in Table 1.1 which summarizes production since the inception of the industry in Kenya.

## 1.2 An Overview of the Role of Agriculture in Kenya

It is convenient at this juncture to emphasize that Kenya, like most developing countries depends heavily on agriculture and agro-allied industries like sugar processing for its general economic growth and development. Agriculture provides the largest source not only of income, but also of employment and foreign exchange earnings. About 29% of Kenya's total G.D.P. is derived from the agricultural sector of the economy (14.3 p.8). It

TABLE 1.1: ANNUAL SUGAR PRODUCTION IN KENYA 1923 - 1977

('000 Metric tons)

Year	Production	Year	Production
1923-1930	5.5	1967	60.0
1931-1940	11.3	1968	81.0
1941-1950	11.3	1969	115.0
1951-1960	21.5	1970	125.0
1961	33.0	1971	124.0
1962	33.0	1972	92.0
1963	38.0	1973	138.0
1964	35.0	1974	163.0
1965	29.0	1975	183.0
1966	36.0	1976	190.0
		1977	195.0*

Source: (i) 1922 - 1960: "Commodity Review Series No.1: The World Sugar Economy 1880-1959", UN,FAO, 1959. .

(ii) 1961-1977: "Statistical Abstract" and "Kenya Statistical Digest."

(iii) "East African Statistics of Sugar 1966-1974"

Note: \* = estimated.

reckoned that not far short of 80% of Kenya's population earn their living in rural areas on holdings of under 20 hectares (14.3 pp. 40;80). In 1976 it was estimated that out of a total population of about 13 million, Kenya's economically active population numbered about 6.6 million and that only 14% of these were engaged in the monetary sector of the economy. The remainder were engaged as self-employed or unpaid family workers on rural farms or in urban informal business establishments; while the rest were either seeking employment in urban areas or were pursuing higher education (14.3 p.40).

Recognizing that 80% of Kenya's population depend on rural farms for their livelihood, the current Kenya Development Plan places great emphasis on increased public expenditure on rural programmes geared to helping the rural farmer. The plan reflects an increasing concern with widespread poverty and relative income disparities in the rural areas vis-a-vis the urban sector. High priority is given to the development and modernization of the agricultural sector with the ultimate aim of increasing farm incomes and generating rural employment opportunities. With the important role of agriculture in mind the Development Plan sets out the following targets for the agricultural sector:-

"(a) to achieve an average annual growth rate of 6.7 per cent of the marketed production through intensified resource use;

(b) to improve the distribution of rural income through significant increase in the production of farmers who obtain a

cash income from their land;

(c) to devise methods of developing the less favoured areas and to promote a more even development among different areas of the country;

(d) to improve the opportunities for employment in the agricultural sector;

(e) to improve standards of living and nutrition in the rural areas;

(f) to attain self-sufficiency in food supply and increased agricultural exports;

(g) to complete the Kenyanization of large-scale mixed farms and make significant progress towards Kenyanization of ranches and plantations" (14.4 Vol. II p.2).

The sugar industry, which is the theme of this study, being by its nature a rural agro-based industry has a significant role to play in realizing some of the above targets set for the agricultural sector.

### 1.3. The Role of the Sugar Industry in Kenya

Food processing industries like that of sugar using agricultural raw materials offer a good starting point for the early stages of industrialization. This is particularly

so for a country like Kenya "endowed with particularly favourable geographical conditions for the production of a wide range of crops ---- which lend themselves to food and beverage processing" (13. p.1).

Although Kenya is still a net importer of sugar, local production by providing about 80% of the current domestic needs goes a long way to helping save badly required foreign exchange reserves. In addition it is estimated that the sugar industry employs about 15000 people directly. It is further forecast that by 1990, if Kenya can produce about 550000 tonnes of sugar required by that time for domestic consumption, the industry would be able to employ about 100000 people (46. p.33). Apart from direct employment in the industry the field survey conducted during this study reveals that there are about 19000 family farms growing sugar cane and supporting about 160000 people (see Table 5.1).

Sugar cane as a crop in Kenya earned for farmers about K£9.618 million out of a total of K£ 252.4 million from marketed production in 1976 (14.3). This represented 5% of total marketed gross farm revenue from all crops and 3.8% of total gross farm revenue. Table 1.2 shows how sugar cane ranks among the major cash crops in Kenya and records its contribution to gross farm revenue from 1964 to 1976.

Since sugar cane farms are in the rural areas, it can be deduced from tables 1.2 and 5.1 that the impact of the sugar industry towards achieving distributional objectives in the

TABLE 1.2 GROSS FARM REVENUE AND PERCENTAGE SHARE OF SUGAR CANE IN KENYA 1964-1976 (KE'000)

	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
1. Cereals	6793	7009	6994	9640	12940	11577	9000	10746	12953	14491	17658	28928	39246
2. Temporary Industrial crops:													
- sugar cane	1490	1544	991	1598	2179	2942	3509	3457	3038	4453	5916	8230	9618
- others	1893	2502	3631	3755	3986	2890	3005	4024	5271	4919	6286	7592	7504
Total temporary industrial crops	3383	4046	4622	5353	6165	5832	6514	7481	8309	9372	12202	15822	17122
3. Other temporary Crops	643	597	1132	1029	1237	2783	2746	3497	4249	3563	5356	7123	8309
4. Permanent Crops	30770	26478	33965	27881	25950	31645	40238	35181	44881	59406	96108	68571	143755
5. Livestock and Products	15901	16228	18963	20148	21672	20940	23303	26049	31438	32172	32457	36123	37873
6. Unrecorded Marketed Production	2888	2865	3155	3257	3342	3425	4950	3741	4100	4299	4668	5404	6070
Total Crops	41589	38130	46713	43903	46292	51837	58498	56905	70392	86832	111324	120439	208432
Total Gross Farm Revenue	60378	57223	68831	67308	71306	76202	86751	86695	105931	123303	148449	161966	252375
Sugar cane as % of total crops	3.4	4.0	2.1	3.6	4.7	5.7	6.0	6.0	4.3	5.1	5.3	7.0	5.0
Sugar cane as % of total Gross Farm Revenue	2.5	2.7	1.4	2.4	3.1	3.9	4.0	4.0	3.0	3.6	4.0	5.1	3.8

Source: Calculated from figures and tables in "Statistical Digest" 1964-1976 various volumes, Central Bureau of Statistics, Ministry of Finance and Planning.

economy, is quite considerable. The earnings from cane accrue to rural households where the poor, who are engaged in agricultural and allied occupations, are disproportionately located.

Other beneficiaries from the sugar industry apart from cane producers, include processors, distributors, retailers and their employees.

In addition to the benefits already mentioned, sugar forms a significant part of the government revenue source for excise duty. Details of government excise revenue receipts from various commodities in 1976 show that sugar ranked third after beer and cigarettes (See Appendix IIIA).

#### 1.4 Uses of Sugar in Kenya.

Economic matters aside, nutritionally sugar is a very important source of energy in many Kenyan diets. Sugar has become a common household foodstuff, especially among the urban dwellers to whom it is now an essential rather than a luxury dietary constituent. Its use in various forms has also spread extensively to rural households where it was once regarded as the preserve of the wealthy and urban sophisticated families. Sugar in Kenya is used in various ways:-

(i) As a sweetener in tea, coffee, milk, porridge, pudding and other foodstuffs prepared in homes. Sweetness is an important sensation to humans as it improves food palatability and taste.



Although the relative importance of taste and calories in accounting for sugar ingestion may be difficult to quantify, it is apparent that the large consumption of sugar in Kenya occurs more because people like its sweet taste and less for the energy it provides.

(ii) in industrial processes for sweetening, texturing, fermentation, preservation and other purposes in the manufacture of such products as beverages, confectioneries, beer, canned fruits and other foodstuffs.

With growing dietary sophistication and urbanization in Kenya this latter use is bound to grow in importance.

## 1.5 Industry Problems

### 1.5.1. The Problems

The problems in the sugar industry are many and varied. First, Kenya is still not yet self-sufficient in sugar and the over-all annual rate of growth of total domestic consumption has been estimated at  $7\frac{1}{2}$  per cent (14.2 p.14). The present (1977) consumption of sugar in Kenya is estimated to be about 219000 tonnes and of this amount only about 195000 tonnes is being produced locally (14.7). National consumption needs therefore must of necessity be met by importing about 24000 tonnes to supplement domestic production with the subsequent drain on the country's foreign currency reserves.

The government has since independence (1963) been committed to a policy of self-sufficiency with an ultimate target of a domestic surplus for stock . The strategy which the government pursues to achieve this objective, is to increase the number of white sugar factories and encourage cane production in both large and small outgrower farms so that factories can operate near to full capacity.

The problem of excess capacity is widespread in all existing mills except Mumias. The under-utilization of capacity is most acute in the Nyanza Sugar Belt, where the study found that the three factories (Miwani, Chemelil, and Muhoroni) only use from 30 to 60 per cent of their normal capacity. This situation came to a head in April 1977 when Miwani Sugar Mills suffering from lack of adequate cane supply threatened to close down and lay off over 2000 employees.

This study analyses the problems and causes of excess capacity and cane procurement in Kenya with special emphasis on the Nyanza Sugar Belt. At the moment expansion and improvement of the industry is one of the major pre-occupations of the Kenya Government. To that end a sugar rehabilitation programme has been proposed under a special five-year programme, which is expected to be launched when the World Bank completes a study on how to improve production of the Nyanza Sugar Belt and Ramisi factories. This programme is recognition by the government of the existing failures and problems under present arrangements in the industry. Under the

programme about Ksh.500 million will be spent on updating the four old factories and bringing them into optimum production (46p.33).

In summary, problems in the sugar industry include pricing policy (18p.336) under-utilization of factory capacity, alleged excessive processing costs, and alleged inefficiencies arising from the system of distribution and illicit sales to neighbouring countries, resulting in local and national sugar shortages (18 p. 335).

#### 1.5.2 Relevance of the Study

The sugar industry has a vital role to play in the growth and development of the Kenyan economy (8 p.2) and this alone points to the need for strengthening the industry through research and evaluation studies. The present study describes and analyzes the current organization, structure and practices in the industry. It also evaluates the problems inherent in the system. Recent international shortages of sugar and the relatively high world prices (6.2) experienced during the 1974-1976 period call for re-examination of the national sugar policy (see Appendix VII).

The current objective underlying Kenya's sugar policy is to achieve self-sufficiency with stock surplus by 1980/81. To this end the government has embarked on ambitious projects, involving over-all expansion of the industry together with proposed rehabilitation and improvement of the older projects in the Nyanza Sugar Belt and at Ramisi on the Coast. The rehabilitation programme is

aimed at boosting cane production to help reduce the chronic problem of unused capacity experienced at Miwani, Chemelil, Muhoroni and Ramisi factories.

The present study looks at the root causes of excess capacity in the three factories in the Nyanza Sugar Belt. The study therefore lays special emphasis on cane procurement problems in the whole area. It must be emphasized that with persistent cane supply problems and subsequent under-utilization of existing factory capacities, the Kenyan self-sufficiency objective might be defeated despite physical expansion of existing or new factory projects. Recent analysis of the trend of production and consumption in Kenya (14.6) shows that other approaches in addition to physical expansion are necessary if self-sufficiency in sugar is to be realized. One useful approach is to carry out research studies such as the present one to analyse important problems facing the industry.

The study consists of nine major chapters. Chapter I, the Introduction leads on to Chapter II which gives an over-view of the structure and organization of the sugar industry in general. The Literature Review is done in Chapter III. Chapter IV discusses the objectives and methodology used in the study, while Chapter V explains the analysis and results. Chapter VI is devoted to the analysis of the excess capacity problem, while Chapter VII deals with cane procurement problems. Tests of hypothesis are formed in Chapter VIII and Chapter IX presents the summary, conclusions and recommendations of the study.

## CHAPTER II

### AN OVER-VIEW OF THE STRUCTURE AND ORGANIZATION OF THE INDUSTRY

#### 2.1 Introduction:

In this chapter an attempt is made to describe the institutional and organizational set-up within the sugar industry in Kenya, starting with the sugar cane farmer and proceeding to the processing firms and the final consumer. To be able to understand problems inherent in the industry, we need to know and examine the various operations and organizational arrangements in cane production, sugar processing and marketing.

#### 2.2 Sugar-cane Production:

It is appropriate to give a brief account of sugar cane growing conditions in Kenya as a background to the discussion that will follow on the industry.

##### 2.2.1 Environmental Requirements for Sugar

Sugar-cane (Saccharum officinarum L.) is the sole source of sugar produced in Kenya. Beet sugar can only reach the domestic market through import sources. Sugar cane grows in the equatorial region and the tropics, and even in warm temperate zones, between 35° North and 25° South (35p.93). By world standards, Kenya may be considered a marginal area for commercial sugar cane cultivation. On average sugar cane requires a minimum of 1500 mm. of rainfall, distributed throughout the year if a satisfactory yield is to be realized (1p.193). In Kenya, with the exception of Mumias in Western

Province, most cane growing areas like the Nyanza Sugar Belt and Ramisi at the Coast have variable and often deficient rainfall often resulting in drought damage and poor yields.

In Kenya sugar cane is grown from a few metres above sea level at Ramisi on the Coast to 1500 metres in Nyanza and the Western Provinces. Due to high altitude effect, the typical maturity period for cane in Nyanza and Western Provinces ranges from 22 to 24 months for the plant crop and 18 to 22 months for ratoons, while at the coast it can be as short as 12 to 14 months for both plant and ratoon crops.

Another ecological factor affecting cane growth and yield is soils. It is generally recognized that sugar cane tolerates a wide variety of soil conditions, but for good yields free drainage and a proper supply of nutrients are necessary prerequisites. Among the present sugar schemes, only Mumias seems endowed with less problematic soils. The coastal sugar zone has reddish brown alluvial and sandy soil formations with relatively good drainage but low moisture retaining capacity, thus making the coastal areas most marginal and very sensitive to dry spells. The Nyanza Sugar Belt soils are invariably heavy "black cotton" (montmorillonitic) soils with impeded drainage. In addition these soils are too hard to break during the dry season and again too sticky and plastic during rains, thus requiring heavy machinery and extra expenses for land preparation.

## 2.2.2 The Agricultural Phase

Apart from the geo-physical environmental factors described above, sugar cane needs proper attention by the farmer if reasonable economic yields are to be realized. This section is devoted to a description of cane husbandry practices recommended for sugar cane farmers in Kenya at the time of writing (1977).

### 2.2.2.1 Land Preparation

Preparing the land for the plant crop is both time-consuming and expensive (1 p.194). Clearing, destumping, levelling and grading in the case of virgin land or ripping and removal of old cane stools in the case of old cane land, are some of the initial operations. The soil is opened up by deep ploughing and then several rounds of light ploughing and harrowing must be done to ensure a suitable soil tilth. Heavy machinery like crawler tractors with heavy cultivators and subsoilers are often used on heavy soils as in the case of Nyanza Sugar Belt. In areas with lighter soils like Mumias, the conventional wheel tractors can be used successfully, thereby reducing costs considerably.

### 2.2.2.2: Planting

After final harrowing the land is furrowed to make appropriate planting "furrow holes" about 15 - 20 cm deep and spaced 1.2 to 1.8 metres apart. Ideally cane for planting should be obtained from nurseries which have been established from heat treated cane, as a control measure against ratoon stunting disease. However, few farmers are known to use such heat-treated seed-cane. At planting, the seed-cane is cut into about three-node stem pieces called "setts"

which are then planted end-to-end and buried horizontally about 5 - 8 cm. deep with the buds pointing sideways and not upwards or downwards in the furrow. The time of planting should coincide with the on-set of rains if proper cane establishment is to be ensured.

#### 2.2.2.3 Fertilizers

Sugar cane requires nitrogenous, potassic and phosphatic fertilizers and lime. Little or no response has been noted from the application of phosphate and potash in most cane growing areas in Kenya, but especially so in the Nyanza Sugar Belt. Thus nitrogen remains the most important fertilizer for the crop. About 65 to 80 kg of nitrogen per hectare in two split applications during the rains is considered an average application rate for either the plant or ratoon crop. In Mumias and at the coast phosphate response has been realized and in addition to nitrogen about 65 kg  $P_2 O_5$  per hectare applied at planting time is known to give good yield response (l.p.196).

#### 2.2.2.4 Weed Control

For good yields sugar cane fields should be kept weed-free throughout the crop life. Hoeing or hand weeding is widely used, although due to increasing wage rates and shortage of casual labour during certain seasons, large farms and factory nucleus plantations extensively use herbicides and/or mechanical weed control.

#### 2.2.2.5 Harvesting

Harvesting is done when cane is considered mature and millable. In all areas of Kenya, sugar cane is cut by hand using "pangas" or other cutlery. In most cases the cane is burnt before cutting to



make harvesting less laborious.

Ideally, cane should be sent for milling immediately after harvesting, at least within 48 hours if quality and sugar content are to remain high. However, on certain farms cane seldom reaches factories in a good state because of inadequate labour and transport facilities.

#### 2.2.2.6 The Crop Cycle

Generally speaking three harvests are obtained in a five-year cycle period in all areas other than the Coast where a crop cycle takes three years (14.2 p.13). On outgrower farms, the tendency is to extend the crop cycle by taking off more than three to four ratoons before the field is ploughed out and replanted. Yield levels often drop with subsequent ratoon takings and this may explain the common low yield levels on outgrower farms (see Table 5.14)

### 2.3 Sugarcane Production Systems:

Historically and still in most countries sugar cane is mainly a plantation crop. However in Kenya sugar cane growing as described above (in section 2.2) takes place under three major distinct types of farming systems, namely, the nucleus estates, and the outgrower farms consisting of large farms and small scale farms.

#### 2.3.1 The Nucleus Estates

The Kenya Government, though committed to encouraging small farmers' participation in the industry, still recognizes the importance

of providing a central plantation, known as a "nucleus estate" in order to ensure a steady and reliable source of cane supply to the factories. This type of arrangement avoids the danger of totally relying on the whims of outgrowers for cane supply to the factories. Apart from helping balance the flow of cane supply to the factory, a nucleus estate is also intended to act as a "demonstration and service centre for small outgrower farms around the factory".  
(40 p. 90)

All the existing five factories and those planned for the future have provisions for a nucleus estate (see section 5.3.3.1). As shown in Tables 2.1 and 2.2 Ramisi relies heavily on its nucleus estate for its cane supply since it accounts for about 83% of its cane area and 75% of total cane delivery. On area basis the proportion of the cane area accounted for by the nucleus estate under each factory is as follows:- Miwani 30.8%; Mumias 29%; Chemelil 22%; and Muhoroni 21%. However, on the basis of cane supply, nucleus estates with the exception of Ramisi, account for about 20 - 30% of total cane delivery (Table 2.2)

Although the nucleus estates still supply a significant proportion of cane to the various factories, it is apparent (Table 2.2) that except for Ramisi, the outgrowers are bound to be the dominant suppliers.

TABLE 2.1: ESTIMATES OF CANE LAND AREA DISTRIBUTION BY TYPE OF PRODUCER IN KENYA - 1975/76 (hectares and %)

Type of Farm	Nucleus Estate			Large Scale Growers			Small Scale Growers			Total Cane Area			Additional Cane Land			Total Canable Land
	ha	%	%	ha	%	%	ha	%	%	ha	%	%	ha	%	%	ha
Factory	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a
Mumias*	3238	28.6	28.6	0	0	0	8094	71.4	71.4	11332	100	100	0	0	0	11332
Chemelil	2833	21.9	18.9	6475	50	43.2	3642	28.1	24.3	12950	100	88.9	2024	15.6	13.5	14974
Muhoroni	2024	20.8	13.9	1214	12.5	8.3	6475	66.7	44.4	9713	100	66.7	4856	50	33.3	14569
Miwani	3228	30.8	25.0	5666	53.8	43.8	1619	15.4	12.5	10522	100	81.3	2428	23.1	18.7	12950
Ramisi	4856	82.8	36.9	202	3.4	1.5	809	13.8	6.6	5868	100	44.6	7285	124	53.4	13153
TOTAL	16189	32.1	24.2	13557	26.9	20.2	20639	41.0	30.8	50385	100	75.2	16593	32.9	24.8	66978

Source: Adapted from Economic Review of Agriculture Vol. 7 No. 1, 1975 p. 12.

Note: a = hectares; b = % of total cane acreage

c = % of total canable land area

\* Mumias zone has no large scale farms.

TABLE 2.2: PROPORTION OF CANE SUPPLIED TO THE FACTORIES BY NUCLEUS ESTATES AND OUTGROWER FARMS IN KENYA - 1977 (%)

Source of Cane Supply	Factories									
	Mumias		Miwani		Chemelil		Muhoroni		Rarisi	
	A	B	A	B	A	B	A *	B	A	B
Nucleus Estate	31	33	33	33	30	20	0	20	n.a.	75
Outgrowers	69	67	67	67	70	80	100	80	n.a.	25
Total	100	100	100	100	100	100	100	100	100	100

Source: A = Authors Field Survey, 1977; B = Economic Review of Agric. Vol. 9, No.2, 1977 p.37.

\* = During the survey Muhoroni insisted on regarding their nucleus estate as an outgrower farm (see section 5.3.3.1.)

n.a = not available.

### 2.3.2 Large Farms

In the early stages, the development of Kenya's sugar industry was carried out by settlers from England and India (40 p. 89). It is these types of settler who acquired large farms and who actually formed the outgrowers in the early stages of the industry. With the advent of political independence (in 1963) some of these farms changed hands through the government policy of Kenyanization of the large farms. As can be seen in Table 5.1, apart from Mumias, all the other factories

have large-scale farms accounting for a significant proportion of cane area in their respective zones. These farms are arbitrarily classified as those with sizes ranging from 20 hectares and above (see section 5.2) .

### 2.3.3 Small Scale Farms

A third group supplying cane to the factories is the numerically superior small scale farmers with between 1.2 to 6 hectares of cane. A rough estimate made during this study puts such farm units at about 16000 to 20,000 in the country (see Table 5.1). Some of the small scale farmers have formed cane production and marketing cooperatives while others operate individually (see section 5.2.4). In the Mumias zone, where virtually all outgrowers are small-scale farmers, an outgrower company has been formed (in April 1977) to co-ordinate in liaison with Mumias Sugar Company all the activities of cane outgrowers in that area including production and marketing.

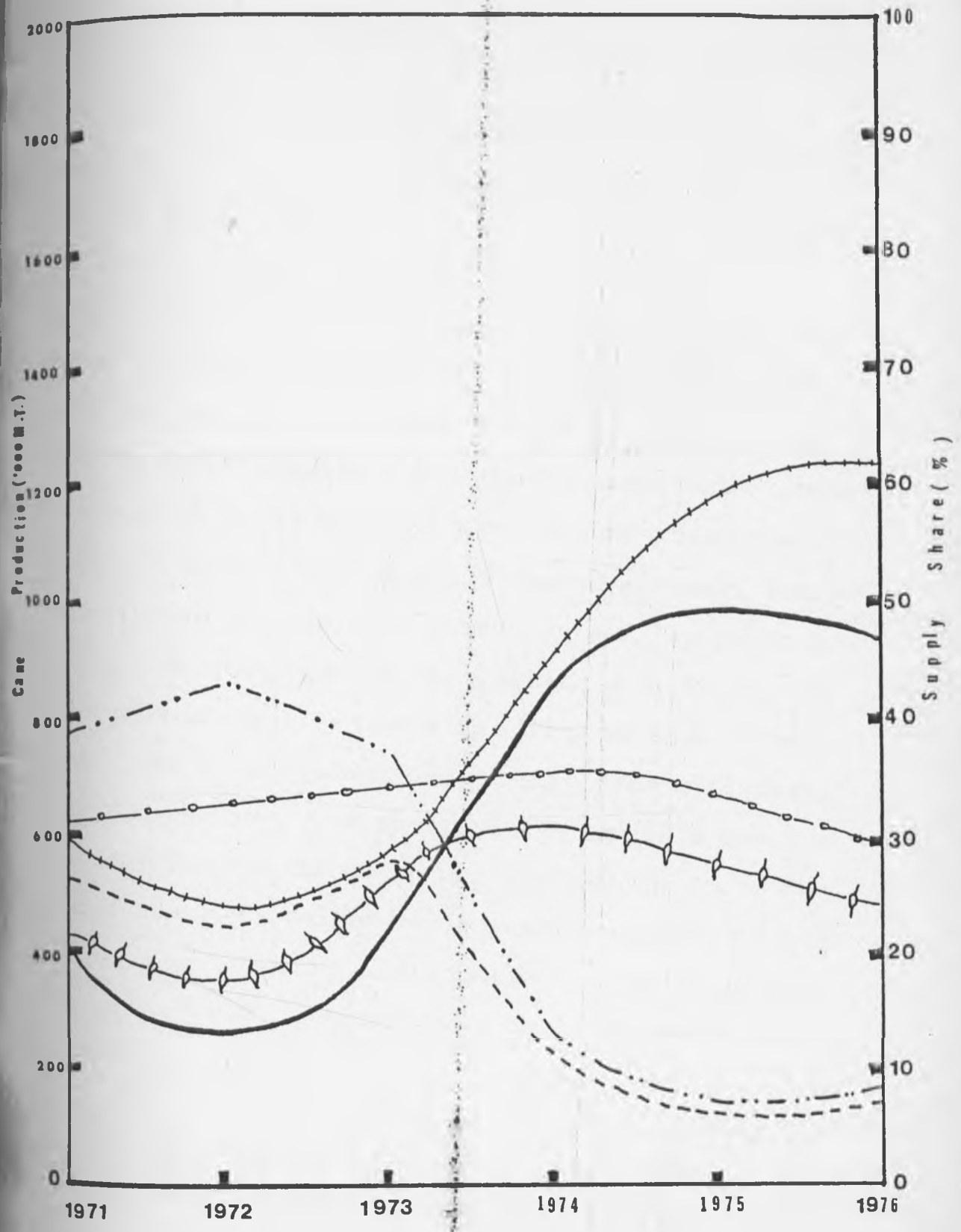
A breakdown of cane delivery to factories in Tables 2.2 and 2.3 indicates the trend and importance of the contribution that the various categories of sugar farms make towards meeting cane supply needs of sugar factories in Kenya. It is worth noting that the small-holders have proved to be both the numerically superior and the dominant cane supplier group, presently accounting for about 62% of cane delivered to the factories (Fig. 2.1). The leading position held by small scale farmers as a group of cane suppliers is bound to remain so and even grow stronger as the new factory projects in South Nyanza and Nzoia come into production with almost the same set-up as Mumias.

TABLE 2.3: TOTAL SUGAR CANE PRODUCTION BY TYPE OF GROWERS IN KENYA 1971 - 1976

	1971		1972		1973		1974		1975		1976	
	tonnes	% Share	tonnes	% Share	Tonnes	% Share	Tonnes	% Share	Tonnes	% Share	Tonnes	% Share
Factory Nucleus Estates	434270	31.5	351967	33.1	534132	34.6	622056	36.2	551752	33.3	487328	29.5
Large Farms	532155	38.6	452399	42.6	570595	36.9	228358	13.3	124721	7.5	138353	8.4
Small holders: a.Private	100262	7.3	86872	8.2	165361	10.7	427595	24.9	443654	26.8	500479	30.3
b.Cooperative Societies	89399	6.2			78444	5.1	238117	13.9	326562	19.7	332603	20.1
c.Settlement Schemes	221916	16.1			171057	16.1	196530	12.7	202957	11.8	207894	12.6
TOTAL	1378002	100	1062295	100	1545062	100	1719083	100	1654583	100	1652697	100

Source: Adapted from Economic Survey 1975 - 1977.

FIG.2-1:GRAPH SHOWING TOTAL CANE PRODUCTION AND SUPPLY SHARE BY TYPE OF PRODUCERS IN KENYA



Source : Table 2-3

- KEY :**
- Small Farms (% Supply Share)
  - Small Farms (tonnes)
  - ◇— Nucleus Estates (% Supply Share)
  - △— Nucleus Estates (tonnes)
  - Large Farms (% Supply Share)
  - Large Farms (tonnes)

## 2.4 Sugar Cane Marketing System

### 2.4.1 Cane Marketing and Pricing

The sugar factories form the markets for all the sugar cane produced in each factory zone. In some zones jaggery production and "chewing" of sugar cane which would offer alternative markets for cane are legally banned. This leaves sugar cane produced in each factory zone to be purchased monopsonistically by the factory. Even competition among sugar factories for cane procurement is thoroughly checked and discouraged by the government through a strict zoning scheme. No farmer is allowed to sell his cane to any factory outside his zone and no factory is allowed to procure cane from another factory zone without express permission from the government. Factory-grower relations are largely set by the government. Cane prices are fixed and constantly reviewed by the government as is also the case for the price of sugar. The farmers are paid on the basis of the weight of cane delivered rather than on quality basis as no grading either on sugar content or on physical quality aspects is ever done. It has often been felt that cane prices have been quite low in the past thus discouraging farmers from increasing production, (18 p.336) leading to under-utilization of factory capacity. The cane producer prices as fixed by the government during the last decade are shown in Table 2.4.

### 2.4.2 Cane Transport

The transportation of cane to factories is usually done by tractor-drawn trailers or large truck lorries, often hired from the factory or from private transporters or owned by the farmer in the case of some large farms. The transport charges are standardized by



TABLE 2.4: CANE PRODUCER PRICES IN KENYA 1966 - 1977

Year	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Price Ksh/tonne	42.20	42.20	46.00	45.20	45.20	45.20	50.00	51.80	61.80	89.40	104.50	133.00

Source: Statistical Abstracts 1966-1977; Economic Review of Agriculture Vol. 7 No.1.

TABLE 2.5: TRANSPORT ZONING AND CHARGE RATES IN THE NYANZA SUGAR BELT

Zoning	Distance (km)		Charge Rates Ksh/tonne	
	Old* (1976/77)	New** (1977/78)	Old (1976/77)	New (1977/78)
A	0-10	0-10	21	25
B	11-16	11-16	23	28
C	17-24	17-24	26	32
D	Over 24	25-32	28	34
		Over 32		negotiable

Source: \* Old Charges: Study Survey  
 \*\* New Charges: Daily Nation 4th Nov. 1977

the government on the basis of constant reviews by a locally instituted "transport committee" in each zone. The charges now range from Ksh . 25 to Ksh. 34 per tonne within a radius of 32 Kilometers (Table 2.5). Gross margin analysis shows that after cane establishment cost, transport cost appears to be the second highest single variable cost item per hectare of cane produced.

#### 2.4.3: Cane Quality and Grading:

As mentioned earlier, sugar cane in Kenya is paid for by the factories at a simple flat rate based on weight and not quality of cane delivered. This system is not without its problems; it neither awards bonuses to good quality cane nor does it give penalty for poor cane marketed to the factory.

##### 2.4.3.1 Factors Affecting Cane Quality

Good millable cane of high quality and recoverable sugar content is an asset to factory owners especially in a place like Kenya where cane is paid for on quantity rather than on a quality basis. Cane quality is known to be affected by some of the following factors:-

(i) The age of cane at harvest: It is therefore important to harvest cane at the right age of maturity.

(ii) Burning of cane: Cane burnt either for ease of harvesting or through arson deteriorates very fast in quality as a result of the inversion process triggered off by the fire. Such cane ought

to be cut and delivered to the factory immediately.

(iii) - Other factors such as the type of cane variety, climate and agronomic practices are also known to affect cane quality.

## 2.5 The Processing Phase

### 2.5.1 Cane Milling:

All the five factories processing sugar in Kenya work basically on the same principle. After weighing at the mill yard the cane is conveyed and fed into cutter units and shredders which prepare the mass of sugar cane for roller mills where it is squeezed to extract juice. The juice is strained through screens, then subjected to a "clarification" process involving heating, liming or phosphating to raise pH and prevent inversion of sucrose to simple sugars. Further boiling of the juice follows in evaporators to remove water. After evaporation the next process is crystallization where the thick syrup obtained from the evaporators is fed into vacuum pans where at low pressure a super-saturated mixture of molasses and sucrose crystals form the massecuite. The massecuite is then led to crystallizer (open pans) where it is agitated by stirring to encourage growth of sugar crystals. The massecuite is then purged in automatic centrifugals with a modicum of washing which separates the crystals from the molasses (40p.91). The sugar crystals are then dried and bagged in 100 kg bags which are then stored within the factory precincts to await distribution to KNTC depots. Figure 2.2 shows a schematic flow chart for cane sugar manufacture.

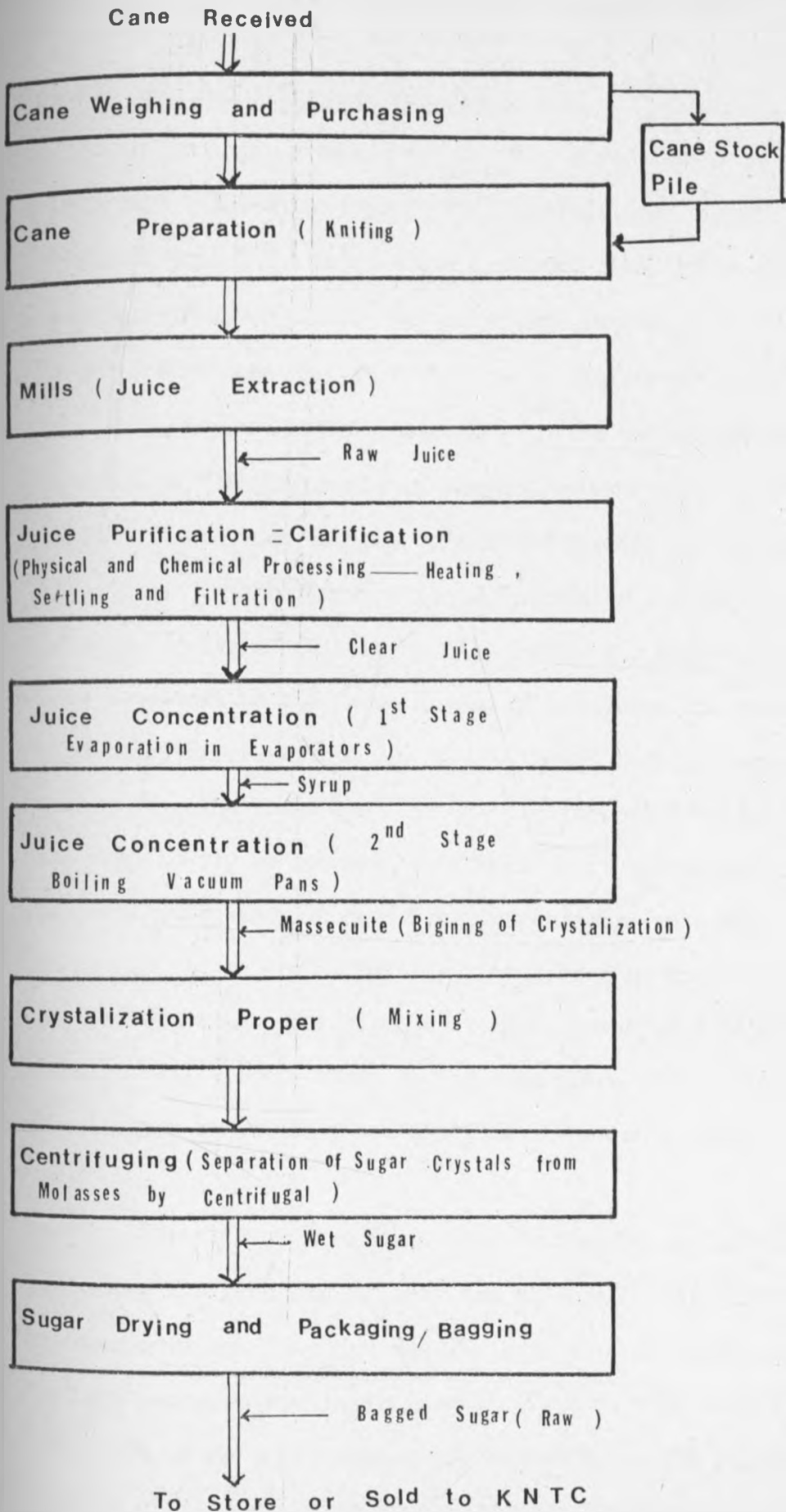


FIG  
FIG:2-2 A TYPICAL FLOW CHART FOR SUGAR MANUFACTURE IN KENYA ( 1977 )

### 2.5.2 Sugar Quality and Refining

The sugar produced in all the Kenyan factories is what is termed "mill-white sugar" or "commercial raw sugar" but not "refined sugar". The Kenya sugar produced locally has therefore a brownish colour due to the incomplete removal of molasses coating, which may vary from factory to factory or from time to time with a given factory depending on the extent and method of processing. The government of Kenya however has put a minimum quality standard as regards colour and foreign matter content of sugar based on the "International Commission for Uniform Methods of Sugar Analysis" (=I.C.U.M.S.A.) units. The acceptable I.C.U.M.S.A. unit range put by the Kenya Bureau of Standards for locally produced sugar is within 300 to 500 taking refined sugar to be 100 such units. The lower the units the better or whiter the sugar but the more costly it becomes to produce as it approaches the refining process, which entails additional expenditure on energy and chemicals. It is not surprising therefore that most factories tend to produce brown sugar given that under government regulations they have to sell all the sugar at the same price irrespective of colour provided it is within the acceptable ICUMSA unit range.

The Miwani Sugar Mills used to operate and still retain machinery for refining but they had to abandon refining as it proved uneconomic, since the price was the same for both refined and unrefined sugar. According to Miwani figures, they used to lose as much as 30% of raw sugar equivalent by weight in the refinery i.e. instead of 670 bags of raw sugar per day they would only obtain 470 bags

per day using the same amount of cane (6 Nov. 8 1977).

### 2.5.3 By-Products of Sugar Manufacture

The range and utilization of the by-products in Kenyan sugar industry is still quite limited. The following are two of the present by-products of some economic significance:-

#### 2.5.3.1 Bagasse:

Bagasse is the fibrous stem waste material left after juice extraction. In Kenya the bagasse is mainly used as fuel in the factory boilers and with the current high world oil prices, the use of bagasse provides a great saving on fuel oil in the industry. It is estimated that 3kg of bagasse with 45 per cent water content is equivalent to one kg. of coal (35 p.101). In some countries, like South Africa for example, other uses of bagasse include the manufacture of particle board, plastics, high quality writing paper and furfural.

#### 2.5.3.2 Molasses:

This by far is the most important by-product of the sugar industry in Kenya. At present some of it is sold locally and used as an ingredient in cattle feeds, while some is used for the manufacture of industrial spirits and fermentation alcohol. So far only Miwani factory has a distillery for spirits attached to it. Unfortunately its capacity is so limited that it cannot even cope with molasses from Miwani factory alone. Molasses from other factories which cannot be sold locally are exported in raw form via Mombasa to Europe and the United States. Due to lack of storage and railway transport facilities some factories have had to run some of their molasses to waste. The production and export figures for molasses in Kenya during the last

decade is given in Appendix IIID, while the price structure for molasses in 1976 is given in Table 2.6 below.

TABLE 2.6: PRICE STRUCTURE FOR MOLASSES IN KENYA- 1976

	<u>K.Sh / tonne</u>
Ex-factory	228.00
Rail transport to Mombasa	72.00
Siding Charges	1.50
Handling Charges	16.00
Warfage	2.50
f.o.b. Mombasa	320.00

Source: Small Scale Sugar Project Report (op. cit)

At the time of writing (1977) a factory intended to utilize molasses for the manufacture of spirits and other industrial products was planned to be put up in Kisumu. This project is expected to expand the domestic market and utilization of molasses in Kenya.

## 2.6 Sugar Marketing System

As a net importer and with neighbouring countries experiencing persistent shortages resulting in smuggling of sugar across the border, the government of Kenya has long been obliged to have full control over the pricing and marketing of sugar. In 1973, this control was further tightened when sugar cane and sugar were both declared special produce under section 190 of the Agricultural Act which also established the Kenya Sugar Authority.

## 2.6.1 Sugar Supply Sources

The sugar found in Kenya's domestic market is either produced in the five local factories or is imported from abroad (see Fig. 2.2 and Table 2.7).

Although consumption still outstrips domestic production, the contribution of the local factories to the domestic market now stands at about 80% as compared to 31% in 1965 (Table 2.7). The share contribution to the domestic market by each of the five factories is shown in section 5.3.2 and Table 5.20.

## 2.6.2. Sugar Distribution

2.6.2.1. The Sole Distributor: The general distribution and marketing of sugar is arranged by the government through the Ministry of Commerce and Industry. The Ministry, through its Department of Trade and Supplies, instructs the various sugar factories in the country to dispatch a stated quantity of sugar to various Kenya National Trading Corporation (KNTC) depots. The KNTC with a system of 18 depots strategically located throughout the country is a government-owned commercial concern which acts as the sole distributor of sugar in the country. It also receives imported sugar from the Kenya Farmers Association (Coop. Ltd) which is the government agent for handling imported sugar.

## 2.6.2.2. KNTC Sub-agents (Wholesale)

The sugar received in the various 18 KNTC depots is distributed further by selling to appointed distributing (wholesale) agents in various consumption centres in the country. To be appointed



TABLE 2.7: PRODUCTION, IMPORT AND CONSUMPTION OF SUGAR IN KENYA 1955 - 1976 ('000 M.T.)

Year	Domestic Production		Imports M.T.	Consumption M.T.	Stocks M.T.	Year	Domestic Production		Imports M.T.	Consumption M.T.	Stocks M.T.
	M.T.	%					M.T.	%			
1955	17	31	28	55	-	1966	36	30	85	121	-
1956	20	31	45	65	-	1967	60	50	61	121	-
1957	20	29	49	69	-	1968	81	61.4	51	132	-
1958	28	39	43	71	-	1969	115	81	27	142	4
1959	28	36	50	78	-	1970	125	79	38	160	9
1960	30	34	58	88	-	1971	124	69	59	183	12
1961	33	35	60	93	-	1972	92	47	114	195	23
1962	33	33	67	100	-	1973	138	64	76	217	20
1963	38	39	60	98	-	1974	163	72	80	224	38
1964	35	33	70	105	-	1975	180	77	50	203	33
1965	29	26	83	112	-	1976	170	77	50	195	25

Source: "Statistical Abstracts" and "Statistical Digest" various issues

NB: % = domestic production as % of consumption; - = None

SUGAR CANE

SUGAR

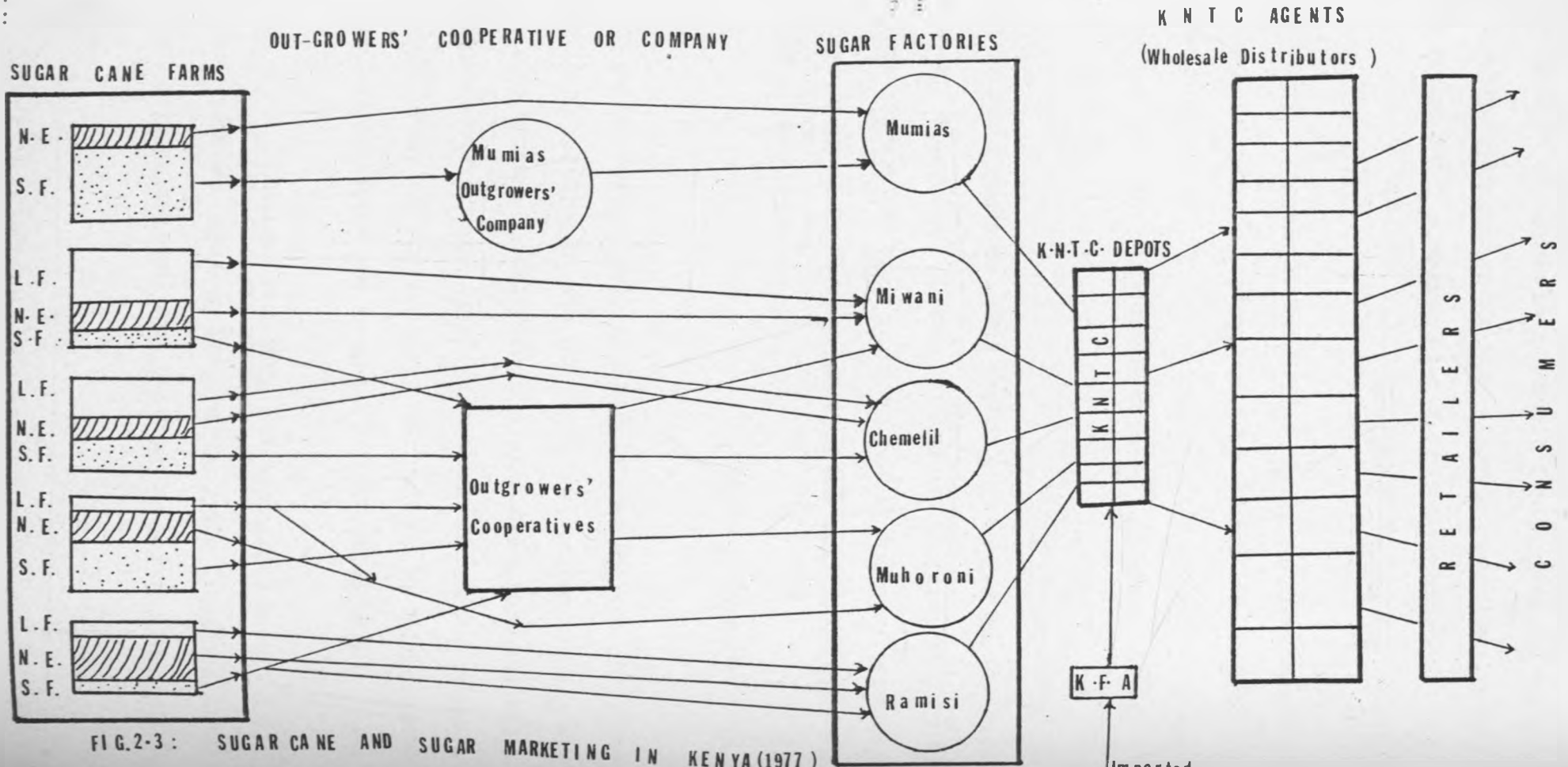


FIG.2-3: SUGAR CANE AND SUGAR MARKETING IN KENYA (1977)

Note: N.E. = Nucleus Estate; S.F. = Small Farms; L.F. = Large Farms

a KNTC distributor for a given area, one has to fill KNTC distributorship application forms in which the applicant states his business experience and financial ability.

