THE WESTERN KENYA SUGAR INDUSTRY; WITH SPECIFIC REFERENCE TO NYANZA AND WESTERN PROVINCES.

BY

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DECLARATION:

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

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ABSTRACT

This study examines "The Western Kenya sugar industry with specific reference to Nyanza and Western Provinces". It gives a detailed economic development analysis of the Western Kenya Sugar Industry and its general impact on both regional and national economic development. This has been viewed in terms of sugar production, generation of employment opportunities and the development and/or the establishment of development facilities in the sugar zone.

The sugar companies and the selected samples of outgrower farmers from Nyanza and Western Provinces were interviewed using a recording schedule and through personal interviews. Direct field observations, secondary data and information were also used in data collection.

The collected data were compiled, as a first step into comprehensive tables, then analysed for interpretive purposes using the location quotient, regional multiplier analysis and correlation coefficient.

The principal findings resulting from the testing of a set of hypotheses based on this study are:

a). the location of the Western Kenya sugar industry is apparently influenced by physical rather than economic factors, owing to certain anomalies in the economic operations of the various established sugar factories.

b). there is a very high concentration of the sugar industry in Western Kenya as shown by a high location quotient of 8.39.

c). the sugar industry is an important growth - inducing industry.

d). the sugar industry has generated many employment opportunities in the area.

e). several development facilities have been developed as a result of the industry in the sugar zone.

f). the aim of the government is to be self-sufficient in sugar production.

g). a major negative effect experienced in the area is monocultural development of sugarcane, inevitably resulting in food shortage, in many parts of the sugar zone.

h). most of the sugar factories are operating below their production capacity.

The basic recommendations for future planning of the sugar industry are:

a). sugar companies should meet their own production costs instead of being heavily subsidized both by the outgrower farmers and the government, especially in transportation costs.

b). the sugar companies should be discouraged from rejecting any cane delivered at the factory.

c). the farmers should be offered agricultural education to reduce their problems of food shortage and over production of sugarcane.

d). the government should assist the farmers in developing essential development facilities in the sugarcane outgrower areas.

e). sugar refineries should be established in the sugar areas.

f). problems encountered in the sugar factories should be rectified so that they could operate at their full capacity.

For purposes of further lines of research, it has been suggested that intensive survey should be conducted on the Kenyan sugar industry. This should include the small sugar factories, jaggery plants and other factories utilizing sugar by-products. Such a study would reveal more of the regional and national benefits of the industry.

CHAPTER I

INTRODUCTION

1:1 STATEMENT OF THE PROBLEM

This study aims at presenting a detailed economic development analysis of the Western Kenya sugar processing industry and its general impact on both regional and national economic development.

In this study, a comprehensive analysis of both physical and human factors influencing the development of the sugar industry in the area have been examined. The physical factors include the different types of soil, especially those suitable for sugarcane cultivation in the area and rainfall distribution, amounts ,variability and probability in the sugar zone. Consequently, human factors studied comprise population density as related to sources of labour (for both the factory and outgrower farmers) and the amount of land available for sugarcane cultivation. This has been related to the problem of migration which is common in areas where land scarcity and lack of employment opportunities prevail. Additionally, economic factors such as infrastructure, capital and market availability have also been examined.

A proper analysis of these factors influencing the sugar processing industry in Western Kenya should either validate or render null and void the hypothesis that "The location of the sugar processing industry in Western Kenya is determined mainly by economic rather than physical factors."

Over and above these, the various indices such as manufacturing operatives, wages and salaries have been fully integrated into this study. This should demonstrate the importance of the Western Kenya sugar processing industry, either on a regional or national level. This as well as the other section on the anticipated regional and national benefits resulting from the sugar processing industry in Western Kenya should validate the hypothesis that "The Industry is beneficial not only to Western Kenya, but also to the Kenya nation as a whole."

The anticipated regional impact resulting from the sugar processing industry in Western Kenya includes the following aspects: development of infrastructure which includes roads, railways, telephones, electricity and water supply. The road network forms an important part of transportation system along which movement of inputs (such as sugarcane from outgrower farmers to the factory) and output (as in the case of processed sugar leaving the factory to the railway station for transportation to other parts of the country) depend. In the initial stages of development, however, only a few people in the area (especially the residents at the factory) benefit from facilities such as piped water, electricity and telephones, which have been, or may be developed in the area. But in the long-run (as it has been noted in parts of Nyanza sugar-belts) these benefits usually spread outwards inducing and thus spreading development into the surrounding areas.

Similarly as a result of increased income in the surrounding areas, the development of both education and health facilities are likely to follow. Education in this study includes the development of both primary and secondary schools, farmers training centres and village polytechnics. This should, as expected, result in increased agricultural output hence an increase in the farmers' income from their farm produce.

A further regional impact may result from the development of intra-regional trade emerging from improved road network. Efficiency in the transportation system should enable traders to move faster from place to place, especially from areas with low demand to areas with high demand (as in the residential areas at the factory). Likewise, increased income from sugarcane yields may also raise the local people's purchasing power of various products produced in other parts of the country. This latter impact is not only beneficial to the Western Kenya sugar zone, but also to the Kenya nation as a whole.

The provision of employment- opportunities in the sugar-zone is an important regional aspect which should arrest migration from the area to other parts of the country. The problem of migration has become a nation-wide concern as it removes the younger members of the population from the rural areas to urban areas where employment opportunities, apparently, appear to be bright. This initially leaves the rural areas with the old conservative population who, being less progressive, are incapable of adopting new development ideas. These areas may eventually develop into problem regions which lag behind the national level. However, problems associated with migration are both economic and social, and involve such aspects as unemployment and development of slums. These are usually experienced in destination areas, mainly urban centres. It is therefore assumed that through the establishment of the sugar industry in Western Kenya, new employment opportunities would materialise at the sugar factories and on outgrower farms. Besides these, many other related services such as education and trade which offer more employment opportunities would be established in the area.

Investment in new industries related to sugar industry is one of the anticipated benefits in the sugar zone. This is very important as it also alleviates the migration problem by creating more employment opportunities in the area. Such industries include those utilizing the by-products of the sugar industry, good examples of which are molasses, bagasse and cane dirt residue resulting in filter-cake.

Apart from these regional benefits, this study has also made investigations into the possible national benefits resulting from the Western Kenya sugar industry. Of great significance is the nation's target of becoming self-sufficient in the sugar production in order to meet the demand of the country's growing population. The achievement of this target would definitely reduce the amount of sugar imported into the country and in the long-run result in surplus production which may be exported. This should not only save Kenya's foreign currency, but also attract more through sugar export. It is important to note that, although efforts are currently being made to increase sugar production in the country, alot of sugar is still imported. This is because the sugar presently produced in the country is only mill-white type which is unsuitable for many industrial purposes (such as beer brewing and the processing of soft drinks which require refined sugar).

Employment at the factory is at present not merely limited to the surrounding area within the sugar-zone. The sugar factories in Western Kenya have as their labour reservoir the whole of the Kenyan nation. Thus the importance of the Western Kenya sugar industry lies in the provision of employment opportunities to that part of the population which could be unemployed due to lack of employment opportunities, either in urban areas or in the agricultural sector.

From this summary of benefits expected to emerge from the Western Kenya sugar industry, it has been possible to look at the whole of Western Kenya sugar zone as a development zone. The sugar processing plants have been viewed as development points where growth is supposed to originate and operate most efficiently and then radiate into the surrounding less favoured areas. The growth inducing effects originating from these development points to the peripheral areas is increased due to spatial relationship with a core area, that is the sugar processing zone. This analysis should therefore aim at either validating or discarding the hypothesis that "The sugar industry in the area has been responsible for negative effects and has had no growth inducing effects."

1.2: REASONS FOR CHOICE OF THE TOPIC

Several researches concerning the sugar industry in Western Kenya have been and are still being conducted in the area. However in their various approaches, none of them is similar to the current study. For instance, Barclay A.H. (1974) conducted research in the area on "Aspects of social and economic change relating to Mumias sugar Project". This study, conducted by Barclay is only based on Mumias Sugar Project, while the current one examines the whole of the Western Kenya Sugar Industry. Furthermore, Barclay's study was conducted from a sociological approach while the present study is largely geographical. Obara D.A. (1976) has carried out research on "Environmental Problems of Small holder sugarcane Production in the Nyanza Sugar Belt." Although this study has some similarities with Obara's study in terms of the physical factors affecting the location of the sugar industry in Western Kenya, the former is only restricted to environmental factors in the sugar belt, while the latter goes further and examines as well, similar physical factors existing in Mumias, Nzoia and Awendo sugar belts. Furthermore, the current study only investigates into rainfall and soil factors, while Obara's study makes a detailed analysis of other environmental factors, such as geomorphology vegetation, diseases and ecological aspects of the Nyanza Sugar Belt. Odada J.E.O. (1979) has researched on "The Role of the Sugar Industry in Kenyan Economy: A case study of the Lake Victoria Basin." This study has been conducted from the view point of an economist and therefore its findings are in a sense rather different from those of the current study, which are mainly geographical. In addition to this, Odhiambo M., an agricultural economist carried out research on "The performance and conduct of the Sugar Industry, with special reference to the Nyanza Sugar Belt," also from a different view point from the current study. Other areas of interest being investigated are "The level and determinants of rural savings; the case of Mumias Sugarcane outgrowers" by Ochieng A. and "An evaluation of the sugar Industry: the case of Mumias Sugar Scheme", by Makwata J. Owing to the different approaches and the associated non-geographical findings of the above quoted researches, the present researcher thought it necessary to introduce a geographical investigation, in order to find out from a geographical viewpoint, the general impact of the Western Kenya Sugar Industry on both regional and national economic development.

Secondly, the development of the sugar industry in Kenya is basically concentrated in Western Kenya, and at the Coast to a limited extend. Initially only one sugar factory (processing mill-white sugar) existed and it was in Western Kenya, that is, the Miwani Sugar Mills, in Kisumu District, Nyanza Province, which started operating in 1923. However, since independence, the Government of Kenya has devoted alot of interest in the development of the sugar industry in this part of the country. Four large sugar factories, namely, Muhoroni, Chemelil, Mumias and Nzoia have been established in the area since 1966, and the fifth one at Awendo in South Nyanza is now under construction. Together with these, several feasibility studies are being undertaken in the area. For these reasons, it has been necessary to investigate into the major factors underlying this vast development of the sugar industry in Western Kenya.

Thirdly, the study area is one of the densely populated parts of the country, as illustrated in chapter 4. The dense population therefore acts as an important source of labour for the sugar industry in the area. It is therefore expected that the establishment of various sugar factories in the area should provide important employment opportunities in the area and hence arrest the migration problem which is a major problem in Kenya. The validity of this statement can only be proved after making a detailed investigation on those aspects relating to employment in the area. Employment opportunities arising from the sugar industry in the area exist both at the factories concerned, on the Nucleus and outgrower farms. Employment is also made available in services related to the sugar industry in the area. The importance of such an industry, in terms of available employment opportunities can only be discovered through such analysis as this.

Lastly, the sugar industry derives its principal raw material (sugarcane) from the farmers in the surrounding areas, who in turn earn an income from the industry. A proper utilization of this money is likely to facilitate the establishment of new development facilities in the area. These include educational and medical facilities, the development of roads and other related infrastructural facilities in the area. This increase in income should also raise the farmers' standard of living, as they will be in a position to purchase articles which they could not previously afford. These growth inducing effects expected to arise from the sugar industry can only be examined through a proper analysis offered by such a study.

1.3: OPERATIONAL DEFINITIONS

In this study, many new terms have been used and these require some discussion, explanation and perhaps definitions to avoid possible confusion.

The terms "regional" and "national" have been frequently applied in this thesis, the former applies to the Western Kenya sugar zone, while the latter refers to Kenya as a nation.

"Manufacturing" is regarded as the conversion of any of the (primary or secondary) raw materials of vegetable or animal origin into more useful form(s).[1] During the process, the materials are assembled in an establishment (which is a sugar factory in this case), where they are upgraded by changing their forms into more valuable commodities, and then lastly transferring the manufactured product(s) to other places (such as markets).

"Processing" is one of the forms of manufacturing and the term has been used in this thesis to refer to the early stages of the conversion of primary agricultural raw materials. In the case of the sugar processing industry, the early stage during which sugarcane is converted so as to result in mill-white sugar may be referred to as primary processing. The later stage in which the mill-white sugar is processed into a refined form to produce refined sugar may be referred to as secondary processing.

The term "Location factor" applies to any phenomenon which influences the location of an industry, while the "Location of the sugar industry" refers to the distribution pattern of this industry in the area.

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[1] Ogendo R.B. (1972) "Industrial Geography of Kenya, with special emphasis on the agricultural processing and fabricating industries" East African Publishing House, Nairobi. pp.2.

"Manufacturing operatives" are workers engaged on the assembly line in the factory (which is the sugar factory in this thesis).

"Location quotient" is an industrial index which measures a specified degree to which the specified region or area (Western Kenya in this study) has more or less than its national share of the given industry. For instance, an index of less than 1 indicates that Western Kenya has less than its share in the sugar processing industry. While an index of more than 1 indicates that Western Kenya has more than its share in the sugar industry.

"Wage earners" are daily rated employees whose pay depends on the amount of work done within a given period of time. For example, a cane cutter may be expected to cut about two tons of sugarcane in a given day,in order to earn a given amount of money.

"Salary earners" are employees who are paid monthly irrespective of the amount of work done in a given amount of time. For instance, it is very difficult to relate the amount of work done by a manager or an accountant to the time in which the work is performed.

"Skilled worker" is a worker who has acquired competence in his work (for example, a mechanic or an accountant) by the knowledge he has attained and which was obtained either through training or experience.

"Unskilled worker" is an untrained or an inexperienced worker who has no recognized competence in his work.

A "Semi-skilled worker" may therefore be classified as a worker who has gained some experience in his work, but has not reached the level of a skilled worker.

The term "Sugar-belt" in this study, applies to the area covered by the relevant Nucleus Estate and the related outgrower farms of each sugar factory. Alternatively, the term "sugar-complex" has been used to refer to the sugar-belts which are closely located as in the case of Chemelil, Muhoroni and Miwani sugar-belts. "Sugar-zone" therefore refers to the whole area in Western Kenya both under sugarcane and including those adjacent or peripheral areas likely to be brought under cane in the future.

"Development points" refer to the sugar processing plants where growth is supposed to originate and operate most efficiently and then radiate to the surrounding more or less favoured areas. On the other hand "development zone" applies to both the sugar processing plants and the respective outgrower farms in the Western Kenya sugar zone.

The term "negative effects" refers to a set of processes which result in a decrease of absolute level of development of a peripheral area. For instance, migration in an area may be referred to as a negative or depopulation effect because it removes most of the population from peripheral to core areas.

"Growth-inducing effects" relate to a set of processes, where-by the absolute level of development of a peripheral area is increased due to spatial interaction with a core area.

1:4 OBJECTIVES, SCOPE AND LIMITS OF THE STUDY

In the light of the above stated problem, the main objectives and their related aspects constitute the relevant scopes as follows:

Objective 1: To examine the physical factors affecting the location of sugar processing industry in Western Kenya.

i). the significance of different types of soils in the area,

ii). rainfall distribution, variability and probability.

Objective 2: To investigate into human factors influencing the location of the Western Kenya Sugar Industry.

i). social factors

ii). economic factors (land, capital, manpower, market(s) and infrastructure).

Objective 3: To carry out a quantitative analysis of the concentration of the sugar industry in the area.

i). Manufacturing operatives (to be used as a measuring index).

Objective 4: To investigate into possible growth inducing effects likely to be experienced in the area, as a result of the Western Kenya sugar industry.

i). the development of infrastructure which includes roads, railways, telephones, electricity, water supply, educational and medical facilities.

ii). provision of employment opportunities,

iii). investments in new industries.

Objective 5: To examine, if any, the negative effects that might have occurred in the area a result of the sugar industry.

i).Migration from peripheral areas to the sugar factories.

ii) Problems encountered in the area as a result of the sugar industry (such as food shortage).

Objective 6: To find out the beneficial effects of the Western Kenya Sugar Industry to the Kenyan nation.

i) Self-sufficiency in sugar production

ii) Savings in and attraction of foreign currency

iii) increase in national employment.

Objective 7: To pinpoint the future short-comings of the Western Kenya sugar industry and hence make recommendations on how they should be corrected in the course of future planning.

ii). Research findings

iii). Recommendations:

a). for academic purposes with particular emphasis on further lines of research to be undertaken by other scholars interested in this aspect of economic geography and

b). relating to Government policy associated with regional planning in the Western Kenya sugar zone.

Limits of the entire scope of the current study.

In this study, aspects within the scope include:

a).The Western Kenya mill-white sugar processing plants examined consist only of major processing plants such as Chemelil, Muhoroni, Miwani and Awendo (the latter under construction) in Nyanza province; but also including Mumias and Nzoia in Western Province.

b). Outgrower farmers who at the time of the research survey had, at least, received an income from their sugarcane. This limited the interviews to farmers in Mumias sugarbelt in Western Province, and Chemilil, Muhoroni and Miwani in Nyanza Province. The Nzoia and Awendo sugar factories are referred to later, see below.

On the other hand, aspects which fall outside the scope include the small sugar factories processing mill-white sugar, as no information could be obtained from such factories during the fieldwork. Such small mill-white sugar factories include the Kabras factory in Kakamega district, Western Province, which had been closed at the time of the research, and the Yala Ulumbi Sugar factory, in Siaya district, Nyanza Province. This is personally owned and therefore no information was released.

Ramisi sugar factory at the coast is outside Western Kenya, hence it has been excluded from the study, although minor references have been made to it. Similarly, the large number of jaggery plants in the area have been omitted from this study. Outgrower farmers, who had already planted sugarcane, but had not yet earned any income from them at the time of the survey also fall outside the scope of the study. These include farmers in the Nzoia sugarbelt, as the factory had just started operating and was still utilizing the cane from the Nucleus Estate and those of Awendo where the factory was still under construction.

1:5 CONCEPTUAL FRAMEWORK

This section attempts to provide a theoretical framework, together with the related models for use in this study. The first part discusses the theories of Industrial location as formulated or discussed in the least-cost theories of Weber and Hoover, the market area locational interdependence analysis of Fetter and Hotelling and the maximum profit theories of Lösch and Greenhut. In this discussion, we shall therefore attempt to make an assessment of the relationship between these theories and the realities of location factors as they relate to the Western Kenya sugar industry.

The second part takes into account theories relating to the problem of unemployment. Apart from this, possible solutions to the unemployment problem are examined. The idea is largely to suggest ways in which employment opportunities could be created in the long-run to reduce unemployment, at present a major problem in the research area and, indeed, in Kenya as one of the developing countries.

The third section takes into consideration the theories related to regional development as formulated by some of the leading, especially, earlier economists. These include Perroux's Growth Pole model (1955) and the centre-periphery model as discussed by G. Myrdal (1957); Hirschmann A. (1958) and Friedmann J. (1964). However, it should be observed that the formulation of these models was based on the economies of advanced countries. Nonetheless, today the application of such model has been extended to those economies of the developing countries, of which Kenya is an example. It should therefore be emphasised that since the two economies are quite different, these models require some modification before they can be meaningfully and realistically applied to the developing countries. Although references were made to the location of industry in the earliest economic writings, the classical economists in general did not consider location to be a problem deserving particular attention. It was, however, recognized that industries developed in certain regions for specific reasons. For example, Ure A., writing on "The philosophy of manufactures" in 1835, mentioned cheap fuel, abundant population and nearness to seaports as factors encouraging the development of industrial enterprises. But, on the whole, the classical economists appeared not to isolate any clear problems, while the few who did could not clearly see the full implication of the said problems.