2.6.2.3 The Retailers are numerous and scattered everywhere in most centres of consumption. They include and range from small traders in the country-side to kiosk-dealers, shop-keepers, general store dealers, super-market and self-service store owners in the major urban centres. The retailers buy in bulk (at least 100kg-bag each) and sell in smaller quantities as desired by the consumer.

### 2.6.3 Pricing of Sugar

The government of Kenya controls prices for both sugar cane and sugar at all levels of their respective marketing channels. As a corollary, therefore, all the margins ranging from ex-factory to retail price margins are regulated. The government imposes some excise duty on all sugar consumed in Kenya (see Table 2.9 and Appendix III A).

Since 1966 several government legal notices have appeared making successive price increases in sugar and sugar cane prices. Table 2.8 below shows such changes and helps to illustrate the extent of government control in the sugar pricing system.

#### 2.6.3.1 The Pricing Structure

From 1961 to 1972 the government fixed ex-factory price of sugar was linked directly with the Commonwealth Sugar Agreement formula. Thereafter the pricing system seemed to have deviated from the

TABLE 2.8. CANE AND SUGAR PRICES IN KENYA SET BY VARIOUS LEGAL NOTICES 1966-1977

Year/Date	Legal Notice	Cane Price Ksh/tonne	Mill-White Sugar Ex-factory price before excise Ksh/tonne	Consumer Price Ksh/kg
Pre-1966	-	7-38	-	1.55
Oct. 1966	LN 334/1966	45	919.38	1.55
April 1969- 1971	LN 113/1969 } LN 136/1971 }	45	904.90	1.65
March 1972	LN 54/72 } LN 55/1971 }	50	1080	1.85
Jan.-Feb. 1974	LN 35/74	60-62	1230	2.40
March 1975	LN 30/75	90-92	1860	3.50
1976*	-	104.60	1860	4.50
1977*	-	133.00	3700	4.50

Source: Economic Review of Agric. Jan-March 1975

N.B. \* Author's Survey; - Not available

C.S.A. formula (44p.83) even up to the time C.S.A. became defunct in 1975. However in formulating the prices and the trader's margins the government takes into account:- (a) the trend in the rising costs of production at farm and factory levels; (b) the world price levels and the sugar equalization funds requirements needed to subsidize

TABLE 2.9: COMPONENTS AND STRUCTURE OF SUGAR PRICES IN KENYA 1971 - 1976 (Ksh/tonne)

Description	1971	1972	1973	1974	1975	1976
Cane Acquisition Cost (TC/TS=10:1	452.00	500.00	518.00	618.00	894.00	1045.00
Factory Milling Margin	452.90	580.00	562.00	612.00	966.00	1255.00
Price paid to the factory	904.90	1080.00	1080.00	1230.00	1860.00	2300.00
Government Levies:-						
Excise duty	440.90	440.90	440.90	440.90	440.90	440.90
Sugar Equalization Fund	100.00	100.00	100.00	500.00	800.00	1376.00
Distribution Cost	24.70	49.10	49.10	49.10	71.50	70.00
Value as at KNTC Depot	1470.50	1670.00	1670.00	2220.00	3172.40	4186.00
KNTC Margin	18.00	18.00	18.00	18.00	37.60	17.00
KNTC selling Price to Wholesalers	1488.50	1688.00	1688.00	2238.00	3210.00	4203.00
Whole-salers' Margin	34.00	34.00	34.00	34.00	40.00	59.00
Wholesalers' Selling Price to Retailers	1522.50	1722.00	1722.00	2272.00	3250.00	4262.00
Retailers' Margin	127.50	128.00	128.00	128.00	250.00	235.00
Retailers' price to consumers	1650.00	1850.00	1850.00	2400.00	3500.00	4500.00

Calculated from

Source: /Tale & Lyle Report Vol.I p.81 and Small Scale Sugar Production Report Vol III Appendix 1.2

sugar imports in the face of rising world prices; (c) the cost of distribution and the cost of living index in the country with regard to the consumer. Table 2.9 above gives a break-down of sugar prices as per 1971-1976.

Trade margin analysis tends to show that the sugar price structure is heavily burdened with government levies in the form of excise duty, sugar equalization fund and distribution costs. In 1975 for example, the government charges accounted for about 37% of the consumer price while the margins for KNTC, wholesale and retail each accounted for 1.1%; 1.1% and 7.1% of the consumer price respectively. Low trade margins at both wholesale and retail levels (Table 2.10) may be one reason for hoarding and smuggling resulting in shortages in some areas.

TABLE 2.10: SUGAR TRADE MARGINS AS PER-CENTAGE OF SELLING PRICE 1971-1976

	1971	1972	1973	1974	1975	1976
Government	38	35	35	45	41	45
KNTC	1.2	1.1	1.1	0.8	1.2	0.4
Wholesale	2.2	2.0	2.0	1.5	1.2	1.4
Retail	7.7	6.9	6.9	5.3	7.1	5.2

Source: Calculated from Table 2.9

#### 2.6.4 Sugar Consumption and Demand

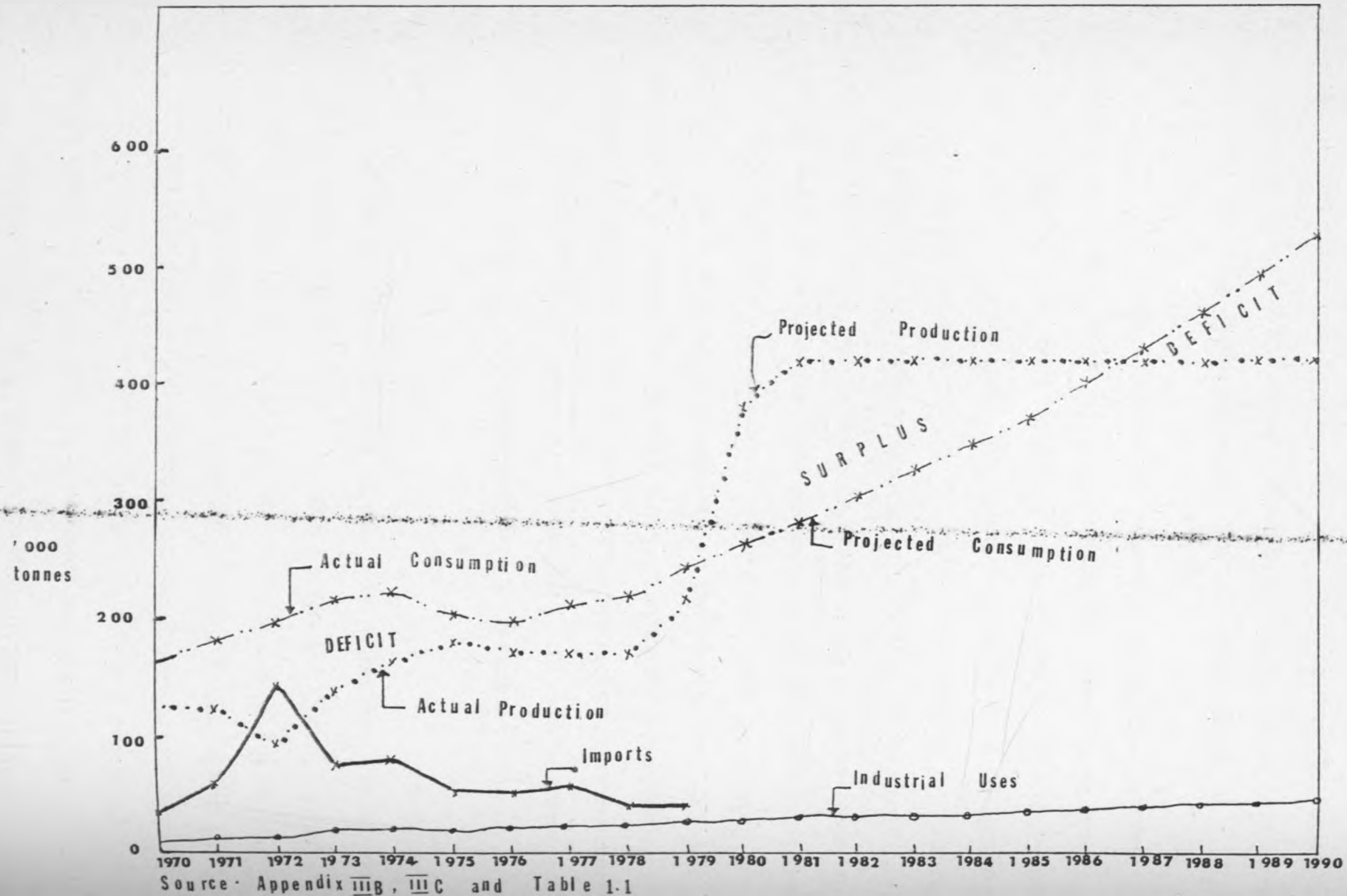
Sugar consumption now estimated to be increasing at 7½% (14.2 op.cit) is determined by several factors, the major ones being:- (i) Disposable income per capita; (ii) Retail price of sugar; (iii) Prices of other products including manufactured products using sugar; (iv) Time trend factors which include such factors as urbanization, improved sugar distribution and transport.

Although sugar consumption in Kenya shows a very close fit to a 7½% increase per annum between 1955 to 1975, in the last two years with the price now at Ksh.4.50/kg there has been a significant break in the trend resulting in a decline in consumption (see Fig.2.4 and Appendix III B). This is because "for the first time in nearly 20 years, the price of sugar has been increased very sharply both in terms of other goods and in relation to disposable income" (10.6 op.cit).

Projections done by the Ministry of Agriculture (10.6 op.cit) forecast self-sufficiency by 1980/81. The same projections forecast deficits re-emerging by 1987 unless new projects, not yet planned for now, are started just before that date (Fig.2.4 and Appendix IIIB).

Industrial sugar utilization in Kenya accounts for a very low percentage of domestic consumption (see Fig. 2.4 and appendix IIIc). However this percentage is expected to increase given the rising per capita incomes and increasing industrialization and urbanization.

FIG. 2-4: GRAPH SHOWING ACTUAL AND PROJECTED CONSUMPTION AND PRODUCTION OF SUGAR IN AERIN 1970



Source: Appendix III B, III C and Table 1.1



## 2.7 Government Facilitating Programmes in the Sugar Industry

Not only has the government of Kenya been a dominant factor in sugar pricing and marketing, but it has also been involved in planning and financing various programmes aimed at facilitating rapid development within the industry. The government has been involved in the construction of new factories through direct investment of public funds. It has also engaged in negotiating foreign loans and expert management contracts to help establish and run the new factories.

Infrastructural development, provision of extension services and research are other programmes undertaken by the government. These programmes invariably entail intricate inter-Ministerial involvement and sometimes a clear-cut dividing line may not be easy to draw with respect to the role played by the various Ministries in the government. The Ministry of Works for example undertakes the responsibility of supplying and maintaining adequate all-weather road networks around the sugar schemes. The Ministry of Commerce and Industry on the other hand provides the distribution depots through KNTC. Technically the Ministry of Agriculture through its Extension and Training Division together with the Crops Division is supposed to be in charge of all the extension work on various crops including sugar cane. However extension services among sugar cane farmers in Kenya are provided by a variety of staff from different institutional organizations.

In the Muhorani zone the Settlement Sugar Organization (S.S.O) instituted by the Ministry of Lands and Settlement is the dominant source of the extension services. In Chemalil and Miwani zones however,

with more powers to control the industry. However at the moment, K.S.A. lays down the blue-print and carries out the appraisal for sugar development and expansion schemes in the whole sugar industry.

In accordance with Chapter 318 of the Agricultural Act, the Minister for Agriculture instituted the K.S.A. to consist of the following:- (i) a Chairman (ii) two permanent secretaries from the Ministries of Agriculture and Finance and Planning (iii) one chief executive officer (iv) farmers' representatives and (v) representatives of sugar factories (40 p Vol. I p.54). The K.S.A is expected to expand both in scope and powers; and at the time of writing (1977) several job advertisements had appeared in local papers requiring some specialized personnel to join the Authority.

#### 2.8.1.2. The Kenya National Trading Corporation (K.N.T.C.)

The KNTC, started in 1965, is a commercial concern owned and financed by the Industrial and Commercial Development Corporation (I.C.D.C.) of the Ministry of Commerce and Industry. The distribution of sugar is solely monopolized by the KNTC. Though initially started to deal mainly with sugar, the KNTC now handles a range of products including salt, cement, textiles, edible oils, rice and various other items. However, sugar still remains the dominant product handled by the KNTC accounting for about 70% of the Corporation's turn-over (Table 5.11). During the field survey for this study, many people interviewed felt that with many products to handle, KNTC's role in sugar distribution left a lot to be desired and there were suggestions that K.S.A. should take over this task.

the Sugar Belt Cooperative Union (S.B.C.U) at present, with the help of a German organization Friedrich-Ebert-Stiftung (F.E.S), is monitoring and co-ordinating various farm activities including extension services to the small scale sugar cane farmers. Thus the Ministry of Cooperative Development has also a role to play in the industry. In the Mumias zone the Sugar Company provides extension and other services in liaison with the newly formed Mumias Outgrowers' Company.

With respect to research, Kenya has a well-established sugar cane research station at Kibos which falls under the Research Division of the Ministry of Agriculture. The station conducts research on various aspects covering breeding, variety selection, agronomy, soil chemistry, sugar technology, entomology and pathology.

## 2.8 Other Institutions involved in the Industry

### 2.8.1 Government Sponsored Organizations:

Although sugar is an important commodity in Kenya, the government control has been direct rather than through a statutory board as has been the case with most agricultural commodities. But now it seems the government has fully adapted a move towards handing over the control of the industry to a statutory body in the face of rapid development in the industry.

#### 2.8.1.1. The Kenya Sugar Authority: (K.S.A.)

This is an advisory body formed within the Ministry of Agriculture in 1972 under legal Notice 32/72 which also declared sugar a special crop. The Authority was started with the initial objective of promoting and fostering the development of cane cultivation and sugar production. In the long-run K.S.A. is intended to be vested

TABLE 2.11: KNTC TURN-OVER FROM SUGAR AND OTHER PRODUCTS  
1965 - 1974

Year Ending 30th June	Value K£ Million			Total	Sugar Value as % of Total
	Sugar	Other	Products		
1965/66	7.5	0.63		8.13	92.3
1967	7.6	0.36		7.96	95.5
1968	8.4	2.90		11.30	74.3
1969	9.1	3.23		12.33	73.8
1970	9.8	4.90		14.70	66.7
1971	11.3	4.72		16.02	70.5
1972	13.8	6.29		20.09	68.7
1973	15.9	8.06		23.96	66.4
1974	18.8	7.08		25.88	72.6

Source: Tate and Lyle Report 1976 (op.cit) Vol. I p.24.

## 2.8.2 Non-government Organizations

### 2.8.2.1 Labour Organizations:

Collective bargaining in the form of a labour union is a legalized process characteristic of most industrial set-ups in Kenya. Nearly all the regular wage workers in the sugar industry are members of the Kenya Union of Sugar Plantation Workers (K.U.S.P.W.) (40p.92). The K.U.S.P.W. acts as a watchdog to ensure that workers enjoy their rights and privileges

as stipulated by law. Thus the Union watches against any elements of injustices like bad working conditions, subsistence wages, long hours and sudden or arbitrary lay-offs, which may be effected by the various sugar firms due to greed or in an attempt by management to earn extra profits. The Union bargains with the respective sugar companies in case of minor problems. For major industrial disputes or if the Union and the employer(s) are at logger-heads on an issue, the matter is taken to the Kenya Industrial Court where the Union bargains with the Kenya Federation of Employers (K.F.E) representing the sugar firms.

#### 2.8.2.2. The Kenya Sugar Manufacturers' Association (K.S.M.A.)

The K.S.M.A is a body formed by the various sugar manufacturing companies in Kenya with the sole purpose of inter-changing ideas among the various firms. The organization also presents sugar manufacturers' views to the government and the Kenya Sugar Authority on various aspects concerning the industry.

### CHAPTER III

#### LITERATURE REVIEW

##### 3.1. Introduction:

This Chapter is intended to analyse and give a summary of available literature deemed relevant to the present study. It is a matter of common knowledge and frequent comment that in developing countries literature on most topics is hard to come-by, and the present study topic is no exception in this respect. For systematic analysis the review will first start with literature on the Kenyan and East African sugar industry before touching on other literature elsewhere.

##### 3.2 Literature on the Kenyan and East African Sugar Industry

###### 3.2.1 Studies by Frank

There is only a limited amount of published material on the sugar industry in Kenya. The most recent and relevant study was by Frank in 1964 under the title of "Sugar Industry in East Africa" (12.3) in which he analysed some problems and policy questions relating to the expansion of the sugar industry in East Africa. "Sugar Industry in East Africa" is a combination of two earlier studies by Frank on "The Production and Distribution of Sugar in East Africa" (12.1) and the "Analysis and Projection of Demand for Sugar in East Africa" (12.2). The two studies had earlier been presented as papers to the East African Institute of Social Research Conference at Makerere University during 1963 and 1964 sessions.

In his study, Frank carried out some analyses which are of relevance to policy makers and planners in the industry:

(i) First, Frank reveals that as far back as 1955 Uganda (now a net importer!) had experienced consistent surplus production over consumption, while Kenya and Tanzania had persistent shortfalls forcing them to import sugar from Uganda and abroad throughout most of the past. Further he observes that there has been a high per capita sugar consumption in urban areas of East Africa and that most of the sugar has been consumed by a small and relatively wealthy proportion of the population. His study also noted the low industrial consumption of sugar which accounted for only about 3 to 5 per cent of total consumption in 1964.

(ii) Using, least squares estimation techniques Frank analysed and projected sugar demand in Kenya and East Africa upto 1970 using projection models estimated with time series data from 1954 to 1963 (12.3 p 33 and 12.2 pp. 1-5).

#### 3.2.1.1 Frank's Demand Model

Given that governments in East Africa always import sugar and sell it at prevailing internal fixed prices, Frank postulated that "the supply of sugar effectively has been perfectly elastic with respect to price" (12.2 p.1), and that all changes in demand are attributable to factors affecting the sugar demand schedule. Such factors include:-

(i) per capita disposable income ( $Z_2$ ); (ii) the retail price of sugar ( $Z_3$ ); and (iii) other time trend factors difficult to measure ( $Z_4$ ). Grouped under time trend ( $Z_4$ ) are factors like:-  
 (a) improvement in transport and distribution;  
 (b) changing food habits; (c) increased knowledge; and  
 (d) changes in income distribution favouring low income households which tend to have higher individual income elasticities (12.2 pp 1-3 and 12.3 p. 39).

Thus the basic demand equation can be written:

$$X = a_1 + a_2 Z_2 + a_3 Z_3 + a_4 Z_4 \quad (\text{Eq I}), \text{ where}$$

$X$  is a measure of sugar consumption on a per capita or an aggregate basis;  $Z_2, Z_3, Z_4$  are as defined in parentheses above. And also for  $Z_4$ : 1954 = 0; 1963 = 9;  $a_1, a_2, a_3, a_4$  are constants.

Under the assumption that the price and income elasticities of demand for sugar decrease with increasing levels of per capita sugar consumption and that the increasing trend in sugar consumption results in a constant absolute increase in per capita consumption over time (12.2 p.5 and 12.3 p.40), Frank formulated the following equation (Eq II) from Eq. I:

$$y = a_1 + a_2 \log_e w_2 + a_3 \log_e w_3 + a_4 w_4 \quad (\text{Eq II});$$

where  $y$  = sugar consumption measured either on an aggregate (total) basis or on a per capita basis;  $w_2$  = disposable income, also measured either on an aggregate or per capita basis;  $w_3$  = retail price of sugar;  $w_4$  = time trend.



A third equation (Eq. III) was also formulated under the assumption that the price and income elasticities are constant and the trend factors result in a constant percentage increase in consumption per unit time (12.5 p.5 and 12.3 p.40 op.cit). Most of Frank's discussions were based on results obtained from this assumption using equation III, formulated as follows:

$$\log_e y = a_1 + a_2 \log_e w_2 + a_3 \log_e w_3 + a_4 w_4 \quad (\text{Eq. III})$$

where  $y, w_2, w_3, w_4$  are the same as above.

From equation III, with:  $\delta y / \delta w_2$ ;  $\delta y / \delta w_3$  and  $\delta y / \delta w_4$  representing partial derivatives one obtains the following:

(i) Income elasticity of demand =  $(\delta y / \delta w_2) \cdot \left(\frac{w_2}{y}\right) = a_2$

(ii) Price elasticity of demand =  $(-\delta y / \delta w_3) \cdot \left(\frac{w_3}{y}\right) = -a_3$

(iii) Percentage rate of increase of sugar consumption per unit time  $(\delta y / \delta w_4) \cdot \left(\frac{1}{y}\right) = a_4$

### 3.2.1.2 Frank's Regression Results

Frank found that the time trend factors ( $Z_4$ ) were highly significant while retail price and disposable income effects on sugar demand were very weak (Table 3.1)

TABLE 3.1 : FRANK'S RESULTS FOR KENYA'S SUGAR DEMAND REGRESSION

Basis of measurement of consumption and income	Income Variable deflated	Price Variable deflated	Constant $a_1$	Income Elasticity $a_2$	Price Elasticity $a_3$	Annual % Trend Increase $a_4 \times 100$	$R^2$	Significant correlation (r) between Independent variables
Per Capita	No	Yes	3.39	0.45	-0.46	3.7*	0.936	Income and Trend 0.84
	Yes	Yes	3.82	0.27	-0.44	4.5*	0.931	None
Aggregate	No	Yes	11.32	0.27	-0.44	7.8*	0.978	Income and Time 0.97
	Yes	Yes	13.72	-0.12	-0.52	6.3*	0.977	Income and Time 0.96

\* Significant at 0.05 level using t test

Source: Frank, C.R.: "The Sugar Industry in East Africa" p.43

### 3.2.1.3 Comments on Frank's Study

In the three works, Frank had in mind the possibility of developing a common sugar policy within the (now defunct) East African Community (12.3 p.10) as opposed to the policy of autarchy. A common sugar policy as envisaged by Frank is now out of the question following the break up of the East African Community. Kenya, Tanzania and Uganda obviously must each pursue a policy of autarchy with respect to sugar and similar commodities.

However, some of his comments on such aspects as distribution, transportation, future expansion and government policy in the industry are still relevant to any current planning or policy issues in the sugar industry. His demand model structure is a useful guide for predictive and projection purposes, but it calls for redefinition of coefficients in relation to contemporary conditions. Frank himself points out that his work should not be regarded as a definitive study of the economics of the sugar industry of East Africa . Indeed ever since his study was done (1964) many changes have taken place in the industry and in the East Africa economies in general.

### 3.2.2 Study by Mwebesa and Owiti

Another study on a similar line is by Mwebesa and Owiti (29) which outlines : factors of production (land, labour and capital), marketing (demand and supply), and policy issues in the sugar industry. In all fairness to the authors, one would say that the paper is actually a summarized version of Frank's book on "Sugar

Industry in East Africa" which bears the same title and to which the authors refer extensively. The authors concede that it is not easy to cover the economics of an important commodity like sugar in a few pages (ten) of their report and that they have left the reader to explore further what they have generalized (29 p.1 and p.10)

### 3.2.3: Ministry of Agriculture Demand and Projection Study

In March 1977, the Development Planning Division of the Ministry of Agriculture in Kenya prepared a paper (of 22 pages) entitled "Projections on White Sugar Consumption in Kenya to 1990, Their Reconciliation with Sugar Production and Policy Implications" (14.6), which among other things dealt with:-

- (i) An analysis of past trends of sugar consumption in Kenya from 1954 to 1976;
- (ii) Pricing Policy and Sugar Consumption;
- (iii) The projections for sugar consumption in Kenya to 1990 and their reconciliation with the proposed expansion of sugar production;
- (iv) The inherent risk in a major sugar export programme; and
- (v) The industrial uses of sugar.

#### 3.2.3.1 The Analysis and the Results

The Ministry's paper analysed the historic trend of sugar consumption in Kenya with data from 1954 to 1976 using a linear regression model (similar to that used by Frank). From economic theory the paper suggested the following demand function for sugar (14.6 p.3).

$D_S = f(Y, P_S, P_N, T)$ , where  $D_S$  is demand for sugar Kg/capita;  $Y$  is income per capita;  $P_S$  is price of sugar;  $P_N$  are prices of other products including manufactured products using sugar;  $T$  is a trend term.

After modifying the above demand function and running several regressions using consumption as the dependent variable and deflated disposable income and retail price, and time trend as the independent variables; only disposable income and time trend came out as significant explanatory variables in the regression. Therefore, there have been upwards shifts in demand explained by rising income and time trend, but a meaningful price-quantity relationship (change in demand) was not established, no doubt because of the relatively stable pattern of controlled sugar prices between 1954 and 1976.

Thus the paper's resulting equation was:

$$C = 0.25 + 0.36 Y_d + 0.30T, \text{ with } R^2 = 0.955 \text{ where}$$

$C$  = sugar consumption, kg/capita/annum

$Y_d$  = deflated disposable income, K£/capita /annum.

This regression result means that "for each increment in per capita deflated disposable income of K£ 1, sugar consumption increased by 0.36kg per capita; and each year that passed, per capita consumption increased by 0.30kg" (14.6 p.7)

Using this regression result and taking into account the annual growth rates of population and disposable income the authors projected future sugar consumption for Kenya upto 1990. The forecast is that consumption will be 260 thousand tonnes by 1980 rising

to between 358 and 375 thousand by 1985 and reaching about 500 thousand by 1990.

In its concluding remarks the paper advocates inter alia: (i) a slower rate of expansion especially after attainment of self-sufficiency in 1980/81. Expansion schemes should restart by 1987 when shortages may re-emerge; (ii) the use of price policy to regulate demand to enable orderly expansion, given the high cost of expansion and limited resources; (iii) a modest rather than an ambitious export programme, given the unreliability of world sugar prices; (iv) an appraisal of the starting of refining plants, given the inevitable rise in industrial sugar consumption projected to be about 40 thousand tonnes by 1990; (v) the need to appraise other refined sugar substitutes like jaggery and corn sugar .

#### 3.2.3.2. Comments on the Paper

The above paper is the most recent one on sugar projection and demand analysis in Kenya. It points out that the trend in the sugar industry cannot be reversed but must be met by appropriate economic, technological and institutional adaptations. Policy makers and planners in the industry ought to be familiar with the paper and take to heart some of the points raised.

Of course the predictions made in the paper assume successful rehabilitation of existing sugar schemes and the completion of the planned new projects. It is therefore relevant to the present

study which looks into the structure and performance of the industry.

### 3.2.4 General Studies

3.2.4.1. Few authors have made a specific study to the sugar industry in Kenya. Heyer, et al (18 pp 334-337) tackled briefly a few of the current problems in the industry but not with an analytical perspective. Heyer remarks that the major sugar marketing problems include: "pricing policy, under-utilization of factory capacity and excessive factory costs, inefficiencies arising from the system of appointment and remuneration of sugar whole-salers and retailers, and illegal sales to Uganda resulting in local and national sugar shortages" (18p. 335).

She further notes that "producers have been paid too little and this has clearly affected supply of sugar cane to the factories and resulted in a great deal of under-utilization of factory capacity in the past" (18 p.336). Heyer further alleges (without any empirical evidence) existence of malpractices and favouritism in appointments of sugar distribution agents, whereby "influence rather than efficiency or ability to distribute sugar" is the basis used for selection (18p 337).

Heyer's paper raises many points which have lasting and far-reaching significance to current policy issues in the country's sugar industry. These problems warrant urgent attention in the process of modernization of Kenya's sugar industry and the present study looks at some of them.

3.2.4.2: Tate and Lyle Report:

This study was done under joint World Bank/Kenya Government sponsorship and gives a general description of the present sugar industry in Kenya with a view to recommending strategy for rehabilitation, improvement and expansion of factory and farm facilities for stepping up production. It is a general study but the final report is not circulated outside Government of Kenya. Therefore it would be prejudicial to comment on the findings.

3.2.4.3 Small Scale Sugar Production Study:

The Agro-Invest Industrial Consultants and Management Agents group (2) carried out in 1976 a survey on the feasibility of "Small Scale Sugar Production in Kenya". This study done on behalf of the Ministry of Agriculture also gives an over-view of the present sugar industry and concludes by recommending the desirability of setting up at least 60 small scale "open pan" or "mini sugar plants" in various parts of Kenya (see Appendix V). Already two such factories are ready, one in Kakamega District, at Kabras, and the other in Siaya District, at Yala.

Despite Agro-Invest's defence of the small scale sugar plants on the basis of "appropriate technology" and socio-economic benefits, many people in the industry tend to view the scheme with skepticism especially from the standpoint of economies of scale and cane conversion rates into sugar in such "mini plants".



### 3.2.5 Agronomic Study.

3.2.5.1. Acland, J.D. (1) gives a clear description of the geographical distribution, ecology and agronomic practices for sugar cane in Kenya and in the whole of East Africa (1 pp. 192-201). His work under the title of "East African Crops ...", is a good handbook for farmers, farm managers, extension workers and scholars in Agronomy.

Written by an agronomist, some of the recommended levels of variable inputs may reflect ideal agronomic applications. Most of the prescriptions are "blanket recommendations" for good cane husbandry practices, leaving economic implications to the extension services or the farmer to decide on. Although Acland describes agronomic practices with which most people engaged in sugar cane production are quite familiar, the implications of his prescriptions on the other hand may be a complete mystery to the majority of farmers, as evidenced by low yields obtained on most sugar cane farms. It remains the task of agricultural economists to constantly appraise and adjust these recommendations in the form of farm management guidelines to suit changing farm input and farm product prices. Acland need not be over-criticized for the extent to which his agronomic practice recommendations dominate all other economic considerations.

### 3.2.6. Geographical Studies

Other studies connected with the sugar industry in Kenya include geographical studies by Obara (31), Ochung (32) Ogungo(30),

and Oduol (34). Written by geographers, they are necessarily superficial and less comprehensive on agronomic and socio-economic problems of the industry.

However, the most striking study in this field is the one by Obara (31), which in many geographical aspects reviews the problem with a multi-disciplinary approach. In his conclusion Obara noted some problems of agricultural production affecting performance in the Nyanza Sugar Belt where he did his study. These problems include:- "farmer's age and health; lack of title deeds; lack of dynamic leadership; absenteeism; land disputes; incomplete migration of family to the sugar farms; illiteracy; religion; unavailability of credit schemes and fencing materials against wild animals" (31 p.219).

To solve these problems Obara recommends a multidisciplinary approach among scientists towards the study and solution of the problems in the industry.

### 3.3 Literature from Other Countries.

Outside of East Africa, there are numerous publications on sugar in general and industries in particular. However, given the East African and Kenyan geographical, economic and social setting only a few may be cited as relevant to our sugar industry:

3.3.1 Hirsch (20) in 1959 made a study of North India's sugar industry. In the study he gave a description and analysis of the industry as regards background setting, procurement, marketing and

consumption. However, Hirsch's work lacks relevance for Kenya's current situation given lapse of time since its publication and the Indian conditions in which the study was made. One other aspect worth noting in Hirsch's work is the proportion of the study devoted to jaggery and other sugar sweetening products, which in most studies are often ignored.

3.3.2 Smith (40) edited on behalf of "Sugar Y Azucar

Journal" publishers, a series of five volumes of "Sugar Y Azucar Yearbooks". The fifth volume in this series published in 1976 carries an extensive study of sugar industries in Africa including Kenya. To prepare this volume Smith had to make extensive tours to various parts of Africa visiting sugar factories and plantations and carrying out discussions with various private and government personnel.

During his study tour in Kenya, Smith noted (though citing no statistical data) many problems some of which were:

(i) Continued high levels of sugar imports in Kenya despite expansion schemes in the industry.

(ii) The tendency among independent outgrowers to take off a larger number of ratoons than the plantations, where the practice is to have cane production cycles of one plant crop and two to three ratoons.

(iii) Poor stands on outgrower farms resulting from poor land preparation and planting techniques and inadequate or total lack of fertilizer application.

- (iv) The unsatisfactory factory-grower and employer-employee relations which seemed not to have achieved the importance they have in other countries.
- (v) Problem of adequately trained technical and skilled Kenyans for posts requiring special scientific and managerial training; people trained in such jobs "prefer to live in the major urban centres, rather than isolated sugar properties" (40 p. 91).
- (vi) Problems of research and development in the industry which included substantial past reliance on research results from South Africa.

Smith's study though short and lacking in statistical analysis gives a fair over-view of the status of the industry at present. According to the publishers, Smith's research "..... of the sugar industry of this vital continent is the most extensive ever undertaken" (40 p.3).

3.3.3 Paturau (37) in his paper presented to a Joint UNEP/UNIDO seminar on the "Implications of Technology Choice in the African Sugar Industry" dealt with question of "economies of scale in the sugar industry" using his experience with the sugar industry in Mauritius.

On cane growing, Paturau observed that large estates and smallholder cooperatives can use mechanized implements for land preparation, fertilizer application, planting, herbicide treatment, cutting and loading which would not prove economical on very small

fields. This is an important aspect to note for our Kenyan situation.

On processing he stresses that under-utilization of factory capacity or its over-utilization will lead to increased milling cost per tonne of cane. The former causing cost increases through idle capital and the latter through rapid wear and heavy maintenance. He observes that earlier studies show that with each factory working at its designed optimal capacity there is a general trend towards lowering of production cost with increasing capacity.

As an approximation he gave (without any statistical support) relationships between capacity and three categories of cost items in the cost structure of sugar production as follows:

(i) That cost ratio of factory employees does not increase in direct proportion to the factory capacity, but that it increases fairly slowly with capacity; it increases as the  $2/10^{\text{th}}$  power of the ratio of capacity. Thus:  $\frac{P_1}{P_2} = \frac{C_1^{0.2}}{C_2^{0.2}}$ , where  $P_1$  and  $P_2$  represent original and new costs of employees respectively, and  $C_1$  and  $C_2$  represent original and new capacities respectively.

(ii) Capital cost ration of a factory varies approximately with the  $7/10^{\text{th}}$  power of the capacity ratio. Capital cost includes costs of depreciation, repairs, maintenance and plant insurance.

(iii) All other costs may be assumed to vary directly with the capacity of the factory.

Paturau concludes that a large central sugar factory can prove beneficial given efficient organization. However, it is worth noting that interesting as these findings may be, they were obtained under Mauritius conditions and are not supported by any hard statistical data.

#### 3.4. Literature on the International Sugar Situation:

On the international sugar marketing scene literature is abundant, with some noteworthy references mentioned below:

3.4.1. Hegelberg and Harris (16) in their paper "Pluralism and Uncertainty in the World Sugar Economy" examine current trends and development in world sugar trade and sound a warning about uncertainties facing the world sugar economy, but conclude that with some policy adjustments a balance between supply and demand does seem likely. The authors note that recent developments in the sugar economy are only imperfectly understood:

"Never before has the world sugar economy faced so many uncertainties. Developments such as the quintupling of oil prices between 1972 and 1974, the increased monetary and trade instabilities of the 1970's, the lapse of the U.S. Sugar Act since 1975, the replacement of the Commonwealth Sugar Agreement by the Lome Convention, also in 1975, and increased threat of product substitutes, have all served to change the rules of the game....." (16 p. 271).

These authors further note that arbitrary government policy changes and unpredictability of world sugar developments in

individual countries, and the absence of regular and reliable forecasts, are the crucial uncertainties in the world sugar economy.

Remarks by Hagelberg and Harris are relevant and worth noting especially if Kenya has to pursue a policy of self-sufficiency which may entail exporting sugar in the world market.

3.4.2. Another publication of relevance on the international sugar situation is the "International Sugar Colloquium Official Report" published in 1975 (23). The report reviews present and future prospects for world sugar production and demand during the next ten years. The colloquium received contribution from many participants. On the outlook for international sugar trade a participant noted that " despite the break-down of some of the special Arrangements in the international sugar trade, these will one day be reconstituted in some form and will cover the bulk of movements in world sugar" (23 p. 13). However, another participant sounds a warning that "there is considerable uncertainty about world forecasts for 1980 and beyond owing to many political decisions and factors. If producers and governments do not change their policies there will be no chance of producing the 100 million tonnes which are needed and the world will run short of sugar". (23 p.3).

It is such uncertainties in the world sugar situation that makes it really necessary that Kenya develops her sugar industry by every means possible including economic research studies.

2.4.3: Other publications touching on the International sugar situation include: F.A.O., "Committee on Commodity Problems 1974" (10.2) and F.A.O: "Commodity Review and Outlook 1975/76" (10.1) reports which also point to the uncertainty in the future world sugar market. These reports note the rising sugar consumption and current prices, paralleled by world sugar shortages and increasing production and expansion costs.

Timoshenko and Swerling (27p. 344) had in 1957 warned that "sugar can hardly insulate itself against the effects of general inflation or deflation of commodity prices".

### 3.5: Concluding Remarks on the Literature Review

In conclusion to the Literature review of the Kenyan and world wide sugar industry we can note that most of the observations made by the various authors cited are relevant to current sugar policies and schemes in Kenya. Particularly in reading the existing literature one feels the need for further research and constant appraisal of certain aspects of the sugar industry in Kenya. The current study which looks into the structure and performance of the Kenyan sugar industry goes a long way in trying to bridge some of the gaps. Thus such aspects as industry concentration, integration schemes, institutional and technological problems including that of excess capacity are now treated by the present study.



Thus it is really from the inadequancies of existing literature on the economics of the sugar industry in Kenya that the research has been guided in its emphasis. And therefore while the literature may have suggested certain areas for investigation, it is true to say that the study undertaken has very much had to depend on independent and first-time inquiry.

## CHAPTER IV

### OBJECTIVES AND METHODOLOGY

#### 4.1 Objectives of the Study

The relevant objectives of the study can be summarized generally as follows:-

- (i) To analyse the structure, conduct and performance of white sugar production and marketing systems.
- (ii) To identify some of the major constraints in the industry at production, processing and marketing levels.
- (iii) To look at specifically and determine the extent of excess capacity in sugar factories in the Nyanza Sugar Belt and relate it to the whole industry.
- (iv) To examine the root causes of such excess capacity.
- (v) To determine the extent and causes of the cane procurement (supply) problem in the Nyanza Sugar Belt and relate the problem to the whole industry.

#### 4.2 Questions Answered in the Study:

Against the background of these general objectives the study attempts to answer the following questions:

- (i) What are the major factors affecting sugar production? Who grows sugar cane? What problems face the sugar cane growers and to what extent, if any, do such problems affect the industry's performance? What area is under cane for white sugar? How much sugar cane is produced and by how much can this be increased from economic and agronomic standpoints?

(ii) Who own sugar factories? How much sugar does each factory produce? What are the normal capacities of the existing factories, and to what extent are these capacities under-utilized? What are the causes of such under-utilization of capacity? Do factories experience cane shortages? If so when and why? What is the role of the nucleus estates? What costs are involved in sugar production?

(iii) What are the major institutional organizations involved in the production, processing and marketing of both sugar cane and sugar? How efficient are these institutions?

(iv) To what extent if any is there vertical and horizontal integration in the sugar industry?

(v) To what extent is the government involved in the industry and how does this affect the industry's performance?

#### 4.3: Methodology

4.3.1. Hypotheses were formulated as counterparts of the objectives set and questions answered in the Study. Specific hypotheses tested were:-

(i) That unit production costs differ significantly between the outgrower farms and the factory managed nucleus estates:

To test this hypothesis it had been originally intended to get the cost structures for both the nucleus estates and the individual outgrower farms sampled. As it turned out, many farmers particularly some members of the cooperative movements did not know how much they spend on cane production. This is because most cooperative societies undertake all cane operations and only deduct

their costs when cane is marketed. It was decided to test the hypothesis by using service charge rates used by the Cooperatives together with charge rates recommended by the "Land Preparation and Seedcane Costs Sub-committee" appointed by the Joint Milling Committee and the Kenya Sugar Authority. These charges were calculated and compared on a per hectare basis with the nucleus estate costs provided by the companies.

(ii) That cane yields per hectare on outgrower farms are far below the yields realized on nucleus estates, because the cane fields in the nucleus estates are managed better than those on outgrower farms:

To test this hypothesis the farmers sampled were asked what yields they realized with both plant and ratoon crops on their farms. They were also asked how often they weed and when they carry out other farm operations. Further more, they were asked to rank in importance the cane production problems they experience on their farms. The nucleus estates were also asked to give their comparative yields and respective production problems.

(iii) That at least some of the factories often work below capacity and that this results from the problem of cane procurement:

In order to test this hypothesis information regarding each factory's nominal capacity and actual output was sought using a questionnaire (see appendix II). Technical excess capacity for each factory was calculated on the basis of actual output figures

expressed as a percentage of nominal capacity. Further information gathered from some sugar experts pointed out that the nominal capacity of a factory very much approximates the economic optimal capacity. An index of capacity was then constructed using Mumias as the base, since Mumias in 1976 managed to operate at 91% nominal capacity. The factories were also asked to give reasons if any, for the excess capacity.

(iv) That the factory zoning system meant to define the catchment area of each factory is not satisfactory to both farmers and the factory managements:

To test this hypothesis farmers were asked in the questionnaire whether or not given free choice they would remain under the same factory zones. The farmers were also asked to rank the factories according to their preference and give reason for such ranking. The views of the various factory managements and the Kenya Sugar Authority regarding the zoning system were also sought.