A major contribution to the development of location theory was the work of Alfred Weber which appeared in 1909. Weber's theory is based upon three general factors of location namely, transportation cost, labour cost, and agglomerating forces. In Weber's original theory, the location of industry is seen as determined by costs of transport but when differences in labour costs are introduced, the basic network is altered. Agglomerating forces are also a factor making for distortion of the locational pattern based on transportation charges. Labour costs only become a factor in the location decision when they vary from place to place. Thus changes in location from the point of minimum transport cost occur when savings in labour costs are greater than the additional transportation charges. But these two factors may be counter-balanced or influenced by Weber's third location factor namely, the[2]

[2]Nixson F.I. 1973 - Economic Integration and Industrial Location : An East African Case Study. Longman pp.7

"agglomerating" or "deglomerating forces". Agglomerating factor is "an advantage or cheapening of production which results from the fact that industry, to a certain extent, is carried on in one place, while a deglomerative factor is a cheapening of production which results from the decentralization of industry." Examples of the former are savings due to the proximity of auxiliary industries, better marketing outlets, a wider range of financial and commercial services. A good example of deglomerating force consists of say, higher rents and other increased costs which discourage the tendency towards industrial concentration.[3]

Weber believed that with a denser population industrial location becomes more labour orientated, especially when facilitated by decreased transport costs[4]. Generally speaking, this is not applicable to our Kenyan situation. In fact such areas are usually dominated by unemployment problem which results in great labour mobility to seek for employment opportunities elsewhere. Alternatively, his analysis of the characteristics of raw materials used, as determinant factor of location is quite relevant in our Kenyan situation, especially in the sugar industry. According to Weber, orientation will depend on the material index (that is the ratio of the weight of used localized materials to the

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[3] Ibid. Nixson F.I. 1973 pp.8

[4] Ibid. Nixson F.I. 1973 pp.8

weight of the final product), and the locational weight (that is the weight of the product plus the weight of localized materials or the total weight to be moved).[5] This material index is quite significant in the location of the sugar industry. Due to the bulky nature of sugarcane (raw material) which gives a material index of 10:1, the industry is actually raw material orientated, and therefore locates at the area of raw material production.

Despite Weber's attempt in the formulation of factors of industrial location, his work has been criticised on three main bases, which are as follows: a) the assumptions made by Weber for the analysis were such that the theory did not give an adequate explanation of locational factors. He did not give reasons for selecting the three factors which he designated as important, as opposed to those he rejected, b) the analysis abstracts from costs and prices and appears to lead to unnecessary degree of unreality, c) the assumption of fixed labour location is unrealistic taking into account great labour mobility especially in Kenya.[6]

Hoover's(1954) analysis is largely within the framework of costs, for example, he deals with least-cost analysis. The cost factors of location are separated into two groups, the transportation and production factors. As in Weber's case, he considers the cost of procuring raw materials and distribution costs of the final product as transport cost. But, unlike Weber, he clarifies the point that the cost of

5. Ibid, Nixson F.I. 1973. pp.7-8
6. Ibid, Nixson F.I. 1973 pp.9

transfer does not increase proportionately with distance. For instance, the tapering of any freight rate structure decreases the relative importance of the transfer factor as distance increases and such tariffs encourage a small number of long hauls in preference to a large number of short hauls.[7]

The above theories have dealt with least-cost approach, and largely abstracted from demand. They have assumed unlimited demand for the output of firm at a prevailing market price, so that all sellers have access to the buying centre which is quite unrealistic. The approach of more recent studies takes into account a monopolistic competition analysis. Buyers are conceived as being scatered over an area rather than concentrated at a given region of consumption, which is quite normal. Each seller thus becomes monopolist with respect to consumers who are located near his plant. Any decrease in either the sales, prices or freight rate of one firm will widen the market area controlled by that firm, while any increase narrows that area. Fetter states that "....the relation of prices in the two markets determines the location of the boundary line, and the lower the relative price, the larger the tributary area"[8]

7. Ibid. Nixson F.I. 1973, pp.9
8. Fetter F.A. - "The economic law of Market Areas" Quarterly Journal of Economics (Q.J.E.) Vol. 38 May 1924 pp. 520.

The market-area theory is quite similar to that of locational interdependence as both of them emphasise the monopolistic aspects of space. The interdependence approach, formulated by Hotelling (1926) assumes freely movable locations. In this analysis, Hotelling concluded that firms would tend to locate at the mid-point of the entire market area. This would enable a firm to supply consumers at the extremity of the market area while still retaining locational advantages at the centre.[9]

The Fetter-Hotelling theory of the market area as stated above is quite insignificant in the location of the sugar industry. This is because almost all the sugar factories are located in Western Kenya which outrules their basic concept of the location at the mid-point of the market area. Thus, other factors basically physical, as we are later going to see, have determined the location of the sugar industry in Western Kenya. Secondly, the price of sugar to consumers in the country is constant (Ksh.4.50 per kg) irrespective of distance travelled to the market area, although consumers will prefer to buy their sugar from the nearest seller. Furthermore, even if they preferred to do this, sugar is not purchased by consumers from the processing plants, for this is the sole prerogative of the Government.

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[9] Ibid. Nixson, F.I. 1973, pp.12.

The major short-coming of the above analysis is that they abstract from cost in a similar manner to the abstraction from demand of the least-cost theories. It is therefore necessary to combine both cost and demand elements to obtain a comprehensive and definite theory of location.

Lösch, A. (1954) presents a simplified static model of the space economy operating under conditions of monopolistic competition. He postulates a broad homogeneous plain within uniform transport features, even scatter of industrial raw material in sufficient quantity for production, a uniform distribution of population with a uniform set of tastes and preferences. If in this situation an entrepreneur produces a commodity in greater amounts than is demanded by his homestead, his market area would assume a circular form (fig. 1a). But if one finds it profitable to produce more than he needs, others will also do the same, resulting in competition. This will not only contract the market area of the original producer, but will also transform the circular shape of the market area into a hexagon (fig. 1b). According to Lösch, equilibrium is achieved when the hexagons are so reduced in size that profits are completely eliminated. Lösch maintains that this is the ideal economic form of market area because:[10]

a) a network of hexagonal market forms will completely cover any area under consideration and,

[10] Ibid. Nixson, F.I. 1973, pp.13

b). of all the regular polygons which will cover a given area completely, the hexagons deviate least from the circular form and thus minimize transport costs in supplying a given demand. Depending on the nature of the product, the respective sizes vary from very small hexagons to very large ones. These are grouped around a common central production point. This gives one group of sectors where production units are denser and the second group where production units are sparse, (fig. 1c). The coincidence of many of these centres concentrates population and minimizes freight burdens, thus leading to agglomeration of industry. Losch's major contribution to location theory were his definition of the firms' minimum size market area and the picture he presented of industrial agglomeration. However, his work has been subject to criticism. His conclusion that attempts to maximize effective demand leading to a hexagonic type of intra-industry dispersion of firms is clearly inadequate as a general explanation of plant location in non-socialist, that is, in capitalistic economy. This is because of his failure:

a). to include cost differentials other than those attributable to agglomerating and transportation advantage.

b). to carry out to its logical conclusion the analysis of the impact of agglomerating cost advantages on the location of firms belonging to a given industry.[11]

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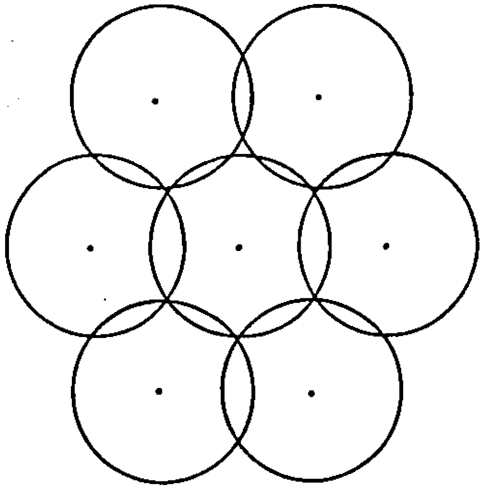
[11] Ibid. Nixson F.I. 1973. pp.13-14.

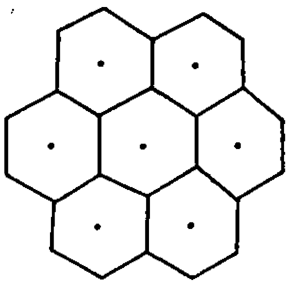
Fig. 1a-c

a.



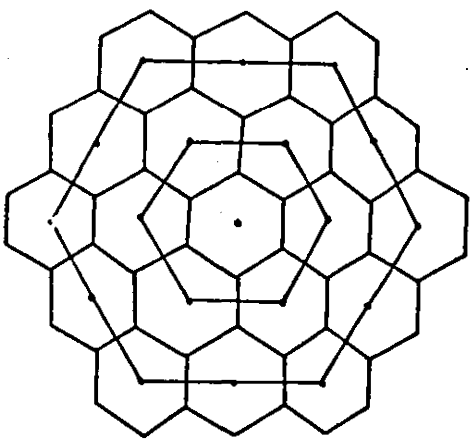
Circular Market Areas with overlapping Areas.

b.



Collapse of Circular Market Areas into Hexagons.

c.



Development of hierarchical Hexagonal Market Areas.

THE DEVELOPMENT OF LÖSCH'S MARKET AREAS FROM CIRCULAR TO HEXAGONAL FORM.

Despite these shortcomings, it is by Lösch, more than any other scholar that the theory is advanced, namely that the location of manufacturing establishment depends upon the firm's cost of production at alternative locations and the market area which it is able to control from each site. It was Lösch who first stressed that the correct criterion for location of the industrial enterprise lies where the net profit is greatest.

Greenhut has further developed the concept of the maximum profit location, emphasizing the need for a broader statement of the determinants of plant location than one which simply concludes that firms seek the location of least cost or one which states that firms seek the location with the largest possible area. Greenhut defines the concept of maximum profit location as that site from which a given number of buyers (whose purchases are required for the greatest possible profits) can be served at the lowest total cost. Average production costs may be higher at the chosen site than at alternative ones, but the monopolistic control gained over a larger number of buyers makes it the maximum profit location.[12]

The theories of industrial location discussed above form a good basis for the study of industrial location factors. Despite this, alot has been assumed by each writer as noted above. For this reason, they need some modification before they can be realistically applied to our local situation.

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12 Ibid, Nixson, F.I. 1973, pp.14.

Besides these assumptions, various factors which, in practice, affect the location of industries have been excluded. Such factors include, the role and/or policies of the government in influencing industrial location, influences of such aspects as capital, industrial power and physical factors. To-day, in most countries the development of industries is largely controlled by the relevant government policies. The location of certain industries in some areas may therefore have little connection with the above purely economic factors. This is because the government may wish to develop an area which is either underdeveloped or undeveloped, and this could only be achieved by allocating suitable industries in such area through government development planning policies.

Capital and industrial power are very important factors of industrial location which were totally omitted from the theories formulated by classical theorists. Their importance vary from industry to industry. Generally, capital is a very crucial factor in industrial location, as very little (or nothing) can be done without it. Similarly, physical factors which play a very significant role in determining the location of most of the agricultural manufacturing industries (of which sugar industry is an example), have been excluded from the discussion. For instance, rainfall and soils, among other physical factors, largely determine the availability of the agrico-industrial raw material with which Kenya's generalized pattern of industrial location approximately coincides. It is therefore important to note that some of these factors of industrial location (such as physical factors, capital and power) initially omitted from the early writings have been considered in industrial location studies by recent scholars, such as Ogendo, R.B. (1972).[4] The model below (fig. 2) summarizes major factors of industrial location as formulated by the classic theorists.

Having looked at the conceptual framework underlying the theories of industrial location, we may now examine some of the concepts of unemployment and employment. During the Kericho conference, it was stated that "unemployment is associated with unbalanced economic progress".[5] It was conceived as being a by-product of growth, a disease of industrialization and a consequence of introduction of modern ideas and institutions. In short, modernization appeared to generate unemployment. Despite this, it would be unreasonable to argue that developing countries should forego modernization in order to eliminate unemployment. Instead, the solution lies in choosing a strategy of modernization which will control the spread of unemployment and minimize its demoralising impact on the economic, social and political life of developing nations. In order to overcome this problem, a diagnosis of the cause of unemployment and remedies to reduce it are necessary.

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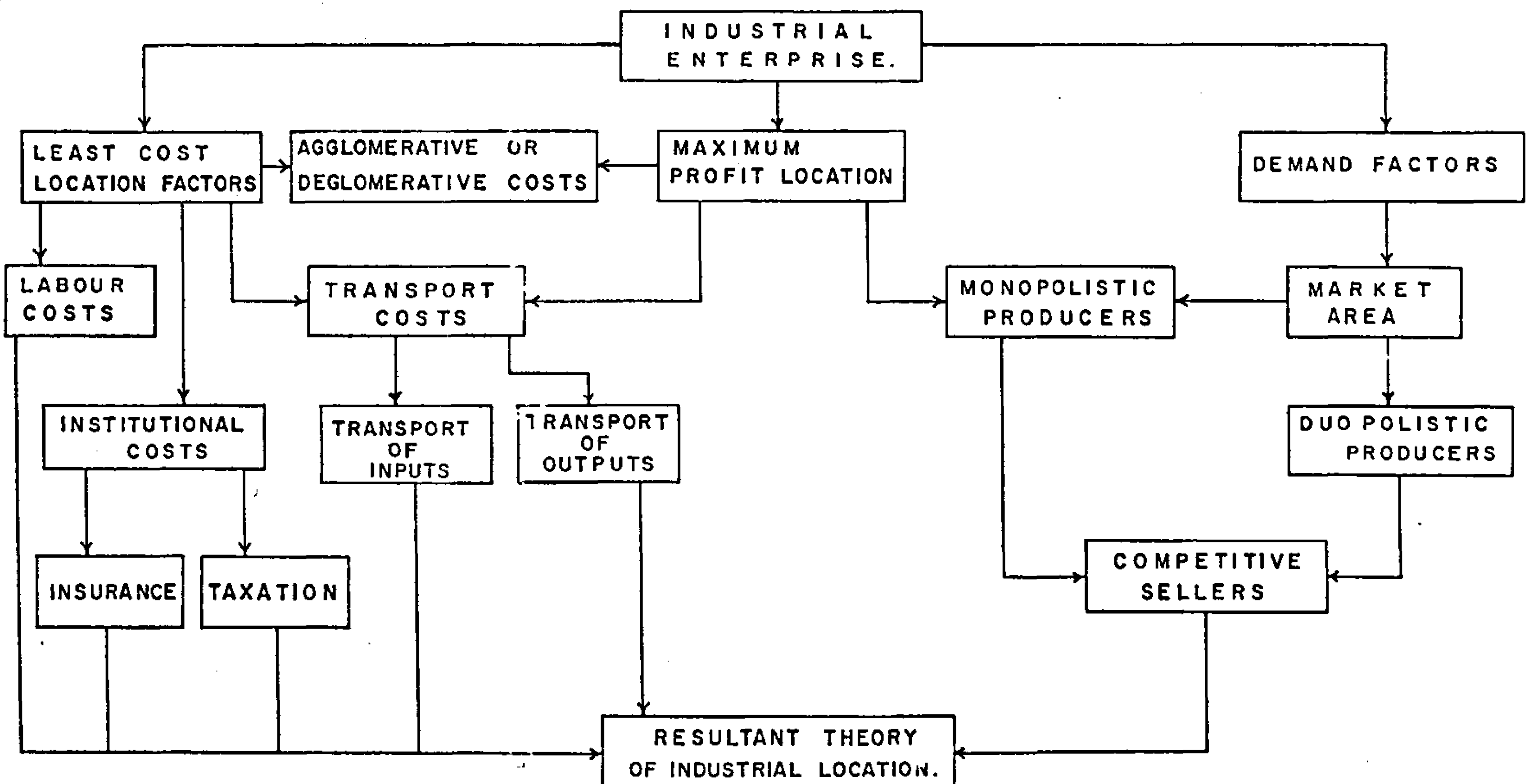
[4] Op cit pp..10... No. 1

[5] Harbison F.H. - "The Generation of Employment in Newly Developing Countries" Conference on Education Employment and Rural Development Kericho 1966 E.A.P.H. pp.174.

FIG. 2 A MODEL ILLUSTRATING THE MAIN FACTORS OF INDUSTRIAL LOCATION AS FORMULATED BY THE CLASSIC THEORISTS



Some of the causes of unemployment have been recognized to emerge from the dual economy, which is typical of developing countries. This consists of a modern sector, as well as a traditional sector. The former consists of government activities including education, medium and large scale commerce, manufacturing, construction, transportation as well as plantations and commercial cash crop agriculture. Thus, the modern sector is a market economy with wage earners, entrepreneurs and salaried government personnel. On the other hand, the traditional sector includes, subsistence agriculture, petty trade and barter as well as some family sized craft and cottage industries. Unemployment exists in both sectors, but it is more open and visible in the modern sector, because the people seeking work for wages and salaries and are unable to find employment in the modern sector can be easily noted. Alternatively, in the traditional sector, labour surpluses take the form of disguised unemployment or presumed under-employment.

High wages and salaries (as noted in chapter 6) in the Modern sector attract employment. As a result, hundreds of people go to places (such as factories) where such activities are available, but they are constantly turned down, thus increasing unemployment problem. Furthermore, rising wage levels, provide an incentive to invest in more labour-saving machinery. Over and above this, labour requirements per unit of product are reduced through better personnel policies and more efficient management.

Today, traditional agriculture has little holding power in the modern society. Once a person has completed some formal education where the curriculum is orientated to the modern sector, he or she is not willing to join the traditional agricultural sector. Moreover, as wages continue to rise in the modern sector, the greater is the aspiration of young people in the rural areas to seek employment in the cities. Thus, high wages, modern technology, improved managerial practices and high productivity place limits on the ability of the modern sector to absorb more labour. At the same time, high rates of population growth, high aspirations and the spread of education increase the problem of unemployment.

In order, partly or completely to solve the unemployment problem, the following possible viable solutions may be implemented. Industrial and commercial enterprises should be introduced to provide more employment to potential workers by establishing more labour intensive economic activities, instead of those which are capital intensive. It is only in this way that the suggested unemployment solution by ILO* (that the government should employ more workers, and through subsidies, it should induce private enterprise to hire more labour) could be realized.

Despite these suggestions, it has been argued by Harbison F.H. (1966) that "the adoption of labour intensive techniques in the modern sector offers no solution for the

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* International Labour Organization.

unemployment problem. Instead the additional employment opportunities created simply increase the number of job-seekers." We may therefore conclude that the problem of unemployment is unlikely to be solved by greater investment in the existing modern sector, but in the modernization of the traditional sector. This will raise levels of living in this sector and thus attract more people.

Of all economic activities, agriculture is probably the most labour intensive. But as noted earlier, this has little holding powers for people with ambitions, especially the youth who have just left school. Thus transformation of rural life must be the central objective of any programme to effectively utilize growing labour surpluses. This can possibly be done through:

a). an increase of both quality and quantity of cash crops,
b). improvement in rural communities and villages, through better housing, sanitation, water and community services,
c). improvement of communication systems, especially access roads, and, d). encouragement of local trades and industries to process agricultural products and supply the demands of rural population by way of increased incomes.

The central purpose of the rural transformation as conceived above is to raise incomes and create more employment opportunities in rural areas. But is should be noted that modernization of agriculture is likely to release labour from the land and thus create more unemployment. This can only be avoided if the right techniques are employed. For example, emphasis can be placed on measures to increase the quality and quantity of production per unit of land area rather than on the use of labour saving implements or machinery. Furthermore, the development of local industries with labour intensive technology can create more employment opportunities.

In conclusion, it should be realized that the problem of unemployment cannot be fully solved without controlling population growth. Most developing countries have a growth rate of more than 3% (for instance Kenya has a growth rate of 3.5%), and these rates seem to be increasing rather than levelling off. Thus, even if the rapid expansion of the modern sector, coupled with a rural transformation are fully implemented, these will not be sufficient to absorb the labour surpluses of these countries, unless the birth rates are reduced.