(v) That outgrower farms respond to price changes:

A cross sectional response to price changes was sought by asking the farmers whether they would increase, decrease or have no change at all on their current cane acreages (a) if cane price was increased by KSh 25 per tonne; (b) if the price remained as it was at KSh 133 per tonne; (c) if the price per tonne decreased by KSh 25.

(vi) That there are barriers to entry in the sugar industry:

To test this hypothesis; first, farmers were asked whether they ever sell their cane anywhere else apart from the sugar factory in their zone. The sugar company managements and the Kenya Sugar Authority officials were also interviewed about the prospects of starting new factory schemes.

(vii) That the distribution system is inefficient and the reason for this includes the monopoly of sugar distribution by the Kenya National Trading Corporation (KNTC):

The sugar companies' views regarding KNTC were sought through a questionnaire. Through interviews with some government officials and other private individuals in sugar trade further views were sought. The KNTC officials were also interviewed to get their views.

#### 4.3.2. Data Collection

The study is based on both primary and secondary data.

##### 4-3-2-1. Primary Data Collection

###### A. Location of the Study

Due to limited money and time it was decided to conduct the field survey mainly in the Nyanza Sugar Belt covering Chemelil, Miwani and Muhoroni sugar factories and their outgrowers. The map of the study area is shown on the next page (Fig. 4.1). Ramisi and Mumias areas were excluded in the primary data survey. However, copies of the companies' questionnaire used in the survey was posted to them to get more information about them to augment the secondary data sources, but only Mumias responded.

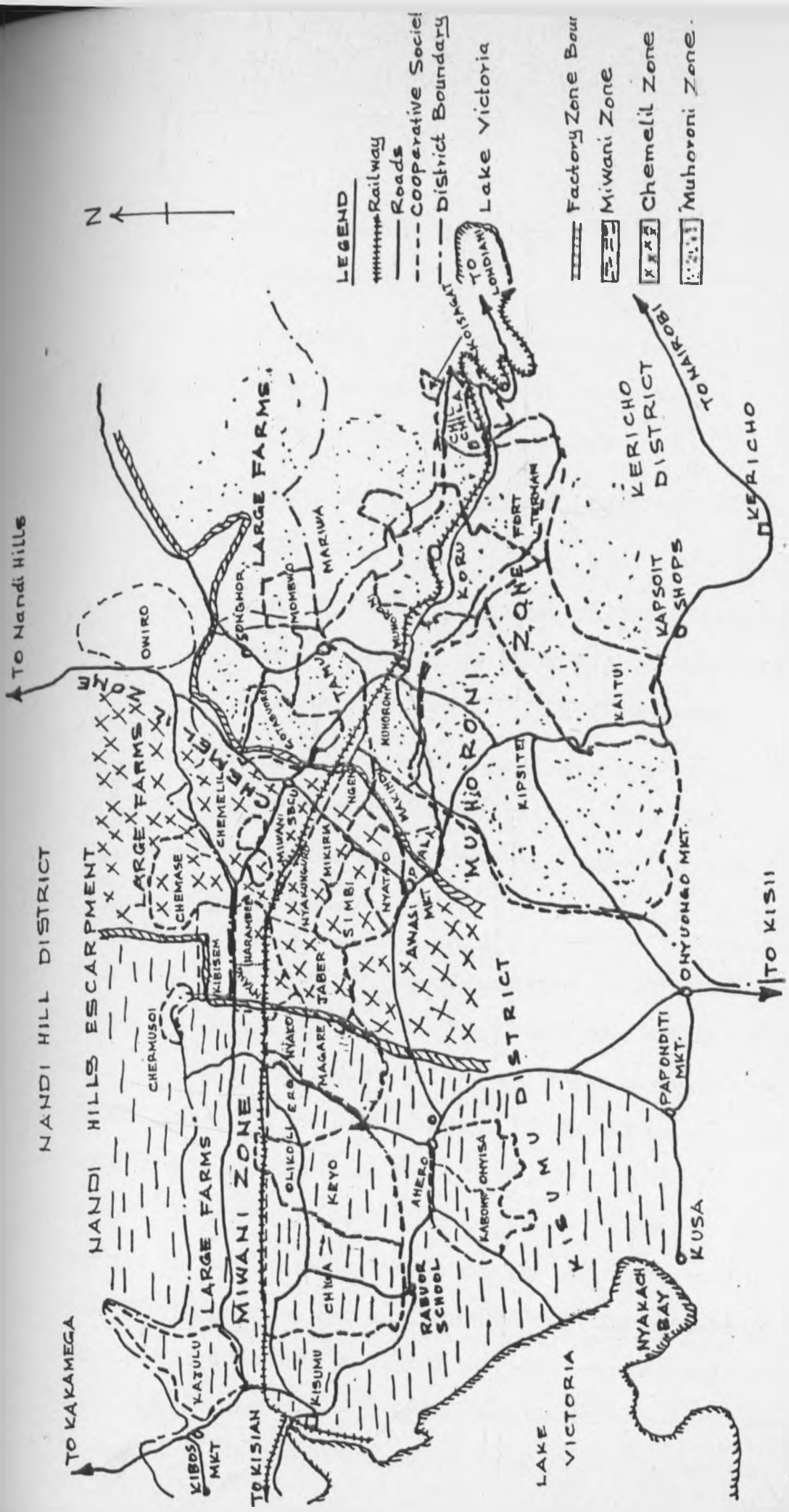


FIG.4.1 MAP OF THE NYANZA SUGAR BELT SHOWING FACTORY ZONES, COOPERATIVE SOCIETIES AND - THE INFRA-STRUCTURE

The following reasons led to the choice of the Nyanza Sugar Belt for the study:-

(i) This area has three out of the five sugar factories in Kenya and at present accounts for about 58 per cent of the total annual sugar production in the country.

(ii) The three factories in this area represent two distinct types of ownership, namely:

(a) private ownership in the case of Miwani which would hence be expected to simulate the management and administrative set up found in Ramisi, another privately owned company.

(b) Government sponsored or semi-government owned factories as in the case of Chemelil and Muhoroni each with over 80% government share. These two latter cases therefore represent to some extent the situation in Mumias.

(iii) In the Belt are also found outgrowers of different economic, ethnic and social backgrounds. The farmers here are from three major ethnic groups, viz: (a) the Asians, (b) the Luos and (c) the Kalenjin (the Kipsigis and the Nandi) tribes. The farms here also consist of both large scale and small scale farms, which is not the case in the Mumias zone where all outgrowers are small-holders. The small scale farmers in the Nyanza Sugar Belt are further categorized into private, cooperative and settlement farmers. The Settlement farmers acquired land through government settlement schemes and their case is unique in that their farm plans and budgets are structured according to the settlement scheme regulations. In this area are



also farmers who have been there for long, formerly engaged in subsistence agriculture and have just recently shifted to commercial cane growing with the emergence of the new factories at Chemelil and Muhoroni.

(iv) The Belt is also unique for study in that it is where geographical or locational concentration of the sugar firms seems to have occurred in Kenya despite the fact that the area is not all that big.

(v) Lastly the three factories were reportedly experiencing cane procurement problems with subsequent utilization of factories below capacity. This latter reason needed urgent research attention.

## B. The Survey

The survey was conducted from April-June 1977 using:-

- (a) Interviews with the sugar companies in the Nyanza Sugar Belt;
- (b) Farm Surveys;
- (c) Interviews with officials from various government departments, the statutory bodies and other organizations involved in the sugar industry.

### (a) Sugar Companies' Survey

A standard questionnaire was used to gather information from all the three sugar companies in the Nyanza Sugar Belt (see Appendix II). The respective personnel and administrative managers of these factories were contacted to arrange for convenient interview dates. As it turned out, all the three companies needed more time to study the questionnaire before they could fill it. On

average they each took two to three weeks to fill in the questionnaire. With the exception of Chemelil, the other two factories did not respond well to some of the questions, and in some instances were either reluctant or totally unwilling to divulge certain information.

Apart from the structured questionnaire, arrangements were also made through the respective personnel departments to have appointments with the various departmental heads in the three companies. Through such arrangements and where possible the following were interviewed in each company:- the General Manager, the Chief Accountant/Company Secretary, the Agriculture Manager, the Factory Manager, the Personnel Manager and other section heads. This type of interview was conducted using some question guides and in most cases was in the form of discussion to find out problems and viewpoints of these people as regards the industry in general and their company and the sections they head in particular. Extensive notes were taken during such discussions, and in fact these meetings appeared more informative than the formal questionnaire.

(b) Farms' Survey.

The farms' survey was conducted using a standard questionnaire different from the one used for companies' survey, (see appendix I). Two assistants were trained to help the author interview a total of 130 small scale farmers. The large scale farmers (15 in number) were exclusively interviewed by the author. The term "large scale farm" is used here to refer to farms of 50 acres (20 hectares) or more in size. This is the definition being used by Chemelil Sugar Company.

Having discovered that the three companies had no comprehensive lists of the farms in their respective factory zones, it became obvious that making a random sample using such a list which could have been a simpler exercise, was out of question. Only Chemelil had such a list but only for its 22 large scale farms and none on small scale farms.

From the information gathered from the Cooperative Unions and the government officials, it was estimated that there were about 10,000 small scale farms in the Nyanza Sugar Belt. Each factory zone was estimated to have between 3000 to 4000 small scale farms. The large scale farms are estimated to number about 100 in the whole Sugar Belt with Chemelil and Muhoroni each having about 20 farms while the rest are under Miwani.

It was decided therefore to use a stratified two stage cluster sampling technique to include both the small scale and large farms in the survey. The Nyanza Sugar Belt was divided into three primary cluster units using the factory zones as the basis for the division. Further sampling units in each factory zone were defined with the aid of the map of the area as described below and the samples were drawn as follows:-

(i) Muhoroni Zone:

Farmers in the Muhoroni Zone were put into eight cluster units. The first seven clusters were based on the Settlement Scheme sub-divisions, namely: God Abuoro, Songhor, Oduwo, Muhoroni, Tamu, Koru, and Fort Ternan sub-scheme areas. The eighth cluster was defined to cater for non-settlement scheme farmers in the

area bordering the Kisumu-Kericho main road. Fifty small scale farmers were randomly picked from these 8 clusters aiming at 6 or 7 farms in each cluster. The first farm in each cluster was selected arbitrarily. To make the exercise approximate random sampling home-steads were used as a proxy for farms. After interviewing a farmer in one home, the next three homes in the immediate area were skipped before picking a home for interviewing another farmer. In case of no response the next home was picked. The exercise was repeated in Songhor and Koru areas to pick 5 large scale farms in this area.

(ii) Chemelil Zone

A total of 40 small scale farmers and 5 large scale farmers were interviewed in the Chemelil Zone. Since Chemelil had a list of its 22 large scale farms, a random sample was drawn from this list by writing down the name of each farm on a piece of paper then mixing the papers in a container from which the 5 farms were selected.

As for the small scale farms, a sample was drawn by dividing the Chemelil Zone into 6 distinct subdivisions with the aid of a map. Using the map, three parallel lines were defined made up of the Kisumu - Muhoroni road, the Kisumu - Nairobi railwayline and the Kisumu - Kericho road which were used to divide the zone from East to West. Three other feeder roads linking the Kisumu - Kericho and the Kisumu - Muhoroni major roads were further used to make the 6 cluster units. As in the case of Muhoroni 6 or 7 farms

were picked from each cluster unit by using homesteads to represent farms, skipping every 3 other homes after each interview and replacing a non-response home with the next.

(iii) Miwani Zone: In the Miwani zone as in Chemelil, 5 large farms and 40 small scale farms were sampled. For

the small scale farms the zone was sub-divided into 4 cluster units using the same railway line and the two major roads as in Chemelil and the local feeder roads. About 10 farms per cluster unit were picked using the same technique used under Chemelil.

The large farms in Miwani zone are concentrated just between the railway line and the Nandi Hills escarpment and were only divided into two clusters east and west of the factory. Sampling was done by picking up one farm and skipping every other 5 farms before picking another.

The Farm survey can be summarized in a table form as below:-

TABLE 4.1. SUMMARY OF FARM SURVEY PROCEDURE FOR RANDOM SAMPLING  
(APRIL - JUNE, 1977)

	Estimated*		Sample Size		Cluster Units	
	L.F.	S.F.	L.F.	S.F.	L.F	S.F.
Muhoroni	20	3000	5	50	2	8
Chemelil	22	3000-4000	5	40	List	6
Miwani	60**	3000-4000	5	40	2	4

Note: L.F = Large Farms; S.F. = Small Scale Farms

\* = Estimated on basis of factory information and Cooperative files:

\*\* = Subsequently found to exceed these numbers on basis of Central Bureau of Statistics Sugar

C. Interviews with Other People:

The information gathered through interviews and discussion with people connected with the sugar industry form an important part of this study. The following categories of people were interviewed or consulted during the study and extensive notes were made during such consultations:-

(i) The Settlement Scheme Officials:

- the settlement scheme Area Controller at Muhoroni
- the settlement field superintendents and supervisors working with the cane farms.

(ii) The Cooperative Officials:

- The Sugar Belt Cooperative Union (S.B.C.U.);
- Friedrich-Ebert-Stiftung (F.E.S.), a German organization advising the cooperative movements in the area;
- Ministry of Cooperative officials.

(iii) The Ministry of Agriculture Officials : both field extension staff and the research staff at Kibos Sugar Research Station.

(iv) The Kenya Sugar Development Authority Staff.

(v) The Government Administrative Staff (the local chiefs and the district officers).

4.3.2.2 Secondary Data Collection

Extensive use has been made of relevant literature and statistics as valuable source of information during the study. The information gathered from secondary source include:-

- (a) the sugar consumption patterns and production levels in Kenya;
- (b) the projected consumption and production;
- (c) the proposed sugar schemes;
- (d) the government policy on the sugar industry;
- (e) the world sugar situation and outlook.

The secondary data forming part of the survey was mainly gathered from:-

- (a) The Central Bureau of Statistics in the Ministry of Finance and Planning;
- (b) The Government annual reports made by provincial and district heads in the Ministries of Agriculture, Cooperative Development, and Lands and Settlement;
- (c) The Feasibility Studies on sugar projects done in Kenya by various consultancy firms.

#### 4.3.3 Data Analysis

Both the primary and secondary data collected were analysed to get a consistent information about the sugar industry. Descriptive analysis, supplemented by relevant statistical data, has been used to describe the agronomic, processing and marketing conditions. The computer facilities at the University Institute of Computer Science were used to analyse both quantitative and qualitative data gathered from farmers. This was mainly aimed at finding out the problems facing the sugar cane farmers.

(i) In carrying out computer analysis of farmers' problems, first, the questionnaire was recoded to suit available computer programmes. In all, 165 quantitative and qualitative variables were coded. For quantitative analysis the ICL Computer XDS3 programme was used to run a correlation matrix for 43 selected quantitative subset variables to determine their importance for further analysis.

From the same 43 subset variables some linear regression analysis was done using the same XDS<sub>3</sub> programme to find out what factors related to cane acreage and other farm enterprises on the farm. First a general regression was run with all possible variables from the subset just to see the effects of these variables.

Later, fewer variables were selected for further regression to determine how they are related to cane acreage. These included such variables as farm size, subsistence acreage, maize acreage as a cash crop, other cash crop acreage, cane yield, family size and permanent labour. Other variables were excluded either because of too many missing values or due to low correlation. The variables excluded are such variables as number of years of farming, amount of credit, amount of grazing land, family labour and casual labour.

(ii) The "XDS<sub>3</sub> programme" was also used to calculate the means, the standard deviations, the minimum and maximum values of the quantitative variables.

(iii) For qualitative analysis of farm survey data, the "ICL EDIT programme" was used to count the frequency of response to a qualitative question. This procedure helped sort out the numbers



of farmers with similar responses. An electronic calculator was then used to compute the percentage of response for a given sample. Cross tabulations were done for each qualitative variable to show the number of respondents and the percentage of response.

(iv) The sugar companies' questionnaire was however analysed with the aid of an electronic calculator because only four factories were involved.

(v) Secondary data were also analysed by electronic calculator.

#### 4.4. Problems Encountered in the Study

Many problems were encountered during the course of this study, but the following are worth mentioning:-

(i) Lack of response from some farmers especially absentee farmers who left instructions for their managers not to release information without their consent. This was particularly serious on large farms.

(ii) Though the timing of the field survey in the April-June period was desirable in order to find the farmers at their busiest, it was unfortunate that in 1977 the long rains in the area at this time were exceptionally heavy and made communication difficult.

(iii) Some important variables in the questionnaire turned out to have many missing values, especially for cooperative farmers, who were unable to tell more about their farms because the cooperatives sometimes take over farm operations leaving the farmer just as an observer. This made analysis more difficult.

(iv) Some sugar companies were also unwilling to divulge some information about their firms. Such data could not be released from the Central Bureau of Statistics (C.B.S) without some consent from these firms as there is a legal clause preventing C.B.S. from giving out such data without prior permission .

## CHAPTER V

### DESCRIPTION OF ANALYSIS AND RESULTS

#### 5.1 Introduction:

The sugar industry is a heterogeneous collection of enterprises and functions tied together by common product interest and a variety of economic and social forces. The analysis of the industry therefore includes such sectors and institutions as the farming, transportation, processing and distribution systems. In this section the farming and processing sectors are analysed.

#### 5.2 The Farming Sector: Structure, Conduct and Performance

Three categories of farms supply sugar cane to the factories. These are the factory nucleus estates, the small scale farms with less than 20 hectares of land each, and the large scale farms each with over 20 hectares. The nucleus estates are large plantations averaging about 3000 hectares.

##### 5.2.1 The Number and Sizes of the Sugar Farms:

Census data on actual number and sizes of sugar farms are lacking, except for the large farms and hence it is not easy to give a precise statement with respect to the number and size per se. This study estimated that in 1977 there were altogether 19077 sugar cane farms in Kenya serving the existing five sugar factories. This number excludes the five factory nucleus estates. Of the 19077 farms, 123 are large scale farms and the rest are small scale farms. It was further estimated that excluding labourers employed, these farms supported about 160,000 family members

living on such farms (Table 5.1).

TABLE 5.1 ESTIMATE OF NUMBER OF SUGAR FARMS AND DEPENDANTS BY FACTORY ZONES (Excluding Nucleus Estates). - 1977.

Description	Miwani	Chemelil	Muhoroni	Mumias	Ramisi	Total
Large Scale-Farms <sup>1)</sup>	77	21	21	0	4	123
Small Scale-Farms <sup>2)</sup>	3661	4019	4908	6000	366	18954
Total No of Farms	3738	4040	4929	6000	370	19077
Average Family Member/Farm	8.7	8.9	8.6	7.4*	8.4*	8.4
Total Family Members	32521	35956	42389	44400	3108	158374

Source: Author's Survey 1977, (1) Central Bureau of Statistics, Sugar Census Files.

2) Ministry of Cooperatives Annual Reports

\* C.B.S. Integrated Rural Surveys.

The farm sizes in the study area were found to vary from zone to zone and so were cane acreages. The average size for the small scale farms in the Nyanza Sugar Belt was found to be 3.4 hectares. The small scale farms tended to be bigger in size in the Muhoroni zone with a mean of 4.2 hectares followed by Miwani with a mean of 3.2 hectares. The average for Chemelil zone small scale farms

was relatively lower being only 2.9 hectares.

In the large scale sector, Miwani zone had more of such farms (77 in total) but relatively smaller in size. The Miwani large farms had a sample mean size of 94 hectares with a standard error of 37 hectares. Muhoroni and Chemelil on the other hand had each about 20 large farms with sample mean sizes of 442 hectares with a standard error of 103 hectares for Muhoroni, and 737 hectares with standard error of 250 hectares for Chemelil respectively. Overall, the analysis found that the large scale farms in the Nyanza Sugar Belt as a whole, had a mean size of 424 hectares with a standard error of 29 hectares. Table 5.2 below shows the mean farm size and cane acreage analysis in the study area.

TABLE 5.2: AVERAGE OUTGROWER FARM SIZES AND CANE HECTARAGE IN THE NYANZA SUGAR BELT. (in ha.) - 1977

		Miwani		Chemelil		Muhoroni		Whole Nyanza Sugar Belt	
		$\bar{X}$	S.E	$\bar{X}$	S.E	$\bar{X}$	S.E	$\bar{X}$	S.E
Mean Farm Size	Large Scale	94	37	737	112	442	46	424	29
	Small Scale	3.2	0.3	2.9	0.04	4.2	0.14	3.5	0.1
Mean Area under cane	Large Scale	68	11	297	98	281	99	215	84
	Small Scale	1.9	0.14	1.9	0.05	2.2	0.12	2.0	0.1

Source: Study Survey, 1977.

Statistical tests were carried out to investigate whether or not there were any significant interzonal differences between any pair of farm size means in the Nyanza Sugar Belt. Separate tests were done for both the large and the small scale farms. The Null hypothesis  $H_0: \mu_i = \mu_n$  or  $\mu_i - \mu_n = 0$  i.e. that there is no difference between the pair of means, was set against an alternative hypothesis, namely that the pair of means under comparison are not equal i.e.  $H_1: \mu_i \neq \mu_n$  or  $\mu_i - \mu_n \neq 0$ .

For small scale farms, these tests showed that only between Muhoroni and Miwani was it judged that any difference occurred between the population means at both 0.05 and 0.01 levels of significance. The difference noted between Muhoroni and Miwani small farm population mean sizes is not surprising given that Muhoroni farms are predominantly a part of recent government settlement scheme where farm sizes had been predetermined by government regulations, while Miwani small scale farms are in a traditional rural area where subdivision of farms have taken place unabated as population pressure increased. Chemelil small scale farms on the other hand has a mixture of both traditional rural farms and a few settlement farms.

A similar test of significance done on the means of small scale cane acreage showed no significant difference between the means in any pair of zones compared.

Although preliminary analysis showed that Chemelil had bigger large scale farm units followed by Muhoroni and Miwani in

that order, there was no significant difference noted between the mean sizes of Muhoroni and Chemelil large scale farms. On the other hand, significant differences were noted between the means of Miwani large farms and those of either Chemelil or Muhoroni at both .05 and .01 levels of significance.

One striking feature about the large scale farms, however is that there was no significant difference between the means of the sugar cane acreage at both .05 and .01 levels of significance, although Chemelil and Muhoroni farms had bigger mean cane acreage (Table 5.2).

On the basis of proportion of farm area allocated to cane, it was found that on average: (a) Miwani zone had the highest proportion of farm area allocated to sugar cane in the large farm sector, followed by Muhoroni and Chemelil in that order; (b) In the small scale sector Chemelil had bigger farm proportion under cane followed by Miwani and Muhoroni in that order (Table 5.3).

TABLE 5.3: PROPORTION OF FARM AREA ALLOCATED TO SUGAR CANE IN UYANZA SUGAR BELT (%) - 1977

Descriptions	Factory Zones		
	Miwani	Chemelil	Muhoroni
Large Farms	73.2	40.3	63.6
Small Farms	59.2	65.5	52.4

Source: Author's Survey, 1977.

### 5.2.2 Concentration in the Farming Sector:

Sugar cane farming, like many agricultural activities, approximates the requirements of perfectly competitive industry. There is a large number of sellers (producers) thus no farmer can independently affect market price and supply perceptibly by his production policy. The sugar cane grown is nearly homogeneous with neither objective nor subjective standardized grades. Brand names and advertising as a means of boosting sugar cane sales are unheard of. The farming sector of the industry fits the description of unconcentrated industry. The large scale farms, now numbering about 123 have been losing the market share to the small scale farms steadily since 1963. By 1976 the large farms accounted for only 8.4% of cane supply to the factories, compared to 42.6% share they held in 1972. The smallholder farms totalling about 19000 have increased their share of cane supply from 24.3% held in 1972 to about 62% at the moment. Comparatively the factory owned nucleus estates' share has been showing a downward trend from 33.1% in 1972 to 29.5% at the moment (Table 5.4). Thus at present no single group of farmers hold the monopoly of cane supply to the factories. On average however, the nucleus estates taken as single farm entities occupy a dominant role in each zone controlling about  $1/3$  of the cane supply to the factory.



TABLE 5.4: PERCENTAGE OF TOTAL CANE SUPPLY TO FACTORIES IN KENYA ACCOUNTED FOR BY THE NUCLEUS ESTATES, THE LARGE AND THE SMALL SCALE FARMS 1972, 1974 AND 1976.

	1972	1974	1976	Number of Farms now
Factory Nucleus Estates	33.1	36.2	29.5	5
Large Farms	42.6	13.3	8.4	123
Small Scale Farms	24.1	50.6	62.1	18954
Total*	100	100	100	19082

Source: Calculated from Economic Survey 1975 - 1977 and Table 5.1

Note: \*totals may not add up to 100 exactly due to rounding up of some figures.

### 5.2.3 Specialization Among Cane Farmers

The degree of diversification in the surveyed sugar farms was found to be quite low. The study reveals a marked tendency towards specialization in cane production within both large and small scale farming sectors. Apart from subsistence plots, which had significant acreage allocation among the farm enterprises, no cash crops appear to compete cane for farm resources (Table 5.5). Land allocation to grazing in the study area was found to be minimal and according to farmers, diseases and stock theft have discouraged livestock farming. The few livestock that are still kept in the area especially among the small scale farmers are usually grazed communally or in between the cane fields and non-canable land. Given the low degree of diversification on the sugar farms with the

TABLE 5.5: MEAN HECTAREAGE ALLOCATION AMONG VARIOUS ENTERPRISES ON THE SUGAR FARMS STUDIED

Enterprises	Factory						Zones						Total									
	Miwani			Chemelil			Muhoroni			Total												
	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d						
Nucleus Estates	3804	2914	0	0	0	0	3246	1992	0	0	0	0	*	*	*	*	*	*				
Large Scale	94	68	0.4	0	0.9	0	737	297	1.2	0	1.9	24	442	281	1.9	0.7	1.5	28	424	215	1.2	0.2
Small Scale	3.2	1.9	0.04	0	0.97	0.04	2.9	1.9	0	0	0.81	0.08	4.2	2.2	0.04	0	1.2	0.2	3.5	2.0	0.04	0.9

Source: Study Survey, 1977.

Note a = Farm Size; b = Sugar cane; c = Maize as a cash crop; d = Other Cash crops;

e = Subsistence; f = Grazing; \* = No response.

TABLE 5.6: NUMBER AND PROPORTION OF FULL TIME AND PART-TIME FARMERS  
AMONG THE SAMPLE STUDIED

Zone	Type of Farm	Full time		Part time		Sample Size
		No	%	No	%	
Miwani	Small Scale	31	77.5	9	22.5	40
	Large Scale	4	80	1	20	5
Chemelil	Small Scale	39	97.5	1	2.5	40
	Large Scale	3	60	2	40	5
Muhoroni	Small Scale	37	74	13	24	50
	Large Scale	3	60	2	40	5
Total	Small Scale	107	82.3	23	17.7	130
	Large Scale	10	67	5	33	15

Source: Study Survey, 1977.

significant area proportion of most farms not under cane (Table 5.3) it seems the sugar farms are underutilized.

Apart from specialization on the basis of acreage allocation to crops, farmers were also asked whether or not they had some other occupation or business in addition to growing cane. The results showed that a significant proportion of the large scale farmers tended to be engaged in other business or occupation as opposed to the small scale farmers who tended to be full time farmers. However in both cases the majority of respondents were full time farmers (Table 5.6).

The part-time farmers are engaged in various activities ranging from teaching, other government or private employment including general trading business. The category of part-time farmers also included the so called absentee farmers who had delegated the management of their farms to some employee or relative. Cases of extreme absenteeism, where nobody lived on the farm were also noted during the study, but due to lack of respondents, such farms could not be included in the survey. Such abandoned farms were usually in abject state of neglect, and indeed some factory and government personnel often blamed them for the low cane supply situation prevalent in the Nyanza Sugar Belt.

#### 5.2.4 Integration by Sugarcane Farmers

##### 5.2.4.1 Horizontal Integration: - The Cooperatives

Sugar cane farmers are integrated to some extent. The most important structural integration is the horizontal integration in the form of cooperative movements. During this study, 98.5% of the

130 smallholders interviewed were found to belong to some sugar cane cooperative society. Among the large scale farmers however, only 33.3% of the farmers interviewed were members of some cooperative movement (Table 5.7).

TABLE 5.7: EXTENT OF COOPERATIVE MEMBERSHIP AMONG THE SAMPLED FARMS IN THE NYANZA SUGAR BELT.

Category of Farm	Member-ship	Miwani		Chemelil		Muhoroni		Total		Sample Size
		Number	%	Number	%	Number	%	Number	%	
Small Scale	Yes	39	97.5	40	100	49	98	128	98.6	
	No	1	2.5	0	0	1	2	2	1.5	
	Sample-Size	40		40		50		130	100	130
Large Scale	Yes	1	20	0	0	4	80	5	33.3	
	No	4	80	5	100	1	20	10	66.7	
	Sample Size	5		5		5		15	100	15

Source: Study Survey 1977:

At the time of the survey (1977) there were altogether about 40 sugar cane cooperative societies in the Nyanza Sugar Belt out of a national total of 44 sugarcane cooperatives, thus giving Nyanza the highest concentration of sugar cane cooperatives in the

country. These cooperative societies in the Nyanza Sugar Belt were affiliated to two major Cooperative Unions, namely: - the Nyanza Sugar Belt Cooperative Union (S.B.C.U.) with a membership of 34 cooperative societies, and the Muhoroni Cooperative Union (M.C.U.) with 8 societies mainly from the Settlement Schemes. While the M.C.U. caters only for the settlement scheme farms under the Muhoroni factory zone, S.B.C.U on the other hand caters for societies in the non-settlement scheme farms under all the three factory zones in the Nyanza Sugar Belt. Table 5.8 gives a full list of the sugar cooperative societies in the study area.

As mentioned earlier, the Nyanza Sugar Belt with 42 sugar cane cooperatives has the highest number of such cooperative societies compared to other sugar producing zones in Kenya (Table 5.9). Ramisi factory zone in the Coast has only one society, while in Mumias zone in Western Province the societies have dwindled from 4 in 1974 to a single active one by 1977. Perhaps the formation of an outgrowers' company at Mumias has overshadowed the cooperative movements in the zone.

#### (i) Cooperative Activities

Most cane cooperative societies were formed to alleviate the farmers' problems of cane production and marketing. In the Nyanza Sugar Belt the societies under S.B.C.U were classified as either "Marketing Cooperatives Societies" or "Production Cooperatives Societies". Initially the marketing societies were formed solely to

TABLE 5.8: LIST OF SUGAR CANE COOPERATIVES AND MEMBERSHIP IN THE NYANZA SUGAR BELT 1976 - 1977

Society Name	Miwani Zone		Chemelil Zone		Muhoroni Zone			
	Membership		Society Name	Membership		Society Name	Membership	
	1976	1977		1976	1977		1976	1977
Keyo	600	362	Orago	n.a	n.a	Kipsitet	808	966
Onyisa	620	780	Kibisem	300	301	Kaitui	307	300
Olik Oliero	500	546	Nyatao	340	290	Mariwa	40	40
Magare	300	370	Harambee	191	191	Mombwo	61	61
Chiga	600	802	Jaber	300	259	Makindu	157	154
Kabonyo	364	355	Amilo	344	400	Pala	230	280
Chemursoi	200	186	Nyang	185	185	Chilchila	140	143
Magare	219	370	Mikiria	183	222	Koisagat	150	n.a
Nyakoko	316	329	Nyakunguru	179	199	Urafiki	157	n.a
Kajulu	300	160	Simbi	304	324	Songor*	478	n.a
			Chemase	491	500	Tamu*	421	n.a
			Ngeny	194	210	God Abuoro*	329	n.a
			Owiro	250	200	Muhoroni*	480	n.a
			Masaka	n.a.	n.a.	Oduwo*	180	n.a.
			Mbidhi	400	400	Fort Ternan*	275	n.a.
						Kunyak*	431	n.a.
						Koru*	450	n.a.
<b>TOTAL</b>	<b>4019</b>	<b>4260</b>		<b>3661</b>	<b>3681</b>		<b>5094</b>	<b>?</b>

Source: Ministry of Cooperative Development Annual Report and Registry Returns.

Note: \* = The 8 Societies under Muhoroni Cooperative Union;  
unesterisked = Societies under S.B.C.U.

n.a. = not available.

TABLE 5.9: NUMBER AND MEMBERSHIP OF SUGAR CANE COOPERATIVE IN KENYA AND THEIR TURN-OVER 1976/77

District	Zone	No. of Societies	Membership	Turn-over Ksh. '000	Share Capital K.Sh '000	Locational Concentration (%)
Kisumu	Miwani	10	4260	47727.20	4.5	95.4
	Chemelil	15	3661			
	Muhoroni	17	5094			
Kakamega	Mumias	1	430	36.4	107.0	2.3
Kwale	Ramisi	1	366	1285.7	6.3	2.3
TOTAL		44	13811	49049.30	117.80	100

Source: Calculated from "Cooperative Statistics" and "Registry Files" Ministry of Cooperative Development (1975-1977).



market members' cane and were mainly concerned with cane transport arrangements to the factories. In marketing societies therefore, the members were individually responsible for all other farm operations including procurement of inputs. The marketing societies could however advance loans to members to carry out farm activities and such loans were to be recovered in full during the sale of the first cane harvest.

The "production societies" on the other hand, were formed to act in conjunction with the parent union (S.B.C.U) to organize farm operations including harvesting for the members. In principle the farmer is supposed to carry out the weeding and general maintenance of the crop. During the survey however it was apparent that the cooperative movements in fear of losing a crop and money invested in it, often intervened to carry out all the cane operations thereby rendering the farmer redundant on his own farm! Many farmers interviewed were critical of this type of intervention especially when they were not kept informed of the expenses involved.

Although in theory the societies under S.B.C.U were dichotomously divided into "production" and "marketing" cooperatives, in practice all societies are now known to combine both production and marketing activities.

The Muhoroni Cooperative Union (M.C.U) formed to provide both production and marketing services to its members has had mismanagement problems throughout most of its past. At the time of the

survey it was being run by a special committee appointed to replace the old officials suspended following a recommendation by a Commission of Inquiry instituted by the Ministry of Cooperative Development. Most of the farmers in the Muhoroni zone have either acted independently or resorted mainly to the Settlement Sugar Organization (S.S.O) of the Ministry of Lands and Settlement with respect to production and marketing of their cane. The S.S.O. was meant to be a stop-gap institution, and the inability of M.C.U to help its members is unfortunate.

(ii) Farmers Attitude Towards Cooperatives

Many farmers interviewed felt that the cooperatives have performed poorly and have therefore not lived upto their expectations. There is an air of mistrust among members. About 74% of the small scale farmers interviewed were dissatisfied with their cooperatives. Another 79% felt that their societies and their parent union(s) were too poor to render adequate services to the members.

An over-all analysis (see Table 5.10) of farmers' response shows that farmers under Muhoroni got less help from cooperatives compared to the ones under Chemelil and Miwani. This is understandable given that the parent union. M.C.U., had problems of mismanagement and was reportedly financially incapable of handling centralized activities and services to members.

The S.B.C.U and its affiliated societies catering for non-settlement scheme farmers, especially under Miwani and Chemelil

TABLE 5.10

PROPORTION OF INTERVIEWED SMALL SCALE FARMERS RECEIVING COOPERATIVE BENEFITS.

Benefit	Zones							
	Miwani		Chemelil		Muhoroni		Total	
	No	%	No	%	No	%	No	%
Advice	30	75	21	52.5	17	34	68	52.3
Credit	14	35	35	87.5	13	26	62	47.7
Transport	14	35	22	55	18	36	54	41.5
Land preparation	11	27.5	21	52.5	4	8	36	27.7
Others	13	32.5	24	60	33	66	70	54.0
Sample Size	40		40		50		130	

Source: Study Survey, 1977

Note: No = Number.

zones, seemed to have performed better than M.C.U. although it was also not free from problems and blames.

(iii) Cooperative Problems

According to the farmers some of the inherent problems with the cooperative movements include:-

(a) Inadequate financial outlay and capital stock leading to inability to provide adequate:

- machinery services;
- transport facilities; and
- credit facilities to members.

(b) Mismanagement of cooperatives by the officials leading to:

- financial losses;
- heavy debts and lack of faith among creditors;
- expensive court cases against creditors seeking court injunction for repayments;
- poor services to farmers;
- mistrust of the officials by the members.

(c) Staff with inadequate knowledge of management.

(d) Alleged "mysterious" deductions made on farmers' cane proceeds without satisfactory explanations.

(e) Problems of pooling farmers' land into large block systems without proper boundary demarcation and accompanying recording system that ensures each farmer gets his dues according to the size of his land and magnitude of his contribution in such block systems.

(f) Alleged "farmer politics", clanism or sectionalism including some forms of favouritism resulting in:

- feuding factions among both officials and members;
- electing officials not on administrative qualities, but out of sheer personal favours;
- apathy and ineptitude among dissatisfied members.

Thus in conclusion, one would assert that the farmers in the sugar industry are far from satisfied with the cooperatives in that sector.

#### 5.2.4.2: Vertical Integration in Cane Farming

Vertical integration is limited in sugar cane Production. Farmer-processor integration is mainly in Mumias and to some extent in Chemelil where the farmers get services and advice from the factories. Through farming cooperatives some attempts have been made by farmers to combine cane production and transport under same management but still private transporters dominate the industry (see Table 5.11). Again only in Mumias have farmers recently (1977) formed an outgrower company charged with the responsibility of maintaining administrative and technical link between farmers and the factory.

#### 5.2.5: Farmers' Institutional and Technological Environment

##### 5.2.5.1. Institutional Environment

The sugar cane farmer is subjected to many institutional organizations which affect the economic environment and performance.

These include:

- (i) The government public institutions which direct the national sugar policies like the Ministry of Agriculture and the Kenya Sugar Authority which review and advise on cane pricing, transport rates, farm rehabilitation programmes and factory zoning systems. The Ministry of Cooperative Development also advises sugar cooperative movements, while the Ministry of Lands and Settlement through its Sugar Settlement Organization (S.S.O) advises settlement farmers under Muhoroni zone.
- (ii) The factories which form the sole buyers of farmers' cane.
- (iii) The cooperatives, which as already discussed were formed to help improve productivity and marketing of sugar cane among farmers.

#### 5.2.5.2. Farmers' Technological Environment

Modern sugarcane production and marketing entail a lot of technological innovation on the part of the farmers. The establishment and maintenance of a good cane crop requires proper land preparation, planting, weeding and fertilizer application. Adequate transport facilities are also necessary for proper scheduling of cane harvesting and delivery to the factories.

During the study, many farmers complained of:

- (i) inadequate land preparation equipment and machinery for hiring;
- (ii) inadequate transport facilities; and
- (iii) inadequate distribution systems of such inputs as fertilizers and herbicides.

TABLE 5.11: SOURCES OF FARM MACHINERY AND TRANSPORT USED BY CANE FARMERS INTERVIEWED (%)

Operation	Source of Machinery	Factory		Zones		Total			
		Miwani		Chemelil		Muhorani		Total	
		S.F	L.F	S.F	L.F	S.F	L.F	S.F	L.F
Land Pre- ration:	Farmers' own	0	80	0	60	0	20	0	53.3
	Sugar Company	0	0	7	20	0	0	2.3	6.7
	Cooperative	35	20	88	0	0	0	38	6.7
	Settlement Organization	0	0	0	0	62	40	23.8	13.4
	Others(private)	65	0	5	20	38	40	36	19.9
Total		100	100	100	100	100	100	100	100
Transport	Farmers' own	0	40	0	80	0	20	0	46.7
	Sugar Company	0	0	2.5	0	0	0	0.8	0
	Cooperative	20	20	12.5	0	2	0	10.8	6.6
	Settlement Organization	0	0	2.5	0	52	0	20.8	0
	Other(Private)	80	40	82.5	20	46	80	68	46.7
Total *		100	100	100	100	100	100	100	100

Source: Study Survey, 1977.

Note:

S.F. = Small Farms  
L.F. = Large Farms

\* Totals may not add upto 100 exactly due to rounding up of some figures.

In the small scale sector, all the farmers interviewed (ie.100%) did not have their own equipment for land preparation and cane transport. Even among the large scale farmers, only 53.3% of the number interviewed used their own equipment for land preparation, while only 46% of these large scale farmers had own transport facilities.

As shown in Table 5.11 private farm machinery and transport facilities, inadequate though they may be, still provide more services to the farmers than other alternative sources. Other sources for these services include the cooperatives, the sugar companies and in the case of Muhoroni Zone, the Sugar Settlement Organization.

The majority of farmers interviewed felt that significant increases in cane acreage and productivity could be achieved if adequate farm machinery and transport services could be made readily available. Most of the farmers further felt that such services would best be provided by the sugar companies since according<sup>to</sup>/their experience cooperative and private organization arrangements have failed to render such services efficiently.

A priori observations, based on the Mumias experience suggest there is justification in having such services provided by the sugar companies.

#### 5.2.6: Condition of Entry and Exit in Cane Farming Sector

To some extent, there is freedom of entry and exit in cane farming. Acquisition of land through inheritance, buying, government settlement scheme or renting in any sugar factory zone allows one to become a cane farmer, provided of course such land is suitable for cane and the farmer has adequate financial and capital stock for sugarcane operations.



The majority of the large scale farmers interviewed had

acquired their land by buying them from former foreign owners.

The small scale farmers, however, had invariably acquired their land through: (a) inheritance (b) buying or (c) government Settlement Scheme in case of some farms under Muhoroni zone.

### 5.2.7 Farmers Conduct

#### 5.2.7.1 Competitive Conduct

Sugarcane production and marketing practices as well as pricing are described in the second chapter. The system is mostly government regulated and hence competitive conduct among farmers is minimal. Competition is only marked in acquisition of credit and purchased inputs like fertilizers, farm machinery and transport services. Failure to procure these services usually results in poor farm performance. Lack of machinery for land preparation result in idle fallow land, while lack of transport results in delayed cane harvest and deterioration of cane. In the Nyanza Sugar Belt there is stiff competition for transport and machinery services which usually results in alleged unethical practices like bribery and favouritism during acquisition of such services.

#### 5.2.7.2 Farmers' Response to Price Changes

Knowledge of farmers' response to price changes is a very important policy tool for such an important crop like sugar cane. Due to paucity of data on cane acreage, however, this study did not include a time series analysis of sugar cane farmers' supply response to price changes. Such quantitative analysis would have included the use of the Nerlovian

"adaptive expectation" and the "partial adjustment" models to test whether or not the Kenyan sugar growers try to plant more of the crop when the price rises. As a corollary the use of the models would try to indicate whether or not the farmers' production decisions are random and hence unrelated to price.

To measure the farmers' response to price changes, when acreage series data was unavailable, this study resorted to subjective cross-sectional assessment of farmers' price response. Farmers were asked what their reactions would be under three conditions of price changes:-

- (a) - if price of cane rises by K.sh 25.00 per tonne above the present level.
- (b) - if the price of cane falls by K.sh 25.00 per tonne.
- (c) - if the price of cane remained at the present level of K.sh 133/tonne.

Among the small scale farmers interviewed, 88.5% indicated they would increase their cane acreage if the price were to rise by further K.sh 25.00. A corresponding response from the large scale farmers was nearly the same standing at 86.7%. Under price increase situation only 10% of the small scale farmers and 1.5% of the large scale farmers would leave their cane acreages unchanged. On the other hand only 1.5% of the small scale farmers gave perverse response that they would reduce their cane acreage if the price of cane rose. No large scale farmer would reduce cane acreage under price increase situation.

TABLE 5.12: CROSS SECTIONAL PRICE RESPONSE AMONG FARMERS INTERVIEWED

Response Condition	Type of Response	Small Scale Farms		Large Scale Farms	
		No	%	No	%
i) Price Rise by 25/= per tonne	increase acreage	115	88.5	13	86.7
	reduce acreage	2	1.5	0	0
	no change	13	10.0	2	13.3
	Total	130	100	15	100
ii) Price Fall by 25/= per tonne	increase acreage	45	34.6	6	40
	reduce acreage	21	16.2	2	13.3
	no change	64	49.2	7	46.7
	Total	130	100	15	100
iii) No Price Change	increase acreage	26	20	4	26.7
	reduce acreage	10	7.7	0	0
	no change	94	72.3	11	73.3
	Total	130	100	15	100

Source: Study survey, 1977.

The farmers' response under the three price situations is summarized in Table 5.12. Reduction of cane acreage is not a popular response even in case where price falls. In case of either a price fall or no price change at all it seems the majority of farmers would rather have no change in their cane acreage. This may possibly be due to the perennial nature of sugar cane and farmers therefore subconsciously lagging their response, since it needs time to convert cane field to other crops. Another explanation could be that there is no other cash crop that seriously competes with sugar cane (see section 5.1.2.3)

#### 5.2.7.3 Factors Related to Area Allocated to Cane on Individual Farms:

Many factors can be said to determine the area that a farmer allocates to sugar cane. These factors include:- (i) The size of holding; (ii) the anticipated level of cane output, (iii) Relative price of cane; (iv) relative price levels of products from other farm enterprises; (v) economic and general financial status of the farmer; (vi) credit facilities; (vii) available technology like access to farm inputs including machinery; (viii) size of the family and the expected reliance of the family on the cane crop for financial obligation; (ix) subsistence obligations with respect to labour and land utilization and (x) availability of labour (family or hired).

One would therefore postulate a general model of relationship between cane acreage and the above factors as follows:

$$A = f(V_1, V_2, V_3, \dots, V_n) \quad (\text{Eq.5.1}) \cdot$$

Using a simple linear relationship the general equation becomes

$$A = \alpha + \sum_{i=0}^n \beta_i V_i + \epsilon, \quad (\text{Eq.5.2}),$$
 where in both cases: A is cane

acreage, the dependent variable;  $V_i : i=0, 1, 2, 3, \dots, n$  are the explanatory variables which are assumed to be non-stochastic or if stochastic are independent of the error term  $\epsilon$ ;

$\epsilon$  = error term assumed to be normally distributed with a zero mean and includes as well a bundle of other variables excluded in the model but are known to determine cane acreage;  $\alpha$  and  $\beta$  are constant parameters of the regression.

Obviously some of the factors listed above, though known to affect farmers' decisions when allocating land to sugar cane, are not easy to quantify. In this study only those variables which could be adequately obtained from cross-sectional interviews with farmers were included in the analysis.

(i) Correlation Analysis:

A computer output of correlation matrix was obtained to pretest the association between the variables (Table 5.13a,b,c). With respect to large scale farms, the area under cane (A) on a farm had significant positive correlation with such variables as farm size ( $V_1$ ); cane yields per acre ( $V_5$ ); and permanent labour ( $V_6$ ). On the other hand negative correlations were observed for the large farms between area under cane and variables like subsistence acreage ( $V_4$ ); acreage under other cash crops ( $V_3$ ); maize acreage as a cash crop ( $V_2$ ) and family size ( $V_7$ ).

In the small scale sector, the area under cane had positive correlation with farm size; cane yields; permanent labour; and family size. However with the exception of farm size these correlation coefficients were very low. Again negative but low coefficients were obtained between the area under cane and cash crop maize acreage, other cash crops, and subsistence acreage in the small scale sector.

Generally as would be expected farm size has a high positive correlation with the area allocated to cane on both large scale and small scale sectors. The coefficient of correlation 'r' was higher in the large scale sector, being 0.98 as compared to 0.63 for the small scale farms. This is in conformity with our earlier finding that large farms allocate a bigger proportion of their farm area to sugar cane (Table 5.3). Permanent labour has also a very high positive correlation with area under cane on large farms. On the

TABLE 5.13 CORRELATION MATRIX OF SELECTED VARIABLES RELATED TO ACREAGE ALLOCATION TO CANE

(a) Small Scale Farms

	A	V <sub>1</sub>	V <sub>2</sub>	V <sub>3</sub>	V <sub>4</sub>	V <sub>5</sub>	V <sub>6</sub>	V <sub>7</sub>
A=Cane acreage	1	0.63*	-0.25*	-0.15	-0.18*	0.15	0.25*	0.17*
V <sub>1</sub> =Farm Size		1	0.56*	0.04	0.57*	-0.01	0.35*	0.10
V <sub>2</sub> =Maize acreage as a cash crop			1	-0.01	0.50*	-0.03	0.17*	0.19*
V <sub>3</sub> =Other Cash crops				1	0.16*	-0.24*	-0.06	-0.10
V <sub>4</sub> =Subsistence					1	-0.08	0.30*	0.07
V <sub>5</sub> =Cane Yield						1	0.17*	0.17*
V <sub>6</sub> =Permanent labour							1	-0.07
V <sub>7</sub> =Family Size								1

(b) Large Scale Farms

	A	V <sub>1</sub>	V <sub>2</sub>	V <sub>3</sub>	V <sub>4</sub>	V <sub>5</sub>	V <sub>6</sub>	V <sub>7</sub>
A	1	0.98*	-0.34	-0.20	-0.56*	0.43	0.90*	-0.48*
V <sub>1</sub>		1	-0.24	-0.13	-0.50*	0.48	0.90*	-0.40
V <sub>2</sub>			1	0.74*	0.50*	-0.06	-0.14	0.34
V <sub>3</sub>				1	0.61*	0.08	-0.11	0.15
V <sub>4</sub>					1	-0.39	-0.64*	0.56*
V <sub>5</sub>						1	0.41	-0.13
V <sub>6</sub>							1	-0.40
V <sub>7</sub>								1

Note: \* Significant at 0.05 level.

Table 5.13 Cont.  
 (c) Large and Small Scale Farms Combined

A	V <sub>1</sub>	V <sub>2</sub>	V <sub>3</sub>	V <sub>4</sub>	V <sub>5</sub>	V <sub>6</sub>	V <sub>7</sub>
1	0.93*	-0.17*	-0.01	-0.12	0.23*	0.91*	-0.33*
	1	0.11	0.001	0.004	0.27*	0.90*	-0.30*
		1	0.61*	0.58*	0.03	0.32*	-0.001
			1	0.28*	-0.02	0.05	0.02
				1	-0.05	0.18*	0.01
					1	0.28*	0.07
						1	0.32*
							1

Note: \* Significant at 0.05 level



Small scale farms the correlation is positive but low implying that large farms determine their cane acreage according to the size of permanent labour force they have, whereas for the small scale farms permanent labour may not be as important in this respect. Unfortunately data on family and casual labour were not adequate and had to be excluded in the analysis.

Surprisingly cane acreage in the large scale sector had a negative and significant correlation coefficient with family size, whereas for the small scale farms family size had low but positive correlation with cane acreage. However, this could be explained by the fact that large farms do not depend on family labour as much as the small scale farms.

(ii) Regression Analysis of Factors Related to Acreage Allocation to Cane

The Cross sectional data collected from the farms was used in the regression analysis to determine what factors and to what extent may affect allocation of land to cane on farms.

(a) The Model

The general model cited earlier (eq.5.1) was used:  $A=f(V_1, V_2, V_3, \dots, V_n)$ . Several regressions were run as a pre-test for several variables. Depending on whether or not there was adequate observation for certain variables after screening out missing values, a few variables from the original list were selected for the final regression. Using area allocated to cane (A) as the dependent variable separate regressions were run for the small scale farms, the large farms, and with both large and small farms combined. The idea of running the large and small farms regressions separately was to avoid having the "size" effect that could occur if only one

regression was run with all the farms combined.

Thus the general equation was reduced to the following

$$A = \alpha + \beta_1 V_1 + \beta_2 V_2 + \beta_3 V_3 + \beta_4 V_4 + \beta_5 V_5 + \beta_6 V_6 + \beta_7 V_7 + \epsilon \quad (\text{Eq.5.3})$$

where A = Cane acreage, the dependent variable;

$V_1$  = Farm size ;  $V_2$  = Maize acreage as a cash crop;

$V_3$  = Other cash crop acreage;  $V_4$  = Subsistence acreage;

$V_5$  = Cane yield per hectare;  $V_6$  = Permanent labour and

$V_7$  = Family size. For the small scale farms the variable

$V_3$  was excluded by the computer from the regression set because the observations were all nearly zero.

(b) Results: \*

The regression results are summarized in Table 5.14. The coefficient of determination ( $R^2$ ) is 0.47 for small scale farms, 0.49 for the large farms and 0.51 for all farms combined.

Thus in general, the regression is shown to explain 50% of the total variation in the observed dependent variable. Other factors excluded in the model obviously affect the farmer's decisions when allocating land to sugar cane. Such factors include attitude to price of cane; attitude to prices of other farm products; access to machinery and other farm inputs; availability of other types of labour (family and casual); credit facilities; economic and general status of the farmer. Adequate data on these variables were not obtained for this study. The cross-sectional regression attempted did not measure any of these variables.

\* Some pairs of independent variables used in the regression have the problem of being correlated, giving rise to the condition known as multicollinearity. This adversely affects the sensitivity of the regression technique and therefore accounts for the general lack of significance on the regression coefficients essentially (Table 5.14)

TABLE 5.14: ESTIMATED COEFFICIENTS OF FACTORS RELATED TO ACREAGE ALLOCATION TO CANE

Type of Farm	't' Values in bracket	Regression							R <sup>2</sup>	
		Constant α	β <sub>1</sub>	β <sub>2</sub>	β <sub>3</sub>	β <sub>4</sub>	β <sub>5</sub>	β <sub>6</sub>		β <sub>7</sub>
1. Small Scale Farms	t	1.24 (1.32)	0.45 <sup>***</sup> (8.52)	-0.40 (1.12)		-0.49 <sup>***</sup> (3.10)	0.02 <sup>***</sup> (1.60)	0.12 (0.74)	0.05 (1.22)	0.47
2. Large Scale Farms	t	-110.55 (0.22)	0.40 <sup>***</sup> * (1.79)	-3.23 (0.09)	-71.39 (1.00)	-14.75 (0.35)	40.09 (1.25)	21.84 <sup>***</sup> (1.81)	-9.70 (0.26)	0.49
3. Large & Small Farms	t	-53.10 (1.63)	29.0 <sup>***</sup> (7.57)	-4.63 (0.56)	-30.79 <sup>*</sup> (2.28)	-19.75 <sup>***</sup> (3.45)	1.21 (0.76)	4.63 (0.85)	-0.41 (0.11)	0.51

\* Significant at .05 level  
 \*\* Significant at both 0.01 and .05 levels of significance  
 \*\*\* Significant at 0.20 level of significance.

However, among the variables in our regression set, farm size, subsistence acreage and in case of large farms permanent labour, are significant explanatory variables. The high negative effect of subsistence acreage on cane acreage would suggest that in any planning for expansion of cane production adequate attention must be given to farmers' subsistence needs in such plans. This is particularly important in the smallholder sectors where due to the long gestation period of cane, a farmer has to rely for quite a time on his subsistence plot for food and cash needs.

Since we observed in section 5.2.3 that the degree of crop diversification is very low on most of the sugarcane farms, any promotion of sugar cane production must either reassure the farmer of dependable cash flow or should incorporate provision for adequate subsistence enterprises on the farms.

#### 5.2.8 Farmers' Performance

Economic performance among sugar cane farmers varies, being satisfactory in some instances and poor in some cases. Farm gross margins differ markedly among farms depending on: (i) level of technology employed (ii) yield levels achieved per hectare (iii) institutional forces like the level of contribution by the cooperatives, the sugar companies or the government service schemes.

5.2.8.1 Cane Yields: On average, cane yields were found to be generally lower on the small scale farms than on either the large farms or the nucleus estates. This may be explained by the fact that the large scale farms and the nucleus estates do practice better cane husbandry. The analysis of yields is given on Table 5.15.

TABLE 5.15: COMPARATIVE MEAN CANE YIELDS UNDER VARIOUS ZONES AND CATEGORY OF FARMS IN THE STUDY ZONE (TONNES PER HECTARE)

Factory Zones									
Type of farm	Crop	Miwani		Chemelil		Muhoroni		Combined	
		$\bar{X}$	S.E.	$\bar{X}$	S.E.	$\bar{X}$	S.E.	$\bar{X}$	S.E.
Nucleus Estate	Plant	74	-	96	-	-	-	85	-
	Ratoon	37	-	68	-	-	-	53	-
Large Scale	Plant	72	1.3	90	5.4	124	19.6	88	8.5
	Ratoon	59	2.4	64	4.0	63	13.6	62	4.7
Small Scale	Plant	58	1.9	77	4.2	76	3.5	72	2.6
	Ratoon	41	0.7	51	3.9	57	2.7	51	2.1

Source: Study Survey 1977.

Note: - Not available.

Significant differences tests performed on the mean yields at both .05 and .01 levels of significance gave the following results:

- (i) That in the large scale sector although Muhoroni and Chemelil zone samples realized higher mean yields than Miwani zone, there was no significant statistical differences found between population mean .

(ii) On comparing the large scale farms vis-a-vis the small scale farms there were found significant population mean yield differences between these two sectors, except for population mean ratoon crop yields in Muhoroni zone where small farms compare favourably with the large farms.

(iii) In the small scale sector for both plant and ratoon crops, there is no significant difference between population mean yields on such farms in both Muhoroni and Chemelil zones. On the other hand small scale farms under Miwani zones had significant population mean yield differences from those in Muhoroni and Chemelil.

(iv) The nucleus estate yields were invariably higher than both the small and large scale outgrower yields in all the three zones studied.

The survey found wide inter-zonal and inter-farm yield variations. In Table 5.16 we see that even the yields in the nucleus estates range from 3 tonnes to 230 tonnes per hectare . On outgrower farms, the yields were observed to vary from 20 to 160 tonnes per hectare on small scale farms; and 20 to 185 tonnes per hectare on large farms. The average yield for all outgrower farms stand at about 70 tonnes per hectare.

#### 5.2.8.2 Factors Related to Yield Performance on Farms.

Sugar cane yields are known to be affected by such factors as climatic conditions especially rainfall; soil fertility; level of management; damage levels by pests and diseases; varieties of cane planted and other factors inherent in the farm set up.

Table 5.16

CANE YIELD RANGE ON NUCLEUS ESTATES AND OUTGROWER FARMS

(TONNES/HECTARE)

	Miwani			Chemelil			Muhoroni			Combined		
	Min.	Max.	Range Units	Min.	Max.	Range Units	Min.	Max.	Range Units	Min.	Max.	Range Units
Nucleus Estate	3	230	227	41	200	159	-	-	-	3	230	227
Large Farms	49	74	25	49	99	50	20	185	165	20	185	165
Small Farms	22	96	74	24	160	136	20	156	136	20	160	130
All Farms incl.N.E.	3	230	227	24	200	176	-	-	-	3	230	227
All Farms excl.N.E.	22	96	74	24	160	136	20	185	165	20	185	165

Source: Study Survey, 1977

Note: - = Not available

Min= minimum; Max= maximum.; NE = Nucleus Estate  
incl.= including; excl.= excluding.

A multiple regression with yield per hectare (Y) as the dependent variable was run using farm size ( $X_1$ ), area under cane ( $X_2$ ), area under other cash crops ( $X_3$ ), area under subsistence production ( $X_4$ ) and available permanent labour ( $X_5$ ) as the dependent variables. The idea was to find out to what extent these farm factors relate to cane yields since they in some way or other affect management decisions. Thus the regression equation used was:-

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + \epsilon, \text{ (Eq. 5.4) where } Y$$

is yield, per hectare the dependent variable and  $X_1, X_2, \dots, X_5$  are the explanatory variables as given in parenthesis above already;  $a_0, a_1, \dots, a_5$  are the constant parameters; and  $\epsilon$  is the error term.

To avoid "size" effects the large scale farms and the small scale farms were analysed separately. However the regressions showed that the variables included in the regression set do not adequately explain variation in yield both in the large scale and small scale sectors. The coefficient of determination ( $R^2$ ) was 0.12 for the small scale farms and 0.27 for the large farms. It is apparent therefore that cane yields are more explained by other factors excluded from our model. Obviously such factors must include rainfall, soil fertility levels, level of technology and cane management practices employed, levels of pest and disease damage, and the varieties of cane planted. In a study such as this one, the collection and quantification of data on such variables is not possible and we leave this aspect as an open field for further research.

### 5.2.3.3 Profitability and Gross Margins in Cane Farming

According to the officials interviewed from government, cooperative movements and sugar companies, sugar cane with the current price levels and constant price reviews can be a well paying crop. As for the farmers, 74% of the large scale farmers interviewed stated that sugar cane was more profitable than most crops in the Nyanza Sugar Belt. Only 40% of the small scale farmers, on the other hand, agreed it was profitable to grow sugar cane. It must be noted however,



that the understanding of the small scale farmer about sugar cane profitability is obscured by the alleged mysterious deductions they claim cooperatives make on their cane proceeds. Instances were given where some farmers ended up with no net cash income from cane proceeds following deductions by the cooperatives for services rendered to the farmers!

Gross margin analysis on cane farms shows that with good cane yields cane growing can be remunerative. However, on some farms cane yield can be too miserably low to be profitable (see Tables 5.16 and 5.17). To bring out the disparity in gross margins among farms, this study analysed the gross margins using the minimum, the mean and the maximum yield regimes as indicated in Table 5.17.

From Tables 5.17a and 5.17b it is clear that gross margins vary considerably depending on yield levels on the farms. Generally ratoons give higher gross margins than do the plant crops since the cost of cane establishment is drastically reduced to mere crop maintenance operations in case of ratoons. Many farmers tend therefore to reduce their costs by taking more ratoons than the recommended two. Four or five ratoons per crop cycle were not uncommon among outgrowers thereby stretching the crop cycle far beyond the usual five years. There is also a tendency among some farmers to try to reduce costs by doing less weeding and/or fertilizer application, but this practice invariably results in low yields and hence reduced gross margins.

TABLE 5.17a : GROSS MARGIN ANALYSIS ASSUMING MINIMUM YIELD OF 20 TONNES PER HECTARE PER HARVEST (K.Sh) BASED ON 1977 ESTIMATES

	Plant Crop (2yrs)	First Ratoon (1½yrs)	Second Ratoon (1½yrs)	5 year Cycle
1. Gross Revenue per hectare @ 133/= tonne	2660.00	2660.00	2 660.00	7980.00
2. Variable Costs per * hectare :-				
i. Cane establishment	3538.00	N/A	N/A	3538.00
ii. Weeding	630.00	618.00	618.00	1866.00
iii. Fertilizers	1038.00	1038.00	1038.00	3114.00
iv. Harvesting and Tran- sport @ 30/= /tonne	600.00	600.00	600.00	1800.00
v. Union and Society Cess @ 8/= /tonne	160.00	160.00	160.00	480.00
vii. Miscellaneous	124.00	124.00	124.00	372.00
Total Variable Costs	6090.00	2540.00	2540.00	11170.00
3. Gross Margin/ha (1-2)	(-3430.00)	120.00	120.00	(-3190.00)
4. Gross Margin/ha/year	(-1715.00)	80.00	80.00	(-638.00)
5. Gross Margin/Tonne	(-171.50)	6.00	6.00	(-53.17)

Source: Study survey, and cooperative files

Note: \* See Appendix XA and XB for details of costs

N/A = Not Applicable.

TABLE 5.17b: SUMMARY\* OF GROSS MARGIN ANALYSIS ASSUMING AVERAGE AND MAXIMUM YIELDS BASED ON 1977 ESTIMATES.

Crop	YIELD REGIMES				M A X I M U M**			
	A V E R A G E							
	Plant Crop	First Ratoon	Second Ratoon	5 year Life Cycle	Plant	First Ratoon	Second Ratoon	5 Year Life Cycle
Yield tonnes/ha	70	50	50	170	185	139	139	463
Age at Harvest (yrs)	2	1½	1½		2	1½	1½	
Gross Revenue/ha (Sh)	9310.00	6650.00	6650.00	22610.00	24605.00	18487.00	18487.00	61579.00
Total Variable Costs (sh)	7990.00	3580.00	3580.00	15350.00	12360.00	7032.00	7062.00	26484.00
Gross Margin/ha (sh)	1320.00	2970.00	2970.00	7260.00	12245.00	11425.00	11425.00	35095.00
Gross Margin/ha/year (sh)	660	1980.00	1980.00	1452.00	6123.00	7617.00	7617.00	7019.00
Gross Margin/tonne	18.60	59.40	59.40	42.71	66.19	82.19	82.19	75.80

Source: Study Survey and Cooperative Files

Note: \* Detailed cost items are in Appendix (YA and XB)

\*\* Maximum yield is not easy to achieve

On average gross margins on nucleus estates though varying with companies are higher than those on outgrower farms due to good husbandry techniques resulting in higher yield on nucleus estates (see Table 5 18)

TABLE 5.18: GROSS MARGINS ON NUCLEUS ESTATES BASED ON 1977  
STUDY ESTIMATES

	Mumias		Miwani		Chemelil	
	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
Yields (tonnes/ha)	135	110	74	37	96	68
Gross Returns(K.Sh)/ ha	17955.00	14630.00	9842.00	4921.00	7138.00	5787.00
Total Variable Costs/ha K.Sh	7155.00	4350.00	3300.00	1650.00	5630.00	3257.00
Gross Margin/ha (K.sh)	10800.00	10280.00	6542.00	3271.00	7138.00	5787.00
Gross Margin/ha/yr (K.Sh)	5400.00	6853.00	3271.00	1454.00	3569.00	3858.00
Gross Margin/tonne	80.00	93.45	88.41	88.41	74.35	85.10

Source: Study Survey, 1977.

Note: See Appendix XA and XB for details of cost items.

5.2.8.4: Farmers' Conceived Problems Leading to Poor Performance

The farmers gave a list of problems which they face in their endeavour to produce cane. These problems given in Table 7.2 include: (i) lack of credit; (ii) lack of machinery for land preparation ;(iii) low profits ;(iv) poor cooperative services ;(v) unavailability of inputs ;(vi) inadequate transport facilities ;(vii) high production costs as input prices increase; (viii) drought ;(ix) pests and diseases; (x) fire outbreak ;(xi) poor management ;(xii)labour shortage ;(xiii) inadequate extension services. These problems are discussed in detail in Chapter seven where they are used to help explain cane procurement problems in the industry.

Suffice it to say here that from the study it is apparent that sugar cane farmers are faced with a multiplicity of problems most of which are not of their own making and which need urgent attention from government and other bodies in the sugar industry if sugar production is to be stepped up.

5.3: THE STRUCTURE, CONDUCT AND PERFORMANCE OF THE PROCESSING SUB-SECTOR

The Kenyan sugar industry at present (1977) consists of five major factories with an aggregate daily grinding capacity of about 10,000 metric tons of cane (34 p.91). On numerical strength therefore, the sugar processing subsector is characterized by an organizational structure that closely approximates the concept of

oligopolistic competition. However government intervention prevents unfavourable oligopolistic tendencies from dominating the industry.

### 5.3.1 Ownership, Number, Size and Location of Processing Plants:

Two of the five factories - Miwani in the Nyanza Sugar Belt and Ramisi at the coast - are wholly under private ownership and are the oldest, having been established over 50 years ago. The remaining factories - Mumias in Western Province, Chemelil and Muhoroni in Nyanza Province - were constructed under government sponsorship though managed on behalf of the government by specialized sugar expert agencies. The government has a greater control and shareholding in the latter three.

Two additional government sponsored sugar factories are in their advanced stages of development and are expected to go into production by 1979/80. These are Nzoia and South Nyanza Sugar Projects in Western and Nyanza Provinces respectively (see Fig. 1.1).

Apart from the conventional (big) sugar factories mentioned already, feasibility studies are under way for the possibility of establishing smaller "mini sugar plants" or "open pan" sugar factories to serve pockets of remote sugar growing areas now not being served by the orthodox large sugar establishments (Appendix VI). One such factory is already in production at Kabras in Kakamega District and a second one is in its final stages of development at Yala in Siaya district. Table 5.19 below gives detailed aspects of the current and proposed sugar factories in Kenya.

TABLE 5.19: PRESENT AND PROPOSED SUGAR FACTORIES IN KENYA - THEIR OWNERSHIP, LOCATION, CAPACITIES AND WORK SHIFT SCHEDULES.

Status	NAME		Year	Ownership	Daily		Annual	No. of	Shift	Location	
	Common	Full	Production	%	t.c	t.s	Capacity	Shifts	Dura- tion	Province	District
			Started	Govt.ate			'000t.s	Perday	(hours)		
E X I S T I N G	Mumias <sup>a)</sup>	Mumias Sugar Co.Ltd	1973/4	68.97 31.03	2750	300	70	3	8	Western	Kakamega
	Chemelil	Chemelil Sugar Co.Ltd	1968	95 5	2400	267	60	3	8	Nyanza	Kisumu
	Muhoroni	East African Sugar Industries Ltd.	1966	83 17	1400	140	60	3	8	Nyanza	Kisumu
	Miwani	Miwani Sugar Mills Ltd.	1923/4	0 100	2000	170	60	3	8	Nyanza	Kisumu
	Ramisi*	Associated Sugar Co.Ltd.	1926/7	0 100	850	85	30	3	8	Coast	Kwale
P R O D U C I N G	South Nyanza	South Nyanza Sugar Co. Ltd. (SONY)	1979	- -	-	-	50-60	3	8	Nyanza	South Nyanza
	Nzoia	Nzoia Sugar Co.Ltd.	1979	- -	-	-	70-100	3	8	Western	Bungoma
P L A N T I N G	Kabras	-	1976	- -	-	-	-	-	-	Western	Kakamega
	Yala	-	1978/9	- -	-	-	-	-	-	Nyanza	Siaya

Source: Study Survey;

\*Economic Review of Agriculture Vol. 7 No.1 1975

Note: a) Prior to July 1976 rated capacity in Mumias was 1800 tonnes of cane per day and 200 tonnes of sugar per day. With the current expansion programme the daily capacity here is expected

### 5.3.2 Concentration in the Sugar Processing Sector

Currently Mumias alone accounts for 25% of the total national processing capacity and 38% of the market share. The top two firms Mumias and Chemelil combined, account for about 66% of the market share. On the other hand geographically the Nyanza Sugar Belt alone has 60% of the existing factories and on production basis accounts for 58% of the market share (see Tables 5.19-5.21 and 6.4). Thus the processing sector of the sugar industry depicts the characteristics of an industry with a high concentration.

From table 5.20 we observe that Mumias leads the other sugar firms in both sugar production and in the number of people employed. It is then followed by Chemelil, Muhoroni, Miwani and Ramisi except with respect to employment when Miwani interchange positions with Muhoroni.

Using the above data a simple absolute concentration ratio ( $C_r$ ) expressed in Percentage form was calculated for the industry with respect to output and employment using the formula:

$$C_r = \left\{ \frac{\sum_{i=1}^r Q_i}{\sum_{i=1}^n Q_i} \right\} \times 100, \text{ where } C_r \text{ is the}$$

concentration ratio which in this case is the proportion of the sugar industry's output or employment accounted for by the  $r$  largest firms. Since the sugar industry in Kenya has only 5 firms  $r$  conveniently takes the values from 1 to 4 representing 20% to 80% of the firms (Table 5.21).  $Q_i$  is the quantity of <sup>output</sup> / or employment of the  $i$ th firm;  $n$  is the number of sugar firms in the industry, in this case 5.



TABLE 5.20: OUTPUT AND EMPLOYMENT SHARE AND POSITIONS HELD BY VARIOUS SUGAR COMPANIES IN KENYA 1976/77.

	Miwani	Chemelil	Muhoroni	Mumias	Ramisi*	Total
1. OUTPUT (tonnes sugar)	25236	46146	26228	63699	6062	167371
a) % Share in the industry	15.1	27.6	15.7	38.1	3.6	100
b) Position in the industry	4	2	3	1	5	
2. EMPLOYMENT (persons)	1382	1384	558	3084	392	6800
a) % share in the industry	20.4	20.3	8.2	45.4	5.7	100
b) Position in the industry	3	2	4	1	5	

Source: Field Survey, 1977;

\* For Ramisi the figures are taken from Tate and Lyle Report (op.cit).

The concentration analysis quantifies sensitivity to the three determinants of industrial competition, namely the number of firms, inequality of market shares and coalition or collusion potential. Although time did not allow for further analysis of the behaviour of the concentration measures over time, the result shows that by sheer output and employment levels the industry is small. There are only five firms in the

TABLE 5.21. CONCENTRATION IN THE SUGAR PROCESSING INDUSTRY BY PRODUCTION AND EMPLOYMENT - 1976/77

Description	Single largest. or 20% of firms	2 largest or 40% of firms	3 largest or 60% of firms	4 largest or 80% of firms	Single Smallest 20%	All 100%
w.r.t. Output:						
a).% share	38.1	65.6	81.3	96.4	(3.6)	100
b) Name of firms	Mumias	Mumias and Chemelil	Mumias Chemelil and Muhoroni	Mumias Chemelil Muhoroni	Ramisi	
w.r.t Employment:						
a).%share	45.4	65.7	86.1-	94.3	(5.7)	100
b)Name of firm	Mumias	Mumias and Chemelil	Mumias Chemelil and Miwani	Mumias Chemelil Miwani Muhoroni	Ramisi	

Source: Calculated from Table 4.20

Note: w.r.t = with respect to

industry; a very small number indeed which augurs well for collusive oligopolistic tendencies. However, there also exists inequality of market shares in the industry which again is a situation with competitive or coalition potential. Without government legal restrictions the conduct of the sugar firms would probably take different forms ranging from tacit cooperation through formal price fixing to independent action.

### 5.3.3. Degree of Integration in Sugar Processing

Most sugar factories are integrated to some extent or other. Typical forms of integration noted in the processing sector of the industry are discussed below:-

#### 5.3.3.1 Nucleus Estates

Virtually all the five factories directly own and operate nucleus estates which supply a significant proportion of their cane needs. It has been common practice in Kenya that whenever new investments in factory facilities are made, a large scale commercial farm (nucleus estate) for the cultivation of sugar cane must be provided for in such investment schemes. In most factory zones the nucleus estates provide about 30% of the total cane milled. The nucleus estates are also supposed to act as demonstration and service centres for the outgrowers. Furthermore they help balance the flow of cane to the factories by augmenting the supply from the outgrowers (see section 2.3.1).

In Muhoroni, the nucleus estate and the factory are not run as part of the same company as is the common practice in the other

sugar companies. Here an equivalent of a nucleus estate was formed as a separate Company called "Nyando Estates" but controlled by the same share holders as the factory. During the study survey, the Muhoroni management gave conflicting reports about their nucleus estate, mainly insisting that theirs was a factory without a nucleus estate relying 100 per cent on outgrower cane supply. However, for all practical purposes, and legal implications apart, Muhoroni in this study is taken as owning a nucleus estate as any other sugar company in the country.

The remaining four factories have clearly defined nucleus estates run by their agricultural departments. Thus there is to some extent some degree of integration of cane production and sugar processing in virtually all the firms.

#### 5.3.3.2 Factory - farmer Integration:

Crucial to the performance of sugar processing is the degree of co-ordinating link between the processors and the farmer. The study revealed that written contracts between factories and cane farmers are uncommon in the majority of factory zones. During the study however, two extreme cases were noted:- First, in the Mumias zone, the factory provides under contract agreement a comprehensive outgrower service scheme to enhance outgrower successful performance. Of late, the outgrowers at Mumias have gone a step further by forming an outgrowers' Company as a separate company from the factory but with a co-ordinating role between the farmers and the factory. On the other extreme are Muhoroni and Miwani which have no formal links with their outgrowers. This state of affairs helps explain the poor performance

TABLE 5.22. PROPORTION OF FARMERS INTERVIEWED THAT HAD SOME SERVICES OR INFLUENCE FROM SUGAR COMPANIES

Activity	Response According to Zone (%)							
	Miwani		Chemelil		Muhoroni		Total	
	L.F.	S.F.	L.F.	S.F.	L.F.	S.F.	L.F.	S.F.
Persuasion to grow cane	0	0	0	0	0	0	0	0
Farm Machinery Services	0	0	20	7	0	0	6.7	2.3
Supply of seed cane	0	0	0	2	0	0	0	0.8
Purchased inputs	0	0	0	0	0	0	0	0
Credit	0	0	0	20	0	0	6.7	0
Extension Services	0	0	100	0	0	0	33.3	0
Selection of cane variety	0	0	0	2.5	0	0	0	0.8
Transport	0	0	0	2.5	0	1	0	0.8

Source: Study survey, 1977.

Note

S.F = Small Farms

L.F = Large Farms

of outgrower farms in these zones. Chemelil like Mumias is providing some services to some of its growers but not at a level comparable with Mumias.

In the Nyanza Sugar Belt where most of this study was done, the need for supplementing the market mechanism with processor-farmer relationships is very urgent (see Chapter VIII). Sugar cane production demands more technological and husbandry attention that require advanced planning of all operations. Where cooperative organizations seem to have failed as in the Nyanza Sugar Belt, the task of directing farmers with respect to cane production rests with the sugar companies. Leaving the farmer to his own devices and independent judgement would seriously impair the flow of cane to the factories, usually resulting in unwarranted supply variability.

Bearing in mind that the Nyanza Sugar Belt is a marginal sugar area with respect to rainfall and difficult soils, the absence of management and technical assistance from the factories to the farmers is unfortunate. The virtual lack of processor-farmer integration is best explained by Table 5.22 summarizing the responses of farmers to the question concerning influence or services they receive from the factories.

#### 5.3.3.3: Horizontal Integration in Sugar Processing

Horizontal multi-plant integration is rare in Kenya's sugar industry. No single firm operates more than one factory under the same management. However the government as an institution partly owns three

of the five factories, but still these three factories are sub-contracted to private firms which manage them independently. It is only Mumias and Chemelil that are government owned and run by the same management firm, Bookers Agricultural Holdings under contract. However, during the study it was discovered that Mumias and Chemelil though managed by the same firm hardly aim specifically at reaping internal economies of scale with respect to management. They act independently and share few things in common.

One factor inducing the apparent horizontal integration of government sponsored factories as regard ownership is that the level of investment required to develop a new sugar factory is so high that only the government is likely to make such investments. However the integration does not usually go beyond mere ownership as other operations are run independently. It seems the aim of the government is to decentralize the industry to serve pockets of sugar cane areas and to step up national output. Sugar cane being a bulky and perishable product, it follows that the government should of necessity plan expansion through horizontal integration, decentralizing the firms into new favourable cane areas. In most cases decentralization of the factories is not merely a question of lowering cane acquisition cost, but rather it may be the only practical way to bring an otherwise remote area under sugar production. For example, there was just not any way by which the new projects in South Nyanza and Nzoia could be operated centrally from either the Nyanza Sugar Belt or Mumias. The distances involved in each case prohibit any such centralized scheme.

Although all the sugar companies act independently, they have a registered association called "the Kenya Sugar Manufacturers Association" which acts as a forum for exchanging ideas among the various sugar firms. The association also represents the sugar companies' views to the government and the Kenya Sugar Authority on various policy issues in the industry.

#### 5.3.4. Entry and Exit in Sugar Processing:

It is becoming more difficult for private new comers to enter the sugar processing sector. It must be remembered that of late the level of investment required for establishing a modern sugar factory has been very high and only the government has come up with new projects. Indeed since 1920's when Miwani and Ramisi were established, no other private sugar factory has ever been built. The reason is not due to the processing economics or technology alone, but it also depends on the complex combination of cane growing and organizing the outgrowers to ensure adequate cane supplies.

At the time of writing (1977) feasibility studies were afoot to explore the appropriateness of smaller processing units called "mini sugar plants". Already one such plant is operating at Kabras in Kakamega District, but reportedly at a high loss. If the small scale projects go through, then there may be a spate of new private entrants in the sugar processing subsector. During the study it was found out that jaggery production is discouraged in the Nyanza Sugar Belt, and in other zones its licensing is restricted to ensure that white sugar factories get adequate cane supply.



Exits are rare in the industry; only during the Second World War did two factories at Muhoroni and Kajubi River cease to exist due to recurrent losses. Exit due to bankruptcy, merging or outright sale has never occurred in modern Kenya's Sugar industry. Exit has become costly because of increased investment, and usually as in the case of Chemelil, the factories have been kept going even when they have been incurring losses.

### 5.3.5 Market Conduct Among Processors

#### 5.3.5.1 Pricing System for Cane and Sugar

Day-to-day and general seasonal price fluctuations arising from competitive conduct are non-existent in both sugar cane and sugar markets, due to tight government price control in the industry. Both farmers and processors are price takers who decide to transact at prices set by the government (see section 2.6.3).

#### 5.3.5.2. Competitive Practices Among Factories

As stated earlier, the structure of Kenya's sugar processing approximates an oligopoly model. • Relatively few (five) firms account for the bulk of sugar consumed in the country with the import source accounting for the remainder. Economic theory postulates that in market structures with small numbers of rivaling firms, there is the tendency among such firms to resort to collusion whereby rivals tend to behave in an interdependent manner. No such behaviour has been observed among the Kenyan sugar processors, again largely due to government intervention.

Competition among firms for cane procurement has been avoided through a strict government zoning scheme whereby each sugar factory has a defined geographical catchment area. Through the zoning system, each farmer falling within the catchment area of a factory must by law sell his cane to such a factory. Conversely, the factory is obliged to accept every farmer's cane within that area. Inter-zonal cane transactions cannot be done without express permission from the government. During the survey, the only instances when cane from one factory zone was sold to an outside factory were:- (i) when some mature cane got burnt by accident while the factory in that zone had some scheduled or accidental stoppage, (ii) when in May 1977, Miwani Sugar Company threatened to lay off its employees following alleged shortage of millable cane. In this case the Ministry of Agriculture directed Chemelil to offer Miwani some of their cane.

Except for factories in the Nyanza Sugar Belt, the other factories at Mumias and Ramisi (and the new ones coming up in South Nyanza and Nzoia) enjoy considerable spatial separation so that even in the absence of government zoning their catchment areas would not entail any competition for cane procurement.

#### 53.5.2.1 Relevance of Zoning and its Effects on Competition for Cane:

The zoning scheme has more relevance in the Nyanza Sugar Belt than in other areas. Historically Miwani used to cover the whole Sugar Belt, but with the setting up of Muhoroni and later Chemelil, the then Miwani catchment area had to be judiciously divided among the

three factories to ensure adequate cane supply. When interviewed about the zoning system, both the sugar companies and the farmers had mixed reactions. Among the sugar companies only Miwani felt the zoning system was in its disfavour having lost some of its former large farms to Chemelil under the system. In aggregate inter-zonal analysis showed that the majority of farmers interviewed in the Nyanza Sugar Belt tended to prefer delivering their cane to Chemelil, Miwani and Muhoroni in that order. About 45% of the farmers interviewed ranked Chemelil as number one; 35% ranked Miwani as number one, while only 19% placed Muhoroni as number one and only 1% were indifferent.

Intra-zonal response analysis showed that only 50% of the farmers interviewed under Muhoroni preferred remaining within Muhoroni zone while the other 50% preferred delivering their cane to Chemelil factory. Within Chemelil zone 58% of the farmers interviewed were satisfied with the zoning system while the remaining 42% would prefer to be re-zoned under Miwani. In the Miwani zone however, 73% of the farmers interviewed preferred to remain under Miwani with only 27% desiring re-zoning to Chemelil.

A striking feature of these responses, is that although 50% of Muhoroni farmers were eager to opt out of their present zone, no farmer from either Miwani or Chemelil indicated having Muhoroni zone as even a second choice. There was a general feeling of suspicion and dislike\* for the management of Muhoroni among the farmers. About 48% of the farmers interviewed under Muhoroni felt that the factory was just interested in receiving cane without being mindful of the

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\*At the time of writing, radio reports claimed that farmers under Muhoroni have protested to the government requesting for a new management agency to be appointed instead of the Mehta Group to run the factory.

problems facing the farmers. A further 30% of the Muhoroni farmers felt that the weighing bridge at Muhoroni factory is deliberately made faulty in farmers' disfavour. The factory officials at Muhoroni together with government officials interviewed did not however agree with the farmers' allegation about the weighing bridge.

In ranking their preference for the factories, the farmers based their judgement on such factors as:- nearness of the factory to their farms; credit facilities; provision of advice or extension services, factory-farmer relationship and road accessibility. The aforesaid analysis revealed two important aspects of the zoning system: First, that the government zoning system helps balance the flow of cane to the factories especially in the Nyanza Sugar Belt where three factories are spatially close enough as to bring adverse competitive conduct for cane procurement. Secondly, that a significant proportion of farmers in some zones are not satisfied with the zoning system, so that given free choice such farmers would opt out of their present zones and deprive cane supply to some factories.

#### 5.3.5.2.2 Non-price Competitive Conducts Among Processors:

In general the zoning system together with cane and sugar price controls have averted even non-price competition for cane procurement and for sugar sales. Thus for both cane procurement and sugar sale there are no such practices among the factories as:-

- (a) price discrimination;
- (b) advertising or other forms of product promotion;
- (c) agreement or collusion among sugar processors;
- (d) product differentiation: All the sugar produced in Kenya

must comply with government regulations. The factories therefore produce the direct consumption mill white type of sugar. "Quality standards corresponding to the World Health Organization's Codex Alimentarius Grade A sugar have been recommended by the Kenya Sugar Authority in the past, but ... no attempt has been made to insist that factories reach this standard" (44 Vol. I p.11).

In summary non-price competition has not been necessary among the sugar mills since:- (a) On the buying side for each factory the relevant market is typically a localized zone made up of farmers forced by law to sell cane to it and at a specified price. In selling the produced sugar, the factories face a larger and essentially a national market which again is an assured market since KNTC buys and distributes all the sugar produced in Kenya again at a specified price.

### 5.3.6: Performance of the Processing Subsector

#### 5.3.6.1 Excess Capacity

Economic performance of the sugar processing subsector has been less satisfactory and much room still exists for improvement. At the moment the short-fall of domestic production vis-a-vis consumption estimated at 40,000 tonnes is still great. At the same time virtually all the factories are still working below capacity. The problem of excess capacity is expounded in Chapter Six and only a brief mention of it will be made here. The analysis showed that in 1976 only Mumias and Chemelil worked above 50% of their nominal capacities,

the actual being 91% and 77% respectively. Both Miwani and Muhoroni used only about 40% of their respective capacities while Ramisi only used 20% of its capacity (see Tables 6.3 and 6.4). Continued low capacity utilization does not augur well for the industry as this implies low national output and substantial use of foreign exchange reserves for import of sugar.

#### 5.3.6.2 Profitability:

Although most of the sugar companies were reluctant to release their detailed financial statements, the general impression given was that sugar companies were not making much profit. For the 3 year period 1974 - 1976 all the factories in the Nyanza Sugar Belt except for Chemelil, according to the survey, made some small profits in each year (see Table 6.2 Chapter Six). Indeed, all along since its inception in 1967, Chemelil factory made recurrent losses until 1976, when following financial adjustments, the factory management reported making profits. Mumias factory reported making profits all through. No response however was received from Ramisi for this analysis. All the sugar companies interviewed felt that the ex-factory price of sugar was over-laden with government levy and the sugar equalization funds, and that the levy could be reduced to allow increasing the ex-factory price without appreciably affecting the current consumer price. This step they felt would help increase the milling margins for sugar. Of course excess capacity in the industry has greater adverse impact on sugar milling profitability in the industry.

### 5.3.6.3. Technical Performance at Processing Level

Apart from the factory at Ramisi which is a smaller unit, all the other four factories in Nyanza and Western Provinces including the additional two new projects coming up in South Nyanza and Nzoia are medium sized factories by World standards. However, with a continuous grinding season as we have in Kenya, the potential output from these factories per year is much higher than would be the case in other countries with short grinding seasons. We have noted the wide-spread excess capacity and more is said about it in Chapter Six. Thus on the basis of capacity utilization the whole sugar industry is inefficient. Specifically in this respect, Mumias is the most efficient followed by Chemelil, both operating above 50% nominal capacities. All the other three factories are operating below 50% of their respective nominal capacities (Chapter VI).