The theoretical framework underlying the theories of regional development are those discussed by Perroux (1955), Myrdal (1957), Hirschman (1958) and Friedmann (1964). Perroux in his 1955 paper, extended his argument against national space as an economic concept. Developing the concept of space defined as a field of forces he observed that growth does not appear everywhere at the same time; but it manifests itself in 'points' or 'poles' of growth with variable intensities.

Perroux distinguished between propellent industries (industries motrices) and impellent industries. When the former expand their output, they increase the sales linked to them as buyer or seller. A propellent industry will then induce an aggregate increase in the sales of a whole group of industries which is very much larger than the increase in its sales. This argument is based on external economies showing how the growth of one industry can induce profits in industries producing goods demanded by other firms.

The theory of regional development was clarified by Hirschman and Myrdal in their discussion on economic development and balanced growth. Following the argument that rapid development in one economic sector will create demand for the product of another, Hirschman advocated development through a 'chain of disequilibria'. The expansion of industry 'A' will create external economies for industry 'B' wherever the two industries are in a complementary relationship. New industries will thus be induced as a result of increase in output of existing industries, so that a multiplier effect operates through backward and forward linkages. He therefore favoured an approach through 'unbalanced growth' and cited Perroux's growth poles in support. Hirschman introduced a spatial dimension in his argument. Geographically, growth is unbalanced. Development takes place through 'master industries' which must be located somewhere, and new plants will then gain by being located close to the 'master industry.'

A growing point will therefore be established. Entrepreneurs will thus concentrate at the various growing points. They will over estimate or simply ignore opportunities elsewhere. Growth in the developing region 'North', in Hirschman's terms, will be paralled by retardation elsewhere in the 'South', and as skilled labour is withdrawn, savings are re-invested in the growing 'North', and terms of trade are set against the southern producer of goods experiencing low income.

These polarization effects are however offset, to some extend, by an increase of Northern purchases in the 'South' and by an increase of Northern investments in the 'South' that is likely to take place, if the economies are complementary. The 'North' may also abstract sufficient labour from the 'South' to increase the marginal productivity of labour there, and thus raise the per capital consumption levels. The important consideration that will ensure that these trickling down effects take place is that the 'North' has to rely on the products of the 'South' for its own expansion. Looked at from this point of view, the regional development problem is simply a spatial case of unbalanced growth. It is therefore presumed that the relevant state will intervene to influence the correction of unbalances wherever the normal market mechanism proves inadequate.

The Swedish economist, G. Myrdal (1957) concentrated mainly on the problem of inequality rather than treating it in the context of a general theory of development. He mainly concentrated on the growing differentiation between rich and poor countries and people. He suggested that the principle of interlocking circular interdependence within a process of cummulative causation, has wide validity, and should be the main hypothesis in studying underdevelopment. Free market forces work towards inequality between regions and such inequality is reinforced by the movement of capital, goods and services. All these forces which are virtually identical with those perceived by Hirschman he calls 'backwash effects.' Contrary to these are the "spread effects" of expansionary momentum. At this point, he, however departs from Hirschman when he notes that these two effects usually balance each other resulting in a stagnating region. Apparently, this balance is not a stable equilibrium, for any change in the forces will start accumulative movements upwards or downwards.

Myrdal's and Hirschman's studies should be regarded as a starting point, rather than the more elaborate theorizing that has been reviewed. It was only after these two, that the fact of disequalization in the development process became firmly established.

John Friedmann is outstanding among those who created the "core periphery" concept during the 1960s. In one of his statements on regional development, jointly with Alonzo, W., (1964) noted that spatial patterns usually change with demand and production. Moreover, changes in the level of technology and in the social and political organisation of the nation would also result in a different spatial pattern. He also noted that in the early period of development, marginal returns to the factors of production differ greatly between regions with economic advancement. While, at an advanced stage of development, the national economy would appear as a fully integrated hierarchy of functional areas with most of the population and activities polarized in metropolitan areas. These ideas were further elaborated on in the "centre periphery" model in relation to the rapid expansion of the development centres. These, in the course of time, act as suction pumps, pulling in the more dynamic elements from the more static regions. As a result of these, the rest of the country remains in a peripheral position, experiencing net outflows of people, capital and resources, to the centre where economic growth will tend to be rapid, sustained and cumulative.

So far, the above economists are the founders of the theories relating to regional development. However, recent studies have further developed this idea. Hansen N.M. (1967), Darwent D.F. (1969) and Siebert (1969) have further defined Perroux's "Growth Pole" concept. A regional growth pole has been viewed by Siebert as a set of interdependent expanding industries in an area. The complex of industries is supposed to consist of a key industry and a set of activities which are linked to the key sector. This key industry is expected to expand at a high rate, to have a high level of output and strong linkages with the other activities of the region.

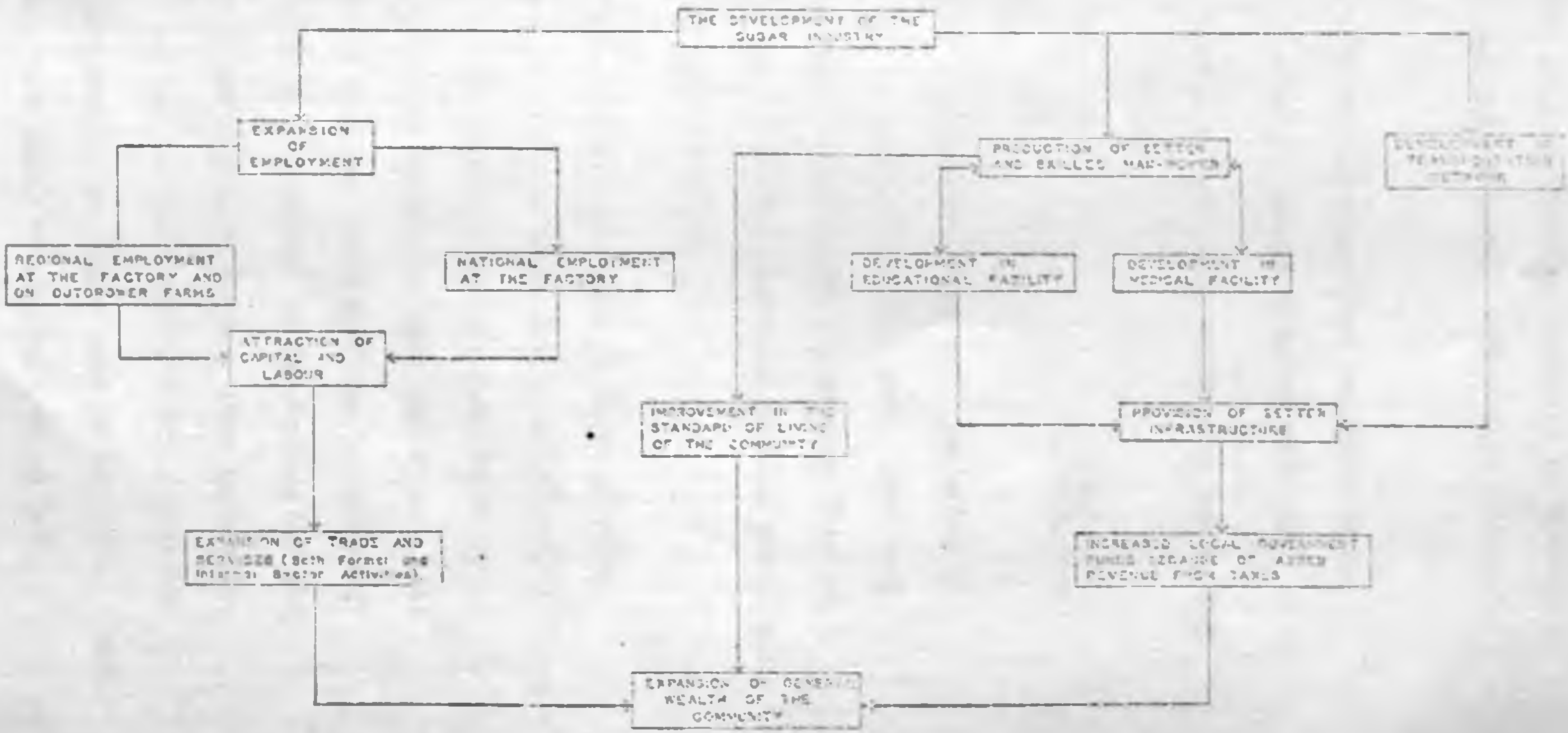
Furthermore, three geographers (Semple, Gauthier and Youngman 1972) have not only interpreted a growth pole as an urban growth centre that transmits growth impulses to a surrounding hinterland, but also identified the presence of growth poles in geographical space as a means through which the growth of regional economy can be understood.

The above concepts of regional development, although developed in advanced economies, are to-day, widely applied in developing countries (of which Kenya is an example). The relevance of these concepts, should not therefore be overlooked as they provide an important planning base. But, in order to achieve the best results, acclimatization and considerable modification of these concepts are quite necessary. The major development inducing effects likely to originate from the sugar industry, as discussed in the above conceptual framework, are clearly illustrated in the following model (fig. 3)

1:6 HYPOTHESES

In the above discussion, several concepts underlying this study have been clearly brought into light. Together with this, the related models have also been developed. In order to support these concepts and models through appropriate tests several hypotheses have been formulated. These include the following:

Fig.3 A MODEL ILLUSTRATING THE DEVELOPMENT INDUCING EFFECTS ORIGINATING FROM THE SUGAR INDUSTRY



1. The location of the sugar processing industry in Western Kenya is determined mainly by economic rather than physical factors.

2. The sugar industry in the area has been responsible for negative effects and has had no growth inducing effects.

3. The industry is beneficial not only to Western Kenya, but to the Kenya nation as a whole.

1:7 LITERATURE REVIEW

Although several researches have been conducted in the area, no investigations similar to this study have been made. Therefore, no adequate literature concerning this topic is available. However, the following somewhat related published works and reports have been reviewed.

Agronomic studies have presented a clear picture of the different types of soils in both Mumias and Chemilil-Miwani-Muhoroni sugar complex. For example, studies undertaken by the Mumias sugar company have indicated that the upper hill slopes have well drained residual reddish brown to red sandy clay soils. They have medium textures at the surface but they tend to become heavy in texture with depth. Thus generally, hill slopes usually have deeper soils which offer a suitable environment for the development of sugar-cane in the area, since sugar-cane grows roots to a depth of at least 18 cm under normal circumstances. Alternatively, shallow soils dominate the hill crest or plinthite may be close to the surface. These soils are mainly unsuitable for sugar cane development and prevent the deep rooting of sugar cane, thus making it impossible for the crop to survive long periods of water stress.

Consequently, the mineralogical composition results obtained from the area have indicated that kaolinite soils are dominant. The contrast with the Chemilil - Miwani - Muhoroni montmorillonites is that the kaolinite soils are easy to work, despite the low cation exchange capacity resulting from the bounded space between the silica-alumina crystals. This limited space only makes it possible for ionic exchange to occur at the crystals' edges. These soils, therefore, tend to have poor reserves of plant nutrients, such as potassium and calcium. Frequent application of fertilizers is therefore necessary.

Similar studies have been conducted in parts of Nyanza sugar-belts by Kenya soil survey of the government of Kenya. The results have shown that the dominant soil types in the area are very dark grey to brown moist clays. Studies on soils in this part of the sugar zone, have also been made by Hill, G.C. (1963) in his work on "The Cultivation of sugarcane in Nyanza". Hill's findings indicate that most of these clays are of montmorillonite type which have powerful adsorbing capacities for a variety of ions. The associated quality of water-holding in the crystal lattice causes these clays to "puff up" in wet weather, and contract leaving large cracks in dry weather. The complete impermeability of this soil, when wet makes these cracks the only way through which the water can reach the lower strata.

Penetration to the lower layers is only possible after violent storms, while in the case of light showers, the lower strata of the soil remain dry and cannot be exploited by roots. Another drawback of these montmorillonites is that, although the moisture holding capacity of such soils is high, most of the moisture is held in the crystal lattice by physiochemical bonds, thus making it unavailable for plant use. This explains the remarkable feature which has been noted in Miwani area. After a short period of drought, the cane on the upper sandy soils show little sign of water stress in marked contrast to that on the black clays below.

Myandat N.N. and D'Costa A. (1968) have also carried out a study on soils in the Nyanza sugar belt, in their publication called "Soils of the proposed sugar research station Kibos." These two have come out with similar results that the soils in the area are dominated by "very dark grey to brown moist clays " mainly of montmorillonite type.

The above mentioned soil findings in the Western Kenya sugar zone have clearly indicated that Kaolinite and montmorillonite clays dominate the Mumias sugar belt and the Nyanza sugar belt, respectively. This study attempts to investigate into how these two different types of clay soils affect sugar production in Nyanza and Western Provinces.

Other studies on physical factors influencing sugar cane development in the area have mainly dealt with rainfall distribution and rainfall amounts. For instance, agronomic reports have shown that the optimum rainfall at Chemelil is 1295 mm (51") and 1524 mm (60") at Muhoroni, per annum, compared to Mumias with an average of about 1778 mm (70"). Alternatively, important aspects such as rainfall reliability, variability and probability as well as eco-climatic zones, have received little attention. The aspects (especially the 30" (762 mm) rainfall probability) will be fully examined in this study.

Several studies on factors of industrial location have been conducted, not only in Kenya, but also in other parts of the world. Smith D.M. (1971) in his work on "Industrial location" on a world basis, as discussed by various economic contributors to industrial location theory has broadly presented the major factors of industrial location. Bale J. (1975) in his work on "The location of manufacturing industry" has also presented similar contributions. The main factors of industrial location outlined by both authors (which include such aspects as labour, transportation, raw material availability and market), form an important part of this study. Alternatively, this study, is only confined to those factors affecting the sugar processing industry. Similarly, this topic (on factors of Industrial Location) specifically relating to the Kenya situation has been well developed in the work presented by Ogendo (1972) on "Industrial Geography of Kenya, with special emphasis on the agricultural processing and fabricating industries." He has made a detailed study of both physical and human factors influencing the location of industries in Kenya. Some of the findings on industrial location in the above mentioned study have been found to be quite useful in this study although it (the study by

Ogendo) deals generally with all the 39 industries (11 agricultural food and 12 non-food agricultural manufacturing, 8 non-agricultural manufacturing and 8 service industries) in Kenya. On the other hand, this study only takes into account the sugar processing industry, (one of the 11 agricultural food processing industries).

The core-periphery model which forms a substantial part of this study was first formulated by Myrdal G.M. (1957) in his work on "Economic Theory and Underdeveloped Regions" and Hirschman, A.O. (1958) in his work on "The strategy of Economic Development." These theorists brought up the idea of the core-area being parasitic on the surrounding areas. For example, Hirschman in his model of the growing "North" and the lagging "South" noted that migration of the labour-force from the "South" to the "North" is a negative effect. This is because these migrants are likely to be the key technicians and managers as well as the more "enterprising young men" in the source area. These negative effects have been referred to as "backwash" effects by Myrdal and polarization effects by Hirschman. But still the term depopulation is more applicable as this negative process actually tends to draw most of the population from the less developed to better developed areas, usually urban centres. These depopulating or negative effects may therefore be regarded as a set of processes which result in a decrease of the absolute level of development of a peripheral area. Alternatively, growth inducing effects relate to a set of processes whereby the absolute level of development of a peripheral area is increased due to spatial interaction with a core area. According to Myrdal, growth inducing effects neutralize the "backwash" effects only at a high level of development. Hirschman however, argued that the higher the level of development that a country has already attained, the stronger the spread or growth inducing effects will usually be. High level of development is accompanied by improved transportation and communications, higher levels of education and a more dynamic communication of ideas and values all of which tend to strengthen the forces for centrifugal spread of economic expansion or remove the obstacles for its operation."

While the above mentioned theorists were founders of the core-periphery model, scholars such as Friedmann J. R. (1969), Moseley, M. J. (1974) and Gilbert A. (1976) have attempted to develop this model in order to make it more applicable to the real situation. For instance, Friedmann's contributions are based on regional change within nations into which the proposed study aims at making investigations. On the other hand, Moseley M. J. (1974) has pointed out several ways through which development can possibly radiate from development centres to the surrounding peripheral areas. For example, he has argued that "a means by which development centre might stimulate further development in near by areas relates to the decentralization of capital typically in the form of a branch plant establishment ..... Economic activity might also be stimulated in peripheral areas by government intervention rather than through free market forces. This might take the form of private industrial expansion being diverted from the centre or else a policy of discriminatory purchasing of materials and services, for example, by means of a requirement that government agencies have to purchase a certain portion of their materials from the periphery. Alternatively, the government might invest in public infrastructure over and above that consistent with present levels of demand or else insist on national standards in the operation of such services as education and health, despite their more expensive provision away from the main centres of population. In each case, the periphery would be benefiting from a level of economic activity greater than that which a 'laissez-faire' policy would have generated."

The core-periphery models formulated by the early theorists, as stated above, were actually based on case studies mainly conducted in developed countries with advanced economies as compared to those of the developing countries, which are still in their early stages of development. It would therefore be unrealistic to apply them to our local (Kenyan) situation (which is still in its early development stages) without empirical evidence. This is because the two worlds (developed and developing) are completely different in their economic development. This study, therefore aims at either confirming or discarding the proposed hypotheses through field work analysis. The sugar processing plants will be considered as development points which can achieve self-sustaining growth to the point that growth is diffused to the less developed peripheral areas.

The problem of rural development has also been tackled by F.H.Harbison (1966) in his work on "The Generation of Employment in Newly Developing Countries." He has argued that, rural modernization involves much more than improvement in agriculture. Other requirements include modernization of rural communities, the development of small scale industrie and crafts, the improvement of communications and the extension of education and health services to the rural areas. It requires massive investment, extensive training of human resources and determination on the part of the government to give priority to rural development.

According to Harbison (1966), rural development will take place, given the above mentioned development facilities. But in reality this is not always true. This study, has therefore tried to find out which of the above mentioned services have been introduced in the area as a result of the establishment of the sugar processing industry. An attempt has also been made to find out whether any development has occurred in the area resulting from the establishment (if any) of these infrastructural facilities.

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CHAPTER 2

METHODOLOGY.

2:1 INTRODUCTION

This section deals with the various methods which have been applied in this study in order to arrive at the relevant data. These include those methods which have been used in:-

a). Selecting the required sample(s) from the working population(s) or sample frame(s).

b). Collecting the required data from the selected sample(s).

c). Analysing the data obtained from the selected sample(s), and

d). Presenting the analysed data.

It is important to mention at this stage that this study involves the analysis of data from several sources, which are as follows:-

(i) the mill-white sugar processing plants in Western Kenya,

(ii) outgrower farmers who had, at least, earned an income from their sugarcane at the time of the research.

(iii) climatic data from the sugar processing factories or from the nearest weather station to the sugar factory,

(iv) soil data from analysed soil samples obtained from both Nyanza and Mumias sugar belts,

(v) secondary data from other recorded and published sources.

2:2: SAMPLING DESIGN

In any statistical investigation, there is some set of objects, about which information is desired. The fundamental set of objects about which we want to obtain information is the working population. This should not be mistaken for the Universe, as the latter is usually larger than the former. It is usually easier to work with a working population rather than the Universe because the latter may have elements which are not required in the analysis or may be quite difficult to locate. Thus, in this study, the working population only takes into account those outgrower farmers, who at the time of the research had earned an income from their sugarcane. This was 88.59% (or 20,409 outgrowers) of the total Universe of 23,037 outgrower farmers from the two provinces. Hence 11.41% of the Universe was therefore excluded from the analysis as this was the portion of the farmers who had not yet earned any income from their sugarcane.

If our working population is relatively small and easily surveyed (as in the case of the sugar factories processing mill-white sugar in Western Kenya), then, we may as well examine every item in the population. However, in practice, most working populations are usually too big, or individual items too inaccessible to enable the whole working population to be examined. Under such circumstances, we may only examine part of the total working population. This selected portion of the population to be examined is referred to as " a sample " and this usually reflects similar characteristics of the population.

In practice, most researchers usually deal with "samples" rather than the whole working population. Harper W.M. (1971) has argued that it is better to survey a sample rather than the whole working population because; it is less costly, it is more accurate as very careful attention and measurement can be given to these samples and it is easier to analyse the data collected on a small scale rather than the whole working population.[1]

STRATIFIED RANDOM SAMPLING.

In this study, a stratified random sampling technique has been used in selecting the required sample from the working population. This involves the division of a heterogeneous population into parts which are fairly homogeneous with respect to the characteristic(s) under study. Thus in order to use this technique, one has to know what groups comprise the total population and in what proportions. For instance, in this study, outgrower farmers have been stratified first, according to provinces and then further stratification has been made in each province. In Mumias Sugar belt, the outgrower farmers have been further stratified according to sub-locations in the sugarbelt. On the other hand, the outgrower farmers in Nyanza Sugar complex were sub-divided into large or small-scale farmers. The small scale farmers were further sub-divided according to their respective societies. Hagood, M.J. (1969) has argued that further stratification of the strata into sub-strata, which in turn may be sub-divided into small groups, further increases efficiency of stratification[2].

[1] Harper W.M.(1971) - Statistics - MacDonald. and Evans; pp.18

[2] Hagood, M.J. (1969). Statistics for Sociologists- Henry Holt and Co. New York. pp.277.

The application of this technique involves first the determination of the sample size from the working population, which is then divided into sub-samples with the same proportions as the groups in the population. From within each group, the appropriate sub-sample is selected at random. Finally the sub-sample results are added together to obtain the overall sample. This sampling technique was preferred in this analysis because estimates made from a stratified sample are more accurate than those selected from a simple unrestricted random sample. Furthermore, the use of this method "lessens the possibility of being one sided."

In this study, it was initially proposed that all the eight sugar factories designed to process mill-white sugar in Western Kenya would be studied. For this reason, the need for sampling did not arise. Unfortunately, it was only possible to study the 6 large sugar factories, of which five are now processing mill-white sugar, while the sixth factory is still under construction. The other two factories, which now fall out of the scope are all small-scale sugar plants. These are Kabras sugar factory in Kakamega district, Western Province and Yala Sugar factory in Siaya district; Nyanza Province. Reasons for their omission have been clearly stated in the "Limits of the Scope". Thus the selected sample is 6 sugar factories out of a universe of 8 factories giving a sample size of 75%.

The relevant data relating to outgrower farmers was derived from both Nyanza and Western Provinces. First of all, the two provinces were stratified so that each district and province had a chance of being equally represented in the study. In Western Province, a total sample of 150 outgrower farmers was selected from a working population of 9,500 outgrowers who had at least earned an income from their sugarcane in Mumias sugar belt. A list of outgrower farmers was obtained from the factory's outgrower section. These were further stratified according to the 25 sub-locations in Mumias sugar belt/Map 1. Every farmer in each sub-location was assigned a number and then a sample of farmers was randomly chosen from each sub-location as shown in table 1. Outgrower farmers from Nzoia and Awendo Sugar belts were excluded from the study because they had not yet earned any income from their sugarcane at the time of the survey.

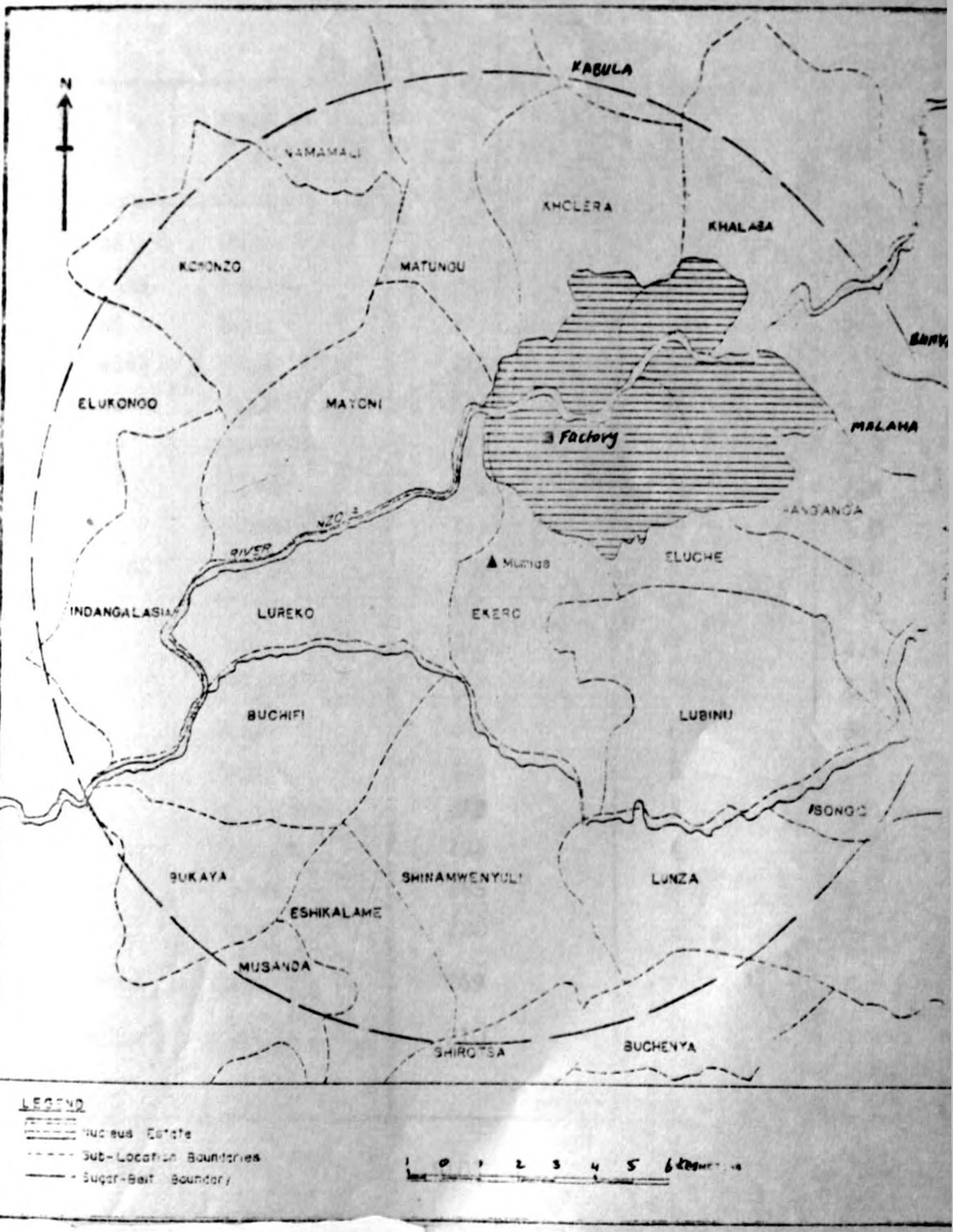
Alternatively, in Nyanza sugar complex (that is in Chemelil, Muhoroni and Miwani), a different procedure was adopted in selecting the necessary sample of outgrowers. The farmers were first stratified into large scale and small scale farmers. Out of a universe of 57 large scale farmers,
were of the 57 farmers were hardly available,as most of
only 10 farmers/interviewed. This was because many/are either them
employed in Nairobi or run some other businesses in Kisumu. Under the circumstances, it was very difficult to find them in their farms for interview, while their farm managers were

Table 1: NUMBER OF OUTGROWER FARMERS INTERVIEWED BY SUB-LOCATION FROM MUMIAS SUGAR BELT.

SUB-LOCATION	NO.OF FARMERS IN EACH SUB-LOCATION	NO.OF FARMERS INTERVIEWED	% OF FARMERS INTERVIEWED*
Lureko	845	14	9.3
Kholera	789	13	8.7
Buchifi	750	12	8.0
Lubinu	695	10	6.7
Shinamwenyuli	665	9	6.0
Koyonzo	615	8	5.3
Mayoni	519	7	4.7
Kholera	481	7	4.7
Eluche	450	7	4.7
Eshikalame	418	6	4.0
Indangalasia	383	6	4.0
Ekero	350	6	4.0
Matungu	312	5	3.3
Lunza	294	5	3.3
Malaba	266	5	3.3
Mung'anga'	217	4	2.7
Isongo	203	4	2.7
Namamali	200	4	2.7
Bukaya	197	3	2.0
Musanda	189	3	2.0
Buchenya	150	3	2.0
Lukongo	133	3	2.0
Shirotsa	132	2	1.3
Bunyala	127	2	1.3
Kabula	160	2	1.3
TOTAL	9500	150	100.0

Source: Field research data.

* $\frac{14}{100} \times 100 = 9.3$



Map 1. Sub-locations in the Mumias Sugar-belt
Source:- Mumias Sugar Co. Ltd.

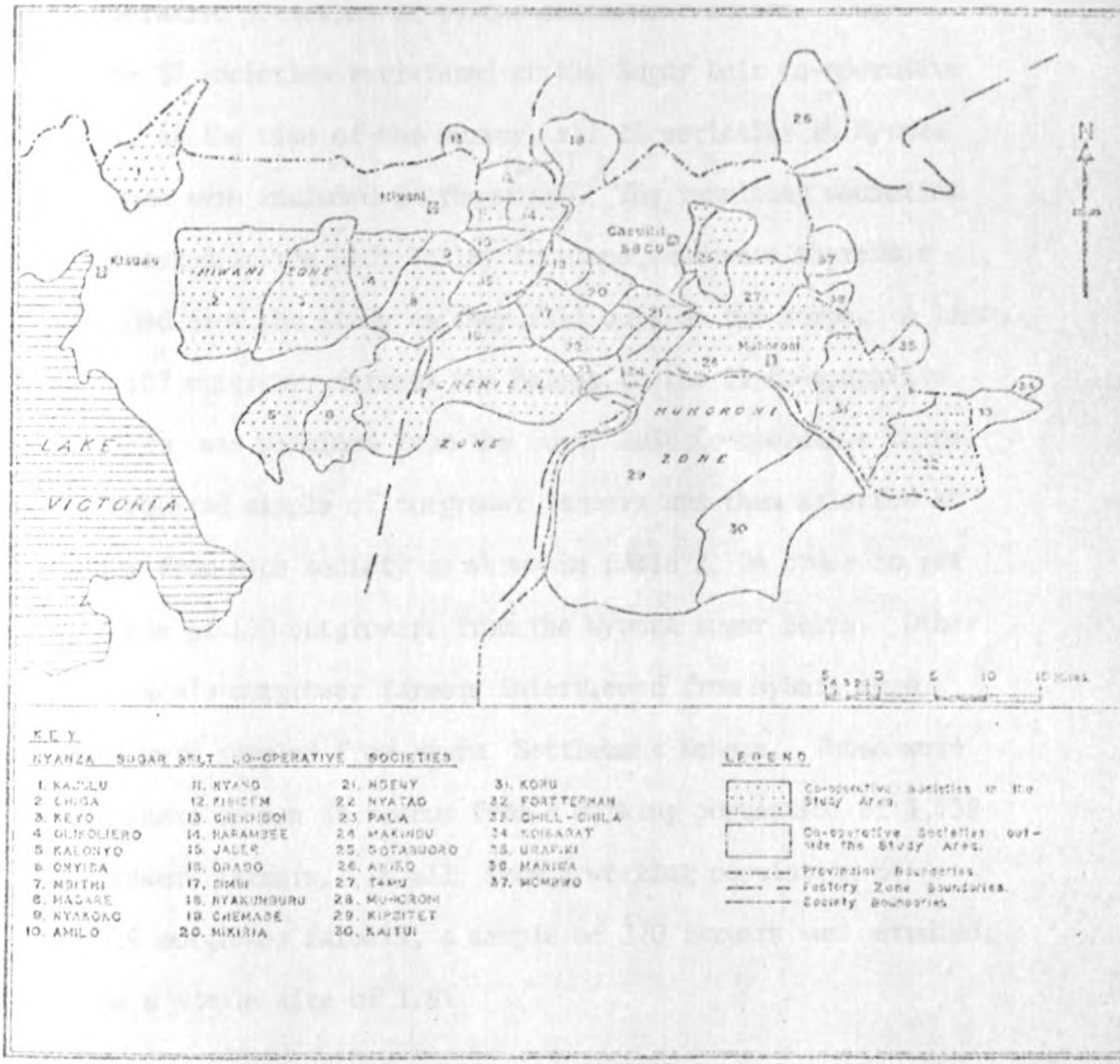
Table 2:

NUMBER OF FARMERS INTERVIEWED BY ZONE AND SOCIETY FROM NYANZA SUGAR COMPLEX.

ZONE	NAME OF CO-OPERATIVE SOCIETY	NO.OF FARMERS IN EACH CO-OP. SOCIETY.	NO.OF FARMERS INTERVIEWED	% OF FARMERS INTERVIEWED*
Miwani	Chiga	860	19	11.9
Chemelil	Nyatao	710	15	9.3
Miwani	Keyo	692	13	8.1
Chemelil	Orago	565	12	7.5
Miwani	Olikoliero	542	10	6.3
Miwani	Onyisa	521	9	5.6
Miwani	Kajulu	515	9	5.6
Miwani	Nyakoko	514	8	5.0
Chemelil	Mbidhi	500	8	5.0
Miwani	Magare	370	7	4.4
Miwani	Jaber	350	7	4.4
Miwani	Kabonyo	350	7	4.4
Miwani	Amilo	349	6	3.7
Miwani	Nyang	332	5	3.1
Miwani	Harambee	312	5	3.1
Muhoroni	Makindu	298	4	2.5
Chemelil	Simbi	285	4	2.5
Chemelil	Nyakunguru	283	4	2.5
Chemelil	Ngeny	280	3	1.9
Muhoroni	Pala	269	3	1.9
Chemelil	Mikiria	210	2	1.3
TOTAL		9107	160	100.0

Source: Field Research data.

* $\frac{19}{160} \times 100 = 11.9$



Map:2 NYANZA SUGAR BELT ZONES AND CO-OPERATIVE SOCIETIES
Source - Sugar-belt Co-operative Union

reluctant to release any information without their employers knowledge. The small-scale farmers, either belong to co-operative societies or to the settlement scheme. Out-of the 37 societies registered at the Sugar Belt Co-operative Union, at the time of the survey, all 21 societies in Nyanza Province were included in the study /Map 1/. The remaining societies are located in the Rift Valley Province, and were therefore excluded from the study as they fall outside the scope. A list of 9,107 outgrower farmers who belong to the 21 co-operative societies was obtained from the Sugar Belt Co-operative Union. The required sample of outgrower farmers was then selected at random from each society as shown in table 2, in order to get a sample of 160 outgrowers from the Nyanza sugar belts. Other small-scale outgrower farmers interviewed from Nyanza sugar belts were sampled from Mnara Settlement Scheme. These were 50 farmers chosen at random from a working population of 1,755 outgrower farmers. In all, from a working population of 20,419 outgrower farmers, a sample of 370 farmers was studied, hence a sample size of 1.8%.

2:3. METHODS OF DATA COLLECTION.

Several methods of data collection have been applied in this research, in order to obtain the relevant data from the selected samples of mill-white sugar processing plants and from outgrower farmers.

A recording schedule was mostly used to get the necessary data from the selected samples of both outgrower farmers and the factory management staff. These were mainly interviewed by the researcher, assisted by a research assistant, and the answers were recorded on the recording schedule, which is a form of a questionnaire (appendix B). In both cases, further elaboration of several questions was necessary to avoid misunderstanding as this would result in giving wrong answers.

The recording schedule type of questionnaire was preferred to the postal questionnaire because the interviewer usually comes face to face with the interviewee, which makes it easier and possible to elaborate various aspects which would be misunderstood. Thus, more accurate answers are expected. However, in a postal questionnaire, where a set of the questions is sent by post and entirely left in the hands of the interviewee, certain problems or limitations are expected to arise. These include, misunderstanding of questions which results in giving wrong answers; and refusal to answer some of the questions if not all. Such unanswered questionnaires are not usually sent back to the researcher and this is likely to affect the final production of the work.

Secondly, personal interviews were conducted with various personalities from different organizations, where a recording schedule was not used. These included outgrower, farmers, factory management staff, and several ministries. The Ministries involved were Commerce and Industry, Economic Planning, Co-operatives and Agriculture. Personal interviewing was only conducted where special kind of information was required from a well informed individual. During the course of such interviews, the use of note books was avoided as much as possible, since these were likely to interfere with the conversation. It was therefore necessary to firmly fix in the memory, in advance, the main items of required information.

The outgrower farmers were interviewed in order to get the relevant data related to the role of the Western Kenya sugar processing industry in the over all development of the area. The farmers were in the best position to state whether they were observing any development generated by the sugar industry in the area or not. Similarly, the factory managers were interviewed in order to get the data related to the concentration of the sugar industry in Western Kenya.

Despite the application of these methods, their shortcomings should not be overlooked. These include inaccurate or false data being given to the interviewer, simply because the informants have either forgotten, misunderstood, or deliberately intended to mislead the interviewer. In spite of these shortcomings, this method has been found to be most appropriate as the interview is not merely restricted to literate population.

Direct field observation is one of the methods which was used in data collection. This was done through writing descriptive notes, plotting the necessary features on maps and taking photographs. The extent of the respective sugar-belts were thus detected during the survey and then plotted on an already drawn base map of the area. Similarly, photographs were taken to further illustrate the information relating to established development facilities in the area. These were both supplemented by descriptive notes which were written during the field-work. This method of collecting information has been recommended as one of the best methods, as it reduces the chance of collecting wrong information, if carefully applied. Unfortunately, it cannot always be used, generally, on account of the cost involved during the survey.

Apart from the above methods of collecting data and information, secondary data and information from both published and recorded sources have been widely used where primary sources could not be applied. These include data on sugar production, consumption and imports, mainly from the Ministry of Commerce and Industry; employment data from Central Bureau of Statistics and climatic data from the sugar factories. Secondary information related to this study, for instance, theories of both industrial locations and regional development have also been examined. These do not only take into consideration findings from Western Kenya sugar zone, but also those from other parts of the world. Such data clearly indicate the type of researches that have already been conducted in this field of study, and what still remains to be done.

It should be noted that when using this type of information or data, we should be aware that we are unlikely to have a thorough understanding of the background of the information as the original investigator, and so may be unaware of its limitations. For this reason, anyone wishing to use published information or data should consider the purpose for which it was originally compiled. Furthermore, such information or data may be incomplete or outdated.

2:4. METHODS OF DATA ANALYSIS

The unprocessed raw data from the field are often disorganized. Harper W.M. (1971) has augued that "It is a psychological fact that data presented higgledy - piggledy are far harder to understand. than data presented in a clear and orderly manner." Thus prior to proper statistical analysis it is necessary to lay out the figures in an orderly manner so that they are easily understood. In this study, tables have been used to organize such data before actual analysis (table 3).

Apart from being more readily intelligible, tables have the following advantages:-

a). they enable required figures to be located more quickly,

b). they facilitate comparison between different items or classes to be made more easily,

c). they reveal patterns within the figures which could not be seen,

d). they occupy less space.

After organizing the raw data in a more comprehensive manner the following statistical techniques have been used in data analysis.

THE LOCATION QUOTIENT.