However, apart from capacity utilization which is treated in detail later, this study also looked into other aspects of factory performance some of which are analysed below:-

#### (i) Tonne Cane/Tonne Sugar Ratio (TC:TS)

The TC:TS ratio is a good measure of sugar extraction efficiency of a factory as it shows how many tonnes of cane a factory uses to produce one tonne of sugar. From the survey it was found that in this respect Mumias with a TC:TS ratio of 8.6 leads all other factories. Chemelil stands second, followed by Muhorani, Miwani

and Ramisi in that order (see Table 5.23 and Appendix IX ).

Experts in the industry reckon that a TC:TS ration of 10.0 should be the average to aim for in Kenya.

TABLE 5.23: FACTORY SUGAR RECOVERY IN TC:TS RATIOS 1974 - 1976

Factory	TC : TS		
	1974	1975	1976
Miwani	11.8	11.4	11.6
Chemelil	10.4	10.4	9.8
Muhoroni	11.1	11.7	10.4
Mumias	8.7	8.7	8.6
Ramisi *	14.2	14.8	13.9
Average	11.2	11.4	10.9

Source: Study Survey, 1977.

\* Obtained from Kenya Sugar Authority Statistics Files.

(ii) Time Utilization Efficiency:

During the survey it was found out that only Mumias and Chemelil had about 2 month scheduled stoppage periods for annual maintenance and repairs. The other factories at Muhoroni, Ramisi and Miwani operate throughout the year only stopping for repairs or maintenance



whenever there is a breakdown or when there is shortage of milling cane. Miwani on the other hand has a one-day-per-week scheduled stoppage for maintenance during peak grinding periods.

On the basis of utilization of gross available time (allowing for scheduled shutdowns) the study found out that on average the factories used only 45% of the time available in 1976. The previous year's figure had been 48.9%. On individual analysis in 1976, Chemelil had the best gross time utilization followed by Muhoroni and Mumias in that order, all using between 50 - 57% of gross available time. Poor time utilization was realized in both Miwani and Ramisi each using less than 40% of available time (see Table 5.24).

However, measured on the basis of tonne cane milled per available hour, then Mumias and Chemelil were more efficient in time utilization than the other three factories in 1976. Miwani, Muhoroni and Ramisi took third, fourth and fifth positions respectively. The previous year Muhoroni switched position with Miwani (Table 5.24).

Time loss in the industry was mainly attributed to such factors as: premeditated stoppage taking up 36% of available time; shortage of milling cane resulting in 12.8% of time utilized, and machinery breakdown taking up 6.2% of the available time.

From Table 5.24 we conclude that apart from premeditated time loss, Ramisi and Miwani have much of their time wasted because of lack of cane which also gives them a lower grinding rate than the other factories. The overall time utilization in the industry, effectively standing

TABLE 5.24. TIME UTILIZATION ANALYSIS IN THE FACTORIES 1975-1976 (% GROSS AVAILABLE TIME)

	Miwani		Chemelil		Muhoroni		Mumias		Ramisi		All	
	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976
Grinding	35.7	32.9	53.7	56.7	66.1	56.1	58.9	53.3	43.4	38.4	48.9	45.0
Lost: - Breakdown (Manufacture)	3.6	5.8	8.3	4.7	14.2	7.5	10.8	10.4	6.1	3.0	7.8	6.2
- Cane Shortage	30.7	22.6	7.9	3.1	10.8	17.1	0.9	1.6	14.1	10.2	15.8	12.8
- Premeditated	30.0	38.7	30.1	35.5	8.9	19.8	29.4	34.7	36.4	48.4	27.5	36.0
Grinding Rate (Tonne cane/hr)	48.6	50.4	87.9	91.4	53.3	56.1	99.4	117.1	29.2	24.9	64.2	69.7

Source: Factory Files and Kenya Sugar Authority Statistics Files.

at only 38% in 1975 and at 45% in 1976, can be regarded as still very poor.

(iii) Other Technical Performance.

Other technical aspects of performance in the processing sector like the levels of losses in various processing stages; apparent purity; brix, fibre and pol percentage, etc. are given in Appendix IX.

CHAPTER VI

ANALYSIS OF EXCESS CAPACITY: THE CASE OF NYANZA SUGAR BELT FACTORIES

6.1 Introduction

This chapter deals with the problem of excess capacity in the Kenyan sugar industry as exemplified by the three sugar factories in the Nyanza Sugar Belt, namely, Miwani, Chemelil and Muhoroni. Naturally the performance of an important industry like that of sugar engages widespread public attention and excess capacity is one aspect that has attracted most critics of the industry. Even the current government Development Plan (1974-1978) states that "the most important task to be undertaken during the new Plan period will be to increase cane production to a level sufficient to utilize the factories to full capacity" (14.4 p.240). In fact, during the field survey for this study all the factories in the Nyanza Sugar Belt admitted working below capacity.

6.2. Definition and the Concept of Excess Capacity :

For the ease of exposition and to avoid technical ambiguity a definition of "excess capacity" and the many conceptual issues implicit in it are better discussed at this juncture.

6.2.1: Technical or Non-economic Concept:

To a non-economist, the term excess capacity (EC) is a simple term used to refer to unutilized factory space; that is the difference between plant designed maximum output (PDMO) and the actual output (AO). As a corollary to this definition full capacity output (FCO) is

then defined as "the output that existing stock of equipment is intended to produce under normal working conditions with respect to hours of work, number of shifts and so forth" (41 p.1).

Mathematically the technical definition of "excess capacity" would be expressed as follows:-

$EC = PDMO - AO$ ; where EC is excess capacity; PDMO is plant designed maximum output; AO is actual output. Likewise, mathematically full capacity output (FCO) occurs when:-

$PDMO - AO = EC = 0$  (=zero); and hence  $PDMO = AO$ , and plant capacity utilization is 100%; ie  $\frac{AO}{PDMO} \times 100 = 100\%$ .

As can be seen, the technical concept so far discussed totally ignores the cost elements involved in capacity utilization. To an economist as we shall see later, this concept does not provide a good measuring yardstick for capacity.

#### 6.2.2. The Economic Concept of Full Capacity and Excess Capacity

In economics the concept and definition of capacity must take cost considerations into account. Lipsey (25 p.221) defines (optimal) plant capacity as the "level of output that corresponds to the minimum level of short-run total cost" and that "capacity in this sense is not the upper limit on what can be produced". As a corollary therefore a firm producing "with excess capacity" is producing an output smaller than the point of minimum average total cost. Conversely, a firm producing above capacity is producing above this output and is incurring higher costs per unit.

The economist's concept of capacity is therefore more difficult to measure and the condition of optimal capacity and excess capacity will depend on whether or not the firm in question is operating under perfect or imperfect conditions.

6.2.2.1: Theoretical Framework of Capacity under Perfect Competition.

Under perfect competition in the sugar industry or in any given industry, full capacity equilibrium would be defined as the output level associated with full competitive equilibrium in the industry. As shown in Figure 6.1. for any given firm, this would occur at the minimum point (K) of the long-run average cost curve (LRAC). In this case the full equilibrium point would be defined by output  $Q_e$ . At this point in the perfect competition model the sugar industry would find itself in a situation where for each firm, marginal cost (MC) equals average cost (AC) equals price (P) and equals marginal revenue (MR). At  $Q_e$  the firm or the industry is realizing full opportunity costs which is the normal profit or "zero profit" position under perfect competition. Operating at either  $Q_1$  or  $Q_2$  for example would incur losses from excess capacity  $Q_1 Q_e$  or over-utilized capacity  $Q_e Q_2$  respectively.

The longrun competitive equilibrium position  $Q_e$  is reached following some longrun adjustment supposed to take place in the industry under perfect competition. If the short-run equilibrium price for a firm or the industry is high, the profit prospects would attract new firms and/or the existing firms would try to expand their plants. This process will continue until price drops to the longrun equilibrium level  $P_e$  when there will be no prospects for unusual profits to be earned. Conversely if the short-run equilibrium price is low so that there are losses, some firms in

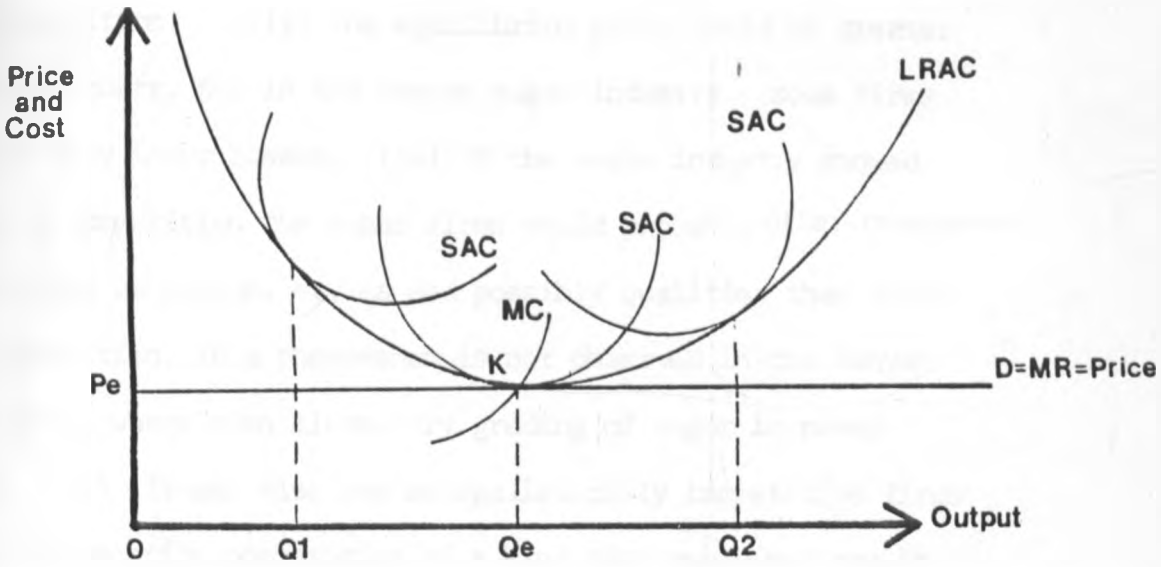


Fig.6.1: LONGRUN EQUILIBRIUM & FULL CAPACITY FOR A FIRM UNDER PERFECT COMPETITION

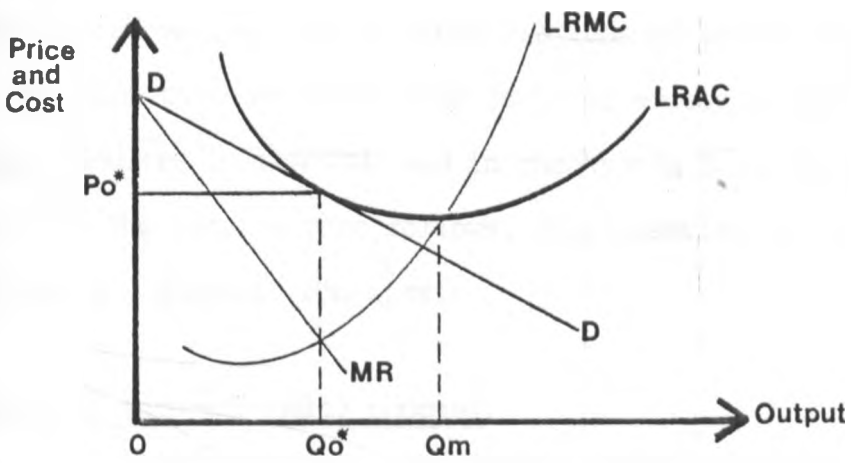


Fig.6.2: LONGRUN MONOPOLISTIC COMPETITION EQUILIBRIUM AND EXCESS CAPACITY FOR A FIRM

be higher and output would be lower, ceteris paribus, than under perfect competition. (iii) The equilibrium price would be greater than marginal costs. But in the Kenyan sugar industry some firms report that they incur losses. (iv) If the sugar industry showed monopolistic competition the sugar firms would probably offer consumers a wider variety of brands, styles and possibly qualities than under perfect competition. This phenomenon is not observed in the Kenyan sugar industry, where even elementary grading of sugar is never attempted. (v) It may also pay monopolistically competitive firms to engage in non-price competition of a kind that would not pay in perfect competition. Again, non-price competition is not a common feature of the sugar industry in Kenya (see section 5.3.5).

### 6.3 Excess Capacity in the Nyanza Sugar Belt

After the above theoretical considerations of excess capacity, the first question that one would pose is "does excess capacity exist in the sugar industry in general and in the Nyanza Sugar Belt in particular?" In the section that follows, this question is tackled in both technical and economic concepts.

#### 6.3.1 Technical (non-economic) concept.

Technically and hence with no economic consideration of costs the answer to the question, whether or not excess capacity exists in the sugar industry, is invariably "YES", as can be seen in Table 6.1 and in the Table of Appendix IX. By this definition none of the three factories in the Nyanza Sugar Belt has ever operated at full capacity in any one year since they were established (also see Appendix IVA and IVB).



the industry would opt out of the business while others may reduce their sizes thus pushing the output and price to equilibrium position  $Q_e$  and  $P_e$ . Thus in the long-run only efficient firms in the sugar industry would remain in production as there would be no super-normal profits to be earned and high cost firms would have to opt out of business.

#### 6.2.2.2.: Theoretical Framework of Capacity under Imperfect Competition

Under imperfect competition (monopolistic or oligopolistic) adjustments in economic organization of a firm or industry give rise to excess capacity (Fig. 6.2). Each firm aims at maximizing its profits by choosing its level of output. However, the demand curve for the product of each firm is expected to have a negative slope and the demand facing each firm depends on what other firms do. At equilibrium each firm must equate its marginal revenue (MR) with marginal cost (MC), given the actions of all other firms. In the short-run equilibrium each firm chooses a profit maximizing price and output levels which in aggregate result in market clearing for the industry.

If super-normal profits are earned in the industry then new firms will be attracted to enter the industry. In the long-run, firms would enter the industry until there are no excess profits to be earned. This occurs at the point of long-run equilibrium in which price ( $P_O^*$ ) must equal long-run average cost (LRAC) for each firm (Fig. 6.2). As depicted in Fig. 6.2 the demand curve DD facing each firm at equilibrium must be tangential to its long-run average cost curve (LRAC) resulting in price  $P_O^*$  and output  $Q_O^*$ . Any output level below or above  $Q_O^*$  will involve a loss to the firm. Thus the long-run imperfect competitive equilibrium involves operating with excess capacity ( $Q_O^* - Q_m^*$ ) since each firm produces at a point where average costs are greater than the minimum average costs. As long as the demand curve facing each firm has some negative slope, each firm will continue producing at a point where average costs are greater than the minimum average costs.

Under the monopolistic competition theory the following conditions would hold in the Kenya Sugar industry:- (i) The equilibrium output of the firm(s) would be less than the one at which average total costs is a minimum and "this is known as the excess capacity theorem" (25p. 268). (ii) Prices at market supply and demand equilibrium would

Given that the full capacity rating for each of the factories is 60,000 tonnes per annum, we can see from Table 6.1 and the Table in Appendix IV that the ten year average throughput for each of the three factories during the 1967—1976 period centres around 50% of plant designed maximum output (PDMO).

Table 6.1 below summarizes the actual average capacity performance during the last decade together with the highest and the lowest throughput ever recorded by each of the factories during the same period.

TABLE 6.1: THE AVERAGE, THE HIGHEST AND THE LOWEST PERCENTAGE FACTORY CAPACITY UTILIZATION IN THE NYANZA SUGAR BELT 1967-1976

	Miwani		Chemelil		Muhoroni	
	%PDMO	Year	%PDMO	Year	%PDMO	Year
Ten Year Average Capacity Utilization (AO)	53	1967-76	57	1968-76	45	1967-76
Ten Year Average Excess Capacity (EC)	47	1967-76	43	1968-76	55	1967-76
Highest Throughput	64	1969	77	1976	57	1971
Lowest Throughput	44	1972	19	1968	30	1967

Source: Appendix IV

The figures in Table 6.1 and in Appendix IV provide measures useful in analysing excess capacity. The plant output expressed as a percentage of plant designed maximum output (PDMO) is a good indicator of technical efficiency. It also shows the level of capital stock utilization in

the industry.

At any rate Table 6.1 and the one in Appendix IV confirm the assertion at least technically, that the factories in the Nyanza Sugar Belt are working with excess capacity. In fact during the factory surveys all the sugar companies in the Nyanza Sugar Belt admitted without any hesitation that excess capacity was their most serious problem (Table 6.2). This is in sharp contrast to Mumias in Western Province, that rejected the proposition that excess capacity was a problem in their firm.

TABLE 6.2: THE RESPONSE OF SUGAR COMPANIES ABOUT EXCESS CAPACITY AS A PROBLEM.

Factory	Response/Comment
Miwani	Serious and chronic
Chemelil	Seasonal Problem
Muhoroni	Recurrent Problem
Mumias	Not a problem
Ramisi	N/A

Source: Author's Survey 1977

Note: N/A = Not Available.

### 6.3.2: Economic Considerations of Excess Capacity in the Sugar Industry

In the preceding section, it has been established that technically excess capacity does exist in the Nyanza Sugar Belt factories. In this section, however economic considerations such as costs, profits and the type of competition obtaining in the industry will be taken into account in explaining excess capacity.

#### 6.3.2.1: Structure of the Sugar Industry and Excess Capacity

The structure of the sugar industry as analysed in Chapter II and V reveals that the industry cannot be categorized distinctly into either perfect or monopolistic market models. At a glance certain characteristics may give the impression that the industry has monopolistic or oligopolistic market structure. At present there are only five firms involved in sugar production. Secondly barriers to entry can also be observed in the industry in terms of absolute costs and scale economy barriers. To enter into sugar production a new firm would need to raise about K£ 17 million for a normal factory producing 60,000 tonnes of sugar per year. Even the small "mini sugar plants" now under feasibility study in Kenya have relatively high initial costs.

In the industry, the product (sugar) is treated as homogeneous. There are no brand names. Even where physical differences exist, as in the colour of sugar, no economic differentiation arises since the government fixes the same price for all acceptable sugar grades. The pricing system in the industry therefore deviates from the perfect competition model. The government-fixed prices may not reflect free market forces of supply and demand but tend to weigh heavily in favour of welfare objectives. The system does not allow for collusive conduct

by participants at any market channel level that would affect price. This may help explain the frequently reported cases of hoarding and smuggling in certain areas in the country. However, knowledge and information about the market are nearly perfect. Neither the producers nor the government ever spend money in advertising as it is never necessary. No one producer can affect the price, although collectively they could affect price through representation in the government policy-making bodies in the industry.

Theoretically, super-normal profits and losses are expected to disappear under perfect competition. The price should just be covering the costs and rents of all firms in the business in the long-run. In recent years no firm in the sugar industry has threatened to opt out of business, thus suggesting no serious losses are occurring in the industry. On the other hand, we have had a trend whereby the industry has been attracting new entrants, albeit with much government assistance. Given that a lot of expert feasibility studies go into such new projects before they are established, it is appropriate to assume that when a project recommendation is drawn up, profit-motives are ranked high in addition to the sheer welfare objectives of self-sufficiency in sugar.

#### 6.3.2.2. Cost Structure in the Sugar Industry and Excess Capacity

The problem of determining the optimum capacity and hence the extent of excess capacity in the sugar industry hinges upon the estimation of the cost structure in the industry. It had been intended to estimate an average cost function from cross-sectional data collected from the factories, but as it turned out, some of the firms totally

refused to divulge any figures concerning their costs. Because of this constraint the analysis given here will be more descriptive rather than empirical.

Given the paucity of cost data, we can only proceed by making certain ad hoc assumptions based on the general observations of the industry to make our analysis complete:

(i) First we assume that in Kenya the demand for sugar produced by the local firms is never subjected to any significant annual cyclic behaviour which would necessitate planned reduction or increase in production in any one year. In fact the firms face the same market price which they know in advance; and they also know that the market is never saturated given that Kenya is still a net importer.

(ii) Secondly we assume that all the firms are facing the same cost structure. A not unreasonable assumption given that all sugar firms operate in the same economic and political environment. The market labour wages and the raw material (sugar cane) prices are controlled by the government.

(iii) Thirdly we assume that the firms are using the same technology as is reflected in the almost uniformly designed technical capacity of their plants.

(iv) Lastly, we assume that any inter-firm cost differences, if they occur, are largely due to the inefficient manner in which some managements utilize their resources.

The question then is: why do some firms operate at lower output levels than others? And why do others claim to be incurring losses

while some are making profits? Although such profits and losses reported (Table 6.3) reflect the "accountant concept" of profits which does not take full opportunity cost of production into considerations, they are still good indicators of economic performance.

Indeed, Mumias which operates at a higher capacity than the other factories, reported making reasonable profits and stated that excess capacity was not a problem they experience. If physical expansion is anything to go by, then the current expansion scheme in Mumias aimed at increasing the factory's scheduled capacity from 70000 tonnes to 156000 tonnes of sugar per year is an indication that economies of scale can be exploited in the sugar industry. The industry is either facing long-run decreasing costs or constant rather than increasing costs with respect to scale of operation. If the case were one of increasing costs with respect to economies of scale then the firms including Mumias, would tend to reduce the scale of operations to cut down on costs. With the assumptions made above it can be argued that economies of scale exist in the industry in such per unit cost items as :- (a) factory fixed costs, (b) administrative costs, (c) general personnel costs, (d) management agency cost in case of factories employing hired management firms, (e) materials and fuel costs and (f) cane assembly costs.

#### 6.3.2.3 Profits or Losses in the Sugar Industry :

When the study was conducted only Chemelil admitted having incurred losses throughout since its inception and only making some profits in 1976. Other factories though reluctant about releasing statistical details, accepted that they have been making some profits (Table 6.3).

TABLE 6.3 PROFIT OR LOSS IN SUGAR COMPANIES IN NYANZA SUGAR BELT AND MUMIAS 1974 - 1977.

	1974	1975	1976	1977*
Miwani	Small profit	Small Profit	Small Profit	Not sure
Chemelil	Loss	Loss	Profit	Expect Profit
Muhoroni	Profit	Small Profit	Profit	Expect small Profit
Mumias	Profit	Profit	Profit	Expect Profit

Source: Field Survey 1977; \* = Forecast

These profits and loss statements are necessarily in terms of the businessman's concept of profit. They are expressed as the difference between the total receipts and the total costs. They in no way take into account the opportunity costs on capital and risk as in the full economic cost concept. But still they are good indicators of economic performance of the industry. Mathematically these accounting profits would be written as:-

$$Y = nX - (nV_c + F_c) = n(X - V_c) - F_c;$$

where Y is gross profit in shillings; n is number of tonnes of sugar produced per year; X is net sales price of sugar in shilling per



tonne;  $V_c$  is variable cost per tonne of sugar produced;  $F_c$  is annual fixed cost in shillings. This functional relationship can be represented graphically as follows (Fig. 6.3)

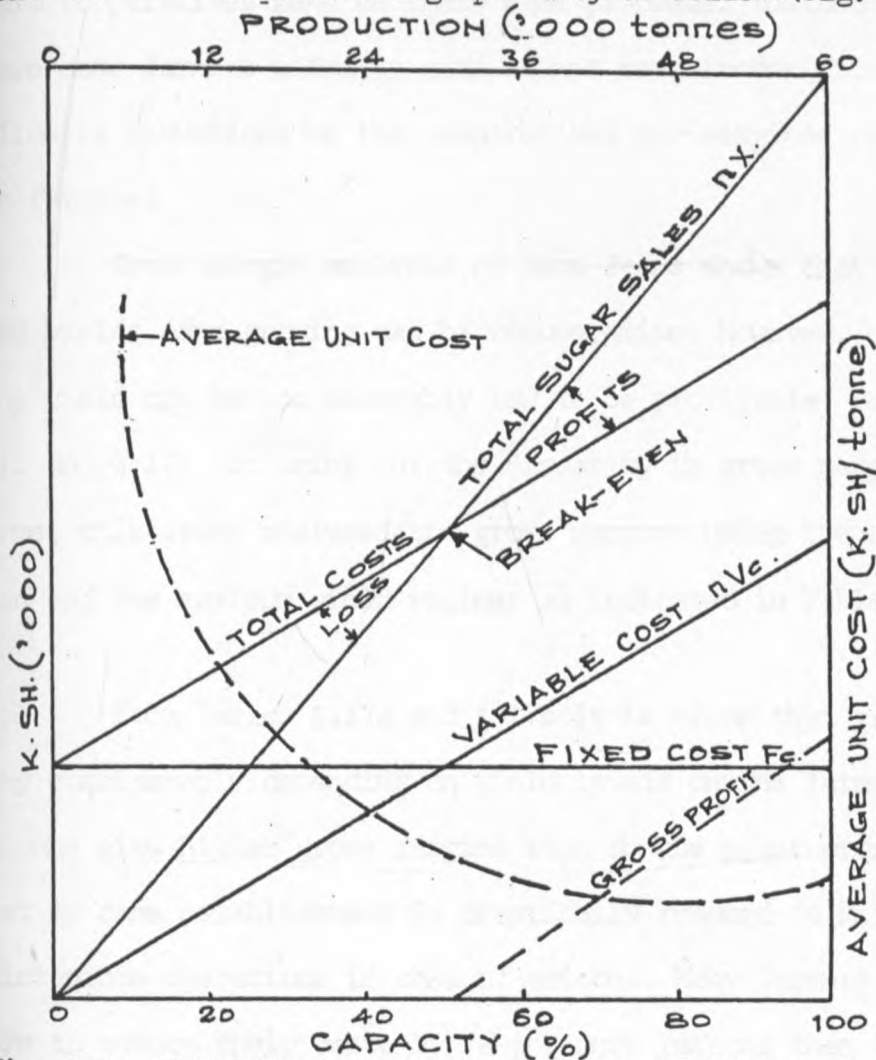


Fig. 6.3: GRAPHICAL ANALYSIS OF PROFITS AND LOSSES IN SUGAR PRODUCTION (HYPOTHETICAL DATA)

In order to explain the anomaly in the sugar industry whereby some firms are operating even when they are incurring losses we need to interpret the graph in Fig. 6.3. When the production function for a firm is such that it finds itself operating below break-even point — that is at a loss- it does not mean that the plant should close down

that the understanding of the small scale farmer about sugar cane profitability is obscured by the alleged mysterious deductions they claim cooperatives make on their cane proceeds. Instances were given where some farmers ended up with no net cash income from cane proceeds following deductions by the cooperatives for services rendered to the farmers!

Gross margin analysis on cane farms shows that with good cane yields cane growing can be remunerative. However, on some farms cane yield can be too miserably low to be profitable (see Tables 5.16 and 5.17). To bring out the disparity in gross margins among farms, this study analysed the gross margins using the minimum, the mean and the maximum yield regimes as indicated in Table 5.17.

From Tables 5.17a and 5.17b it is clear that gross margins vary considerably depending on yield levels on the farms. Generally ratoons give higher gross margins than do the plant crops since the cost of cane establishment is drastically reduced to mere crop maintenance operations in case of ratoons. Many farmers tend therefore to reduce their costs by taking more ratoons than the recommended two. Four or five ratoons per crop cycle were not uncommon among outgrowers thereby stretching the crop cycle far beyond the usual five years. There is also a tendency among some farmers to try to reduce costs by doing less weeding and/or fertilizer application, but this practice invariably results in low yields and hence reduced gross margins.

TABLE 5.17a : GROSS MARGIN ANALYSIS ASSUMING MINIMUM YIELD OF 20 TONNES PER HECTARE PER HARVEST (K.Sh) BASED ON 1977 ESTIMATES

	Plant Crop First (2yrs)	Ratoon (1½yrs)	Second Ratoon (1½yrs)	5 year Cycle
1. Gross Revenue per hectare @ 133/= tonne	2660.00	2660.00	2 660.00	7980.00
2. Variable Costs per hectare *:-				
i. Cane establishment	3538.00	N/A	N/A	3538.00
ii. Weeding	630.00	618.00	618.00	1866.00
iii. Fertilizers	1038.00	1038.00	1038.00	3114.00
iv. Harvesting and Tran- sport @ 30/= /tonne	600.00	600.00	600.00	1800.00
v. Union and Society Cess @ 8/= /tonne	160.00	160.00	160.00	480.00
vii. Miscellaneous	124.00	124.00	124.00	372.00
Total Variable Costs	6090.00	2540.00	2540.00	11170.00
3. Gross Margin/ha (1-2)	(-3430.00)	120.00	120.00	(-3190.00)
4. Gross Margin/ha/year	(-1715.00)	80.00	80.00	(-638.00)
5. Gross Margin/Tonne	(-171.50)	6.00	6.00	(-53.17)

Source: Study survey, and cooperative files

Note: \* See Appendix XA and XB for details of costs

N/A = Not Applicable.

TABLE 5.17b: SUMMARY OF GROSS MARGIN ANALYSIS ASSUMING AVERAGE AND MAXIMUM YIELDS BASED ON 1977 ESTIMATES.

Crop	YIELD REGIMES							
	AVERAGE				MAXIMUM**			
	Plant Crop	First Ratoon	Second Ratoon	5 year Life Cycle	Plant	First Ratoon	Second Ratoon	5 Year Life Cycle
Yield tonnes/ha	70	50	50	170	185	139	139	463
Age at Harvest (yrs)	2	1½	1½		2	1½	1½	
Gross Revenue/ha (Sh)	9310.00	6650.00	6650.00	22610.00	24605.00	18487.00	18487.00	61579.00
Total Variable Costs (sh)	7990.00	3680.00	3680.00	15350.00	12360.00	7052.00	7062.00	26484.00
Gross Margin/ha (sh)	1320.00	2970.00	2970.00	7260.00	12245.00	11425.00	11425.00	35095.00
Gross Margin/ha/year (sh)	660	1980.00	1980.00	1452.00	6123.00	7617.00	7617.00	7019.00
Gross Margin/tonne	18.60	59.40	59.40	42.71	66.19	82.19	82.19	75.80

Source: Study Survey and Cooperative Files

Note: \* Detailed cost items are in Appendix (YA and YB)

On average gross margins on nucleus estates though varying with conditions are higher than those on outgrower farms due to good husbandry techniques resulting in higher yield on nucleus estates (see Table 5.18)

TABLE 5.18: GROSS MARGINS ON NUCLEUS ESTATES BASED ON 1977  
STUDY ESTIMATES

	Mumias		Miwani		Chemelil	
	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
Yields (tonnes/ha)	135	110	74	37	96	68
Gross Returns(K.Sh)/ ha	17955.00	14630.00	9842.00	4921.00	7138.00	5787.00
Total Variable Costs/ha K.Sh	7155.00	4350.00	3300.00	1650.00	5630.00	3257.00
Gross Margin/ha (K.sh)	10800.00	10280.00	6542.00	3271.00	7138.00	5787.00
Gross Margin/ha/yr (K.Sh)	5400.00	6853.00	3271.00	1454.00	3569.00	3858.00
Gross Margin/tonne	80.00	93.45	88.41	88.41	74.35	65.10

Source: Study Survey, 1977.

Note: See Appendix XA and XB for details of cost items.

5.2.8.4: Farmers' Conceived Problems Leading to Poor Performance

The farmers gave a list of problems which they face in their endeavour to produce cane. These problems given in Table 7.2 include: (i) lack of credit; (ii) lack of machinery for land preparation ;(iii) low profits ;(iv) poor cooperative services ;(v) unavailability of inputs ;(vi) inadequate transport facilities ;(vii) high production costs as input prices increase; (viii) drought ;(ix) pests and diseases; (x) fire outbreak ;(xi) poor management ;(xii)labour shortage ;(xiii) inadequate extension services. These problems are discussed in detail in Chapter seven where they are used to help explain cane procurement problems in the industry.

Suffice it to say here that from the study it is apparent that sugar cane farmers are faced with a multiplicity of problems most of which are not of their own making and which need urgent attention from government and other bodies in the sugar industry if sugar production is to be stepped up.

5.3: THE STRUCTURE, CONDUCT AND PERFORMANCE OF THE PROCESSING SUB-SECTOR

The Kenyan sugar industry at present (1977) consists of five major factories with an aggregate daily grinding capacity of about 10,000 metric tons of cane (34 p.91). On numerical strength therefore, the sugar processing subsector is characterized by an organizational structure that closely approximates the concept of

oligopolistic competition. However government intervention prevents unfavourable oligopolistic tendencies from dominating the industry.

### 5.3.1 Ownership, Number, Size and Location of Processing Plants:

Two of the five factories - Miwani in the Nyanza Sugar Belt and Ramisi at the coast-are wholly under private ownership and are the oldest , having been established over 50 years ago. The remaining factories - Mumias in Western Province, Chemelil and Muhoroni in Nyanza Province - were constructed under government sponsorship though managed on behalf of the government by specialized sugar expert agencies. The government has a greater control and shareholding in the latter three.

Two additional government sponsored sugar factories are in their advanced stages of development and are expected to go into production by 1979/80. These are Nzoia and South Nyanza Sugar Projects in Western and Nyanza Provinces respectively (see Fig. 1.1).

Apart from the conventional (big) sugar factories mentioned already, feasibility studies are under way for the possibility of establishing smaller "mini sugar plants" or "open pan" sugar factories to serve pockets of remote sugar growing areas now not being served by the orthodox large sugar establishments(Appendix VI). One such factory is already in production at Kabras in Kakamega District and a second one is in its final stages of development at Yala in Siaya district. Table 5.19 below gives detailed aspects of the current and proposed sugar factories in Kenya.

TABLE 5.19: PRESENT AND PROPOSED SUGAR FACTORIES IN KENYA - THEIR OWNERSHIP, LOCATION, CAPACITIES AND WORK SHIFT SCHEDULES.

Status	NAME		Year	Ownership	Daily Capacity		Annual Capacity	No. of Shifts	Shift Duration	Location		
	Common	Full	Production Started	%	t.c	t.s	'000t.s	Perday	(hours)	Province	District	
EXISTING	Mumias <sup>a)</sup>	Mumias Sugar Co.Ltd	1973/4	68.97	31.03	2750	300	70	3	8	Western	Kakamega
	Chemelil	Chemelil Sugar Co.Ltd	1968	95	5	2400	267	60	3	8	Nyanza	Kisumu
	Muhoroni	East African Sugar Industries Ltd.	1966	83	17	1400	140	60	3	8	Nyanza	Kisumu
	Miwani	Miwani Sugar Mills Ltd.	1923/4	0	100	2000	170	60	3	8	Nyanza	Kisumu
	Ramisi*	Associated Sugar Co.Ltd.	1926/7	0	100	850	85	30	3	8	Coast	Kwale
PROPOSED	South Nyanza	South Nyanza Sugar Co. Ltd. (SONY)	1979	-	-	-	-	50-60	3	8	Nyanza	South Nyanza
	Nzoia	Nzoia Sugar Co.Ltd.	1979	-	-	-	-	70-100	3	8	Western	Bungoma
PLANTS	Kabras	-	1976	-	-	-	-	-	-	-	Western	Kakamega
	Yala	-	1978/9	-	-	-	-	-	-	-	Nyanza	Siaya

Source: Study Survey;  
\*Economic Review of Agriculture Vol. 7 No.1 1975

Note: a) Prior to July 1976 rated capacity in Mumias was 1800 tonnes of cane per day and 200 tonnes of sugar per day. With the current expansion programme the daily capacity here is expected to increase further.



### 5.3.2 Concentration in the Sugar Processing Sector

Currently Mumias alone accounts for 25% of the total national processing capacity and 38% of the market share. The top two firms Mumias and Chemelil combined, account for about 66% of the market share. On the other hand geographically the Nyanza Sugar Belt alone has 60% of the existing factories and on production basis accounts for 58% of the market share (see Tables 5.19-5.21 and 6.4). Thus the processing sector of the sugar industry depicts the characteristics of an industry with a high concentration.

From table 5.20 we observe that Mumias leads the other sugar firms in both sugar production and in the number of people employed. It is then followed by Chemelil, Muhoroni, Miwani and Ramisi except with respect to employment when Miwani interchange positions with Muhoroni.

Using the above data a simple absolute concentration ratio ( $C_r$ ) expressed in percentage form was calculated for the industry with respect to output and employment using the formula:

$$C_r = \left\{ \frac{\sum_{i=1}^r Q_i}{\sum_{i=1}^n Q_i} \right\} \times 100, \text{ where } C_r \text{ is the}$$

concentration ratio which in this case is the proportion of the sugar industry's output or employment accounted for by the  $r$  largest firms. Since the sugar industry in Kenya has only 5 firms  $r$  conveniently takes the values from 1 to 4 representing 20% to 80% of the firms (Table 5.21)  $Q_i$  is the quantity of <sup>output</sup> / or employment of the  $i$ th firm;  $n$  is the number of sugar firms in the industry, in this case 5.

TABLE 5.20: OUTPUT AND EMPLOYMENT SHARE AND POSITIONS HELD BY VARIOUS SUGAR COMPANIES IN KENYA 1976/77.

	Miwani	Chemelil	Muhoroni	Mumias	Ramisi*	Total
1. OUTPUT (tonnes sugar)	25236	46146	26228	63699	6062	167371
a) % Share in the industry	15.1	27.6	15.7	38.1	3.6	100
b) Position in the industry	4	2	3	1	5	
2. EMPLOYMENT (persons)	1382	1384	558	3084	392	680
a) % share in the industry	20.4	20.3	8.2	45.4	5.7	100
b) Position in the industry	3	2	4	1	5	

Source: Field Survey, 1977;

\* For Ramisi the figures are taken from Tate and Lyle Report (op.cit).

The concentration analysis quantifies sensitivity to the three determinants of industrial competition, namely the number of firms, inequality of market shares and coalition or collusion potential. Although time did not allow for further analysis of the behaviour of the concentration measures over time, the result shows that by sheer output and employment levels the industry is small. There are only five firms in the

TABLE 5.21. CONCENTRATION IN THE SUGAR PROCESSING INDUSTRY BY PRODUCTION AND EMPLOYMENT - 1976/77

Description	Single largest. or 20% of firms	2 largest or 40% of firms	3 largest or 60% of firms	4 largest or 80% of firms	Single Smallest 20%	All 100%
w.r.t. Output:						
a).% share	38.1	65.6	81.3	96.4	(3.6)	100
b) Name of firms	Mumias	Mumias and Chemelil	Mumias Chemelil and Muhoroni	Mumias Chemelil Muhoroni	Ramisi	
w.r.t Employment:						
a).%share	45.4	65.7	86.1	94.3	(5.7)	100
b)Name of firm	Mumias	Mumias and Chemelil	Mumias Chemelil and Miwani	Mumias Chemelil Miwani Muhoroni	Ramisi	

Source: Calculated from Table 4.20

Note: w.r.t = with respect to

industry; a very small number indeed which augurs well for collusive oligopolistic tendencies. However, there also exists inequality of market shares in the industry which again is a situation with competitive or coalition potential. Without government legal restrictions the conduct of the sugar firms would probably take different forms ranging from tacit cooperation through formal price fixing to independent action.

### 5.3.3. Degree of Integration in Sugar Processing

Most sugar factories are integrated to some extent or other. Typical forms of integration noted in the processing sector of the industry are discussed below:-

#### 5.3.3.1 Nucleus Estates

Virtually all the five factories directly own and operate nucleus estates which supply a significant proportion of their cane needs. It has been common practice in Kenya that whenever new investments in factory facilities are made, a large scale commercial farm (nucleus estate) for the cultivation of sugar cane must be provided for in such investment schemes. In most factory zones the nucleus estates provide about 30% of the total cane milled. The nucleus estates are also supposed to act as demonstration and service centres for the outgrowers. Furthermore they help balance the flow of cane to the factories by augmenting the supply from the outgrowers (see section 2.3.1).

In Muhoroni, the nucleus estate and the factory are not run as part of the same company as is the common practice in the other

sugar companies. Here an equivalent of a nucleus estate was formed as a separate Company called "Nyando Estates" but controlled by the same share holders as the factory. During the study survey, the Muhoroni management gave conflicting reports about their nucleus estate, mainly insisting that theirs was a factory without a nucleus estate relying 100 per cent on outgrower cane supply. However, for all practical purposes, and legal implications apart, Muhoroni in this study is taken as owning a nucleus estate as any other sugar company in the country.

The remaining four factories have clearly defined nucleus estates run by their agricultural departments. Thus there is to some extent some degree of integration of cane production and sugar processing in virtually all the firms.

#### 5.3.3.2 Factory - farmer Integration:

Crucial to the performance of sugar processing is the degree of co-ordinating link between the processors and the farmer. The study revealed that written contracts between factories and cane farmers are uncommon in the majority of factory zones. During the study however, two extreme cases were noted:- First, in the Mumias zone, the factory provides under contract agreement a comprehensive outgrower service scheme to enhance outgrower successful performance. Of late, the outgrowers at Mumias have gone a step further by forming an outgrowers' Company as a separate company from the factory but with a co-ordinating role between the farmers and the factory. On the other extreme are Muhoroni and Miwani which have no formal links with their outgrowers. This state of affairs helps explain the poor performance

TABLE 5.22. PROPORTION OF FARMERS INTERVIEWED THAT HAD SOME SERVICES OR INFLUENCE FROM SUGAR COMPANIES

Activity	Response According to Zone (%)							
	Miwani		Chemelil		Muhoroni		Total	
	L.F.	S.F.	L.F.	S.F.	L.F.	S.F.	L.F.	S.F.
Persuasion to grow cane	0	0	0	0	0	0	0	0
Farm Machinery Services	0	0	20	7	0	0	6.7	2.3
Supply of seed cane	0	0	0	2	0	0	0	0.8
Purchased inputs	0	0	0	0	0	0	0	0
Credit	0	0	0	20	0	0	6.7	0
Extension Services	0	0	100	0	0	0	33.3	0
Selection of cane variety	0	0	0	2.5	0	0	0	0.8
Transport	0	0	0	2.5	0	1	0	0.8

Source: Study survey, 1977.

Note

S.F = Small Farms

L.F = Large Farms

of outgrower farms in these zones. Chemelil like Mumias is providing some services to some of its growers but not at a level comparable with Mumias.

In the Nyanza Sugar Belt where most of this study was done, the need for supplementing the market mechanism with processor-farmer relationships is very urgent (see Chapter VIII). Sugar cane production demands more technological and husbandry attention that require advanced planning of all operations. Where cooperative organizations seem to have failed as in the Nyanza Sugar Belt, the task of directing farmers with respect to cane production rests with the sugar companies. Leaving the farmer to his own devices and independent judgement would seriously impair the flow of cane to the factories, usually resulting in unwarranted supply variability.

Bearing in mind that the Nyanza Sugar Belt is a marginal sugar area with respect to rainfall and difficult soils, the absence of management and technical assistance from the factories to the farmers is unfortunate. The virtual lack of processor-farmer integration is best explained by Table 5.22 summarizing the responses of farmers to the question concerning influence or services they receive from the factories.

#### 5.3.3.3: Horizontal Integration in Sugar Processing

Horizontal multi-plant integration is rare in Kenya's sugar industry. No single firm operates more than one factory under the same management. However the government as an institution partly owns three

of the five factories, but still these three factories are sub-contracted to private firms which manage them independently. It is only Mumias and Chemelil that are government owned and run by the same management firm, Bookers Agricultural Holdings under contract. However, during the study it was discovered that Mumias and Chemelil though managed by the same firm hardly aim specifically at reaping internal economies of scale with respect to management. They act independently and share few things in common.

One factor inducing the apparent horizontal integration of government sponsored factories as regard ownership is that the level of investment required to develop a new sugar factory is so high that only the government is likely to make such investments. However the integration does not usually go beyond mere ownership as other operations are run independently. It seems the aim of the government is to decentralize the industry to serve pockets of sugar cane areas and to step up national output. Sugar cane being a bulky and perishable product, it follows that the government should of necessity plan expansion through horizontal integration, decentralizing the firms into new favourable cane areas. In most cases decentralization of the factories is not merely a question of lowering cane acquisition cost, but rather it may be the only practical way to bring an otherwise remote area under sugar production. For example, there was just not any way by which the new projects in South Nyanza and Nzoia could be operated centrally from either the Nyanza Sugar Belt or Mumias. The distances involved in each case prohibit any such centralized scheme.



Although all the sugar companies act independently, they have a registered association called "the Kenya Sugar Manufacturers Association" which acts as a forum for exchanging ideas among the various sugar firms. The association also represents the sugar companies' views to the government and the Kenya Sugar Authority on various policy issues in the industry.

#### 5.3.4. Entry and Exit in Sugar Processing:

It is becoming more difficult for private new comers to enter the sugar processing sector. It must be remembered that of late the level of investment required for establishing a modern sugar factory has been very high and only the government has come up with new projects. Indeed since 1920's when Miwani and Ramisi were established, no other private sugar factory has ever been built. The reason is not due to the processing economics or technology alone, but it also depends on the complex combination of cane growing and organizing the outgrowers to ensure adequate cane supplies.

At the time of writing (1977) feasibility studies were afoot to explore the appropriateness of smaller processing units called "mini sugar plants". Already one such plant is operating at Kabras in Kakamega District, but reportedly at a high loss. If the small scale projects go through, then there may be a spate of new private entrants in the sugar processing subsector. During the study it was found out that jaggery production is discouraged in the Nyanza Sugar Belt and in other zones its licensing is restricted to ensure that white sugar factories get adequate cane supply.

Exits are rare in the industry; only during the Second World War did two factories at Muhoroni and Kajubi River cease to exist due to recurrent losses. Exit due to bankruptcy, merging or outright sale has never occurred in modern Kenya's Sugar industry. Exit has become costly because of increased investment, and usually, as in the case of Chemelil, the factories have been kept going even when they have been incurring losses.

### 5.3.5 Market Conduct Among Processors

#### 5.3.5.1 Pricing System for Cane and Sugar

Day-to-day and general seasonal price fluctuations arising from competitive conduct are non-existent in both sugar cane and sugar markets, due to tight government price control in the industry. Both farmers and processors are price takers who decide to transact at prices set by the government (see section 2.6.3).

#### 5.3.5.2. Competitive Practices Among Factories

As stated earlier, the structure of Kenya's sugar processing approximates an oligopoly model. Relatively few (five) firms account for the bulk of sugar consumed in the country with the import source accounting for the remainder. Economic theory postulates that in market structures with small numbers of rivaling firms, there is the tendency among such firms to resort to collusion whereby rivals tend to behave in an interdependent manner. No such behaviour has been observed among the Kenyan sugar processors, again largely due to government intervention.

Competition among firms for cane procurement has been avoided through a strict government zoning scheme whereby each sugar factory has a defined geographical catchment area. Through the zoning system, each farmer falling within the catchment area of a factory must by law sell his cane to such a factory. Conversely, the factory is obliged to accept every farmer's cane within that area. Inter-zonal cane transactions cannot be done without express permission from the government. During the survey, the only instances when cane from one factory zone was sold to an outside factory were:- (i) when some mature cane got burnt by accident while the factory in that zone had some scheduled or accidental stoppage, (ii) when in May 1977, Miwani Sugar Company threatened to lay off its employees following alleged shortage of millable cane. In this case the Ministry of Agriculture directed Chemelil to offer Miwani some of their cane.

Except for factories in the Nyanza Sugar Belt, the other factories at Mumias and Ramisi (and the new ones coming up in South Nyanza and Nzoia) enjoy considerable spatial separation so that even in the absence of government zoning their catchment areas would not entail any competition for cane procurement.

#### 5.3.5.2.1 Relevance of Zoning and its Effects on Competition for Cane:

The zoning scheme has more relevance in the Nyanza Sugar Belt than in other areas. Historically Miwani used to cover the whole Sugar Belt, but with the setting up of Muhoroni and later Chemelil, the then Miwani catchment area had to be judiciously divided among the

three factories to ensure adequate cane supply. When interviewed about the zoning system, both the sugar companies and the farmers had mixed reactions. Among the sugar companies only Miwani felt the zoning system was in its disfavour having lost some of its former large farms to Chemelil under the system. In aggregate inter-zonal analysis showed that the majority of farmers interviewed in the Nyanza Sugar Belt tended to prefer delivering their cane to Chemelil, Miwani and Muhoroni in that order. About 45% of the farmers interviewed ranked Chemelil as number one; 35% ranked Miwani as number one, while only 19% placed Muhoroni as number one and only 1% were indifferent.

Intra-zonal response analysis showed that only 50% of the farmers interviewed under Muhoroni preferred remaining within Muhoroni zone while the other 50% preferred delivering their cane to Chemelil factory. Within Chemelil zone 58% of the farmers interviewed were satisfied with the zoning system while the remaining 42% would prefer to be re-zoned under Miwani. In the Miwani zone however, 73% of the farmers interviewed preferred to remain under Miwani with only 27% desiring re-zoning to Chemelil.

A striking feature of these responses, is that although 50% of Muhoroni farmers were eager to opt out of their present zone, no farmer from either Miwani or Chemelil indicated having Muhoroni zone as even a second choice. There was a general feeling of suspicion and dislike\* for the management of Muhoroni among the farmers. About 48% of the farmers interviewed under Muhoroni felt that the factory was just interested in receiving cane without being mindful of the

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\*At the time of writing, radio reports claimed that farmers under Muhoroni have protested to the government requesting for a new management agency to be appointed instead of the Mehta Group to run the factory.

problems facing the farmers. A further 30% of the Muhoroni farmers felt that the weighing bridge at Muhoroni factory is deliberately made faulty in farmers' disfavour. The factory officials at Muhoroni together with government officials interviewed did not however agree with the farmers' allegation about the weighing bridge.

In ranking their preference for the factories, the farmers based their judgement on such factors as:- nearness of the factory to their farms; credit facilities; provision of advice or extension services, factory-farmer relationship and road accessibility. The aforesaid analysis revealed two important aspects of the zoning system: First, that the government zoning system helps balance the flow of cane to the factories especially in the Nyanza Sugar Belt where three factories are spatially close enough as to bring adverse competitive conduct for cane procurement. Secondly, that a significant proportion of farmers in some zones are not satisfied with the zoning system, so that given free choice such farmers would opt out of their present zones and deprive cane supply to some factories.

#### 5.3.5.2.2 Non-price Competitive Conducts Among Processors:

In general the zoning system together with cane and sugar price controls have averted even non-price competition for cane procurement and for sugar sales. Thus for both cane procurement and sugar sale there are no such practices among the factories as:-

- (a) price discrimination;
- (b) advertising or other forms of product promotion;
- (c) agreement or collusion among sugar processors;
- (d) product differentiation: All the sugar produced in Kenya

must comply with government regulations. The factories therefore produce the direct consumption mill white type of sugar. "Quality standards corresponding to the World Health Organization's Codex Alimentarius Grade A sugar have been recommended by the Kenya Sugar Authority in the past, but ... no attempt has been made to insist that factories reach this standard" (44 Vol. I p.11).

In summary non-price competition has not been necessary among the sugar mills since:- (a) On the buying side for each factory the relevant market is typically a localized zone made up of farmers forced by law to sell cane to it and at a specified price. In selling the produced sugar, the factories face a larger and essentially a national market which again is an assured market since KNTC buys and distributes all the sugar produced in Kenya again at a specified price.

### 5.3.6: Performance of the Processing Subsector

#### 5.3.6.1 Excess Capacity

Economic performance of the sugar processing subsector has been less satisfactory and much room still exists for improvement. At the moment the short-fall of domestic production vis-a-vis consumption estimated at 40,000 tonnes is still great. At the same time virtually all the factories are still working below capacity. The problem of excess capacity is expounded in Chapter Six and only a brief mention of it will be made here. The analysis showed that in 1976 only Mumias and Chemelil worked above 50% of their nominal capacities,

the actual being 91% and 77% respectively. Both Miwani and Muhoroni used only about 40% of their respective capacities while Ramisi only used 20% of its capacity (see Tables 6.3 and 6.4). Continued low capacity utilization does not augur well for the industry as this implies low national output and substantial use of foreign exchange reserves for import of sugar.

#### 5.3.6.2 Profitability:

Although most of the sugar companies were reluctant to release their detailed financial statements, the general impression given was that sugar companies were not making much profit. For the 3 year period 1974 - 1976 all the factories in the Nyanza Sugar Belt except for Chemelil, according to the survey, made some small profits in each year (see Table 6.2 Chapter Six). Indeed, all along since its inception in 1967, Chemelil factory made recurrent losses until 1976, when following financial adjustments, the factory management reported making profits. Mumias factory reported making profits all through. No response however was received from Ramisi for this analysis. All the sugar companies interviewed felt that the ex-factory price of sugar was over-laden with government levy and the sugar equalization funds, and that the levy could be reduced to allow increasing the ex-factory price without appreciably affecting the current consumer price. This step they felt would help increase the milling margins for sugar. Of course excess capacity in the industry has greater adverse impact on sugar milling profitability in the industry.

### 5.3.6.3. Technical Performance at Processing Level

Apart from the factory at Ramisi which is a smaller unit, all the other four factories in Nyanza and Western Provinces including the additional two new projects coming up in South Nyanza and Nzoia are medium sized factories by World standards. However, with a continuous grinding season as we have in Kenya, the potential output from these factories per year is much higher than would be the case in other countries with short grinding seasons. We have noted the wide-spread excess capacity and more is said about it in Chapter Six. Thus on the basis of capacity utilization the whole sugar industry is inefficient. Specifically in this respect, Mumias is the most efficient followed by Chemelil, both operating above 50% nominal capacities. All the other three factories are operating below 50% of their respective nominal capacities (Chapter VI).

However, apart from capacity utilization which is treated in detail later, this study also looked into other aspects of factory performance some of which are analysed below:-

#### (i) Tonne Cane/Tonne Sugar Ratio (TC:TS)

The TC:TS ratio is a good measure of sugar extraction efficiency of a factory as it shows how many tonnes of cane a factory uses to produce one tonne of sugar. From the survey it was found that in this respect Mumias with a TC:TS ratio of 8.6 leads all other factories. Chemelil stands second, followed by Muhoroni, Miwani



and Ramisi in that order (see Table 5.23 and Appendix IX).

Experts in the industry reckon that a TC:TS ration of 10.0 should be the average to aim for in Kenya.

TABLE 5.23: FACTORY SUGAR RECOVERY IN TC:TS RATIOS 1974 - 1976

Factory	TC : TS		
	1974	1975	1976
Miwani	11.8	11.4	11.6
Chemelil	10.4	10.4	9.8
Muhoroni	11.1	11.7	10.4
Mumias	8.7	8.7	8.6
Ramisi*	14.2	14.8	13.9
Average	11.2	11.4	10.9

Source: Study Survey, 1977.

\* Obtained from Kenya Sugar Authority Statistics Files.

(ii) Time Utilization Efficiency:

During the survey it was found out that only Mumias and Chemelil had about 2 month scheduled stoppage periods for annual maintenance and repairs. The other factories at Muhoroni, Ramisi and Miwani operate throughout the year only stopping for repairs or maintenance

whenever there is a breakdown or when there is shortage of milling cane. Miwani on the other hand has a one-day-per-week scheduled stoppage for maintenance during peak grinding periods.

On the basis of utilization of gross available time (allowing for scheduled shutdowns) the study found out that on average the factories used only 45% of the time available in 1976. The previous year's figure had been 48.9%. On individual analysis in 1976, Chemelil had the best gross time utilization followed by Muhoroni and Mumias in that order, all using between 50 - 57% of gross available time. Poor time utilization was realized in both Miwani and Ramisi each using less than 40% of available time (see Table 5.24).

However, measured on the basis of tonne cane milled per available hour, then Mumias and Chemelil were more efficient in time utilization than the other three factories in 1976. Miwani, Muhoroni and Ramisi took third, fourth and fifth positions respectively. The previous year Muhoroni switched position with Miwani (Table 5.24).

Time loss in the industry was mainly attributed to such factors as: premeditated stoppage taking up 36% of available time; shortage of milling cane resulting in 12.8% of time utilized, and machinery breakdown taking up 6.2% of the available time. From Table 5.24 we conclude that apart from premeditated time loss, Ramisi and Miwani have much of their time wasted because of lack of cane which also gives them a lower grinding rate than the other factories. The overall time utilization in the industry, effectively standing

TABLE 5.24. TIME UTILIZATION ANALYSIS IN THE FACTORIES 1975-1976 (% GROSS AVAILABLE TIME)

	Miwani		Chemelil		Muhoroni		Mumias		Ramisi		All	
	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976
Grinding	35.7	32.9	53.7	56.7	66.1	56.1	58.9	53.3	43.4	38.4	48.9	45.0
Lost: - Breakdown (Manufacture)	3.6	5.8	8.3	4.7	14.2	7.5	10.8	10.4	6.1	3.0	7.8	6.2
- Cane Shortage	30.7	22.6	7.9	3.1	10.8	17.1	0.9	1.6	14.1	10.2	15.8	12.8
- Premeditated	30.0	38.7	30.1	35.5	8.9	19.8	29.4	34.7	36.4	48.4	27.5	36.0
Grinding Rate (Tonne cane/hr)	48.6	50.4	87.9	91.4	53.3	56.1	99.4	117.1	29.2	24.9	64.2	69.7

Source: Factory Files and Kenya Sugar Authority Statistics Files.

at only 38% in 1975 and at 45% in 1976 ,can be regarded as still very poor.

(iii) Other Technical Performance.

Other technical aspects of performance in the processing sector like the levels of losses in various processing stages; apparent purity; brix, fibre and pol percentage; etc. are given in Appendix IX.

## CHAPTER VI

### ANALYSIS OF EXCESS CAPACITY: THE CASE OF NYANZA SUGAR BELT FACTORIES

#### 6.1 Introduction

This chapter deals with the problem of excess capacity in the Kenyan sugar industry as exemplified by the three sugar factories in the Nyanza Sugar Belt, namely, Miwani, Chemelil and Muhoroni. Naturally the performance of an important industry like that of sugar engages widespread public attention and excess capacity is one aspect that has attracted most critics of the industry. Even the current government Development Plan (1974-1978) states that "the most important task to be undertaken during the new Plan period will be to increase cane production to a level sufficient to utilize the factories to full capacity" (14.4 p.240). In fact, during the field survey for this study all the factories in the Nyanza Sugar Belt admitted working below capacity.

#### 6.2. Definition and the Concept of Excess Capacity :

For the ease of exposition and to avoid technical ambiguity a definition of "excess capacity" and the many conceptual issues implicit in it are better discussed at this juncture.

##### 6.2.1: Technical or Non-economic Concept:

To a non-economist, the term excess capacity (EC) is a simple term used to refer to unutilized factory space; that is the difference between plant designed maximum output (PDMO) and the actual output (AO). As a corollary to this definition full capacity output (FCO) is

then defined as "the output that existing stock of equipment is intended to produce under normal working conditions with respect to hours of work, number of shifts and so forth" (41 p.1).

Mathematically the technical definition of "excess capacity" would be expressed as follows:-

$EC = PDMO - AO$ ; where EC is excess capacity; PDMO is plant designed maximum output; AO is actual output. Likewise, mathematically full capacity output (FCO) occurs when:-

$PDMO - AO = EC = 0$  (=zero); and hence  $PDMO = AO$ , and plant capacity utilization is 100%; ie  $\frac{AO}{PDMO} \times 100 = 100\%$ .

As can be seen, the technical concept so far discussed totally ignores the cost elements involved in capacity utilization. To an economist as we shall see later, this concept does not provide a good measuring yardstick for capacity.

#### 6.2.2. The Economic Concept of Full Capacity and Excess Capacity

In economics the concept and definition of capacity must take cost considerations into account. Lipsey (25 p.221) defines (optimal) plant capacity as the "level of output that corresponds to the minimum level of short-run total cost" and that "capacity in this sense is not the upper limit on what can be produced". As a corollary therefore a firm producing "with excess capacity" is producing an output smaller than the point of minimum average total cost. Conversely, a firm producing above capacity is producing above this output and is incurring higher costs per unit.

The economist's concept of capacity is therefore more difficult to measure and the condition of optimal capacity and excess capacity will depend on whether or not the firm in question is operating under perfect or imperfect conditions.

#### 6.2.2.1: Theoretical Framework of Capacity under Perfect Competition

Under perfect competition in the sugar industry or in any given industry, full capacity equilibrium would be defined as the output level associated with full competitive equilibrium in the industry. As shown in Figure 6.1. for any given firm, this would occur at the minimum point (K) of the long-run average cost curve (LRAC). In this case the full equilibrium point would be defined by output  $Q_e$ . At this point in the perfect competition model the sugar industry would find itself in a situation where for each firm, marginal cost (MC) equals average cost (AC) equals price (P) and equals marginal revenue (MR). At  $Q_e$  the firm or the industry is realizing full opportunity costs which is the normal profit or "zero profit" position under perfect competition. Operating at either  $Q_1$  or  $Q_2$  for example would incur losses from excess capacity  $Q_1 Q_e$  or over-utilized capacity  $Q_e Q_2$  respectively.

The longrun competitive equilibrium position  $Q_e$  is reached following some longrun adjustment supposed to take place in the industry under perfect competition. If the short-run equilibrium price for a firm or the industry is high, the profit prospects would attract new firms and/or the existing firms would try to expand their plants. This process will continue until price drops to the longrun equilibrium level  $P_e$  when there will be no prospects for unusual profits to be earned. Conversely if the short-run equilibrium price is low so that there are losses, some firms in

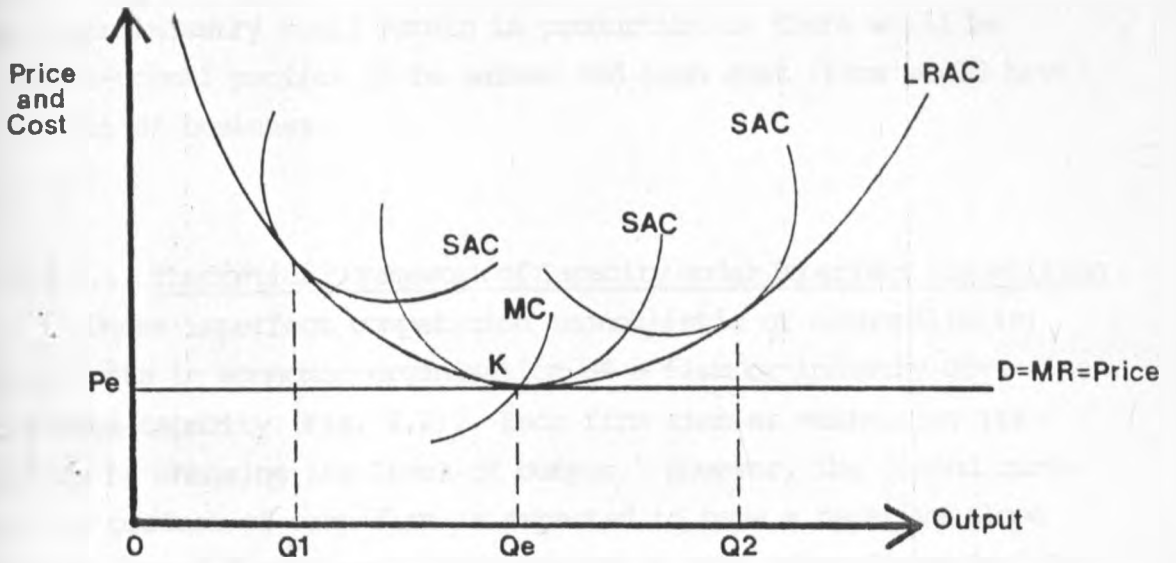


Fig.6.1: LONGRUN EQUILIBRIUM & FULL CAPACITY FOR A FIRM UNDER PERFECT COMPETITION

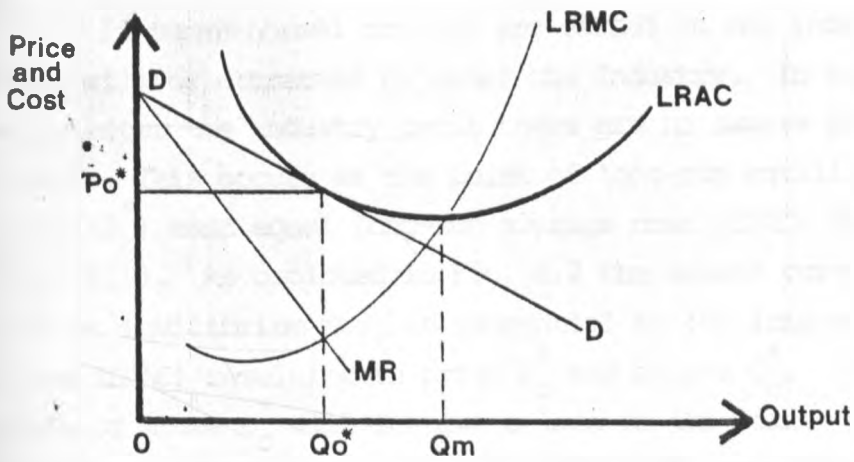


Fig.6.2: LONGRUN MONOPOLISTIC COMPETITION EQUILIBRIUM AND EXCESS CAPACITY FOR A FIRM



the industry would opt out of the business while others may reduce their sizes thus pushing the output and price to equilibrium position  $Q_e$  and  $P_e$ . Thus in the long-run only efficient firms in the sugar industry would remain in production as there would be no super-normal profits to be earned and high cost firms would have to opt out of business.

#### 6.2.2.2.: Theoretical Framework of Capacity under Imperfect Competition

Under imperfect competition (monopolistic or oligopolistic) adjustments in economic organization of a firm or industry give rise to excess capacity (Fig. 6.2). Each firm aims at maximizing its profits by choosing its level of output. However, the demand curve for the product of each firm is expected to have a negative slope and the demand facing each firm depends on what other firms do. At equilibrium each firm must equate its marginal revenue (MR) with marginal cost (MC), given the actions of all other firms. In the short-run equilibrium each firm chooses a profit maximizing price and output levels which in aggregate result in market clearing for the industry.

If super-normal profits are earned in the industry then new firms will be attracted to enter the industry. In the long-run, firms would enter the industry until there are no excess profits to be earned. This occurs at the point of long-run equilibrium in which price ( $P_O^*$ ) must equal long-run average cost (LRAC) for each firm (Fig. 6.2). As depicted in Fig. 6.2 the demand curve DD facing each firm at equilibrium must be tangential to its long-run average cost curve (LRAC) resulting in price  $P_O^*$  and output  $Q_O^*$ . Any output level below or above  $Q_O^*$  will involve a loss to the firm. Thus the long-run imperfect competitive equilibrium involves operating with excess capacity ( $Q_O^* - Q_{O,m}^*$ ) since each firm produces at a point where average costs are greater than the minimum average costs. As long as the demand curve facing each firm has some negative slope, each firm will continue producing at a point where average costs are greater than the minimum average costs.

Under the monopolistic competition theory the following conditions would hold in the Kenya Sugar industry:- (i) The equilibrium output of the firm(s) would be less than the one at which average total costs is a minimum and "this is known as the excess capacity theorem" (25p. 268). (ii) Prices at market supply and demand equilibrium would

be higher and output would be lower, ceteris paribus, than under perfect competition. (iii) The equilibrium price would be greater than marginal costs. But in the Kenyan sugar industry some firms report that they incur losses. (iv) If the sugar industry showed monopolistic competition the sugar firms would probably offer consumers a wider variety of brands, styles and possibly qualities than under perfect competition. This phenomenon is not observed in the Kenyan sugar industry, where even elementary grading of sugar is never attempted. (v) It may also pay monopolistically competitive firms to engage in non-price competition of a kind that would not pay in perfect competition. Again, non-price competition is not a common feature of the sugar industry in Kenya (see section 5.3.5).

### 6.3 Excess Capacity in the Nyanza Sugar Belt

After the above theoretical considerations of excess capacity, the first question that one would pose is "does excess capacity exist in the sugar industry in general and in the Nyanza Sugar Belt in particular?" In the section that follows, this question is tackled in both technical and economic concepts.

#### 6.3.1 Technical (non-economic) concept.

Technically and hence with no economic consideration of costs the answer to the question, whether or not excess capacity exists in the sugar industry, is invariably "YES", as can be seen in Table 6.1 and in the Table of Appendix IX. By this definition none of the three factories in the Nyanza Sugar Belt has ever operated at full capacity in any one year since they were established (also see Appendix IVA and IVB).

Given that the full capacity rating for each of the factories is 60,000 tonnes per annum, we can see from Table 6.1 and the Table in Appendix IV that the ten year average throughput for each of the three factories during the 1967—1976 period centres around 50% of plant designed maximum output (PDMO).

Table 6.1 below summarizes the actual average capacity performance during the last decade together with the highest and the lowest throughput ever recorded by each of the factories during the same period.

TABLE 6.1: THE AVERAGE, THE HIGHEST AND THE LOWEST PERCENTAGE FACTORY CAPACITY UTILIZATION IN THE NYANZA SUGAR BELT 1967-1976

	Miwani		Chemelil		Muhoroni	
	%PDMO	Year	%PDMO	Year	%PDMO	Year
Ten Year Average Capacity Utilization (AO)	53	1967-76	57	1968-76	45	1967-76
Ten Year Average Excess Capacity (EC)	47	1967-76	43	1968-76	55	1967-76
Highest Throughput	64	1969	77	1976	57	1971
Lowest Throughput	44	1972	19	1968	30	1967

Source: Appendix IV

The figures in Table 6.1 and in Appendix IV provide measures useful in analysing excess capacity. The plant output expressed as a percentage of plant designed maximum output (PDMO) is a good indicator of technical efficiency. It also shows the level of capital stock utilization in

the industry.

At any rate Table 6.1 and the one in Appendix IV confirm the assertion at least technically, that the factories in the Nyanza Sugar Belt are working with excess capacity. In fact during the factory surveys all the sugar companies in the Nyanza Sugar Belt admitted without any hesitation that excess capacity was their most serious problem (Table 6.2). This is in sharp contrast to Mumias in Western Province, that rejected the proposition that excess capacity was a problem in their firm.

TABLE 6.2: THE RESPONSE OF SUGAR COMPANIES ABOUT EXCESS CAPACITY AS A PROBLEM.

Factory	Response/Comment
Miwani	Serious and chronic
Chemelil	Seasonal Problem
Muhoroni	Recurrent Problem
Mumias	Not a problem
Ramisi	N/A

Source: Author's Survey 1977

Note: N/A = Not Available.

### 6.3.2: Economic Considerations of Excess Capacity in the Sugar Industry

In the preceding section, it has been established that technically excess capacity does exist in the Nyanza Sugar Belt factories. In this section, however economic considerations such as costs, profits and the type of competition obtaining in the industry will be taken into account in explaining excess capacity.

#### 6.3.2.1: Structure of the Sugar Industry and Excess Capacity

The structure of the sugar industry as analysed in Chapter II and V reveals that the industry cannot be categorized distinctly into either perfect or monopolistic market models. At a glance certain characteristics may give the impression that the industry has monopolistic or oligopolistic market structure. At present there are only five firms involved in sugar production. Secondly barriers to entry can also be observed in the industry in terms of absolute costs and scale economy barriers. To enter into sugar production a new firm would need to raise about Kf 17 million for a normal factory producing 60,000 tonnes of sugar per year. Even the small "mini sugar plants" now under feasibility study in Kenya have relatively high initial costs.

In the industry, the product (sugar) is treated as homogeneous. There are no brand names. Even where physical differences exist, as in the colour of sugar, no economic differentiation arises since the government fixes the same price for all acceptable sugar grades. The pricing system in the industry therefore deviates from the perfect competition model. The government-fixed prices may not reflect free market forces of supply and demand but tend to weigh heavily in favour of welfare objectives. The system does not allow for collusive conduct

by participants at any market channel level that would affect price. This may help explain the frequently reported cases of hoarding and smuggling in certain areas in the country. However, knowledge and information about the market are nearly perfect. Neither the producers nor the government ever spend money in advertising as it is never necessary. No one producer can affect the price, although collectively they could affect price through representation in the government policy-making bodies in the industry.

Theoretically, super-normal profits and losses are expected to disappear under perfect competition. The price should just be covering the costs and rents of all firms in the business in the long-run. In recent years no firm in the sugar industry has threatened to opt out of business, thus suggesting no serious losses are occurring in the industry. On the other hand, we have had a trend whereby the industry has been attracting new entrants, albeit with much government assistance. Given that a lot of expert feasibility studies go into such new projects before they are established, it is appropriate to assume that when a project recommendation is drawn up, profit-motives are ranked high in addition to the sheer welfare objectives of self-sufficiency in sugar.

#### 6.3.2.2. Cost Structure in the Sugar Industry and Excess Capacity

The problem of determining the optimum capacity and hence the extent of excess capacity in the sugar industry hinges upon the estimation of the cost structure in the industry. It had been intended to estimate an average cost function from cross-sectional data collected from the factories, but as it turned out, some of the firms totally

refused to divulge any figures concerning their costs. Because of this constraint the analysis given here will be more descriptive rather than empirical.

Given the paucity of cost data, we can only proceed by making certain ad hoc assumptions based on the general observations of the industry to make our analysis complete:

(i) First we assume that in Kenya the demand for sugar produced by the local firms is never subjected to any significant annual cyclic behaviour which would necessitate planned reduction or increase in production in any one year. In fact the firms face the same market price which they know in advance; and they also know that the market is never saturated given that Kenya is still a net importer.

(ii) Secondly we assume that all the firms are facing the same cost structure. A not unreasonable assumption given that all sugar firms operate in the same economic and political environment. The market labour wages and the raw material (sugar cane) prices are controlled by the government.

(iii) Thirdly we assume that the firms are using the same technology as is reflected in the almost uniformly designed technical capacity of their plants.

(iv) Lastly, we assume that any inter-firm cost differences, if they occur, are largely due to the inefficient manner in which some managements utilize their resources.

The question then is: why do some firms operate at lower output levels than others? And why do others claim to be incurring losses

while some are making profits? Although such profits and losses reported (Table 6.3) reflect the "accountant concept" of profits which does not take full opportunity cost of production into considerations, they are still good indicators of economic performance.

Indeed, Mumias which operates at a higher capacity than the other factories, reported making reasonable profits and stated that excess capacity was not a problem they experience. If physical expansion is anything to go by, then the current expansion scheme in Mumias aimed at increasing the factory's scheduled capacity from 70000 tonnes to 156000 tonnes of sugar per year is an indication that economies of scale can be exploited in the sugar industry. The industry is either facing long-run decreasing costs or constant rather than increasing costs with respect to scale of operation. If the case were one of increasing costs with respect to economies of scale then the firms including Mumias, would tend to reduce the scale of operations to cut down on costs. With the assumptions made above it can be argued that economies of scale exist in the industry in such per unit cost items as :- (a) factory fixed costs, (b) administrative costs, (c) general personnel costs, (d) management agency cost in case of factories employing hired management firms, (e) materials and fuel costs and (f) cane assembly costs.

#### 6.3.2.3 Profits or Losses in the Sugar Industry :

When the study was conducted only Chemelil admitted having incurred losses throughout since its inception and only making some profits in 1976. Other factories though reluctant about releasing statistical details, accepted that they have been making some profits (Table 6.3).



TABLE 6.3 PROFIT OR LOSS IN SUGAR COMPANIES IN NYANZA SUGAR BELT  
AND MUMIAS 1974 - 1977.

	1974	1975	1976	1977*
Miwani	Small profit	Small Profit	Small Profit	Not sure
Chemelil	Loss	Loss	Profit	Expect Profit
Muhoroni	Profit	Small Profit	Profit	Expect small Profit
Mumias	Profit	Profit	Profit	Expect Profit

Source: Field Survey 1977; \* = Forecast

These profits and loss statements are necessarily in terms of the businessman's concept of profit. They are expressed as the difference between the total receipts and the total costs. They in no way take into account the opportunity costs on capital and risk as in the full economic cost concept. But still they are good indicators of economic performance of the industry. Mathematically these accounting profits would be written as:-

$$Y = nX - (nV_c + F_c) = n(X - V_c) - F_c;$$

where Y is gross profit in shillings; n is number of tonnes of sugar produced per year; X is net sales price of sugar in shilling per

tonne:  $V_c$  is variable cost per tonne of sugar produced;  $F_c$  is annual fixed cost in shillings. This functional relationship

can be represented graphically as follows (Fig. 6.3)

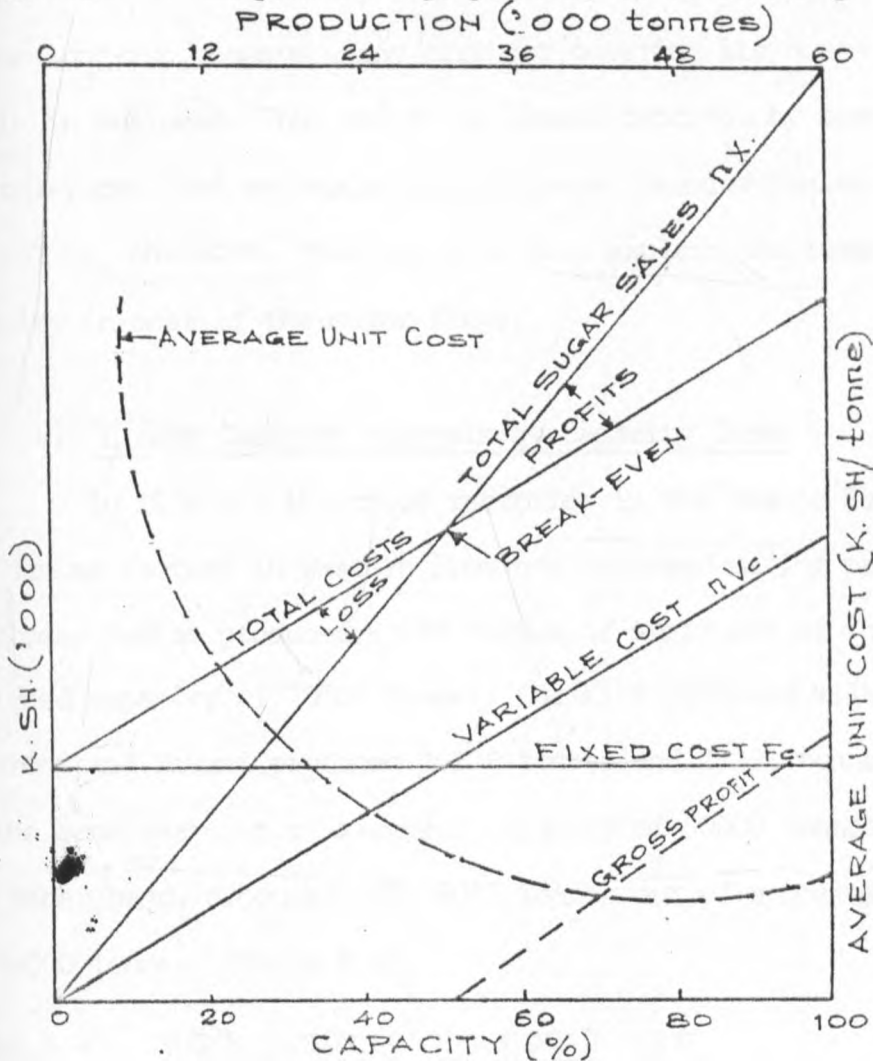


Fig. 6.3: GRAPHICAL ANALYSIS OF PROFITS AND LOSSES IN SUGAR PRODUCTION:

(HYPOTHETICAL DATA)

In order to explain the anomaly in the sugar industry whereby some firms are operating even when they are incurring losses we need to interpret the graph in Fig. 6.3. When the production function for a firm is such that it finds itself operating below break-even point — that is at a loss — it does not mean that the plant should close down.

because it will still have to meet its fixed cost elements. Rationally therefore the firm would in the short-run continue to produce sugar provided its annual losses do not equal or exceed its fixed costs(Fc). In the long-run, however, any firm not covering its costs cannot remain in business. Thus short-run losses reported by some sugar firms can<sup>be</sup> tolerated just to avoid incurring even heavier losses on fixed capital by shutdown. This may also help explain the reason for excess capacity in most of the sugar firms.

6.3.2.4: Excess Capacity Analysis by Capacity Index

In 1976 all the three factories in the Nyanza Sugar Belt and the Mumias factory in Western Province reported making profits. In that year Mumias produced 63699 tonnes of sugar out of the nominal designed capacity of 70000 tonnes. Chemelil produced 46146 tonnes, while Muhoroni and Miwani produced 26228 tonnes and 25236 tonnes respectively in the same year out of a nominal capacity of 60000 tonnes. Ramisi, on the other hand, produced only 6062 tonnes out of a nominal capacity of 30000 tonnes (Table 6.4).

TABLE 6.4: SUGAR FACTORIES' THROUGHPUT 1976

	Tonnes Cane	Tonnes Sugar	Nominal Capacity	Cane/Sugar Ratio	Output as % Nominal Capacity
Miwani	291720	25236	60000	11.6	42
Chemelil	454803	46146	60000	9.8	77
Muhoroni	274100	26228	60000	10.4	44
Mumias	547954	63699	70000	8.6	91
Ramisi*	84064	6062	30000	13.9	20
Total	1652641	167371	280000	10.86	54.8

Source: Study Survey, 1977

By national Standards, (Tables 6.3 and 6.4) both Chemelil and Mumias operated above 70% of their nominal capacities and still reported making profits in 1976. Mumias, working at 91% nominal capacity, is still even encouraged to expand upto 156000 tonnes nominal capacity. The reported profits in both Chemelil and Mumias, working at higher nominal capacities than Miwani and Muhoroni or Ramisi, would tend to confirm that economies of scale occur in the sugar industry and that all firms are still capable of expanding their output levels without increasing their unit costs. Discussions with experts in the sugar industry also revealed that the nominal capacity level of a factory very much approximates the economic optimal capacity. Each factory is capable of achieving even a higher output than the nominal capacity, but it is reckoned that such higher output levels will strain the machinery and hence increase costs of operation and maintenance through wear and tear. Operating below the nominal capacity is also regarded as uneconomic. All firms with lower outputs than their nominal capacities could still increase their output levels with less than proportionate increase in their costs given adequate cane supply.

Since operating nearer the nominal capacity approximates the optimal capacity of a plant, Mumias, working at 91% of nominal capacity can be used as a standard or the base from which a "capacity index" can be constructed to gauge the performance of other firms using the 1976 output figures (see Table 6.4).

"Full capacity Index" can then be calculated as follows:

$$C_n = \frac{X_n}{X_o} \cdot 100; \text{ where } C_n \text{ is the full capacity index for factory n;}$$

$X_n$  is actual output for factory n expressed as a percentage of its

nominal capacity; and  $X_0$  is the actual output of Mumias expressed as a percentage of its nominal capacity and which is 91% for 1976.

TABLE 6.5: FULL CAPACITY INDEX FOR SUGAR FACTORIES 1976 (Mumias = 100)

	Actual Output as % nominal Capacity (= $X_n$ )	Full Capacity Index (= $C_n$ )
Miwani	42	46
Chemelil	77	85
Muhoroni	44	48
Mumias	91 = $X_0$	100
Ramisi	20	22

Source: Calculated from Table 6.4

From the indices in Table 6.5 above, it can be concluded that the Nyanza Sugar Belt factories and Ramisi, compared to Mumias, are still working relatively far below par. Only Chemelil follows Mumias closely. The other factories can still increase their output and exploit the economies of scale which Mumias has been exploiting and intends to exploit further through its present expansion scheme.

#### 6.4 Causes of Excess Capacity

Asked to state what factors, in order of seriousness, contributed to the under-utilization of factory capacity, all the factories studied put the shortage of cane as the number one problem. Miwani even qualified it further stating that cane shortage was their chronic problem. Other factors

TABLE 6.6: FACTORS CONTRIBUTING TO UNDER-UTILIZATION OF FACTORY CAPACITY  
AS RANKED BY THE SUGAR COMPANIES

Factors	RANKING BY FACTORY			
	Mumias	Miwani	Chemelil	Muhoroni
(i) Cane in Short Supply	0	1*	1	1*
(ii) Factory break-down	0	0	6	8
(iii) Drought causing low cane yields	0	2	2	2
(iv) Rainy seasons preventing cane harvesting and delivery	0	6	4	5
(v) Inadequate cane transport facilities	0	0	5	0
(vi) Low cane husbandry levels on outgrower farms (=low yields)	0	3	3	3
(vii) Poor yield on nucleus estate	0	0	0	0
(viii) Poor - public roads	0	0	0	0
- farm roads	0	5	0	7
(ix) Fire outbreaks damaging cane	0	0	0	4
(x) Lack of expertise in the industry	0	4	0	0
(xi) Labour shortages at some seasons	0	7	7	6
(xii) Social Problem	0	8***	0	0

Source: Study Survey 1977

Note: \*Chronic problem; 0=not a problem; \*\*\* Asian farmers neglect their farms when they are about to sell to Africans.

also given as serious, were drought and low cane husbandry techniques in most outgrower farms resulting in low cane yields per hectare. The rest of the other factors mentioned and ranked are included in Table 6.6.

#### 6.5: The Effects of Excess Capacity in the Sugar Industry

The existence of excess capacity in the sugar industry poses several problems, the main ones being:-

- (i) Low annual sugar output, which defeats Kenya's self-sufficiency policy. This results in continuous reliance on sugar imports, thus depleting the foreign exchange reserves which could go into other development schemes;
- (ii) High cost of production and hence low profitability are often associated with excess capacity;
- (iii) With excess capacity the economies of scale are not exploited to the full;
- (iv) Given the high production cost and the inability to realize economies of scale, it follows that sugar provided to society will be unnecessarily expensive.

CHAPTER VIICANE PROCUREMENT PROBLEM

At this juncture it is appropriate to tie a loose end left from the discussion of excess capacity in Chapter Six. Depending on the factory zone in question much of the existing excess capacity can be reduced considerably if the problem of cane procurement and its causes are tackled successfully.

### 7.2. Farmers' Problems: Farmers' Views:

During the study, farmers were asked to state what problems they think hinder their progress in cane production resulting in the universal factory complaints about chronic cane shortages. The farmers gave the following as some of their problems (see Table 7.3):-

7.2.1 Lack of Credit Facilities: About 85% of the small scale farmers interviewed ranked this problem as being "very serious". A sizeable proportion (about 47%) of the large scale farmers also reckoned that the problem was very serious. At the time of carrying out the interviews about 54% of the small scale farmers in the sample had never obtained any credit for cane production for the last three years. For the large scale farmers the corresponding figure was about 67%. Miwani and Muhoroni zones were worse off than Chemelil zone with respect to credit facilities (Table 7.1). Farmers also complained of general delays in procedures of processing loans.

7.2.2. Lack of Adequate Farm Machinery Services: Machinery for land preparation is in short supply resulting in untimely operation or at times it may give rise to so much land lying fallow.



TABLE 7.1: EXTENT OF ACCESS TO CREDIT AMONG INTERVIEWED FARMERS FOR THE LAST THREE YEARS BY ZONE

	Small Scale Farmers								Large Scale Farmers							
	Miwani		Chemelil		Muhoroni		All S.F.		Miwani		Chemelil		Muhoroni		All L.F.	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
received credit	16	40	26	65	18	36	60	46.2	1	20	2	40	2	40	5	33.3
never received	24	60	14	35	32	64	70	53.8	4	80	3	60	3	60	10	66.7
Total (sample)	40	100	40	100	50	100	130	100	5	100	5	100	5	100	15	100

Source: Study survey, 1977

Note: No = number.

L.F.= Large Farms

S.F.= Small Farms.

7.2.3 Cooperative Inefficiencies: Many farmers seem disillusioned with the cooperative movements as a means of redressing their problems. Of the 130 small-scale farmers interviewed, 79% were not satisfied with the way their cooperative movements were serving members (see section 5.2.4.1) .