This is a quantitative index of Industrial Location which measures the exact degree to which the specified region or area (Western Kenya in this case) has more or less than its normal national share of a given industry, (for example the sugar industry). In this study, the results obtained from this analysis show the degree to which the sugar industry is concentrated in Western Kenya as compared to the rest of Kenya. Industrial operatives, in the sugar industry have been used in determining the location quotient. The number of all industrial operatives in Western Kenya and in the whole of Kenya for 1978 has been used to derive the percentages of industrial operatives in Western Kenya and in the whole of Kenya as follows:- (see pp. 69)

Table 3. EMPLOYMENT AT THE 6 SUGAR FACTORIES IN WESTERN KENYA

Name of Factory	No. of Manufacturing Operatives at each Factory.	Other Factory Employees	Total Factory Employment.
Chemelil	808	641	1449
Mumias	782	2745	3527
Miwani	737	923	1660
Muhoroni	654	306	960
Nzoia	400	1300	1700
Awendo (sony)	-	1266	1266
Total	3381	7181	10562

Source: Field Research data.

Percentages have also been used in analysing the data as these present a good comparison base, which cannot be clearly shown by whole numbers (see table 4).

Table 4. SUGAR PRODUCTION IN KENYA, 1978

Name of Factor/	Sugar Production in tons	Sugar Production in %
Mumias	92,500.3	39.12
Chemelil	47,429.7	20.06
Muhoroni	42,348	17.91
Miwani	36,426.7	15.41
Nzoia	7,294	3.08
SUB-TOTAL WESTERN KENYA	225,998.7	95.58
Ramisi	10,440.3	4.42
NATIONAL TOTAL	236,439.	100.00

Sources: Field research data - Western Kenya Sugar Production
Ministry of Commerce and Industry - National Sugar Production.

$$\frac{A}{B} \times 100\%.$$

where A = all industrial operatives in Western Kenya in 1978.

B = all industrial operatives in Kenya in 1978.

The Western Kenya's share of Kenya's industrial operatives in the sugar industry has been obtained as follows:

$$\frac{X}{Y} \times 100\%$$

where X = Western Kenya's industrial operatives in the sugar industry in 1978.

Y = Kenya's Industrial operatives in the sugar industry in 1978.

The location quotient is then derived from these percentages as shown below:

$$L.Q = \frac{\frac{X}{Y} \times 100\%}{\frac{A}{B} \times 100\%}$$

An index of less than '1' indicates that Western Kenya has less than its normal national share in the sugar processing industry. While an index of more than '1' indicates that Western Kenya has more than its normal national share in the sugar industry.

INTER-REGIONAL TRADE MULTIPLIER.

This method is based on the assumption that an injection of a certain amount of money, say from the sugar industry, increases regional income, thus affecting an increase in consumer spending in the area. This method therefore aims at answering questions such as what will be the impact of the injection of say, £Xmillion in the sugar industry on the regional income in Western Kenya? Will it generate twice or half its own value of the regional income in the area through the multiplier effect? This multiplier effect is usually affected by several leakages, such as savings, imports and taxation.

The regional multiplier (K) is therefore expressed as follows:

$$K = \frac{A}{S + I + T}$$

where

K = regional multiplier

A = money initially injected into the relevant region by the specified regional industry.

S = proportion of income saved

I = income spent on imports

T = income spent on taxes.

A low multiplier effect in a region indicates that the industry in question is not playing an important role in developing the region's economy, which may be a result of high savings, taxation and import ratios. Alternatively low savings, low imports and low taxes should increase regional income.

RAINFALL MEANS, STANDARD DEVIATION, COEFFICIENT OF VARIATION AND PROBABILITY.

The rainfall data obtained from secondary sources as already indicated vary over a period of 10-30 years. From these data, mean annual ranfall, standard deviation, coefficient of variation and rainfall probability have been computed. The mean values calculated summarize the rainfall characteristics by one mean value, although they fail to show how the various rainfall values are dispersed about the mean. As a result of this shortcoming inherent in this method of analysis it was necessary to calculate the Standard deviations which are measures of dispersion. These have been computed using the following formula.

$$\sigma = \sqrt{\left(\frac{\Sigma(X - \bar{X})^2}{n}\right)}$$

where σ = standard deviation

X = the individual values of total annual rainfall

$\bar{X}$ = the mean values of the sum of the total annual rainfall

n = the number of occurrences being considered (for example 30 years).

However, it is recognized that the standard deviation is influenced by the magnitude of the mean values which have to be substituted by other values in order to facilitate comparison in relative terms between the various sets of data. This was achieved by the calculation of another index of variability which includes the relative variation and the coefficient of variation. When the average is used to express the deviation value as a percentage of the mean, the index of variability is usually referred to as the "relative variability" and this is derived by using the following formula:-

$$RV = \frac{\sum_{i=1}^{n} d}{\bar{X}} \times 100\%$$

where d = mean deviations

On the other hand, if the standard deviation is used, then the index of variability is known as the coefficient of variation which is;

$$CV = \frac{\sigma}{\bar{X}} \times 100\%$$

In the above calculations, a normal frequency distribution is assumed, but this does not always occur and therefore an index of overall variability will not adequately reflect the different tendencies and degrees of variability above and below the mean. This has therefore made it necessary to make further calculations of probability. The rainfall probability has been computed by using Gregory's (1973)[3] formula, which is as follows:-

$$d = \frac{X - \bar{X}}{\sigma}$$

where d = required figure

X = critical value (1524mm).

$\bar{X}$ = mean value.

σ = standard deviation.

Results obtained from the above calculations show the extent to which the critical value differs from the mean value. The negative 'd' values indicate the number of standard deviations that the critical value is below the mean value. While the positive 'd' values indicate the number of standard deviations that the critical value is above the mean value. The 'd' value is then used to derive the appropriate percentage probability from the "Normal Distribution Function table"; Gregory, S. 1973, pp.61(table X11). The resulting probability value enables us to predict the probability of obtaining a certain critical amount of rainfall and hence the failure or success to be expected in sugarcane production. However, the method fails to show exactly when the crop failure would occur, which is a major weakness.

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[3]Gregory S. (1973) - Statistical methods and the Geographer - Longman. pp. 63.

CORRELATION COEFFICIENT.

Correlation may be referred to as an interrelation between two or more events. These events are known as variables because the study involves the way these events vary. The variables may either be directly or inversely correlated. In the former, an increase in one of the variables (say the independent variable) usually results in an increase in the remaining variable. Such variables are referred to as being positively correlated. Alternatively, an inverse correlation occurs when an increase in one of the variables results in a decrease in the other; and such variables are said to be negatively correlated.

In this study, a simple correlation method which involves; the correlation between one independent variable and one dependent variable, has been applied in the analysis of soil data. This has been used to determine the relationship between the soil nutrients and sugarcane yields from Mumias sugar belt and the Nyanza sugar belts. These soil nutrients are Sodium, Calcium, Magnesium, Potassium, Phosphorus and Nitrogen. Through this analysis, correlation coefficient 'r' and the coefficient of determination "r^2" were obtained using the following formula:-

$$r = \frac{\frac{1}{n}\Sigma(x-\bar{x})(y-\bar{y})}{\sigma x : \sigma y}$$

where: r = correlation coefficient

$x - \bar{x}$ = mean deviations from x

$y - \bar{y}$ = mean deviations from y

σ_x = standard deviation of x

σ_y = standard deviation of y.

n = number of data elements.

The results obtained indicate the degree of interdependence of two variables being correlated. But it should be noted that the information which it provides is liable to be misleading unless the problem is correctly stated. Thus, high correlation may be found to exist between two variables not related as cause and effect, while very low correlation may be found to exist between variables which are highly related. In order to avoid such a pit-fall, it is essential for the author to have a thorough knowledge of the nature of the variables being correlated.

In the calculation of the correlation coefficient, there is always the possibility that the coefficient correlation obtained could have occurred by chance. As a result of this, it is always necessary to test whether such a chance occurrence exists. The null hypotheses, in this study, were therefore tested for statistical significance at 99% level of probability, by the use of student's test. The following formula was used in the analysis:-

$$t = \frac{\sqrt{r \ (n-2)}}{\sqrt{(1-r^2)}}$$

where t = observed values for 't'

r = correlation coefficient

n = the number of pairs of data studied

$n-2$ = the degrees of freedom

r^2 = coefficient of determination.

The tabulated values for 't' have been derived from Gregory; 1973, pp. 144, fig. 30.

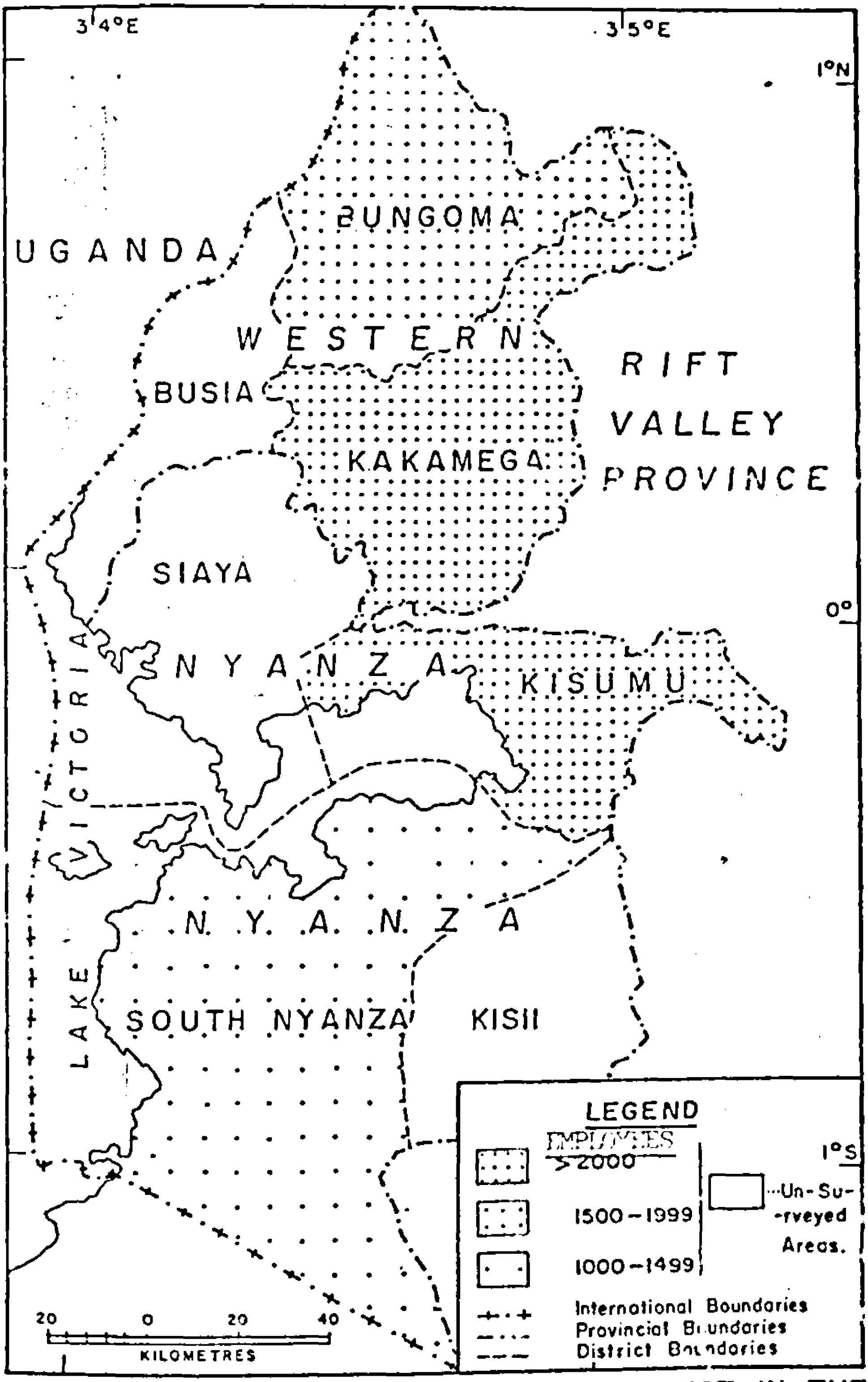
2.5 METHODS OF DATA PRESENTATION.

The analysed data has been mainly presented in the form of maps and diagrams. These usually give a clear picture of such data in a visual form. Both qualitative (map 3) and quantitative (map 4), maps have been applied in this study.

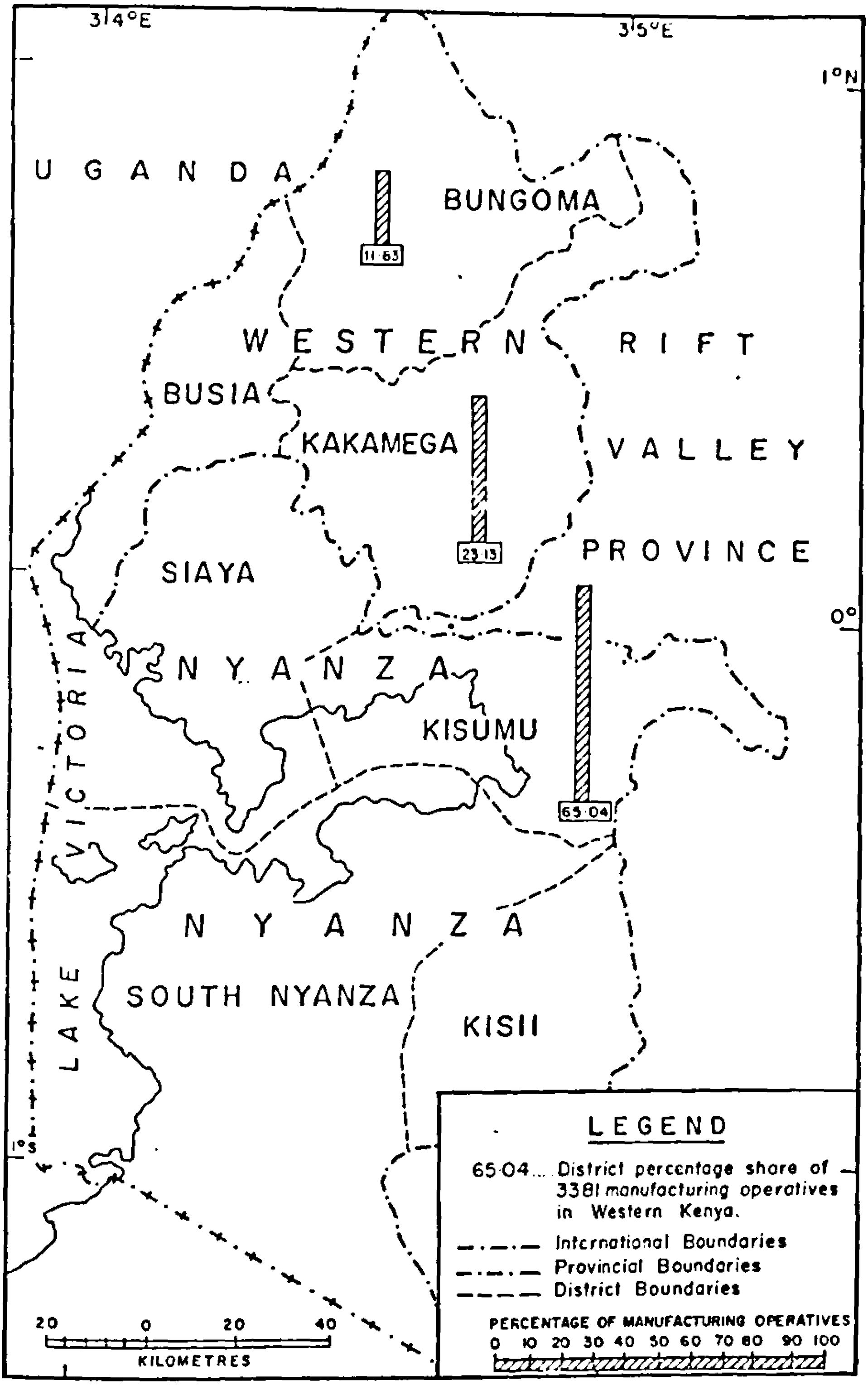
QUALITATIVE MAPS

The qualitative maps involve "marking in places where any features of interest occur without need to differentiate according to size or importance of any feature which occurs more than once".[4] Such maps include those showing the location of

[4]Dickinson, G.C. (1963) - Statistical mapping and presentation of statistics - The Camelot Press, London. pp. 36.



MAP 3 EMPLOYMENT DISTRIBUTION BY DISTRICT IN THE WESTERN KENYA SUGAR INDUSTRY.



MAP 4 WESTERN KENYA'S MANUFACTURING OPERATIVES BY DISTRICT 1978.

the Western Kenya sugar industry, and the location of the sugar factories in their respective sugar belts in Western Kenya. Furthermore, the soil map has been so illustrated in order to indicate the different types of soils found in the area and those suitable for sugarcane cultivation, thus giving a clear picture of the sugarcane growing zone. Similarly, both rainfall distribution and probability have been illustrated qualitatively. The rainfall probability map shows whether or not the sugarzone falls within the 30" (762 mm) rainfall probability (Map 7, pp.98). This is an important factor in agricultural development upon which the sugar industry depends.

Because of the very generalized and semi-or non-quantitative nature of their construction, qualitative maps are easier to draw. However, their very non-quantitative nature is in fact the principal source of their various weaknesses. As we shall see in the next paragraph, the quantitative aspects of various occurrences are often regarded as of sufficient importance to warrant the introduction of very many detailed methods to represent them on statistical maps. Despite this obvious criticism, qualitative maps are often among the most successful visual devices. Their great merit usually lies in their capability to summarize a situation. Being free from any specific code of representation, all confusing details can be eliminated, leaving only the fundamental items for the observer to notice.

QUANTITATIVE MAPS

These maps have been used to show the quantitative aspects of various occurrences. Included in such maps are the distribution of Western Kenya's manufacturing employees together with the amount of sugar produced by each sugar factory. These have been shown either by radial lines (or columns) or by proportional circles drawn according to scale and are shown, both by district and Province in the sugarzone.

Apart from the visual emphasis which this technique offers in terms of radial lines (or columns) and proportional circles, these lines and circles can be easily measured. They can also be easily segmented when necessary. For instance, in this study, radial lines showing employment figures in each factory have been divided into unskilled, semi-skilled and skilled manpower components.

2.6 RESEARCH LIMITATIONS.

An extensive area was chosen for the study and, in order to carry out effective work, alot of time was required. This, consequently, meant spending more time in the field than was originally planned and thus limiting time available for writing up the work. The time factor has therefore dictated the sample size and the kind of data which this researcher could spare for analysis.

Although parts of the Western Kenya sugar zone (particularly the Chemelil, Muhoroni and Miwani sugar complex), have a good tarmacked road network, the feeder roads in both Nyanza and Western Provinces are very poorly developed. These (feeder) roads, being dry weather loose surface roads, were usually very muddy and flooded as it was very wet throughout the research period. The situation was worse in Nyanza sugar complex, where the black clays become very sticky and impassable after heavy showers of rain. Alternatively, prolonged dry weather in some of these areas resulted in rather dusty accident-prone roads. These conditions made it very difficult to travel on such roads.

Another limiting factor was lack of public means of transport, supposed to operate on the feeder roads. Apparently, most of the public vehicles operated only on the main roads. This make i quite difficult to visit outgrower farms located far from the main roads. The problem was more serious in Mumias sugar belt, where all visits to outgrower farmers were made on foot, compared to Nyanza sugar belt where free lifts were occasionally offered by the Chemelil Sugar Company field workers. Under such difficult conditions, it was only possible to interview a limited number of farmers (mostly 10 or less) per day, thus tending to streach out the already limited time available for the research in the field.