7.2.4. Low Profits from Cane: Farmers getting low yields realize poor gross margins per hectare (see section 5.2.8). The situation was even made worse with the previous low cane prices which prevailed before the current price of K.Sh. 133/= per tonne was announced by the government. Net cash receipts from cane were even made lower among some cooperative members following what the farmers term "mysterious deductions" for unspecified cooperative services. The practice among the cooperatives has been to recover all the outstanding loans from members after the first crop harvest instead of spreading out the repayments over a five-year crop cycle. Such outright deductions of farmers' cane proceeds without due care for their private financial obligations have resulted in general disillusionment and apathy among most farmers.

7.2.5 Non-availability of Purchased Inputs at the Right Time:

Many farmers are aware of the value of purchased inputs like fertilizers and herbicides, but have no access to them due to the poor distribution of such inputs.

7.2.6 Transport Problem: This problem is widespread in the Nyanza Sugar Belt. Many farmers interviewed expressed concern about over-mature cane on their farms awaiting transport allocation. Inadequate

transport services are known to result in two other adverse side effects in the industry:- (a) The over-mature cane crop not only deteriorates in milling quality but also unnecessarily prolongs the crop cycle beyond the usual five years. This defeats the idea of practising systematic scheduled planting and in the long-run affects the area under cane and the volume of harvested cane in any one season. (b) Secondly, the over-mature canes awaiting transport availability, are known to attract arsonists. Even the farmers themselves have been known to set fire to cane fields in order to force the factories or the cooperatives to make arrangements for the quick harvest and transport of burnt cane. The arsonist hopes to gain by being recruited as a cane cutter in such emergency cases, while the farmer is assured of earning his otherwise delayed income from cane. Such wild fires, most frequently spread to other farms indiscriminately and cause untold damage and losses to the industry.

7.2.7: High Cost of Production: The current inflationary spiral including the high cost of energy has hit all aspects of the economy, the sugar farmer not excepted. The fertilizer prices and the cost of hiring farm machinery have almost doubled within the last five years, drastically reducing the farmers' gross margins. During the survey, it was learnt that many farmers were abandoning or reducing fertilizer application on cane fields in an attempt to reduce costs. Surprisingly; even in the Mumias zone where the outgrower services are provided by the sugar company under adequate supervision, the company still expresses the worry about some farmers selling out the inputs supplied to them instead of using them on their own cane fields. This practice will of course reduce yields.

However, according to Professor Schenk\* "when you see a thousand farmers doing the same thing - even if it looks primitive in the face of modern farming techniques, there must be a good reason for it ..... The government and the factories should not expect the farmers to use high-cost inputs indiscriminately just to boost cane yields and keep the factories going at full capacity without considering gross margins."

It seems some of the farmers know what they regard as optimum yield, and are therefore not bothered about obtaining higher and more costly cane yields which may involve being heavily indebted to a second party.

7.2.8: Drought: By world standards, Kenya is a marginal area for sugar cane. With the exception of Mumias, all the other four factories often experience dry spells that cause considerable damage and yield reductions. All the three companies interviewed in the Nyanza Sugar Belt felt there was a great need for/<sup>a</sup>selective irrigation scheme to supplement the current rain-fed sugar cane projects. Only one of the companies expressed the possible prohibitive cost of such an irrigation system, while the other two felt that such a scheme would greatly boost the sugar industry economically. They even cited an old irrigation system in the area which used to be operated successfully by Miwani some years back.

Surprisingly, the small scale farmers seem not to view drought as a major stumbling-block as evidenced by 83.1% of those interviewed who ranked it as no problem. The large scale farmers, however, reckon it is a problem, with 53.3% ranking it as either "very serious" or just "serious".

\* Personal Communication with Prof.E.W.Schenk, Head of Agric.Economics at the

7.2.9: Labour Shortage: This seems to be a problem, especially on the large scale farms and to some significant extent on the small scale farms. Only 26.7% of the large scale farmers interviewed felt labour was no problem. The remaining 73.3% of the farmers ranked it between a moderate and a very serious problem.

Asked to state when they experience the greatest labour bottlenecks, both large and small scale farmers listed weeding, planting, land preparation and harvesting in that order, as the most labour-demanding operations in sugar cane production. The nucleus estates however, ranked weeding, harvesting and planting, in that order as the most labour-demanding operations.

Generally weeding, planting and harvesting of some fields coincide with the long rains when most farmers and the would-be casual labourers are hard-pressed with other operations on their subsistence plots. The large scale farms and even the nucleus estates during the long rains lose most of their casual labourers who during this period go back to their homes to prepare their subsistence crops. Most of the labour force on the cane farms, knowing very well the temporary nature of their engagements, are not totally divorced from their home farms and often resort to them as insurance against future uncertainties.

#### 7.2.10 Cane losses on the Farms:

According to both the small and large scale farmers, cane losses from damage by pests and diseases are insignificant. Losses due to fire outbreaks, however, were ranked as "serious" but unpredictable, being common during dry spells (Table 7.3). With respect to pests and diseases it is possible that the farmers are not versed with the intricate symptoms of these pests as to be able to assess their economic damage. Most

sugar cane pests and diseases inflict insidious damage that does not easily permit clear-cut identification, especially by the lay-farmers.

Some farmers under Muhoroni alleged however that they were losing cane through an improper weighing system at the factory. This suspicion was more common among the small scale farmers than the large scale farmers. There were also some allegations among cooperative farmers to the effect that in societies where farmers pooled their plots into a "block system", non-influential members often lose their cane to influential members through alleged malpractices at the time of harvesting and delivery to the factories. These allegations could not be verified during this study, although inquiries from the officials concerned were, as would be expected, met by strong denials.

#### 7.2.11 Inadequate Extension Services

Asked to name what organization sent any officials to advise on cane production, 32.3% of the small scale farmers said they had never been visited by any extension agent in the year. A similar proportion (33.3%) of the large scale farmers too had never been visited by the extension agents for a whole year (Table 7.2). The worst hit zones were Muhoroni and Miwani. The cooperative movement provided the greatest source (48.5%) of extension advice in the Nyanza Sugar Belt to the small scale farmers. However given the mistrust many farmers have with their cooperatives, the effectiveness of the cooperatives as a source of extension service may be slight. The Settlement Sugar Organization (S.S.O), catering solely for settlement farmers under Muhoroni, is the second source of extension service in the

Nyanza Sugar Belt. Among the sugar companies in the Nyanza Sugar Belt, only Chemelil provides extension services but just to its large scale outgrowers. Miwani and Muhoroni do not run such services. The Ministry of Agriculture virtually provides no extension service to the sugar cane farmers.

Only 27.7% of the small scale farmers interviewed had attended courses at a Farmers' Training Centre. The figure was 33.3% for the large scale farmers. A great majority of farmers had attended Agricultural Shows but very few had attended field days on sugar cane growing (Table 7.2.).

TABLE 7.2: SOURCE OF EXTENSION SERVICE TO FARMERS INTERVIEWED

		SMALL FARMS		LARGE FARMS	
		No	%	No	%
1. Visit by agent from	Sugar Company	0	0	5	33.3
	Ministry of Agric.	1	0.1	0	0
	Settlement Sugar Organization	23	17.7	3	20
	Cooperative	63	48.5	1	6.7
	None	43	33.3	5	33.3
2. Through Attendance of	FTC	36	27.7	5	33.3
	Agricultural Shows	106	81.8	14	93.3
	Field Days on sugar	39	30	7	46.7
	Chief's Baraza	127	97.7	6	40
	Others	33	25.4	5	33.3

Source: Survey, 1977.

TABLE 7.3: RANKING OF CANE FARMERS' CONCEIVED PROBLEMS BASED ON FARMS SAMPLED

Problem	Small Farms (n = 130)				Large Farms n=15			
	Ranking	Response	%		Ranking	Response	%	
	V.Serious	Serious	Moderate	No Probl.	V.Serious	Serious	Moderate	No Probl.
Lack of Credit	85.4	3.1	0.8	10.8	46.7	0	0	53.3
Land Preparation Equipment	56.9	5.4	7.7	30.0	46.7	6.7	0	46.7
Low Profits	35.1	7.7	1.6	53.8	13.4	0	0	80
Cooperative Services	72.3	4.6	20.0	3.1*	6.7	0	26.7	66.7*
Input availability	66.8	2.3	3.8	27.1	6.7	13.4	0	80.0
Transport	54.6	6.9	3.1	35.4	6.7	6.7	20.0	66.7
High Production Cost	52.2	14.6	1.5	30.8	33.3	20.0	6.7	26.7
Drought	6.9	6.9	3.0	83.1	40.0	13.3	0.0	46.7
Pests and Diseases	0.8	10.0	8.4	80.8	0	6.7	6.7	53.3
Management	2.3	0	0.8	96.9	6.7	0	6.7	60
Labour Shortage	43.1	2.3	0	54.6	60.0	6.7	6.6	26.7
Fire outbreaks	0	54.6	10.8	34.6	0	60.0	6.7	33.3
Extension Services	33.3	49	17.7	0	33.3	26.7	40	0

Source: Study Survey, 1977

Note \* include non-members of cooperatives

V. Serious = Very Serious

No Probl. = No problem.



## 7.2 Factories' Views about Cane Procurement Problem

The factories interviewed invariably gave lack of millable cane as the major reason for under-utilization of factory capacity. However, shortage of cane per se, is a complex problem with many under-lying causes. In the factories' views, the under-lying causes of cane shortage include such factors as:-

### 7.2.1 Farm Factors: Among the farm factors are:-

- Poor husbandry techniques on many outgrower farms leading to low cane yields;
- Farmers' apathy arising from disenchantment with previous poor cash returns from cane;
- Failure of some cooperatives to live upto the farmers' expectations, and hence killing the farmers incentives;
- Fire outbreaks, both accidental or arsonal in nature, which bring losses to cane of various stages of growth;
- Inadequate farm machinery for the hire services in the various factory zones resulting in delayed farm operations. Some farmers reportedly give up the idea of cane acreage expansion or renewal of cane cycle, after unsuccessfully trying to get machinery for hire. Of course cane operations especially in the Nyanza Sugar Belt require heavy duty machinery, most of which has too high initial costs for the majority of farmers to afford as individuals;
- Inadequate transport facilities: In some factory zones, like Muhoroni, cane is known to over-mature and stay in the field beyond the optimal harvesting age simply because a farmer cannot get transport facilities to deliver the cane to the factory.

- Farmers taking too many ratoons before breaking the crop cycle for replanting. Ratoons being cheap to maintain, tend to attract farmers to extend the cane cycle even upto twice the normal cycle length. Lack of machinery may also make farmers extend ratoon takings beyond the 5-year cycle.

- Absentee farmers who leave their farms neglected. Such farms are unproductive or have low productivity;

- Farms changing hands undergo a transition period during the sale when they invariably get run-down as the out-going owner ceases to invest in its improvement or maintenance.

7.2.2. Geophysical Environmental Factors: These include:-

- Drought damage: this is seasonal but serious especially in the Nyanza Sugar Belt and at the Coast.

- Flood and drainage problem: The black "cotton soils" known to have impeded drainage and poor aeration during heavy rains, presents a paradoxical situation for the Nyanza Sugar Belt farmers! As much as a farmer would wish to have adequate rainfall, the same rains, if in excess, make the soils sticky, plastic and difficult to work. The result is poor crop performance, due to both impeded drainage and poor field operations;

- Poor Soils: - Some soils in the Nyanza Sugar Belt are marginal with respect to fertility levels and require adequate application of fertilizers for good crop performance;

- Pests and diseases: - but these were not very serious according to the comments received from factory officials.

In summary, the three factories interviewed unanimously ranked drought as the number one problem in the Nyanza Sugar Belt. They were also unanimous in placing "poor husbandry techniques on outgrower farms" as the number two problem after drought. The other problems were ranked differently. But on the whole we would conclude that the factories' problems regarding cane procurement are universal and only varying in magnitude with factory zone.

### 7.3. Views of Government and Statutory Organization Officials

Interviews carried out with some officials of government ministries and institutions concerned with sugar, gave some insight into the problems of the industry. Such information does not render itself to quantifiable analytical results. However, coming as it does from people involved in the day-to-day administration of the sugar industry, it must be given serious attention. To this end the next section describes the views expressed by these officials on the problem of cane procurement.

#### 7.3.1: Views about the Factories:

Many people in the sugar industry suggest that some of the sugar factories, particularly Muhoroni and Miwani, have had little or no initiative to boost cane production both on their own nucleus estates and on their outgrower farms. They have become accustomed to having sugar cane brought and sold to them at their door steps and have had no time to look into the problems facing their outgrowers. Through the government zoning system, such factories expect greater patronization by the government and in the absence of competition for cane procurement they see (and perhaps rightly too) no need for resorting to non-price competition: like provision of credit services,

farm machinery, supply of purchased inputs, transport and extension service facilities. It appears that some sugar companies are not willing to extend their risk bearing beyond their factory precincts.

As early as 1957, before the government started controlling cane prices, Miwani Sugar Mills, then having monopsony buying power in the present Nyanza Sugar Belt, was known to have problems with its outgrowers over the pricing of cane. The 1957 Nyanza Province Agricultural Annual Report had this to say about the Miwani situation then:-

"The perennial dissatisfaction of the Kibos Asian farmers with the cane price paid to them by the Miwani Sugar Mills has not abated during the year. Continuous representations have been made that the government should intervene. Government however, has no powers to do so unless both sides agree to accept arbitration. Miwani Sugar Mills are not willing, and their situation will remain impregnable until another mill opens up in the area to introduce competition ....." (14.5 p.18, 1957)

As predicted in the report, another mill soon opened up at Muhoroni and later was followed by another one at Chemelil. However, government intervention through factory zoning and setting cane prices averted the anticipated typical competitive spatial equilibrium price and non-price behaviours that would have taken place among the three factories.

While factories like Mumias, and to some extent Chemelil, resorted to providing services co-ordinating outgrowers' farm activities, Miwani and Muhoroni took no such step and now they are caught up in

a situation of perennial cane shortage. In the middle of 1977 Miwani had to ask for further government patronization to enable it to buy cane from Chemelil zone when it totally ran short of millable cane.

In summary lack of co-ordination between outgrowers and the factories, as at Miwani and Muhoroni, is known to contribute significantly to the severe cane shortage in their respective zones because:-

(i) There is lack of control over the activities of the farmer to ensure:

- a regular cane supply;
- good yields are realized by farmers;
- farmers' problems are identified and where possible help or advice given to overcome the problems;
- smooth farmer/factory relationship that fosters mutual understanding and excludes the feeling of mistrust and exploitation.

(ii) The farmer left to his own devices will have such problems as:

- lack of credit;
- lack of machinery and other inputs; and
- inadequate management techniques.

(iii) Sugar cane cultivation needs heavy machinery such the D<sub>7</sub> or D<sub>8</sub> tractors but these are beyond the reach of many farmers. Ploughing and other land preparations are best provided by the factory, especially where machinery hire services or cooperative machinery units are as inadequate as in the Nyanza Sugar Belt.

(iv) Sugar cane is also a bulky and perishable product that needs quick transport from the time of harvesting to processing. Where transport facilities are known to be inadequate, factories ought to have a transport fleet that can come readily to the farmers' aid.

### 7.3.2. Views about the Farmers:

Government officers' views about the sugar cane farmers' role in the cane shortage problem especially in the Nyanza Sugar Belt are varied, being both favourable and unfavourable.

#### 7.3.2.1. Favourable Views

(a) Unequal natural endowments weigh heavily in disfavour of the Nyanza Sugar Belt cane farmers, viz:

- Soils in the Nyanza Sugar Belt are more difficult to manage. Land preparation and weeding become costly on these soils, thereby reducing farm gross margins;

- The rainfall is inadequate; the temperatures are high and encourage fast and heavy weed growth, all combining to depress cane yields. Low cane yields reduce farm gross margins and hence lower the farmers' motivation;

- Most of the Nyanza Sugar Belt farmers virtually get no assistance at all from the factories.

(b) The Asian farmers (mostly under Miwani and Chemelil) are said to be farming in fear of local politics so that they do not invest heavily on their sugar farms. Their farms are often run-down intentionally in anticipation that when they come to sell, little invested capital will be taken over by the prospective native buyers. It is further alleged

that most Asian farms that have been bought out by the local people have often been in such a poor state that heavy rehabilitation investment is required to bring them back to production. More often than not, such buyers lack funds to carry out such rehabilitation having depleted their funds on the farm purchase.

(c) Some large farms are in the process of changing hands already from Asians to Africans. However, the Agricultural Finance Corporation (A.F.C.), which often advances loans to the African buyers is usually too slow in processing such loans, with the consequence that for some time neither the Asian nor the prospective African buyer can invest in the farm, and therefore the farm deteriorates and the yields go down.

(d) The cooperatives have not lived up to the farmers' expectations. Many of the cooperative societies are criticized for failing in such aspects as:

- shortage of working capital;
- gross mismanagement of owned machinery and equipment;
- politics and personal bickering among cooperative officials resulting in opposing factions, thus defeating the aim of working together. Members' loyalty is often divided under such circumstances.
- members constantly complain of "mysterious deductions" made on their cane proceeds without adequate explanations. Such unexplained deductions erode the members' trust and loyalty to the cooperative movement;
- Some of the cooperatives are allegedly manned by in-

experienced and unqualified personnel usually appointed through favouritism or nepotism.

#### 7.3.2.2.: Unfavourable Views

There are some government officials who lay most of the blame on the cane farmers for the shortage of cane. Laziness and general apathy are commonly cited as wide-spread problems among the Nyanza Sugar Belt farmers. This allegation is subjective and no studies have been done to verify it. Most officers may be using such unfavourable description out of sheer hearsay or through influence of what they read about the Nyanza farmers in the old colonial reports such as this one quoted below:

".....The Central Nyanza Luo are unquestionably the most backward tribe in the province where agriculture is concerned and until there is a change of attitude on their part little can be done..." (14.5 p.13,1955)

Two years later a similar report had this to say:-

"...Poor Central Nyanza is still the cow's tail, in fact, one feels at times that it is no longer even attached to the cow. The people are so torn with intrigue and dissention amongst themselves that progress is inhibited .....There are indeed a few hopeful spots appearing, but they have not got a thrifty look, so no more will be said of them....." (14.5 p. 18, 1957)

#### 7.4: Evaluation of Cane Procurement Problems

All the factory officials interviewed in the Nyanza Sugar Belt admitted having cane procurement problems. The shortage of millable cane was a common feature to all the three factories, resulting in under-utilization of factory capacity. The factory officials had the consensus of opinion that the solution to this problem lies in the



improvement of the outgrower cane yields.

The farmers too were generally dissatisfied with the organization of the industry at farm and factory levels. The farmers harbour suspicion about their relationship with the factories and their own cooperative organizations. Most of the farmers are less motivated, given the array of problems facing them. As recommended in the last chapter some major changes, involving a critical look at the roles of the factories and the cooperative movements in helping the farmer out, are necessary if the cane procurement problems are to be settled. Extension services to the sugar cane farmers have been far from adequate, especially in the Miwani and Muhoroni zones.

TABLE 8.1: OUTGROWERS AND NUCLEUS ESTATE CANE PRODUCTION VARIABLE COSTS

	Plant Crop			1st Ratoon			2nd Ratoon			5yr Cycle		
	Ksh/ha	Ksh/tonne	Index	Ksh/ha	Ksh/tonne	Index	Ksh/ha	Ksh/tonne	Index	Ksh/ha	Ksh/tonne	Index
Mumias N.E.	7155.00	55.00	86	4350.00	40.00	118	4350.00	40.00	118	1585.00	65.00	103
Miwani N.E.	3300.00	44.00	41	1650.00	45.00	45	1650.00	45.00	45	6600.00	45.00	42
Chemelil N.E.	5630.00	59.00	70	3257.00	48.00	87	3257.00	48.00	87	12144.00	52.00	79
Outgrowers*	7990.00	114.00	100	3680.00	74.00	100	3680.00	74.00	100	15350.00	90.00	100

Source: Study Survey, 1977.

N.E.=Nucleus estate

\* outgrowers in the Nyanza Sugar Belt.

Compared to Chemelil nucleus estate however, the farmer spends about 30% more to produce a plant crop and 13% more to produce a ratoon. On the other hand the Mumias nucleus estate spends more money to produce a hectare of either a plant or ratoon crop than both outgrowers and other factories.

On tonnage basis the outgrower costs of producing cane nearly double those of nucleus estates. This is because yields tend to be higher on the nucleus estates than on outgrower farms.

To conclude we observe that either on a per hectareage or on a weight basis, the outgrower production costs are significantly higher than those of the nucleus estates. We thus have no option but to accept our hypothesis "that unit production costs differ significantly between outgrower farms and the nucleus estates". From the result we go further to qualify that the cost difference is not in favour of the outgrower farmers. Next we postulate two possible explanations for the cost imbalances: The first is that the nucleus estates being large and better managed units do realize economies of scale. The second is that since the nucleus estates have their own machinery and equipment for most farm operations, they are not subjected to the vagaries of **received** machinery services regarding charges and timeliness of operations, which affect the outgrowers who depend on hired services.

## 8.2 Hypothesis 2:

"That cane yields per hectare on outgrower farms are far below the yields realized on the nucleus estates because the nucleus estates are better managed than the outgrower farms."

In testing this hypothesis plant crop and ratoon average yield figures were calculated from the questionnaires for the small and large scale farms and the nucleus estates in the Nyanza Sugar Belt. By comparison the cane yields were found to be generally lower on small-scale farms than on either the large farms or the nucleus estates (see table 5.14). Analyses were carried out on these mean yields to establish whether or not there were any significant differences between them (see section 5.2.8.1). At both 0.05 and 0.01 levels of significance it was found that:-

- In the large scale sector, (though mean yields in Miwani zone were lower than those in Muhoroni and Chemelil zones), with the data available no significant inter-zonal population mean yield differences were found.
- There was a significant population mean yield difference between the small farms and the large farms both at factory zone level and on aggregate levels.
- The nucleus estate plant crop mean yield was higher than those found on large and small outgrower farms. However for ratoons, Miwani nucleus estate mean yield was lower than those realized on outgrower farms. Only Mumias and Chemelil on average had superior yields over the outgrowers for both plant and ratoon crops. In aggregate however, the mean yields in the large scale farming sector were higher than those on nucleus estates in the Nyanza Sugar Belt for both plant and ratoon crops. It is only the small scale farms which emerged with lower yields than the nucleus estates on aggregate (see Table 5.14).

This result leads us to reject the hypothesis since it does not hold when yields of nucleus estate are compared to those of the large outgrower farms. The hypothesis could only be accepted in the case of small farms. From the findings we are led to conclude that apart from Chemelil and Mumias, other factory nucleus estates realized no better yields than their outgrowers in the year under study.

### 8.3: Hypothesis 3

"That at least some of the factories often work below capacity and that this is the result of the cane procurement problem:"

To test this hypothesis the actual annual output for each factory was obtained where possible for the last ten years and expressed as a percentage of nominal capacity. A table showing capacity utilization on a percentage basis was constructed (Appendix IV) together with a pictorial graphical representation of capacity utilization (Appendix IV B). As a whole this analysis showed that for the last ten years all the factories in Kenya have been operating below their nominal capacities.

∴ Further analysis of capacity utilization was done by constructing a "capacity utilization index" with the Mumias percentage nominal capacity utilization as the base. In 1976 only Mumias and Chemelil managed to operate above 50% of their respective nominal capacities, having reached 91% and 77% respectively. On the basis of indexation with the Mumias index put at 100 the other factories' scores were as follows:- Ramisi = 22, Miwani = 46; Muhoroni = 48 and Chemelil = 85 (see Table 6.4).

During the survey all the factories except Mumias, blamed the shortage of millable cane for the excess capacity they were experiencing.

From the aforesaid, we accept the hypothesis we set out to test. With the exception of Mumias all the other sugar factories work far below capacity and that this is mainly as a result of the shortage of cane.

#### 8.4: Hypothesis 4:

"That the factory zoning system meant to define the catchment area of each factory is not satisfactory to both farmers and the factory management:"

Through a questionnaire both small scale and large scale farmers' views were sought about their respective factories. Asked whether or not given free choice they would still remain under the same factory zones, the following response was given:-

- 50% of the farmers interviewed under Muhoroni zone preferred remaining in that zone, while a further 50% preferred Chemelil to Muhoroni.
- Within Chemelil zone 58% of the respondents were satisfied with the zoning system, while the remaining 42% would prefer to be re-zoned under Miwani - none opted for Muhoroni in this case.
- In the Miwani zone however 73% of the farmers interviewed preferred to remain under Miwani while only 27% wanted to be re-zoned under Chemelil - again nobody opted for Muhoroni.

When asked to rank the factories in order of preference: 45% of the farmers interviewed in the Nyanza Sugar Belt placed Chemelil as number one while Miwani and Muhoroni were ranked number one by only 35% and 19% of the respondents. Only 1% of the respondents remained indifferent.

As for the opinion of the sugar companies only Miwani Sugar Mills thought the zoning had been in its disfavour having lost some of its former large scale farms to Chemelil\*.

From the analysis we find it difficult to accept the hypothesis in its original form. We therefore reject it as it is clear that the majority of farmers are satisfied with the zoning system and so are the sugar companies. The only exceptions to this rule are the Muhoroni farmers and the Miwani Sugar Company. The Muhoroni farmers are equally divided between the dissatisfied and the 'status quo' groups. The fact that no farmer from other zones placed Muhoroni as a second choice makes the zoning under Muhoroni appear more suspect.

#### 8.5 Hypothesis 5

"That outgrower farms respond to price changes": In the absence of adequate time series data, this study used a subjective cross-sectional analysis of farmers' price response. The farmers were asked whether they would increase, decrease or have no change at all on their current cane acreages under three price regimes:- (a) if cane price was increased by Ksh25/= per tonne, (b) if the price remained as it was i.e. at K.Sh 133/= per tonne, and (c) if the price decreased by Ksh 25 per tonne.

\*Prior to the setting up of Chemelil and Muhoroni, Miwani had the purchasing monopony of cane in the Nyanza Sugar Belt.

In the final analysis (Table 5.12) 88.5% of the small scale farmers interviewed said they would increase cane acreage in the case where price was increased. About a similar response came from the large scale farmers (i.e. 86.7%). In the case of a no price increase only 20% of the small scale farmers and 26.7% of the large scale farmers interviewed said they would increase their acreage, while as many as 72.3% of the small scale farmers and 73.3% of the large scale farmers said they would not change their cane acreages in the event of a no price increase. Only 7.7% of small scale farmers and no large scale farmer indicated a reduction in cane acreage under a no price change. However in the case of a price fall 49.2% of the small scale farmers and 46.7% of the large scale farmers said they would not change their cane acreage. Only 16.2% of the small scale farmers and 13.3% of the large scale farmers said they would reduce if prices fell. A further 34.6% of the small scale farmers and 40% of the large scale farmers thought they would increase cane acreage under a reduced price situation. These statements are of course in relation to the 1977 survey and the prevailing conditions at that time.

On the basis of the analysis result we do accept the hypothesis that outgrower farmers respond to price changes. More definitely we can state that there seems to be a potential for a high positive response to price increases among the cane farmers.

#### 8.6. Hypothesis 6:

"That there are barriers to entry in the sugar industry."

With respect to sugar cane production, the survey revealed that farmers falling under any sugar factory zone could produce and sell cane without any quantitative restrictions. Land ownership in such



areas is the only restriction. The majority of the small scale farmers had acquired land through inheritance, government settlement schemes and a few by direct buying. The large scale farmers on the other hand acquired land mostly through buying and to some extent through settlement schemes. Apart from spatial location and soil suitability which may make sugar cane production uneconomic on some sites, there is no significant barrier to entry in cane production.

As for entry into the processing sector, some barriers are observed. All officials from government and sugar companies interviewed were of the opinion that a modern sugar factory is too costly for an individual to undertake. Historically, we have evidence that all the new sugar projects in post-independent Kenya have been exclusively financed by the government. Jaggery factories which offer low-cost technology are also discouraged by the government within existing sugar zones through a total ban or restricted licensing. The "mini" sugar plants are still in the stages of feasibility studies but even these are proving to be expensive.

Thus the hypothesis that there are barriers to entry in the sugar industry is accepted with respect to the sugar processing subsector but not in the case of cane production.

The barriers identified here are two fold : one is the absolute cost barrier; the other is the government barrier through banning and restricted licensing for jaggery.

### 8.7 Hypothesis 7:

"That the distribution of sugar is inefficient and the reason for this includes the monopoly of sugar distribution by the K.N.T.C.":

The sugar companies' view regarding the K.N.T.C. as a distributor were sought through a questionnaire. Some government and K.N.T.C. officials were also interviewed to get their impression about the distribution system. Due to lack of time the study did not cover the consumers.

The results were that three-quarters of the sugar companies felt that K.N.T.C. was not effective as a sole distributor of sugar and they suggested that the Kenya Sugar Authority (K.S.A.) should be empowered to handle sugar marketing in addition to its present functions. Only one sugar company was satisfied with the K.N.T.C. as a distributor for sugar. The majority of government officials interviewed held K.N.T.C. responsible for inefficiency in sugar distribution resulting in reported shortages. They also suggested that the K.S.A. should handle all sugar matters including marketing since the KNTC was dealing with too many other products to be able to give sugar the attention it deserves.

The reported shortages and alleged cases of smuggling were a common talking point during the survey. They could therefore have biased the conclusions of the respondents.

Therefore instead of accepting the hypothesis on the strength of the sugar companies' and government officials' views it seems reasonable to reserve judgement on it.

CHAPTER IX

SUMMARY, CONCLUSIONS AND RECOMMENDATION:

9.1: SUMMARY

9.1.1. The Kenyan Sugar Industry dates back to the mid-1920's when Miwani and Ramisi factories were established through private entrepreneurship. At present (1977) the industry consists of five factories, with the latest three additions at Muhoroni, Chemelil and Mumias being largely government-owned. Two other new government-sponsored factory projects are expected to start production by 1979/80. These two new projects at Awendo in South Nyanza and at Nzoia in Western Province will increase the numbers of sugar factories in Kenya to seven. According to government projected estimates these additional factory facilities will make Kenya self-sufficient in sugar by 1980/81 (14.6. p.13).

9.1.2. Each sugar factory has a legally defined zone which forms its catchment area for cane supply. Sugar cane supplied to the factories comes from three major sources, namely:-

(i) The nucleus estates which are large commercial sugar cane plantations owned and operated by the respective factories. Each nucleus estate supplies approximately one-third of its factory's annual cane needs. The nucleus estates are also meant to act as demonstration and service centres for the surrounding outgrower farms. However, this study revealed that apart from Mumias and Chemelil, the other factories' nucleus estates were far from meeting this latter objective.

(ii) The large scale farms which in the case of the Nyanza Sugar Belt form a significant source of cane supply to the three factories there. The Mumias factory on the other hand has no large scale farms in its catchment area.

(iii) The small scale farms which consist of farms with 20 hectares and below, are the third source of cane supply to the factories. The smallholder cane farms fall into three categories, viz:- private, cooperative and settlement scheme farms. Until 1973, the large farms followed by the nucleus estates were the major cane suppliers to the factories. However, after 1973 this situation changed. Now with Mumias heavily relying on smallholder outgrowers for cane and the government policy encouraging smallholders in other factory zones, the small scale farming sector on aggregate supplies 62.1% of cane milled by the factories. This leaves the supply from the nucleus estates and the large farms at 29.5% and 8.4% respectively.

9.1.3. The Kenya government exercises substantial control over the sugar industry at virtually all levels. Apart from zoning the factory catchment areas, the government gazettes the producer prices for cane and the prices of sugar ex-factory and at consumer levels. Any contravention of such price orders is punishable in a court of law.

According to farmers, the previous cane prices were set rather too low, though the present one of K.Sh.133/= per tonne seems satisfactory. Factory officials were critical of the present sugar price structure, which seems over-burdened with government levy and the sugar equalization fund. Therefore the latter serve

to reduce the factories' margins. They felt the government ought to relax the levies and increase the ex-factory price without appreciably increasing the consumer prices.

9.1.4: The distribution of sugar in Kenya is the monopoly of the Kenya National Trading Corporation (KNTC), a subsidiary company of the Industrial and Commercial Development Corporation (I.C.D.C.) of the Ministry of Commerce and Industry. The Ministry of Commerce and Industry is the sole purchaser of locally-produced and imported sugar which it then sells to KNTC. The KNTC distribution system consists of 18 depots which further sell sugar to KNTC - appointed wholesale agents in various major consumption centres in the country. The KNTC agents sell sugar to the retailers who sell to consumers in small quantities by weight. Sugar shortages are frequently reported\* in the local news media and are attributed to alleged hoarding and smuggling, but it was beyond the scope of the study to verify this.

9.1.5: The problem of excess capacity was found to be widespread in all the factories except at Mumias where the factory has managed to work at 91% of its nominal capacity. Chemelil working at 77% of nominal capacity may also soon ease its excess capacity problem. The other three factories at Miwani, Muhoroni and Ramisi operate far below 50% of their respective nominal capacities.

The under-utilization of existing factory capacities defeats the government policy of achieving self-sufficiency.

Physical expansion in the industry through new factory projects

\* At the time of writing the Nyanza Provincial Commissioner suspended some KNTC agents because they were held responsible for sugar shortage in Kisumu.

are to supplement existing factory facilities. The sheer increase in the number of factories in the country to seven, cannot in itself make Kenya self-sufficient in sugar unless concerted efforts are made to utilize the existing factory capacities to their planned levels.

9.1.6: The widespread excess capacity in the industry does not arise from planned monopolistic tactics on the part of the factories to reduce output. The factory officials interviewed pointed out that the shortage of milling cane is the major cause of excess capacity experienced in the sugar factories. Other factors like industrial labour disputes, shortage of skilled manpower, factory breakdown and scheduled shut-downs for repairs and maintenance are not regarded as significantly contributing to the problem of excess capacity.

The shortage of cane resulting in the wide-spread excess capacity is attributed to some of the following factors:-

- Poor cane husbandry techniques among the majority of out-grower farms resulting in low yields.
- Lack of proper co-ordination between some factories and their outgrowers as in the case of Muhoroni and Miwani factories. Farmers left to their own devices without proper expert guidance and with no adequate supply of input and machinery services will usually perform poorly.
- Low cane prices in the past, coupled with low cane yields in the face of rising input prices have not been remunerative enough to boost the morale of some farmers.

- Abandonment of sugar farms by absentee farmers and the slow process of transactions when farms change hands, have resulted in many farms being run-down.
- The unpredictable and marginal weather conditions, especially with respect to rainfall often reduce cane yields in Nyanza and Coast Provinces.
- Inadequate or total lack of extension services to cane farmers.

Apart from Mumias farmers and to some extent those linked to Chemelil and a few farmers under the supervision of the the Settlement Sugar Organization, many sugar cane growers in the industry lack a systematized extension and advisory service. Informal education facilities such as field days or organized short term courses at Farmers' Training Centres were found totally lacking in some zones.

## 9.2. CONCLUSIONS

Analysing the structure and performance of such a dynamic and sensitive industry as that of sugar and evaluating the extent and consequences of its inherent problems is an enormous complex research task "in which theory is only of partial help and good empirical evidence often hard to come by.----- Under such circumstances the most the researcher can do is to assemble the available data in mosaic fashion ----, using judgement to bridge the gaps, and taking care that parts add up to a consistent and meaningful whole" (27p.174).

With this in mind, the study comes up with the following conclusions about the Kenya's Sugar Industry:-

9.2.1: Although there are only a few firms involved in sugar processing, there is no observable competitive conduct among the firms. In theory, one would have expected oligopolistic competition to prevail in the industry. However, government intervention at all levels seems to have averted competitive impetus among participants. Although such intervention has reduced squabbles, price wars and non-price competitive conduct including unethical conduct among processors, it has resulted in some factories neglecting or totally lacking formal links with their outgrowers. This has invariably resulted in poor farm performance in form of low yields with some of the farms being completely run-down. The factories have in turn, as a consequence of lacking formal links with their outgrowers, suffered chronic cane shortage resulting in poor capacity utilization. Miwani and Muhoroni factories are victims of this state of affairs.

Government control over the industry needs constant reviewing to ensure it does not weigh heavily in disfavour of some groups of participants. Ideally with government intervention, participants in the industry ranging from the farmer to the sugar consumer, should appear neither to exploit nor to be exploited. In fact no factory was found during the study to contravene the laid-down government regulations and in this respect no observable exploitation was noted. Some of the factories were even found to make do with low profits or even losses without directly tampering with either the cane price or the sugar price.



On the other hand, farmers zoned under factories with no out-grower services felt such factories exploited them by neglecting their problems. It therefore appears that factories should be encouraged (not necessarily through legal notices) by government to extend their investments far afield by providing some services to cane farmers in their respective zones.

9.2.2. The widespread excess capacity in the industry poses a threat to the government's optimistic forecast of self-sufficiency by 1982 unless drastic steps are taken to boost cane production in the existing factory zones. At the time of conducting the research, there were efforts by the government to get a World Bank loan to help save the situation through a cane farms rehabilitation and an expansion programme. But without a thorough structural re-organization at farm and factory levels, especially in the Nyanza Sugar Belt, little may be achieved.

9.2.3: The distribution system of sugar (though not a major theme in this study) does seem inefficient as evidenced by frequent reports of shortages in major consumption centres. Further evidence of inefficiency in the distribution system is supported by interviews held with sugar company officials and other people in the industry, the majority of whom felt that KHTC with a multiplicity of products to handle seems not to be giving sugar adequate attention. Suggestions were made by these people to the effect that the Kenya Sugar Authority should have its functions extended to include sugar marketing.

9.2.4. In summary, the performance of the sugar industry is still far from adequate when judged on the following criteria:- (27p. 399 )

(a) efficiency of the organization of the industry in terms of scale of plant; utilization of plant capacity; cane procurement and sugar distribution.

(b) technological progressiveness both in cane and sugar production techniques.

(c) profits at levels which reward investment, efficiency and innovation at necessary but not excessive rates.

### 9.3. RECOMMENDATIONS

#### 9.3.1. Management and Organization in the Farming Phase

It is apparent that by the time the two additional sugar projects at Muhoroni and Chemelil were instituted in the Nyanza Sugar Belt, Kenya officials planning for these factories did not fully understand that effective economic viability of these factories required a special organizational effort and structure not only at factory levels but more importantly at farm levels. It seems much has now been learnt from this mistake, as evidenced in new projects like Mumias, where farm level organization has resulted in unrivalled success in the industry. It is high time the Nyanza Sugar Belt as a whole re-learns from its mistakes and re-organizes its approach to farmers both for cane rehabilitation and expansion programmes.

9.3.1.1. Basis for Re-organization

The establishment of an independent cane farmer as the basis of production requires specific measures of encouragement coming from a dependable organization. Such measures include:-

(a) Advice and Extension Service

The organization entrusted with outgrowers' cane production should be manned with adequate personnel, well-trained in cane production techniques and general extension services. These people would advise the farmers on such agronomic practices as:

- Field preparation for cane planting.
- Selection of planting material free from diseases and of the recommended variety.
- Weeding and fertilizer application techniques together with the frequency recommended for these operations.
- Harvesting procedures especially with respect to the stage of crop maturity and pre-harvesting burning of cane, should this be necessary.

(b) Provision of Services:

Many farmers are financially handicapped and less endowed with other resources and hence require an organized system that would adequately provide such services as:-

- Farm machinery service that would enable farmers to plough, harrow, furrow and plant cane at the right time and at a reasonable charge, and where possible on soft credit terms.

- Transport services for purchased inputs and more particularly for prompt delivery of cane to the factory. Lack of transport results in over-mature cane of poor milling quality. At the time of study many over-mature cane fields could not be harvested due to lack of transport; and the life cycle of such cane fields gets unnecessarily prolonged thereby distorting new scheduled plantings.

- Provision of credit facilities in soft terms, preferably in kind, is needed to boost farmers' cane output. Of course strict supervision is quite necessary to ascertain that such credits are used for their intended purposes. Credit could take the form of land preparation (ploughing, harrowing, furrowing); fertilizers; herbicides; spray equipment; and transport.

Where cash credit must be given as in the case of hiring labourers for say planting, weeding and harvesting, it would be advisable that the organization should supervise such work and only give payments for work actually done.

(c) Provision of Legal Protection

The institutional organization set up to help farmers should operate within a proper legal framework to protect it and to protect the interests of the farmers. Such legal protection will enable the organization to provide the necessary integration of the agricultural process and the industrial process of sugar.

Preferably there should be a legal contract stipulating that:-

(i) The organization will arrange to do the following operations:

- Own or hire machinery for ploughing, harrowing, furrowing and where applicable, ditching and cutting drains on the outgrower farms.

- Provide purchased inputs like fertilizers and herbicides at the right time and in the right quantities.

- Provide transport for cane promptly.

- Help the farmer draw up his farm plan.

(ii) The farmer on the other hand should be entrusted with the following tasks:-

- Make land available for cane.

- Provide the labour for clearing, planting, weeding and harvesting.

- Take the general responsibility of protecting the cane up to maturity.

(iii) The institutional organization should have the right to intervene and carry out farm operations where a farmer is seen to be failing. This step is necessary to avoid losing a crop already having money invested in it. In such a case the organization would treat expenses incurred during such interventions as a loan advanced to the farmer.

(iv) To prevent farmers from relaxing or doing nothing on their farms expecting intervention by the institutional organization, the contract should have a legal clause disqualifying such farmers from receiving any future aid from the body.

(v) Loan repayments should be recovered from the farmers' cane proceeds. Such loan recovery should be structured in such a way that it is evenly distributed throughout the anticipated 5-year crop cycle, comprising three cuttings. Thus one-third of the loan and interest and service charges could be deducted from the plant crop proceeds, and the other two-thirds equally divided between the first and second ratoon proceeds. This repayment system will avoid the common practice of giving the farmer financial embarrassment when the loan is all recovered from the sales of the plant crop, which often involves higher variable costs than ratoons and hence invariably leaves the farmer with little or no net cash income after two years of great expectations.

(vi) Proper accounting procedure should be maintained by the institutional organization, whereby each farmer's quantity of cane marketed and the amount of money earned or spent are clearly spelt out. This system may allay the common mistrust among farmers about the cooperative loaning institutions which allegedly make "mysterious deductions" for services not rendered.

(vii) Constant review of prices should be done by such an institutional organization to ensure that the government is accordingly informed about changing conditions in the cane input markets.

#### 9.3.1.2: Types of Possible Re-organization Schemes

From the study it is evident that urgent re-organization, involving setting up an institution to take care of and co-ordinate outgrower activities with those of sugar factories, is needed especially in the Nyanza Sugar Belt. The question is, "what form should such an organization take?" There are three possibilities for the Nyanza Sugar Belt.

##### 9.3.1.2.1. Forming an Outgrowers' Company

A new institutional innovation in the sugar industry is the formation of an outgrowers' company, started in the Mumias zone during the course of this study in 1977. Although this organization has not operated long enough to provide enough information for its evaluation, preliminary observations show that it

has every chance of being successful.

Thus forming an outgrowers' company in each of the factory zones is one way of redressing the current pathetic state in which most of the outgrowers in the Nyanza Sugar Belt find themselves. Initially such a company could get financial and administrative help from the Government.

9.3.1.2.2: Forming Sugar Company-Outgrower Integration

Processor-grower integration is a common phenomenon in agro-based industries in many parts of the world. In Kenya, the sugar company at Mumias has successfully pursued full integration with its cane farmers since its inception. A good relationship was established between the Mumias Sugar Company and its outgrowers to the extent that "the techniques of cultivation in this zone are clearly established and the adequacy of the management structure provided to help outgrowers is proven" (44 Vol.II p.35). Chemelil Sugar Company had such a full integration with all its outgrowers until 1970, when the small scale farmers felt dissatisfied with the way the company made deductions on farmers' cane proceeds for recovery of service expenses. These farmers then decided to form the Nyanza Sugar Belt Cooperative Union (S.B.C.U.) to take charge of their operations and to help them in their dealings with the Chemelil Company. At present



(1977) the majority of these farmers interviewed are again dissatisfied with S.B.C.U. and would like the re-establishment of a factory-farmer integration scheme. Indeed Chemelil has a successful direct link with its large scale farmers.

All the factories interviewed were unanimous in thinking that the sugar companies, and not the cooperatives or any other institutions, should be entrusted with the task of advising and providing services to the outgrowers within respective factory organizations.

For successful adaptation of sugar companies to act as institutional prime movers of outgrower sugar cane production, there are several re-organizations that must take place in some of the sugar companies, viz:-

- All the sugar companies must establish viable agricultural departments with strong outgrower units.

- In each case the agricultural department and its outgrower unit must be manned by adequate and qualified agricultural personnel of various grades and well versed with cane production. In this respect, Muhoroni needs a thorough overhaul followed by Miwani Company. Chemelil already has a good set-up and may only need a few additional personnel to handle an expanded outgrower system.

- The agricultural departments so formed should have adequate heavy and light farm machinery, transport facilities, well-equipped agricultural workshops and storage facilities for fertilizers and other inputs, all in readiness for prompt services to the farmers.

- To facilitate such a re-organization, the sugar companies should be given financial aid, preferably by the Kenya Government or from private sources with the government acting as guarantors. The government on the other hand should supervise the use of such loans by the sugar companies to ensure that the needs of the farmers are met.

The role of the cooperatives under this type of re-organization could obviously be reduced to one of mere marketing intermediary, or it could be side-stepped altogether in the exercise.

#### 9.3.1.2.3: Cooperative Approach:

A third possibility of re-organizing the outgrower services is to carry out a complete overhaul of the cooperative system in the Nyanza Sugar Belt. Such re-organization would include:-

- Reducing the number of Cooperative Unions in the Nyanza Sugar Belt to one instead of the present two. In this case the Muhoroni Cooperative Union would be merged with the Sugar Belt Cooperative Union (S.B.C.U.). At present the latter looks a bit more viable than the former, which has had many problems with government - appointed committees of inquiry.

- A campaign to educate and reassure the farmer who is already disenchanted with anything to do with cooperatives, spelling out how the re-organized cooperative structure would serve better than previous cooperative arrangements.

- The cooperative Union so formed and its primary societies can then act as a link between the factories and the farmers. The Union could act in any one of the following ways:-

(a) Become fully involved with the farmers just as in the case of the outgrower company, thereby owning its own equipment and hiring equipment for the service of members. In this case it would initially need a substantial government loan to acquire farm machinery, a transport fleet and to purchase fertilizers.

Strick government control over officials would be quite necessary if re-organization was not to fail in the same way as earlier attempts.

(b) Another alternative is to have the cooperative only helping the Sugar Company mobilize farmers to offer their land for sugar cane production. The cooperative could also help in the legal contracting intricacies between the farmer and the factories and encouraging farmers to carry out their share of work as provided under such contracts. In this case the sugar companies would still, as in the case under 9.3.2.2, be responsible for providing all other services to the farmers but through arrangement with the cooperatives. Such a Cooperative Union and its primary societies should be manned by qualified personnel having the welfare of farmers at heart.

#### 9.3.2. Other Recommendations.

9.3.2.1. There should be a constant review of cane and sugar prices to reflect changing conditions in the farming and processing sectors. Prices should be in line with production costs and should adequately provide for trade margins that would boost incentives to participants in the industry.

#### 9.3.2.2. Recommendations for Further Studies:

During the course of this study it became clear that many problems beset the industry. Some of the problem areas that may need urgent study are:-

(i) The possibility of improving the sugar distribution.

system to reduce the frequently reported shortages.

(ii) The potential for developing a range of sugar by-products.

(iii) The jaggery subsector, its potential and problems.

(iv) The economics of the small scale sugar projects, including both the "mini" sugar plant and the "open pan" factories which are being established in some parts of the country.

(v) The prospects and the problems of Kenya joining the world sugar export market.

(vi) The possibility of supplementary irrigation in the rainfed sugar belts.

#### 9.3.3.3. Provision of Data Bank:

For the development of the industry it is essential that reliable and adequate data be available at farm, processing and marketing levels.

It is therefore advisable that the Kenya Sugar Authority and other relevant government departments should gather and store adequate data on various aspects of the sugar industry. In this respect the sugar companies should be encouraged to cooperate and help in the collection of data for the industry, since it would make it easier to study problems besetting the industry. The data that should be given urgent attention include:-

- Production function data both at farm and factory levels;
- Cane acreage data covering both the small scale and large scale farms in all factory zones;
- Labour data at farm and factory levels.

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Appendix I  
FIELD SURVEY QUESTIONNAIRE No. 1  
UNIVERSITY OF NAIROBI  
SUGAR CANE OUTGROWERS' QUESTIONNAIRE

INTRODUCTION: My name is ..... from the University of Nairobi, Department of Agricultural Economics. I am conducting a survey on sugar cane growing to gather farmers' viewpoints about the industry. I would be grateful if you could spare some time now to answer a few questions I shall be putting to you.

GENERAL INFORMATION:

1. Particulars:
  - Interview Serial Number .....
  - Name of farmer .....
  - Sub-location .....
  - Location .....
  - District .....
  - Province .....
  - Name of interviewer/enumerator .....
  - Date .....
  
2. How long have you been farming in this area? ....
  
3. What is the area of your farm? ..... (ac/ha)
  
4. Crop enterprises:
  - (a) Which crops do you grow on your farm  
(give name and area under the crop):
    - (i) as cash crops?
  
    - (ii) for subsistence?

5. Livestock enterprise:

- (a) Which types of animals do you keep? (mention type and number)
- (b) How much grazing land do you have? ..... ac/ha
- (c) Do you buy feeds for your livestock? .... Yes/No

6. How did you acquire this farm?

- (a) inherited
- (b) Government settlement scheme
- (c) bought

7. (a) Do you own other land? ..... Yes/No

- (b) If yes, how much ..... ac/ha.  
Is this farm land? Yes/No

- (c) If yes, what do you grow on it?

8. When did you start growing sugar cane?

9. How many acres/hectares did you start with? .....  
ac/ha

10. Why were you attracted to sugar cane growing?

- (i) persuaded by sugar factory people
- (ii) Government advice
- (iii) used to grow for jaggery
- (iv) settlement scheme regulations required
- (v) more profitable than alternative crops,  
viz .....
- (vi) my land only suitable for sugar cane
- (vii) other reasons

FARMERS' CONCEIVED CONSTRAINTS:

11. Since you started growing sugar cane what in your opinion have been your major problems (in order of seriousness)?
- (i) lack of credit
  - (ii) low profits
  - (iii) labour shortage
  - (iv) non-availability of inputs at the right time
  - (v) high prices of inputs (fertilizers, herbicides, seedcane)
  - (vi) high cost of production
  - (vii) drought
  - (viii) pests and diseases
  - (ix) management
  - (x) transport
  - (xi) others
- (b) What steps have you taken to solve these problems?
- (c) Which problems still face you?
12. How many acres/hectares are under cane and in what stage of growth?
13. (a) What cane variety do you grow?
- (b) How did you select this?
- (c) On average what yields per acre/hectare did you get last year (1976)? (i) First crop...  
(ii) Ratoon crop ... tonnes per ha/ac

14. (a) To which factory do you sell your cane?  
(i) Chemelil..... (ii) Miwani.....  
(iii) Muhoroni.....
- (b) Is this of your own choice? ... Yes/No
- (c) How do you transport your cane to the factory?
- (d) How much cane did you deliver to the factory last year? (i) .....Tonnes (ii) value ....Kshs
- (e) From how many acres/hectares was this? ....
15. (a) Do you sell your cane anywhere else?.... Yes/No
- (b) If yes, where?
16. Why did you choose to deliver cane to the factory mentioned in 14 (a)?
- (i) nearness (distance)
- (ii) Government zoning
- (iii) transport availability
- (iv) credit facilities
- (v) co-operative society arranged
- (vi) others
17. (a) To which factory (in order of preference) would you deliver your cane if given freedom of choice (indicate 1, 2, 3)?

Miwani	.....
Chemelil	.....
Muhoroni	.....

(b) Why would you choose ..... factory as your first choice?

- (i) distance
- (ii) prompt payments
- (iii) provision of adequate transport
- (iv) accepts cane without delay
- (v) provides credit
- (vi) provides advice
- (vii) road accessibility
- (viii) others

(c) In what way or ways do you think the factory to which you deliver your cane could improve its efficiency, if any?

ORGANIZATION CONSTRAINTS

18. (a) Are you a member of sugar growers co-operative?  
Yes/No

(b) If yes: (i) which one? .....  
(ii) what benefits do you get as a member?

- (1) advice
- (2) credit
- (3) transport arrangements
- (4) easy procuments of inputs
- (5) land preparation services
- (6) makes arrangements with factory for members
- (7) others

19. (a) What are some of the problems you find with your co-operative?



(b) In what ways do you think the society could be improved, if any?

20. Supposing there was no co-operative, how would you dispose of your cane and obtain inputs such as fertilizers, seed cane, etc?

21. (a) Which, if any, of the following visited your farm last year to advise you on cane management?

- (i) Ministry of Agriculture staff
- (ii) Ministry of Lands and Settlement staff
- (iii) Co-operative Society staff
- (iv) Sugar company staff
- (v) Others

(b) How many such visits, if any, do such advisors make to your farm per:

- (i) week? .....
- (ii) month .....
- (iii) per year.....

(c) Was the advice relevant or useful to you?

- (i) fair.....
- (ii) useful.....
- (iii) very useful .....
- (iv) confusing .....
- (v) no use.....

FARM CREDIT

22. Credit Source:

(a) During the past 2 years have you received a loan to help you run your farm? ..... Yes/No

(b) If yes, please give details

Source	amount K.Sh.	period of loan	Did you have to give any security
None	.....	.....	.....
A.F.C.	.....	.....	.....
Co-operative			
Bank	.....	.....	.....
Sugar company	.....	.....	.....
Friends	.....	.....	.....
Relatives	.....	.....	.....
Others	.....	.....	.....
TOTAL			

23. How did you use the loan?

24. (a) Do you have saving facilities for the money you earn from the farm? ..... Yes/No

(b) If yes, where do you save?

LABOUR, DEPENDANTS AND SUBSISTENCE

25. (a) How many workers did you employ on sugar cane last year (1976)?

type of labour	number	hours weekly	weeks per year	wages per month	if seasonal give dates
permanent					
casual					
family					

- (b) How many persons live at your house in the farm?  
 (i) adults (over 18) ..... (ii) children.....
- (c) Do you have to provide subsistence to all of them? .... Yes/No
- (d) When, if at all, do you experience labour shortage? (i) land preparation ..... (ii) planting..... (iii) weeding ..... (iv) harvesting..... (v) others.....
- (e) How do you solve this labour shortage problem?  
 (i) hire more labour (ii) reduce level of activities in other operations (iii) others
- (f) What wage rates on average (K.sh.) do you pay to your adult workers per month? (i) permanent labour..... (ii) temporary labour .....
- (g) Do you give food or other payments in kind to your workers as substitute to cash payment? (specify)...
- (h) (i) Is there any time of the year when you experience seasonal shortage of food either for your labour force or for your household?

- (ii) If yes, is the local marketing system able to provide adequate supply for sale?

FARM MANAGEMENT

- 26. (a) What accounts or other records of your farm business do you maintain if any? (e.g. bank book, receipts and payments)
- (b) When do you carry out the following farm operations? (indicate season or age of crops where appropriate)
  - (i) land preparation
  - (ii) planting
  - (iii) weeding
  - (iv) fertilizing (1) Phosphates  
(2) Nitrogen top dressing
  - (v) harvesting (age of crop): (1) for first crop  
(2) for ratoons
- (c) Do you burn your cane before harvesting?
- (d) Within how many hours of cutting is cane usually collected for factory delivery?
- (e) What other operations or treatments apart from the ones mentioned above do you do as a management practice on sugar cane?
- (f) During the last 4 years what have your losses on sugar cane been and from what sources?

Source of loss	level of loss			
	none	neglegible	low	serious (high)
pests				
diseases				
fire				
thefts				
others				

27. (a) Do you have your own equipment for: Yes/No  
 (i) ploughing? .... (ii) harrowing?.....  
 (iii) furrowing?..... (iv) spraying?.....  
 (v) others?.....
- (b) If no, who owned other equipment that you used during the last operations for: (i) ploughing? .  
 (ii) harrowing?... (iii) furrowing? .....  
 (iv) spraying? ... (v) others? .....
- (c) What payments did you make for any equipment that was hired?

equipment	payment per hour or per hectare
.....	.....
.....	.....
.....	.....
.....	.....

28. (a) Do you use treated seed cane? ..... Yes/No
- (b) If yes, any cost difference from untreated seedcane?

- (c) How do you obtain your seedcane?
- (d) How many ratoon crops do you normally harvest before you plough out old cane to start a new cane cycle?
29. (a) Do you use home made manures? .... Yes/No
- (b) If yes, which ones? and in what quantities/ha?
30. (a) How do you carry out weed control? (i) hand weeding..... (ii) mechanized..... (iii) chemical (herbicides)..... (iv) other methods..
- (b) How often do you weed (i) first crop before maturity? ..... times.
- (ii) ratoon crop before maturity? ..... times.
31. Price response:
- (a) If the price of sugar cane changed dramatically, how would you react?

reaction	price fall by 25/= per tonne	price increase by 25/= per tonne	if there is no change in the next year
(i) try to produce more cane and maintain income			
(ii) reduce cane acreage			
(iii) keep on as at present			
(iv) reduce/increase/cease/no change on: (1) weeding (2) fertilizing (3) manuring (4) hired labour (5) hiring equipment	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>
(v) leave farm and seek employment elsewhere			
(vi) interplant sugar with other crops			
(vii) start on another crop			
(viii) others			

PERSONAL CONSTRAINTS

32. Educational background:

- (a) Did you attend school? ..... Yes/No
- (b) If yes, upto what standard?
- (c) Have you attend any

	F.T.C. Course	Agricultural Shows ?	Field Day on Sugar cane ?	Chief's Baraza ?	Other courses?
Yes/No					

- (d) How often do you: (i) read newspapers..... (ii) listen to the radio..... (iii) watch T.V..... (iv) travel outside the district

33. (a) Do you have any problems relating to: (spec
- (i) poor housing?.....
  - (ii) seasonal food shortage? .....
  - (iii) heavy informal borrowing at high cost?
  - (iv) availability of savings facilities?...
  - (v) lack of supply of easily obtainable consumer goods?.....
  - (vi) social amenities for your family and/ your workers? (specify).....

(b) What steps have you taken to alleviate some of these problems.

34. (a) Who manages your farm?
- (b) Do you have any other occupation or business besides growing cane? .....
- (c) How often are you on the farm?.....

35. Apart from the answers you were kind enough to give my questions, what changes, if any, would like to see in the sugar cane industry?



Appendix II

FIELD SURVEY QUESTIONNAIRE NO. 2

UNIVERSITY OF NAIROBI

SUGAR COMPANIES' QUESTIONNAIRE

1. Particulars:
  - (a) Name of company .....
  - (b) Name of respondent .....
  - (c) Official designation of respondent in  
management.....
  - (d) Altitude ..... (ft/m)
  - (e) Annual rainfall ..... (ii) Rainfall  
reliability .....
  - (f) Date .....
  
2.
  - (a) When was the company established? .....
  - (b) When did your factory start producing  
sugar? .....
  
3.
  - (a) Who are the main shareholders of the company?  
.....
  - (b) Please give a breakdown of share holding  
in the company:
  - (c) Does the company have a management agreement?  
.....  
If so, give: (i) Name of company providing  
this service .....
  - (ii) date began .....
  - (iii) date due to expire .....
  - (iv) the main services provided  
(e.g. planning, field services,  
factory management etc.).....

4. What is the rated capacity of your factory on the basis of ..... shifts of ..... hours per day?

cane crushed		tonnes per day
sugar output		

5. (a) What has been your throughput for the last 3 years?

Year (ending Dec.)	Throughput in tonnes	
	crushed cane	milled sugar
1974		
1975		
1976		

(b) Does your factory work on shift basis throughout the year? ..... (Yes/No).  
If so, how many and how long are the shifts?  
.....

(c) Is there any time your factory had to stop production for 3 or more days? due to:  
(i) breakages .... (ii) lack of cane .....  
(iii) lack of storage space ..... (iv)  
other reasons (specify).....

6. Under-utilization of factory capacity appears to be a great problem in the industry. What do you regard as the major contributing factors to this problem? (Indicate in order of importance i.e. 1, 2, 3, ..... etc.)

- (i) cane in short supply (a) permanently .....  
(b) at particular seasons .  
.....
- (ii) factory breakdown .....
- (iii) drought causing low yields .....
- (iv) rainy season preventing cutting and delivery of cane .....
- (v) inadequate transport arrangements for cane collection (give details) .....
- (vi) low husbandry levels and hence low cane yields on outgrower farms .....
- (vii) low yields on nucleus estate .....
- (viii) Poor: a) public roads .....
- b) farm roads .....
- (ix) fire outbreaks .....
- (x) lack of expertise in the industry. If so, indicate details .....
- (xi) social problems (specify) .....
- (x) others .....

7. Does the company own a nucleus estate? .... Yes/No  
If yes, please answer question 8 to 25.

8. When did the nucleus estate start to operate?.....

9. What is the total area of the nucleus estate?

10. What is the maximum area that has been under cane in any one year since the estate started? .... ac/ha.

(a) When was this? ... ..

(b) What has been the lowest area under cane recorded in any one year since the estate started? ..... ac/ha

Which year was this? .....

11. (a) What area do you have under cane at present? ...

(b) Please give a breakdown:

Age months	First Crop		Ratoons	
	ac	ha	ac	ha
1 - 6				
7 - 12				
13 - 18				
Over 18				

(c) How many ratoon crops do you normally harvest before you plough out and plant fresh seed-cane? .....

12. Is your nucleus estate engaged in other enterprises apart from sugar cane? ..... Yes/No.

If yes, state which .....

13. What is the average yield of sugar cane on your estate? (i) First crop .....tonnes/ha  
(ii) ratoon crop .... tonnes/ha
14. (a) What has been the highest yield recorded on the estate? .....  
(b) When was this? .....
15. (a) What has been the lowest yield recorded on the estate? .....  
(b) When was this? .....
16. What factors do you think account for these low yields?

Factors	order of importance
Drought .....	.....
pests and diseases .....	.....
poor cane varieties .....	.....
lack of timely operations .....	.....
weed problems .....	.....
labour shortage .....	.....
non-availability .....	.....
of fertilizers .....	.....
poor soil .....	.....
drainage problem .....	.....
fire hazzrds .....	.....
theft of cane .....	.....
others .....	.....

17. What cane varieties do you grow on the estate? ....

18. How long does cane take on average to mature on this estate? (i) first crop ..... months  
(ii) ratoon crop ..... months
19. How much cane did the estate supply to the factory in the last 3 years?

Year	1974	1975	1976
Tonnes			

20. What are the major problems on the estate regarding cane production?

Problem	order of seriousness
(i) labour shortage	.....
(ii) high wage rates	.....
(iii) non-availability of purchased inputs	.....
(iv) high prices of purchased inputs	.....
(v) low profits	.....
(vi) high costs of production	.....
(vii) drought	.....
(viii) unsuitable cane variety	.....
(ix) drainage	.....
(x) pests and diseases	.....
(xi) weeds	.....
(xii) floods	.....
(xiii) poor soils	.....
(xiv) non availability of equipment spares	.....
(xv) fire outbreaks	.....
(xvi) social problems (specify)	.....
(xvii) others (specify)	.....

21. Cost of production per hectare of cane on the estate

cost item	first crop	ratoon crop
(i) land preparation	.....	.....
(ii) seed cane	.....	.....
(iii) planting	.....	.....
(iv) weeding	.....	.....
(v) fertilizer	.....	.....
(vi) harvesting	.....	.....
(vii) transport	.....	.....
(viii) wages and salaries	.....	.....
(ix) repairs and maintenance	.....	.....
(x) depreciation	.....	.....
(xi) miscellaneous (insurance interest, water, electricity, etc.)	.....	.....
TOTAL		

22. What fixed assets do you have on the estate?  
(please indicate the value and depreciation rates)

assets	value	depreciation rate
land	.....	.....
buildings	.....	.....
roads	.....	.....
fences	.....	.....
machinery and equipment	.....	.....
water system	.....	.....

23. (a) Are you able to provide me with the financial results for the last 3 years?
- (b) Has the estate been making profits or losses during the last 3 years?

Year	1974	1975	1976
profits			
breaking even			
loss			

24. (a) What factors do you think adversely affect gross margins on this estate? (rank them i.e. 1, 2, 3.....)
- (i) high prices of fertilizers .....
  - (ii) drought .....
  - (iii) high wages .....
  - (iv) fuel costs .....
  - (v) others .....
- (b) What gross margin per hectare do you expect from cane now? ..... K. Sh.....

25. What fertilizers do you apply on cane fields



Fertilizer	Quantity/ha	cost/ha
(1) as Nitrogen:		
.....	.....	.....
.....	.....	.....
.....	.....	.....
(2) as Phosphate	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
(3) as compund fertilizers:		
.....	.....	.....
.....	.....	.....
.....	.....	.....
(4) Others		
.....	.....	.....
.....	.....	.....
.....	.....	.....

(b) How do you apply your fertilizers? (i) by placement..... (ii) by broadcasting..... (iii) by band application ..... (iv) other methods (specify).....

26. (a) Did the company ever experience shortages of labour of any kind during last year (1976)? Yes/No.....

(b) If yes: (i) In what kind of operations and in which time of the year (or season) did you have these shortages?

operation or skills	Types of labour		Season
	permanent	temporary	
land preparation:	.....	.....	.....
planting:	.....	.....	.....
weeding:	.....	.....	.....
harvesting:	.....	.....	.....
factory work	.....	.....	.....
general field work	.....	.....	.....
others:	.....	.....	.....

(ii) What steps have you taken to alleviate the labour shortage and with what prospect? .....

.....

(c) Size and categories of the labour force in 1977:

Category of labour	permanent		temporary	
	male	female	male	female

27. (a) What proportion of your labour force lives in company houses? .....

(b) What do you reckon it costs the company to provide housing per month? .....

(c) What do you estimate it costs the company per year to provide other benefits, if any, to your workers? (e.g. fringe benefits, viz: housing, health service, water, electricity, leave, social services, etc.)

28. (a) What proportion of cane supplied to your factory annually comes from: (i) nucleus estate? .....% (ii) Outgrowers .....%

(b) What cane varieties do your outgrowers plant? .....

29. (a) Do you provide any services to your outgrowers? ..... Yes/No

(b) If yes, which and at what charges?

	Services	charges (K. Shs.)
(i)	extension service	.....
(ii)	ploughing	.....
(iii)	harrowing	.....
(iv)	furrowing	.....
(v)	planting	.....
(vi)	seedcane	.....
(vii)	fertilizers	.....
(viii)	herbicides	.....
(ix)	transport	.....
(x)	labour	.....
(xi)	credit	.....
(xii)	others	.....

(c) How is the money for these services recovered? .....

30. (a) What do you regard as the major problems facing outgrowers? (rank them i.e. 1, 2, 3, .....)
- (i) land preparation .....
  - (ii) fertilizer procurement .....
  - (iii) seed cane procurement .....
  - (iv) poor management (cane husbandry).....
  - (v) high input prices .....
  - (vi) labour shortages .....
  - (vii) drought .....
  - (viii) drainage/floods .....
  - (ix) transport services .....
  - (x) pests and disease .....
  - (xi) credit facilities .....
  - (xii) low sugar prices .....
  - (xiii) high costs of production and hence low profits .....
  - (xiv) social problems (specify) .....
  - (xv) others .....
- (b) What steps are being taken, by whom and are they going to solve the problem(s)?.....
- (c) What (further) steps are required and by whom? .....

31. There are divergent opinions as to who should provide extension service to outgrowers: who in your company's view should advise your outgrowers? (rank in order of preference i.e. 1, 2, 3..... etc

- (i) Ministry of Agriculture .....
- (ii) Co-operative Societies .....
- (iii) Ministry of Settlement .....
- (iv) Your company .....
- (v) all of the above .....
- (vi) others (specify) .....
- (vii) none

32. STORAGE

- (a) What storage capacity does the company have for sugar?
- (b) Do you experience any storage problems?  
Yes/No
- (c) If yes specify:

33. (a) To which Kenya National Trading Corporation (KNTC) depots do you send your sugar for distribution?
- (b) How do you transport your sugar to these depots and who pays for the transport charges?
- (c) What has been the rate of transport charges for the last three years per tonne of sugar?
- (d) In what ways, if any, in your company's view could the present services provided by the KNTC be improved or provided more cheaply?

34. BY-PRODUCTS FROM SUGAR MANUFACTURING:

- (a) Indicate type, quantities and values per annum:

By-products	Quantity	Value
1. ....	.....	.....
2. ....	.....	.....
3. ....	.....	.....
4. ....	.....	.....
5. ....	.....	.....
6. ....	.....	.....
.....	.....	.....

(b) How are these marketed and what problems are experience?

35. (a) Is your company represented in the Sugar Development Authority?

(b) In what ways, if any, would you like to see the Sugar Development Authority make a better contribution to the efficiency of the sugar industry?

36. Apart from information which you have already been kind enough to provide, would you like to suggest any other ways in which Kenya's sugar industry can perform better either at the levels of the farm, factory, marketing and distribution or in the fixing, and implementation of Government policies.

## APPENDIX IIIA

CENTRAL GOVERNMENT EXCISE BY COMMODITIES AND % SUGAR  
CONTRIBUTION IN KENYA 1970-1976 (K£'000)

	1970	1971	1972	1973	1974	1975	1976
Beer	5838	6981	7647	9793	11116	10649	12143
Sugar	3221	2713	2197	2848	3556	3636	5668
Cigarettes	4404	4885	5201	5802	6776	7788	8580
Cigar	-	-	-	-	-	-	-
Matches	162	186	199	247	228	125	1
Tobacco	26	25	24	3	12	27	14
Spirits	211	211	246	333	316	241	371
Mineral Waters	507	629	654	805	953	693	-
Biscuits	26	29	31	36	34	17	-
Fabrics(woven)	553	622	743	670	753	827	850
Soap	487	702	493	867	664	670	802
Paints and Distempers	161	178	229	227	224	221	194
TOTAL	15596	17160	17664	21632	24632	24894	28624
Sugar as % of Total	20.7	15.8	12.4	13.2	14.4	14.6	19.8

Source: Economic Survey 1975 - 1977, Central Bureau of Statistics,  
Ministry of Finance and Planning, Kenya.

Note: - = not available.

APPENDIX IIIB: PROJECTION OF CONSUMPTION AND PRODUCTION OF SUGAR IN KENYA  
1977 - 1990 ('000 Tonnes)

Year	1977	1978	1979	1980	1981*	1982	1983	1984	1985	1986	1987**	1988	1989	1990
Consumption	210	227	244	263	282	303	326	349	375	402	430	460	492	520
Production	170	170	215	270	380	420	420	420	420	420	420	420	420	420
Deficit/Surplus	-40	-57	-29	7	98	117	94	71	45	18	-10	-40	-72	-100

Source: Ministry of Agriculture Paper, 1977 (see Ref. No. 14.6)

\* Self-Sufficiency expected by 1981

\*\* Deficits expected to re-emerge by 1987 unless new Sugar Projects come

APPENDIX IIIC: INDUSTRIAL USE OF SUGAR IN KENYA 1964, 1970-1975 AND PROJECTION FOR 1980, 1985, 1990 ('000 Tonnes)

Year	1964	1970	1971	1972	1973	1974	1975	1980	1985	1990
Industrial tonnes use ('000)	3---	8	10	11	16	17	18---	27	34	41
% of Total Consumption	2.9--	5.1	5.6	5.6	7.4	7.6	8.9--	10.3	9.1	7.8

Source: Ministry of Agriculture Paper op.cit. pp. 21-22

APPENDIX IIID:

PRODUCTION AND EXPORT OF MOLASSES 1967-1975

Year	Production		Export		Balance	
	tonnes		tonnes	%	tonnes	%
1967	24200		14570	60.2	9630	39.8
1968	32600		17370	53.3	15230	46.7
1969	46200		35200	76.2	11000	23.8
1970	50100		24830	49.6	25270	50.4
1971	46600		29260	62.8	20340	37.2
1972	36900		23710	64.3	13190	35.7
1973	55200		32400	56.7	22800	43.3
1974	65800		24260	36.9	41540	63.1
1975	63840		38750	60.7	25090	39.3

Source: Small Scale Sugar Project Report Vol. II p.11



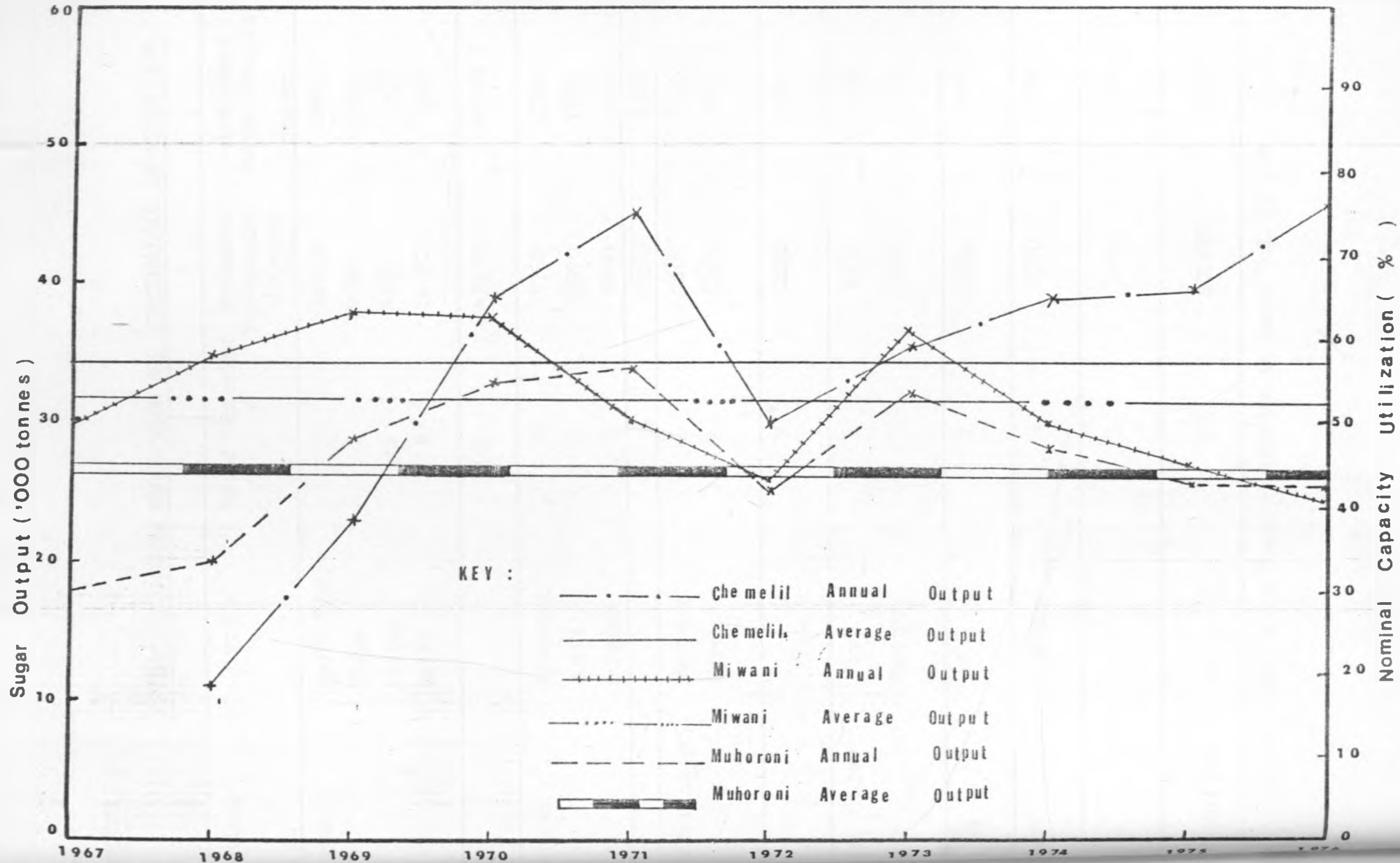
APPENDIX IV A

TABLE 10.4: SUGAR THROUGHPUT AND PERCENTAGE UTILIZATION OF PLANT DESIGNED OUTPUT CAPACITY IN THE NYANZA SUGAR BELT 1967 - 1976.

Year	T.C.	T.S.	Miwani % Capa- city	TC/TS Ratio	T.C.	T.S.	Chemelil % Capa- city	TC/TS Ratio	T.C.	Muhoroni TS	% Capa- city	TC/TS Ratio
1967	348284	29957	50	11.6	-	-	-	-	193565	18203	30	10.6
1968	421336	35005	58	12.0	116619	11179	19	10.4	220674	19988	33	11.0
1969	456642	38114	64	12.0	258812	23020	38	11.2	296434	28655	48	10.3
1970	462243	37725	63	12.3	436977	38993	65	11.2	350527	33010	55	10.6
1971	378167	30347	51	12.5	466777	45355	76	10.3	345414	34197	57	10.1
1972	309635	26175	44	11.8	333737	30044	50	11.1	266880	25431	42	10.5
1973	427532	37105	62	11.5	397164	35676	59	11.1	346000	32429	54	10.7
1974	355421	30230	50	11.8	407334	39226	65	10.4	316650	28490	47	11.1
1975	304076	26711	45	11.4	413637	39921	67	10.4	309022	26355	44	11.7
1976	291651	25201	42	11.6	454803	46146	77	9.9	274100	26100	44	10.6
Total	3754983	316567	-	-	3285760	309560	-	-	2919268	272854	-	-
Average	375498	31657	53	11.9	365084	34396	57	10.0	291927	27285	45	10.7

APPENDIX

GRAPH SHOWING TOTAL AND AVERAGE SUGAR PRODUCTION AND PERCENTAGE CAPACITY UTILIZATION FOR  
 IVB : MIWANI, CHEMELIL, AND MUHORONI FACTORIES 1967 — 1976



## ESTIMATED JAGGERY PRODUCTION AND DISTRIBUTION IN KENYA 1974

Province	District	No. of factories	Estimated Throughput- (tonnes) Cane	Estimated Output (tonnes) Jaggery
Nyanza	South Nyanza	95	380000	38000
	Siaya	1	40000	4000
	Kisumu	1	4380	438
	Kisii	8	24000	2400
		105	412380	41238
Western	Kakamega	25	57250	5725
	Busia	8	18320	1832
	Bungoma	2	4500	450
		35	80070	8007
Eastern	Machakos	1	2500	250
	Meru	2	5000	500
		3	7500	750
High Valley	Nandi	1	2000	200
	Nakuru	1	2000	200
		2	4000	400
Coast	Taita	1	2000	200
		1	2000	200
GRAND TOTAL		146	505950	50595

Source: Small Scale Sugar Production in Kenya Vol. II p.8

APPENDIX: VII

LONDON DAILY PRICE OF SUGAR C.I.F. U.K. IN BULK 1969-1976  
(£ per Long ton)

Month	1969	1970	1971	1972	1973	1974	1975	1976
January	30.75	33.30	48.55	77.20	98.25	170.60	392.05	n.a.
February	32.95	34.85	49.45	79.90	92.20	227.75	341.25	n.a.
March	36.50	37.25	48.10	81.95	89.65	223.95	262.10	n.a.
April	38.20	39.45	46.55	70.05	91.90	224.45	240.35	n.a.
May	38.00	40.30	45.00	65.30	95.85	243.25	179.80	n.a.
June	37.75	41.15	43.10	62.75	96.85	242.75	145.05	n.a.
July	36.05	42.20	42.80	56.25	96.10	235.10	181.85	n.a.
August	31.25	41.95	43.40	62.25	94.15	307.75	209.00	n.a.
September	29.30	42.50	41.20	72.00	95.15	350.00	n.a.	n.a.
October	31.45	43.15	43.70	76.15	101.65	396.95	n.a.	n.a.
November	32.80	43.80	45.55	76.65	109.80	566.35	n.a.	n.a.
December	31.25	44.00	56.90	93.05	131.85	459.45	n.a.	n.a.
January	33.85	40.40	46.10	72.55	99.30	304.70	140.70	170*
February	39.25	45.00	69.50	100.00	152.00	650.00	n.a.	n.a.
March	27.50	30.00	39.50	52.00	87.00	143.00	n.a.	n.a.

Source: Small Scale Sugar Production (op.cit) Appendix 1.6B

Their Source: IC Czarnikow Ltd-London.

Note: \* = Estimate

n.a. = not available.

APPENDIX IX

PRODUCTION AND OVERALL PERFORMANCE OF SUGAR FACTORIES IN KENYA 1975

	PRODUCTION		CANE		TIME ANALYSIS (% TOTAL TIME)		FINAL MOLASSES		POL BALANCE		PERFORMANCE											
	Tons Cane	Tons Sugar	Cane/Sugar ratio	Grinding rate (tch)	Pol %	Fibre %	Grinding	Premeditated	Cane supply	Manufacture	% Cane	Brix	Apparent Purity	Overall Recovery	Bagasse Loss	Mud Loss	Molasses Loss	Undetermined Loss	Reduced extraction	Reduced B.H.Recov.	K.S.R.	P.I
Emelil	454803	46146	9.8	91.4	12.6	16.0	56.7	35.5	3.1	4.7	3.4	82.9	37.4	78.9	8.8	1.7	8.4	2.2	93.4	87.6	9.8	102.6
wani	291720	25236	11.6	50.4	12.1	17.1	32.9	38.7	22.6	5.8	4.3	85.8	40.3	71.1	10.9	2.4	122	3.4	92.4	82.6	9.2	94.1
moroni	274100	26228	10.4	56.1	12.4	17.2	55.6	19.8	17.1	7.5	3.4	94.1	38.8	75.2	12.4	1.8	100	0.6	91.3	86.4	9.5	99.3
mas	547954	63699	8.6	117.1	13.6	14.2	53.3	34.7	1.6	10.4	3.5	82.0	38.6	84.7	6.5	0.5	8.1	0.2	94.0	90.6	10.8	106.7
nisi	84064	6062	13.9	24.9	9.8	16.8	38.4	48.4	10.2	3.0	4.1	86.9	39.5	71.0	9.1	1.1	143	4.5	94.4	87.1	7.1	98.3
rtories	1652641	167371	9.9	69.7	12.1	16.3	45.0	36.0	12.8	6.2	3.7	86.3	38.9	76.2	9.5	1.5	10.6	2.2	93.1	86.9	9.3	100.2

## APPENDIX XA Cont.

(iii) COST OF MAINTAINING ONE ACRE OF RATOON CANE

1. Ripping once by wheel type tractor	@ 180/-	=	£ 9.00
2. Mechanical Intercultivation twice	@ 70/-	=	£ 7.00
3. Herbicide Spraying once including Spraying cost	@ 145/-	=	£ 7.25
4. Sport Spraying in ratoon	@ 45/-	=	£ 2.25
5. Two hand weedings	@ 60/-	=	£ 6.00
6. Nitrogen Fertilizer including appl.	@ 250/-	=	<u>£12.50</u>
		Total =	<u>£44.00</u>

Source: Miwani Sugar Company Files (1977).

APPENDIX X BUNIFORM LAND PREPARATION & SEEDCANE RATES  
WITHIN THE NYANZA SUGAR BELT

The Land Preparation and Seedcane Costs Sub-committee appointed by the Joint Milling Committee /Kenya Sugar Authority has exhaustively deliberated on the need for standardization of land preparation and seedcane rates within the entire Nyanza Sugar Belt and the foregoing resolutions have been made.

a) Land preparation rates1. Ripping

D8/D7 + Ripper 24" x 36"	shs 240.00 per acre
D6/D5 + Ripper 16" - 18" x 36"	shs 205.00 " "

2. Ploughing

D8/D7 + Rome plough 10 x 36 (12" depth)	shs 200.00 " "
D6/D5 + Rome plough 10 x 36 (11" depth)	shs 170.00 " "
D8/D7 + Nardi 24" (2 mould boards)	shs 340.00 " "
D6/D5 + Nardi 18" (2 mould boards)	shs 250.00 " "
Same 4-WD + Disc plough (12" depth)	shs 160.00 " "
Muir Hill 2-WD + light plough (10" depth)	shs 150.00 " "
MF 175/185, Ford 5000/6600 2-WD + Disc plough	shs 150.00 " "

APPENDIX XA

MAJOR COST ITEMS IN CANE PRODUCTION

(i) COST OF DEVELOPING AND REHABILITATING ONE ACRE OF NEW LAND

1.	Bush Clearing(light bush)once	@ 180/-	= £ 9.00
2.	Ripping twice	@ 240/-	= £24.00
3.	1st Ploughing	@ 160/-	= £ 8.00
	2nd Ploughing	@ 140/-	= £ 7.00
4.	Harrowing twice	@ 90/-	= £ 9.00
5.	Ridging once	@ 60/-	= £ 3.00
6.	Making infield drains & roads	@ 80/-	= £ 4.00
7.	Supply of 3 tons of seed cane including transport	@ 180/-	= £27.00
8.	Planting @ 60/- per acre	@ 60/-	= £ 3.00
9.	Nitrogen & Phosphate Fertilizer including application	@ 380/-	= £19.00
10.	Two hand weedings	@ 60/-	= £ 6.00
11.	Three Intercultivations	@ 70/-	= £10.50
12.	Two Herbicide Sprays	@ 145/-	= £14.50
		Total	= £144.00

(ii) COST OF REHABILITATING ONE ACRE OF LAND

1.	Ripping twice	@ 240/-	= £24.00
2.	1st Ploughing	@ 160/-	= £ 8.00
3.	2nd Ploughing	@ 140/-	= £ 7.00
4.	Harrowing twice	@ 100/-	= £ 9.00
5.	Ridging once	@ 60/-	= £ 3.00
6.	Making Infield Drains & Roads	@ 80/-	= £ 4.00
7.	Supply of 3 tons seed-cane plus transport	@ 180/-	= £27.00
8.	Planting @ 60/- per acre	@ 60/-	= £ 3.00
9.	Nitrogen & Phosphae Fertilizer including application	@ 380/-	= £19.00
10.	Two hand weedings	@ 60/-	= £ 6.00
11.	Three Intercultivations	@ 70/-	= £10.50
12.	Two Herbicide Sprays	@ 145/-	= £14.50

Total = £135.00

Appendix XB (Cont.)

3.	<u>2nd Phoughing</u>		
	Wheeled tractor + Disc plough	shs 125.00	per acre
4.	<u>Harrowing</u>		
	D8/D7 + Rome harrow 24" x 32"	shs 160.00	" "
	D6/D5 + Rome harrow 24" x 32"	shs 140.00	" "
	Wheeled tractor + (light harrow)	shs 90.00	" "
5.	<u>Furrowing</u>		
	Wheeled tractor + Ridger	shs 60.00	" "
6.	<u>Ditching</u>		
	D7/D6/D5 + Ditcher (2½ ft deep 2ft wide at the bottom and 4 ft at the top)	shs 210.00	per tractor meter hour.
7.	<u>Grading</u>		
	Grader	shs 180.00	per tractor meter hour
8.	<u>Crawler Machinery tractor</u>		
	Grader/lorry + Low loader/prime mover	shs 200.00	per tractor meter hour
9.	<u>Clearing</u>		
	D8/D7 + Elade	shs 280.00	per tractor meter hour .
	D6/D5 + Blade	shs 230.00	per tractor meter hour.

b). Seedcane Price

(i) Untreated Seedcane:	Kshs 146/- per tonne
(ii) Treated Seedcane:	Kshs 166/- per tonne.

Source: Kenya Sugar Authority Statistics Files (1977).

Note: 1 acre = 0.40468 hectare