The other main problem experienced during the field work was that of misunderstanding the purpose of the research by some informants. Occasionally, they became very suspicious and unco-operative, usually suspecting the researcher to be a Government agent. Some of them went as far as sending away the researcher and her assistants, because they had not heard over the radio that such research would be conducted in the area. Such informants deliberately refused to be interviewed until they were fully convinced that the research was genuine. Reasons for such behaviour were none other than ignorance and illiteracy in some cases.

Refusal to be interviewed was not a problem encountered among outgrower farmers only, but also among some of the management staff in some of the sugar factories. Questions concerning costs were avoided by informants from most companies, because they were not allowed to reveal such information. Such behaviour (by both out-grower farmers and the Company managers) is likely to affect the thesis, as this has made the study fall short of what had been desired by this researcher.

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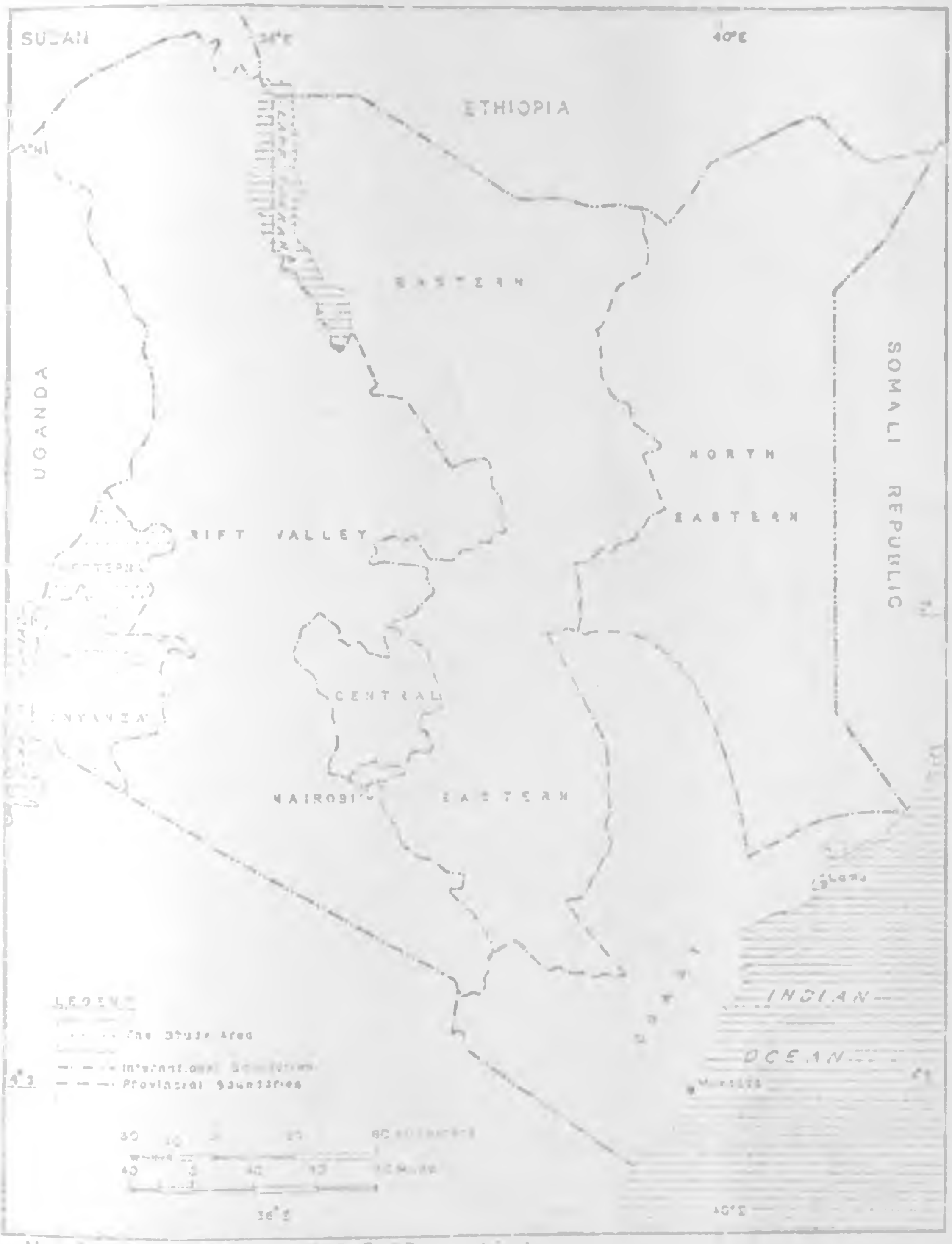
CHAPTER 3.

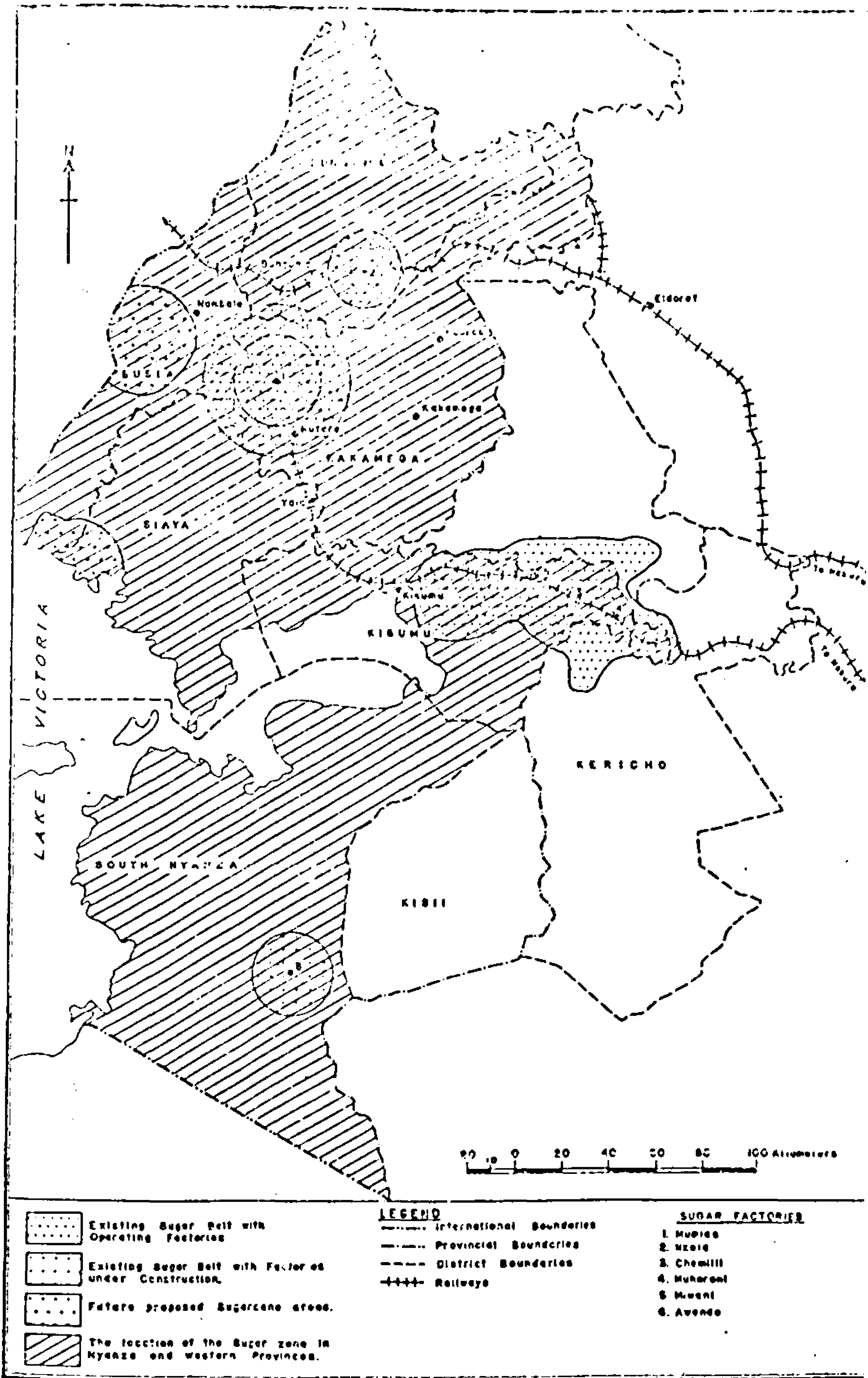
THE LOCATION OF THE WESTERN KENYA SUGAR INDUSTRY

The cultivation of sugarcane upon which the sugar industry depends, is not ubiquitous in Kenya. In fact, it is rather localized due to various locational factors (such as climatic and soil conditions) which limit the production of most of the sugarcane to the Western part of the country. Thus, the sugar industry is basically located in the Lake Victoria Basin. While an enormous area in Western Kenya (which includes, Western and Nyanza Provinces, together with the Southern parts of the Rift Valley Province, adjacent to Nyanza Province) is under commercial sugarcane production, this study only takes into account the sugar factories located in Nyanza and Western Provinces (Map 5).

Currently, the significant sugar producing districts in Western Kenya are Kisumu and Siaya in Nyanza Province, Kakamega, Busia and Bungoma in Western Province, while South Nyanza (also in Nyanza Province) is expected to start producing sugar by January 1980. The respective sugar factories now processing mill-white sugar are located at Chemelil, Muhoroni and Miwani (in Kisumu district); at Yala (in Siaya district); at Mumias and Kabras (in Kakamega district) and at Nzoia near Sudi Railway Station (in Bungoma district)(Map 6). The sugar factories located at Kabras and Yala, although mentioned above, have been excluded from the analysis (although reference



Map. 5 THE LOCATION OF THE STUDY AREA



Map 6 THE LOCATION OF THE SUGAR ZONE, SUGAR BELTS AND FACTORIES IN NYANZA AND WESTERN PROVINCES

will frequently be made to them), because the former has been closed since November 1978 up to now (May 1979) which made it impossible to get any information from there. Alternatively, no information was obtained from Yala factory, despite the visits made to it owing to complete lack of co-operation on the part of the owner.

The Chemelil, Muhoroni and Miwani Sugar factories are distance-wise very closely located, forming a sugar complex in Nyanza Province as shown in Map 6. This sugar complex is, however, located about 32KM East of Kisumu town. All the three factories lie along the railway running from Kisumu to Nairobi, with Muhoroni in the extreme eastern end and Miwani to the Western end. Chemelil Sugar factory, on the other hand, is located between the two factories. Their location along the railway is quite an advantage in relation to the transportation of sugar from the factories to other parts of the country and the procurement of the inputs (such as fertilizers, herbicides, spare parts and so on) to the factory. Similarly, Nzoia Sugar factory is located just beside the Kenya - Uganda railway through Sudi railway station. This situation at Nzoia factory is also an advantage in terms of transportation of both its inputs and outputs to and from the factory, respectively. On the other hand, the Mumias sugar factory is not located along, or close to any railway line, although it is planned that a railway line should be constructed from Butere to Bungoma through Mumias. This should further increase general accessibility in the area. All the same, Mumias is located at a nodal point, with roads running to Kakamega, Busia and Bungoma. Thus, inputs and outputs can be easily transported to and from the factory via these routes. It is mainly along the Bungoma road (which is the only tarmacked road in the Mumias Sugar Belt) that processed sugar leaves the factory to Bungoma railway station, from where it is transported to other parts of the country by rail. Similarly, most of the inputs reach the factory from Bungoma along this route. Moreover, the South Nyanza sugar factory being built at Awendo is located on the main road linking Kenya and Tanzania near the boarder between the two countries.

Unlike the Chemelil, Muhoroni and Miwani Sugar Complex, the remaining sugar factories are not very closely located, although the respective sugar belts, apart from that of South Nyanza at Awendo, are likely to touch in future, due to the expansion programme which involves the increase of both the number and size of outgrower farmers. Thus, another sugar complex is likely to be formed, resulting from the Mumias, Nzoia, Kabras and Yala sugar belts.

Of the above mentioned factories, Kabras and Yala are quite small, both producing less than 100 bags (or 10 tons) of sugar per day. The former is under the management of the Kenya Industrial Estates, while the latter is privately and personally owned. The remaining five sugar factories (that is, Chemelil, Muhoroni, Miwani, Mumias and Nzoia) are large sugar factories and are all designed for mill-white sugar at present.

Of these, Mumias sugar factory has the highest production capacity of about 2,500 bags (or 250 tons) of sugar per day, although it was initially designed to produce 3,000 bags (300 tons) of sugar per day. This factory had a sugar belt of 19,300 ha. by the end of 1978, of which the Nucleus Estate accounted for only 3,300 ha., while outgrower farmers accounted for 16,000 ha. The factory is under the management of the Bookers Company.

The Nzoia sugar factory, which is under the management of a French company,has at the moment a production capacity of about 2,000 bags (or 200 tons) per day. The factory has been designed with an initial production capacity of 50,000 tons of sugar annually, which is expected to increase with time. The Nzoia Sugarbelt is right now composed of the Nucleus Estate with 2,905 ha. and outgrower farmers with 5355 ha. The size of land occupied by outgrower farmers is also expected to increase with time, following the expansion programmes aimed at increasing sugar production in the country.

The sugar factories (such as Chemelil, Muhoroni and Miwani) in the Nyanza sugar complex are each meant to produce up to 60,000 tons of sugar annually, but are each operating much below this target figure. For instance, during 1978, Chemelil sugar factory, managed by the Bookers Company,only produced 47,429 tons of sugar which are equivalent to 150 tons of sugar per day.

This has a sugar belt of 2,225 ha, under the Nucleus Estate and 14,575 ha. under outgrower farmers. Muhoroni sugar factory, on the other hand, only produced about 42,348 tons of sugar during 1978, hence a production capacity of about 120 tons of sugar per day. Miwani only managed to produce 36,426.7 tons of sugar, resulting in a daily production capacity of only about 100 tons of sugar during that year. Muhoroni sugar factory has a Nucleus Estate of 3333.3 ha.,under the management of the Mehta Group of companies,with a total of 7,689 ha. under outgrower farmers. Miwani Sugar Mills, which is privately and personally owned by an Asian family too,has a Nucleus Estate of 3,333.3 ha. and a total of 10,000 ha. under outgrower farmers.

Apart from the above sugar plants, the factory under construction at Awendo,in South Nyanza,is among the large factories designed to produce mill-white sugar. It is expected to go into production by January 1980. Initially, the factory will produce about 60,000 tons of sugar annually, and gradually grow up to 90,000 tons a year within the next few years of its operation. The project comprises a Nucleus Estate of about 3,400 ha. to be owned and managed by the Mehta Group of companies. It is expected to have an outgrower area covering about 53,000 ha.

Over and above these factories, the two sugar factories whose feasibility studies have been completed and are ready to take off at any time, are the proposed Yala River Swamp Factory, and the Busia Factory. The former is to be located somewhere

Table 5 THE SUGAR-BELT SIZES OF THE LARGE SUGAR FACTORIES IN WESTERN KENYA (1978).

Names of Factory	Size of the Nucleus Estate (ha.)	Size of Outgrower farms (ha.)	Total number of hectarages in each sugar belt.
Mumias	3,300	16,000	19,300
Chemelil	2,225	14,575	16,800
Miwani	3,333	10,000	13,333
Muhoroni	3,333	7,689	11,022
Nzoia	2,905	5,355	8,260
South Nyanza (Awendo)	3,400	53,000	56,400*
Total	18,496	106,619	125,115

* proposed figure.

Source: field research data.

not far from Kadenge in Siaya District. It is expected to be under the management of a Dutch Company, known as the Vereenigde HVA Meats-Chappijem NV of Netherlands. According to the feasibility study report, commercial operation of this factory is due to start in 1980. Both the Siaya (Yala River Swamp) and the Busia projects are in a way interconnected as the areas they cover overlap. It is envisaged that the Yala River swamp factory will initially produce 60,000 tons of sugar.

The Busia factory, which is planned for Nambale in Busia District, will initially produce some 50,000 tons of sugar annually. The Madhavani Group of companies, who are the developers of this project, are ready to take off at any time. This (Busia) factory is part of a bigger project aimed at putting an end to the constant flooding menace that has hit the Bunyala location of the district.

Unlike other sugar factories, the proposed Busia factory would be a special one in that it will produce refined sugar for industrial purposes. It is planned that, out of the 50,000 tons of sugar it would be producing annually, 25,000 tons would be refined.

It has been stated so far, that the investigated sugar factories processing mill-white sugar in Kenya, together with those planned, are all located in the Lake Victoria Basin, mainly in Nyanza and Western Provinces. At least the location of this industry in Western Kenya is largely determined by various factors of industrial location, which is the intention of this researcher to investigate into. Chapter 4 therefore looks into these factors of location determining the pattern of the sugar industry in Western Kenya.

1. Mugo N.M. - 1979 - "A tale of continuous growth (Helping farmers to help themselves)- The Weekly Review 27th April.

CHAPTER 4

THE FACTORS INFLUENCING THE LOCATION OF SUGAR PROCESSING INDUSTRY IN WESTERN KENYA.

4:1 INTRODUCTION.

This chapter attempts to analyse, systematically,the location factors, and then proceeds to assess their importance in influencing the location of the sugar industry in Western Kenya. Through this analysis, it will be possible either to validate or reject the hypothesis that "The location of the sugar processing industry in Western Kenya is determined mainly by economic rather than the physical factors".

Although the location of a plant depends upon a combination of factors, in many cases, we find that one factor is basic or governing in the location decision. For instance, if the governing factor leaves alternative sites, the other factors which determine the location ultimately chosen are secondary. Thus,the governing factor is the most influential one in determining the location and limits the range of choice to a certain area or site.

In the following discussion, several factors of industrial location have been examined. These include, physical, social and economic factors. The physical factors studied include, climate and soils; while social factors include population distribution and density in the sugar zone, and the role played by the government in determining the location of the sugar industry in the area. Finally, specific economic factors include land, capital, labour and managerial skill, industrial raw material, transport, power, market(s), industrial cost-structure and personal considerations. We will therefore proceed to examine how each of the above factors has influenced the location of the sugar industry in Western Kenya.

4:2. PHYSICAL FACTORS.

4:2.1. CLIMATE

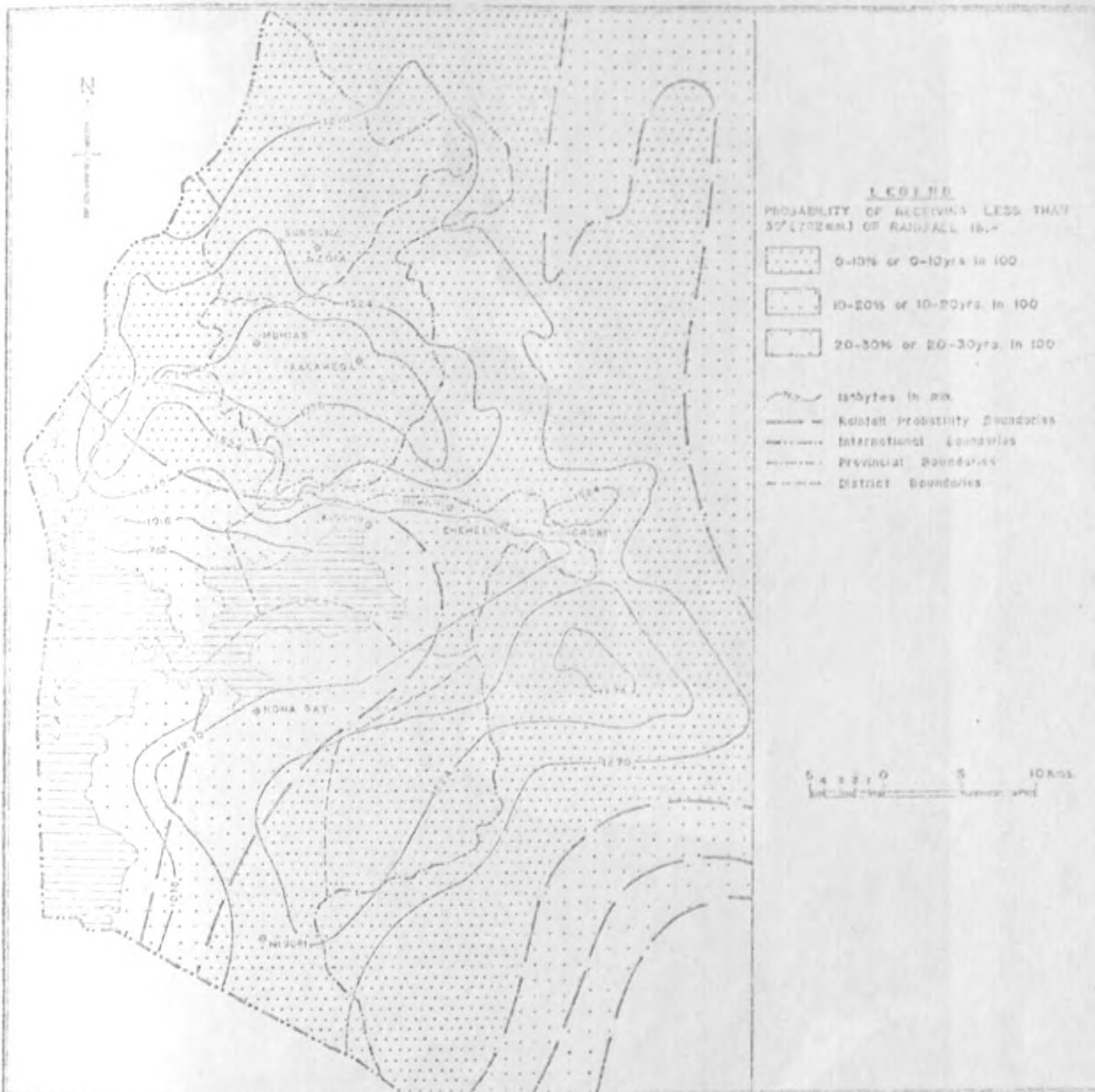
Rainfall, one of the climatic factors, plays an important role in the development of sugarcane, upon which the sugar industry depends. On the average, sugarcane requires an optimum rainfall of 1524 (60") per annum.[1] This should be evenly distributed throughout the year, in order to get better yields. Of the six sugar factories studied, only Mumias and Nzoia have a mean annual rainfall exceeding the optimum (that is 1813.8 mm and 1761.3 mm. per annum, respectively). However, the remaining four sugar factories (namely, Chemelil, Muhoroni, Miwani and Awendo), have a mean annual rainfall of less than 1524 mm. These are 1317 mm, 1341 mm and 1406.8 mm, respectively (table 8). The low rainfall experienced in the areas where the latter sugar factories are located, may therefore account for the, relatively, low sugarcane yields obtained in these areas, compared to the former. For instance, the average sugarcane yields in Mumias area are about 75 tonnes per hectare, while those of the Nyanza Sugar Belts are 40 tonnes per hectare. It should be noted

[1] Ackland J.D. (1971) East African Crops: An introduction to the production of field and plantation crops in Kenya, Tanzania and Uganda; Longman, pp. 193.

that although these quantities merely show averages, yields from individual farmers have been found to be far much higher or lower than the average (Appendix A-3a and b). As noted above, only Mumias and Nzoia receive a mean annual rainfall exceeding the optimum rainfall required for sugarcane cultivation. Alternatively, all the six sugar factories have a mean annual rainfall above 762 mm (or 30") which is the optimum requirement for crop production.

Although rainfall has been noted to be an important factor in sugarcane production, excess rain can be a problem especially if drainage is poor. Usually cane may suffer from water-logging and excessive weed growth and cane transport may become difficult. In order to avoid such problems, proper drainage is usually carried out, especially in river valleys where these problems are common, (plate: 1).

It is recognized that monthly rainfall distribution (table 6) is also important, in determining the planning and harvesting periods for sugarcane. At each of the six factories studied, there is a definite bi-modal rainfall pattern with peaks around April or May and in October or November (fig: 4). From these diagrams, it is evident that there is no month without rainfall, and this actually favours the growth of sugarcane in the area. The long rains occur between March and May, while the short rains normally come between September and November. Usually



Map 7: MEAN ANNUAL RAINFALL AND THE PROBABILITY OF OBTAINING LESS THAN 30" OR 762 mm. OF RAIN A YEAR IN THE SUGAR ZONE

Plate 1. A piece of land being drained for sugarcane plantation.

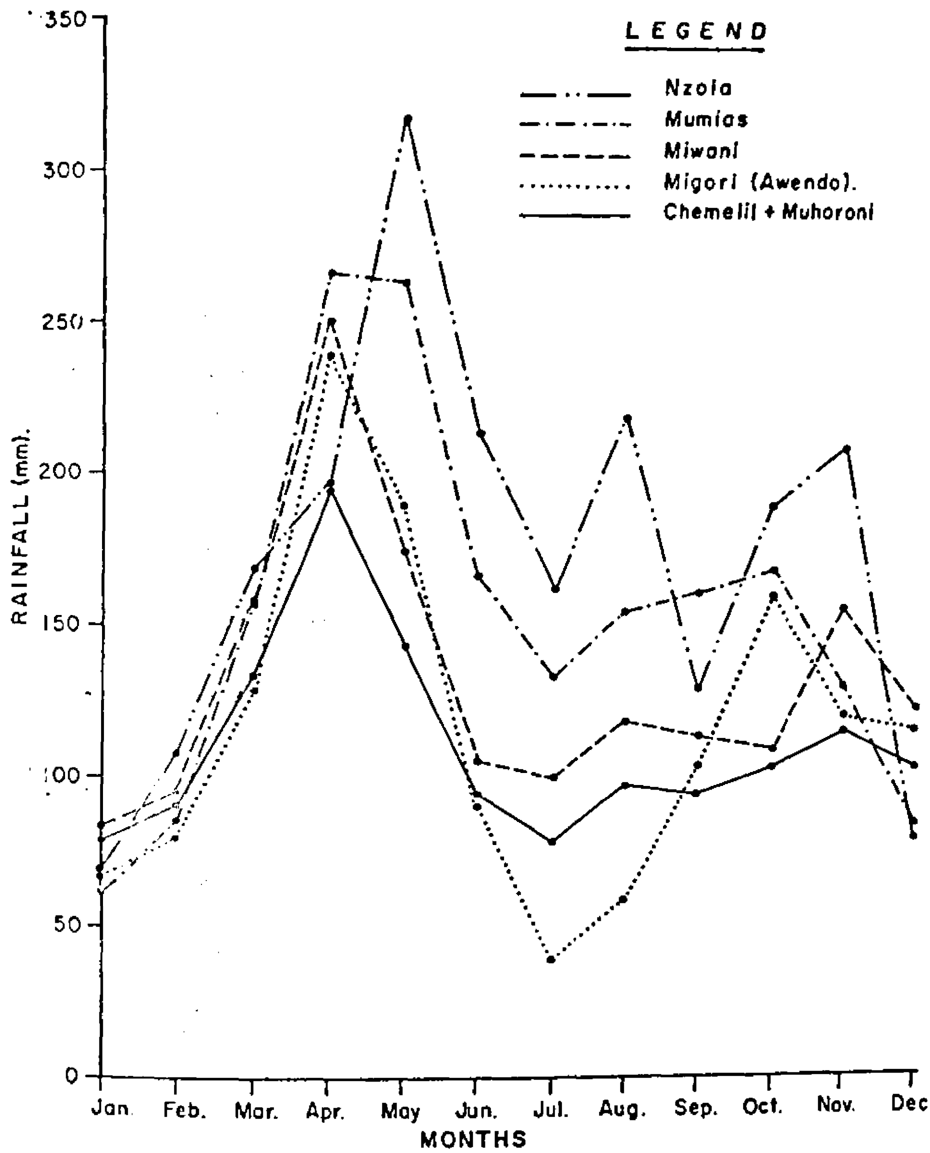


FIG. 4 MONTHLY RAINFALL DISTRIBUTION IN (MM) AT THE SIX SUGAR FACTORIES IN WESTERN KENYA

sugarcane is planted almost throughout the year with the exception of that period between December and January, when rainfall deficit is at its maximum (fig.5). Alternatively, cane harvesting does not cause serious problems as planting. For this reason, harvesting goes on throughout the year, although factories, such as Mumias close during the long rains (April-June) for factory machinery maintenance.

As noted above, 1524 of rainfall per annum is regarded as the optimum mean value for efficient sugarcane production. But it should be pointed out that the mean annual rainfall does not tell us the rainfall dispersion about it. Furthermore, it does not give the regional variations or the probability of this critical value occurring in one year. As a result of these weaknesses of the mean value, the standard deviation, coefficient of variation and rainfall probability for the six sugar factories have been calculated. The regional annual rainfall variations range from 202.95 mm to 415.74 mm and 15.4% to 23.6%, as shown by the Standard deviation and the coefficient of variation, respectively. These variations offer a good rainfall comparison between the six sugar factories (table 8). Thus the variations in sugarcane yields, as noted earlier, may be associated with these rainfall differences in the sugar zone. It may be noted that the large standard deviation values, indicate that the annual rainfall received in these stations are widely spread about the mean values (Appendix A-1a-f).

Fig5 : MONTHLY RAINFALL DEFICITS AND SURPLUSES FOR MUMIAS SUGAR FACTORY (1968-1975).

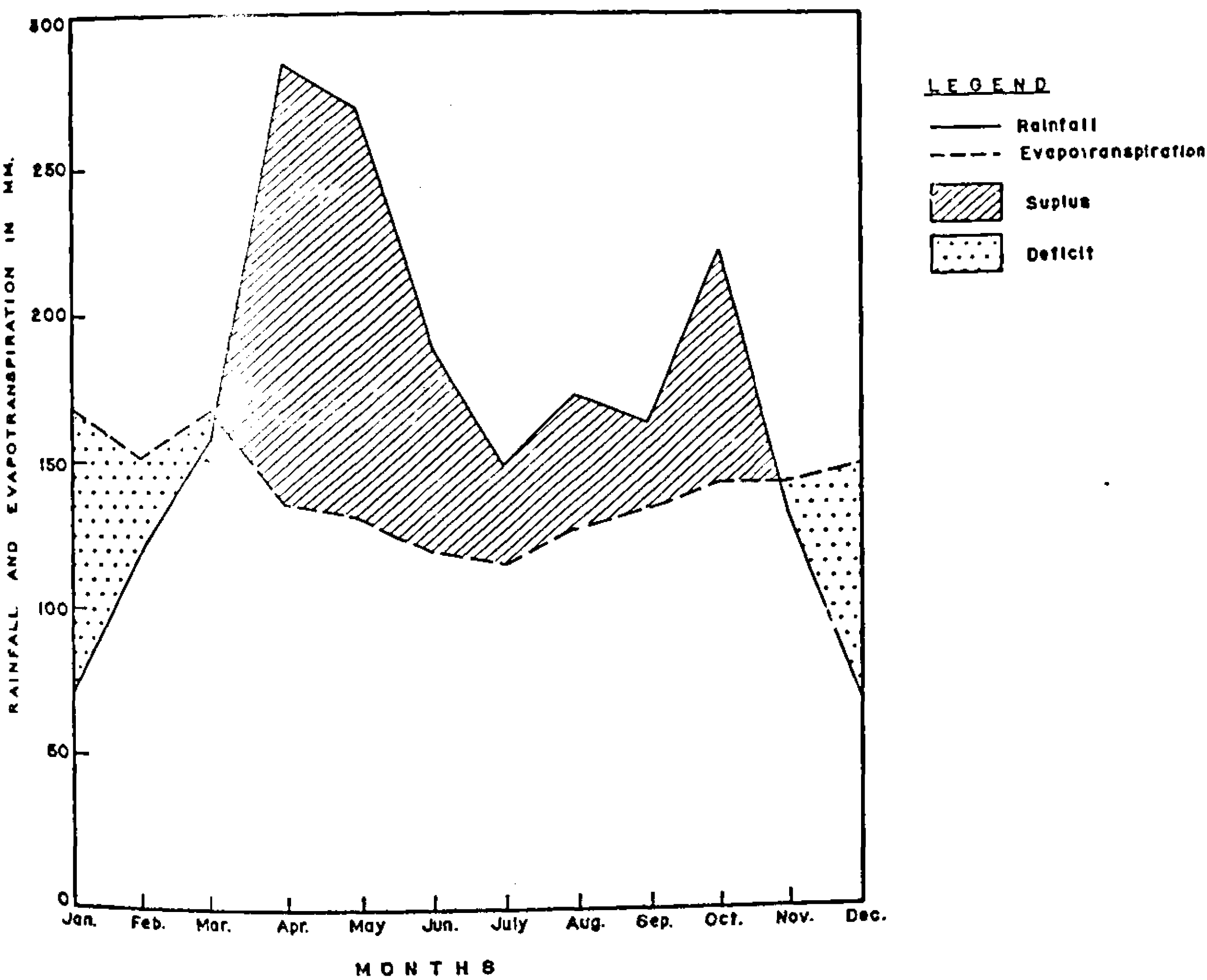


Table 6.

MONTHLY RAINFALL DISTRIBUTION IN MM AT THE SIX SUGAR FACTORIES IN WESTERN KENYA.

MONTHS	SUGAR FACTORIES AND RAINFALL IN MM					
	NZOIA FOREST (NZOIA) (16yrs)	MUMIAS (30yrs)	MIWANI (30yrs)	MIGORI (AWENDO) (30yrs)	CHEMELIL (30yrs)	MUHORONI (30yrs)
JAN.	68.8	61.5	83.7	64.2	78.2	78.2
FEB.	108.7	85.0	95.2	78.5	92.0	92.0
MAR.	169.8	156.3	158.5	129.3	133.4	133.4
APR.	195.8	265.5	249.6	238.4	194.1	194.1
MAY	316.2	262.6	174.9	189.6	142.8	142.8
JUNE	212.5	166.3	106.1	90.5	94.2	94.2
JULY	161.5	133.2	99.1	38.8	78.7	78.7
AUG.	218.3	153.4	118.0	59.7	97.0	97.0
SEPT.	129.3	160.6	112.7	104.4	94.2	94.2
OCTO.	189.0	167.2	108.1	158.1	103.1	103.1
NOV.	208.5	129.2	155.2	120.0	115.1	115.1
DEC.	78.0	84.5	122.6	115.6	102.6	102.6
TOTAL	2056.4	1825.3	1583.7	1387.1	1325.4	1325.4

SOURCE: Sugar Factory (Mumias, Miwani, Chemelil and Muhoroni)
East African Meteorology Dagoreti (Migori + Nzoia Forest).

Table 7.

MONTHLY RAINFALL DEFICITS AND SURPLUSES FOR MUMIAS SUGAR FACTORY (1968-75)

MONTHS	RAINFALL (MM)	EVAPOTRANSPIRATION (MM)	RAINFALL DEFICIT (MM)	RAINFALL SURPLUS (MM)
JAN.	73.6	167.7	94.1	
FEB.	121.7	152.2	30.5	
MAR.	155.9	166.7	10.8	
APR.	284.7	137.3		147.4
MAY	268.1	132.0		136.1
JUNE	189.6	120.8		68.8
JULY	148.9	116.3		32.6
AUG.	172.8	127.4		45.4
SEPT.	163.9	134.8		29.1
OCT.	220.6	142.5		78.1
NOV.	132.8	143.0	10.5	
DEC.	73.5	148.5	75.0	
TOTAL	2016.1	1689.2		

Source: Mumias Sugar Co. Agronomy Section Annual REport 1975.

The calculated rainfall probabilities have been used to predict the success or failure of sugarcane in the sugar zone, over a given period of time. In calculating the rainfall probability for the given critical value, the following formula has been used:-

$$d = \frac{x - \bar{x}}{\sigma}$$

where d = required value used to get the rainfall probability.

x = critical value (1524mm) of rainfall.

$\bar{x}$ = mean value of rainfall at each station,

σ = standard deviation for each station.

The probability of receiving more or less rainfall than the critical value at Mumias has been derived as follows:-

$$d = \frac{1524 - 1313.8}{296.5}$$

$$d = \frac{289.8}{296.5}$$

$$d = -0.97.$$

This 'd' value has been used in reading the probability level, by referring to the normal distribution function table.[2] Thus, the probability of obtaining more than 1524mm of rainfall per

[2] Op cit pp ..72.. No ..3..

Table 8. MEAN ANNUAL RAINFALL STANDARD DEVIATION, COEFFICIENT OF VARIATION AND PROBABILITY OF RECEIVING 1524MM OF RAINFALL PER ANNUM AT THE SUGAR FACTORIES IN WESTERN KENYA.

SUGAR FACTORY	MEAN ANNUAL RAINFALL $\bar{X}$ (MM)	SD (MM)	CV $(\frac{SD}{\bar{X}})$	CV (%)	D	P% <1524	P% >1524
Mumias	1813.8	296.50	0.163	16.3	-1.00	15.87	84.[illegible]
Nzoia	1761.3	415.47	0.236	23.6	-0.60	27.43	72.[illegible]
Awendo	1406.8	321.39	0.228	22.8	+0.40	65.54	34.[illegible]
Miwani	1341.0	221.03	0.165	16.5	+0.80	78.81	21.[illegible]
Chemelil	1317.0	202.95	0.154	15.4	+1.00	84.13	15.[illegible]
Muhoroni	1317.0	202.95	0.154	15.4	+1.00	84.13	15.[illegible]

Source: Analysis from rainfall data obtained from the sugar factories and East African Meteorological Department (E.A.M.D Dagoretti, Nairobi.

annum is 84.13% at Mumias. Similar analysis was carried out for the remaining 5 stations in the sugar zone, and the results are as shown in table 8. From this probability analysis, we can predict that sugarcane can be successfully grown at Mumias in 1 year out of 1.18 years, while this could only be done successful at Chemelil in 1 year out of 6.3 years (table 9).

Table 9

THE SUCCESS OF GROWING SUGARCANE IN THE SUGAR ZONE IN A GIVEN PERIOD OF TIME

SUGAR FACTORIES	
Mumias	1 year out of 1.18 years
Nzoia.	1 year out of 1.37 years
Awendo	1 year out of 2.90 years
Miwani	1 year out of 4.71 years
Chemelil	1 year out of 6.3 years
Muhoroni	1 year out of 6.3 years

Source: Analysis from rainfall data obtained from the sugar factories and East African Meteorological Department (E.A.M.D.) Dagoretti. Nairobi.

The tables show higher probabilities of receiving more than 1524mm of rainfall in Mumias and Nzoia sugar areas; hence a high likelihood that sugarcane cultivation will be more successful in these areas than those of Chemelil, Muhoroni, Miwani and Awendo. As a result of this, irrigation should be regarded as an important factor in sugarcane cultivation in the latter areas, since the likelihood that rain failure will occur is high.

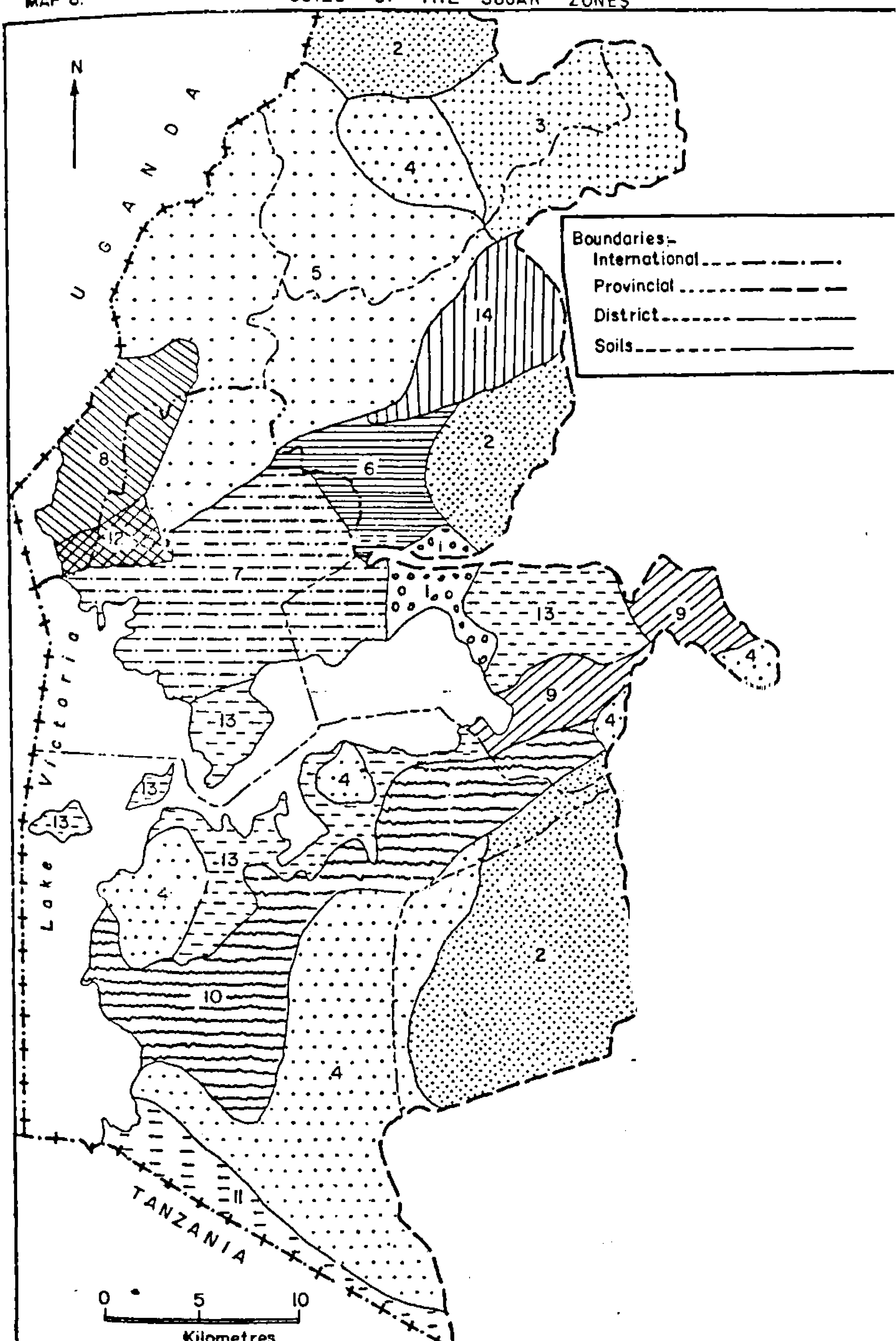
We can therefore conclude that the sugar belts located in Western Province are more suitable for sugarcane cultivation than those located in Nyanza Province.

Apart from the above climatic factor it should be noted that sugarcane cannot stand frosty conditions hence the cool to cold mountain conditions result in slow growing poor crop. It has been however realized that such frosty conditions are not experienced in the present sugar zone, thus making the area more suitable for sugarcane cultivation. Despite this, it may be noted that in Kenya sugarcane is generally grown from a few metres above sea-level at Ramisi in Coast Province, up to an altitude of about 2000m. above sea level in Nyanza and Western Provinces. As a result of the high altitude, sugarcane in Nyanza and Western Provinces matures at a later age compared to that in the Coast Province. For example, cane maturing period ranges from 22 - 24 months for plant crops and 18 - 22 months for ratoon crops in Nyanza and Western Provinces. On the other hand, it is only 12-14 months for both plant and ratoon crops at the Kenya Coast.

4:2:2 SOILS

SOIL TEXTURE: Although sugarcane may be grown on a wide variety of soil types ranging from heavy clays to light sands (Map 8), clay loams are to be preferred. However, lighter soils are better, as they have the distinct advantage of adequate natural drainage. In order to determine the different soil types found in the sugar zone, a mechanical analysis of various soil samples

MAP 8. SOILS OF THE SUGAR ZONES



Source. D.A.Obara; Cotton Production in Lake Victoria Basin of Kenya.IDS

FIG. 5a: SCATTERGRAM SHOWING THE RELATIONSHIP BETWEEN PHOSPHORUS AND SUGAR CANE YIELDS IN MUMIAS SUGAR BELT

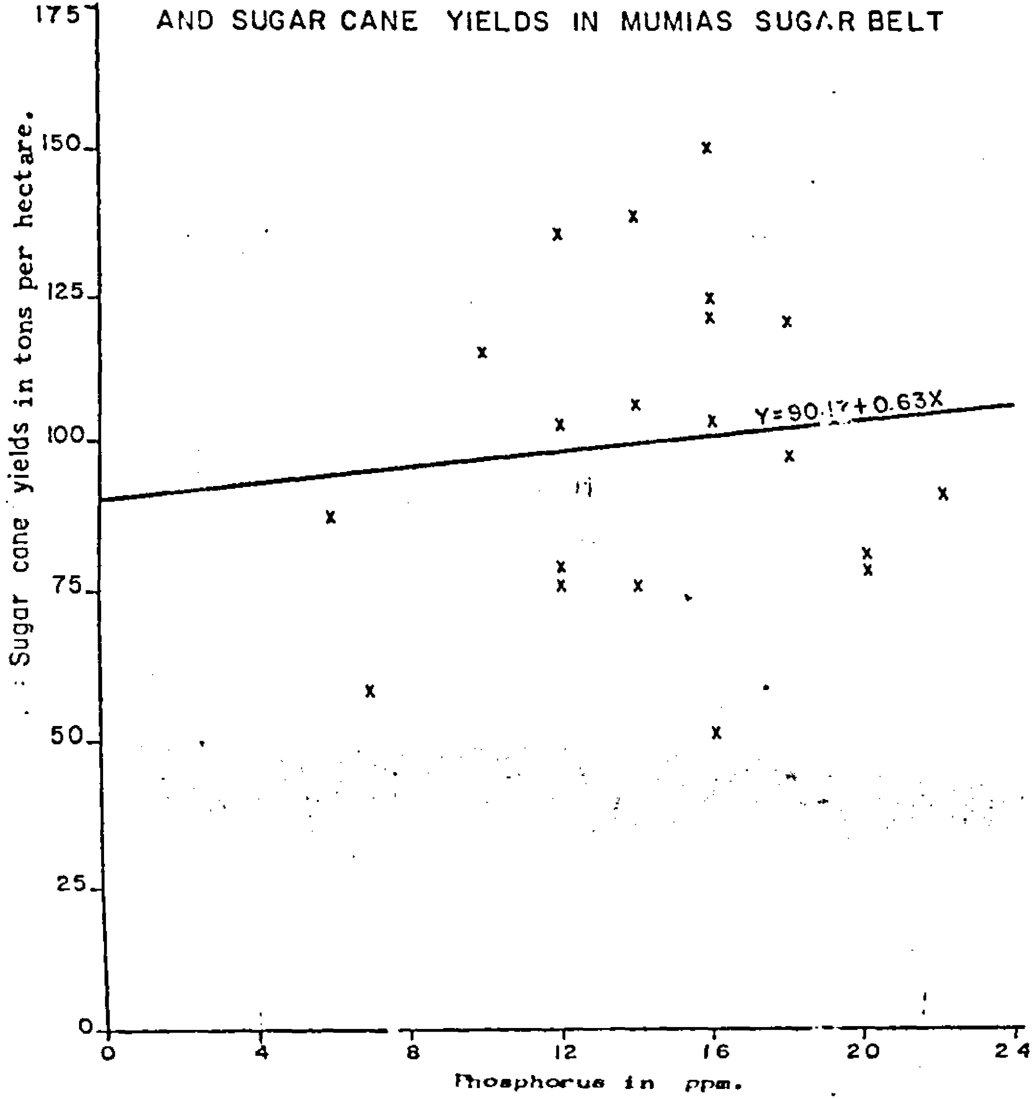


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FIG. 5b: SCATTERGRAM SHOWING THE RELATIONSHIP BETWEEN MAGNESIUM AND SUGAR CANE YIELDS IN NYANZA SUGAR BELT

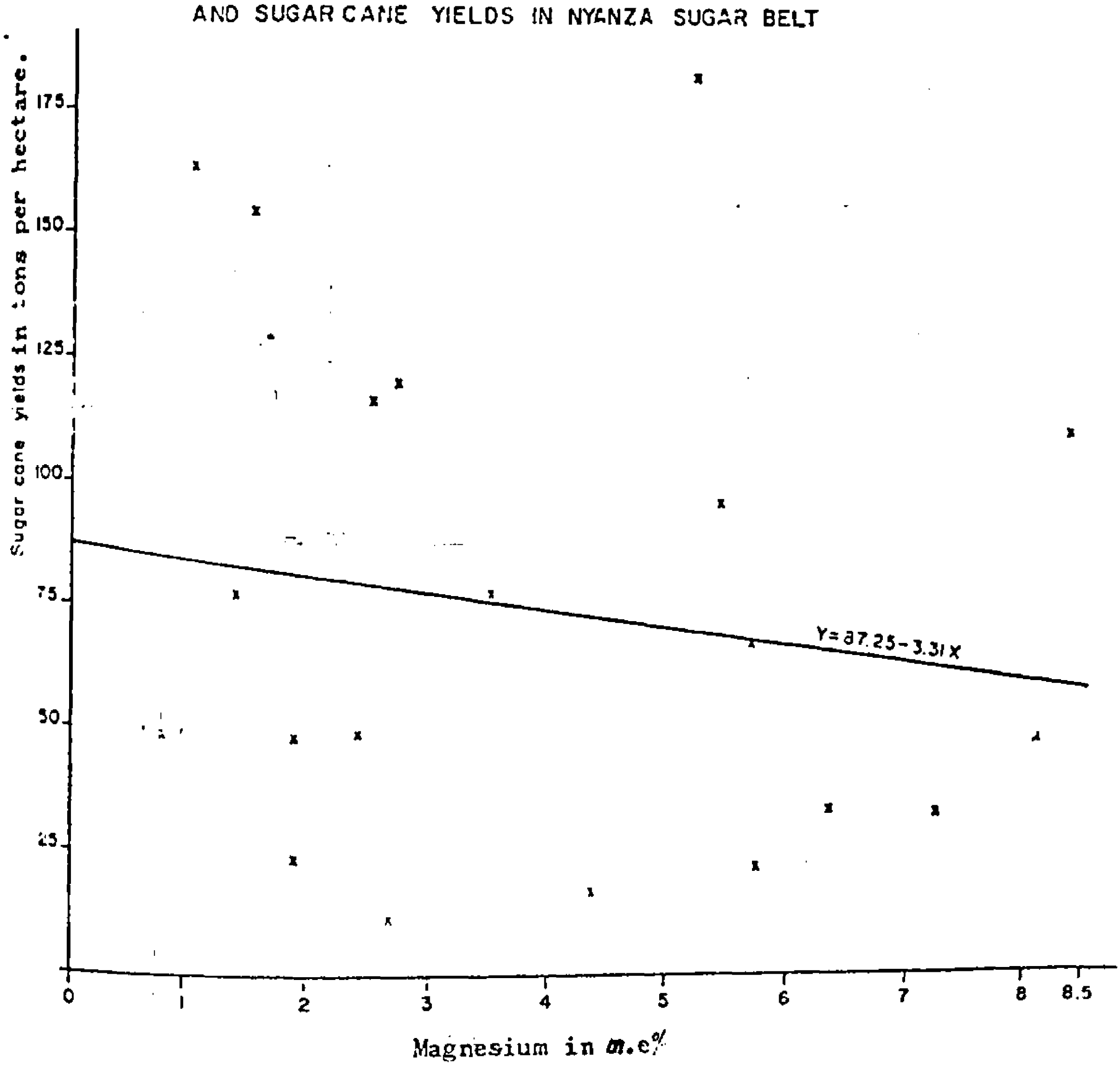


FIG. 5c: SCATTERGRAM SHOWING THE RELATIONSHIP BETWEEN POTASSIUM AND SUGAR CANE YIELDS IN MUMIAS SUGAR BELT

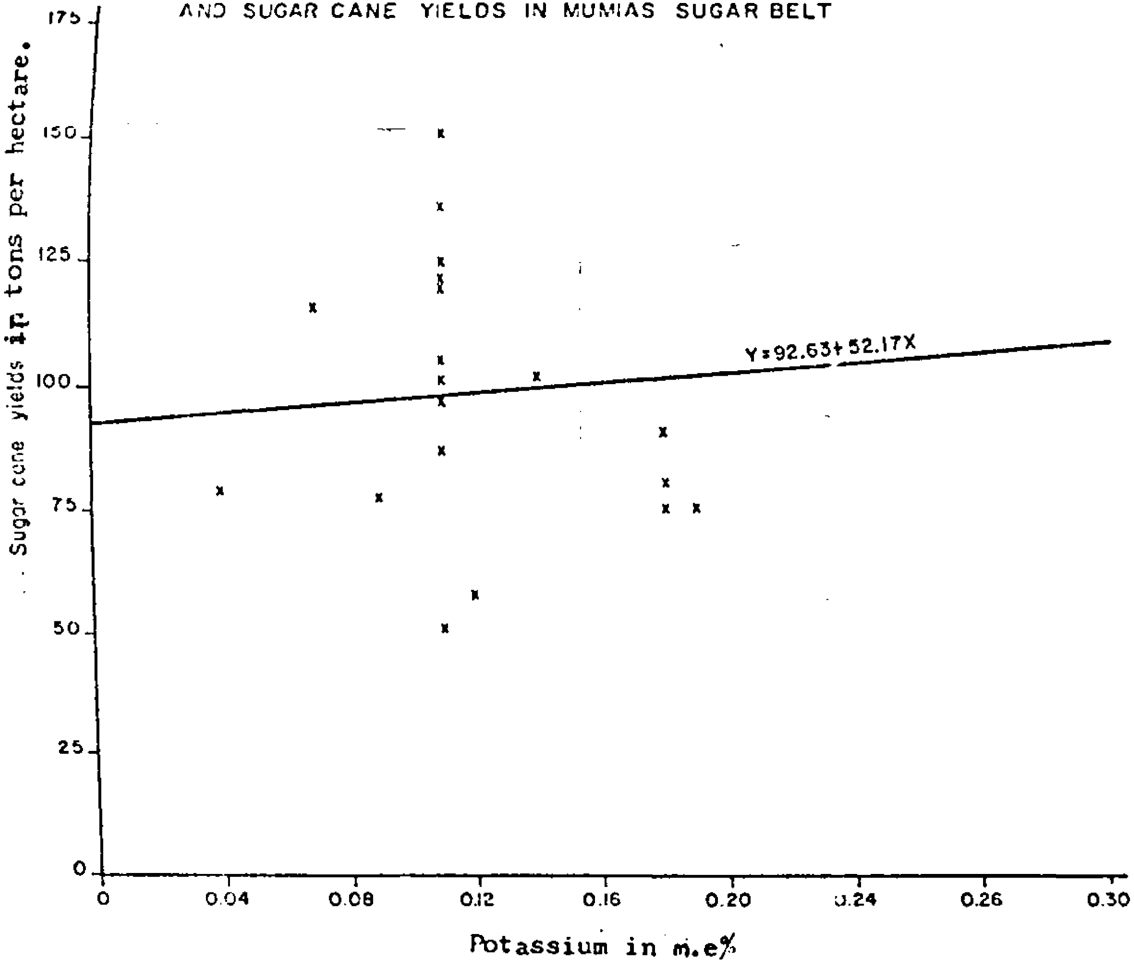


FIG.5d: SCATTERGRAM SHOWING THE RELATIONSHIP BETWEEN SODIUM AND SUGAR CANE YIELDS IN NYANZA SUGAR BELT

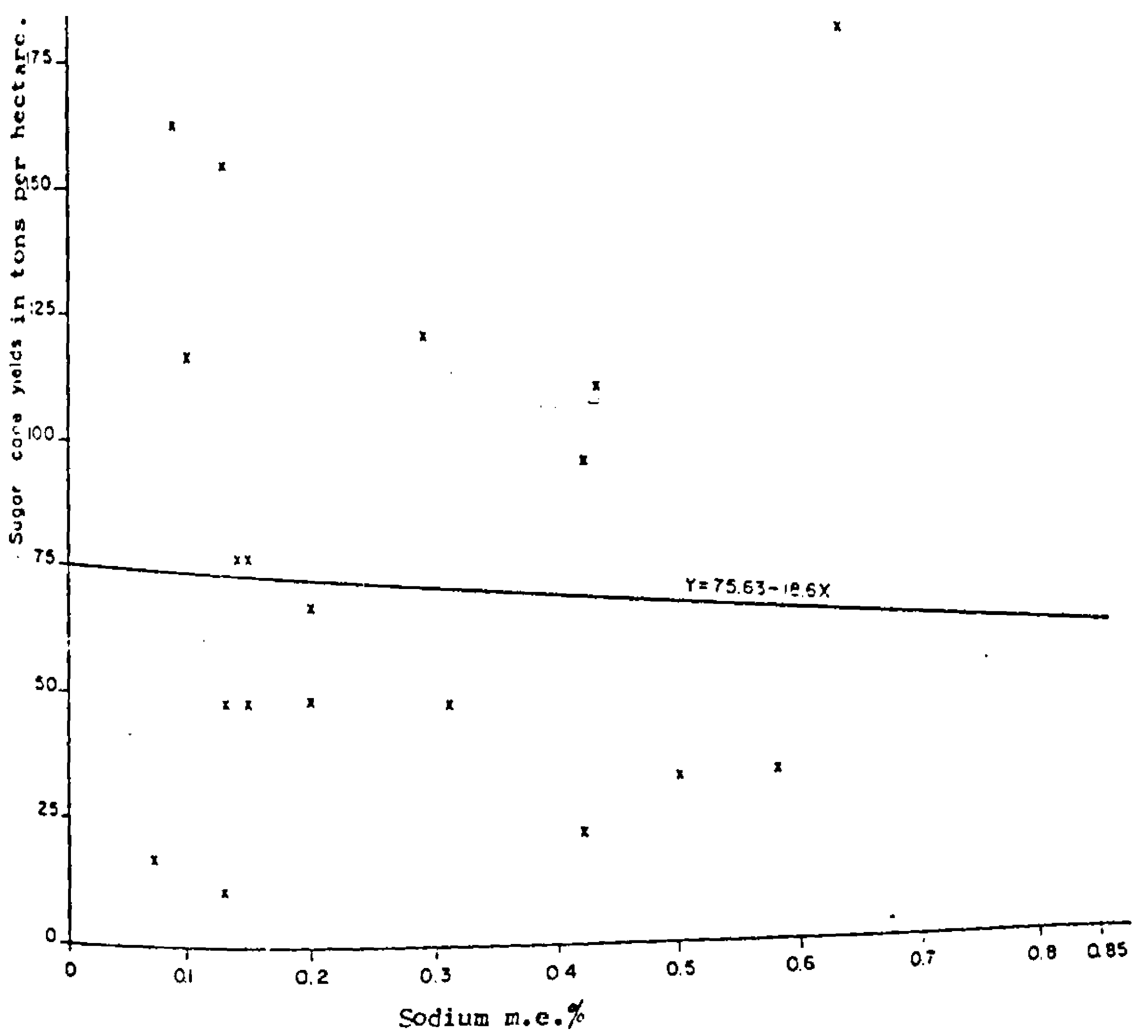


FIG.5e: SCATTERGRAM SHOWING THE RELATIONSHIP BETWEEN NITROGEN AND SUGAR CANE YIELDS IN MUMIAS SUGAR BELT

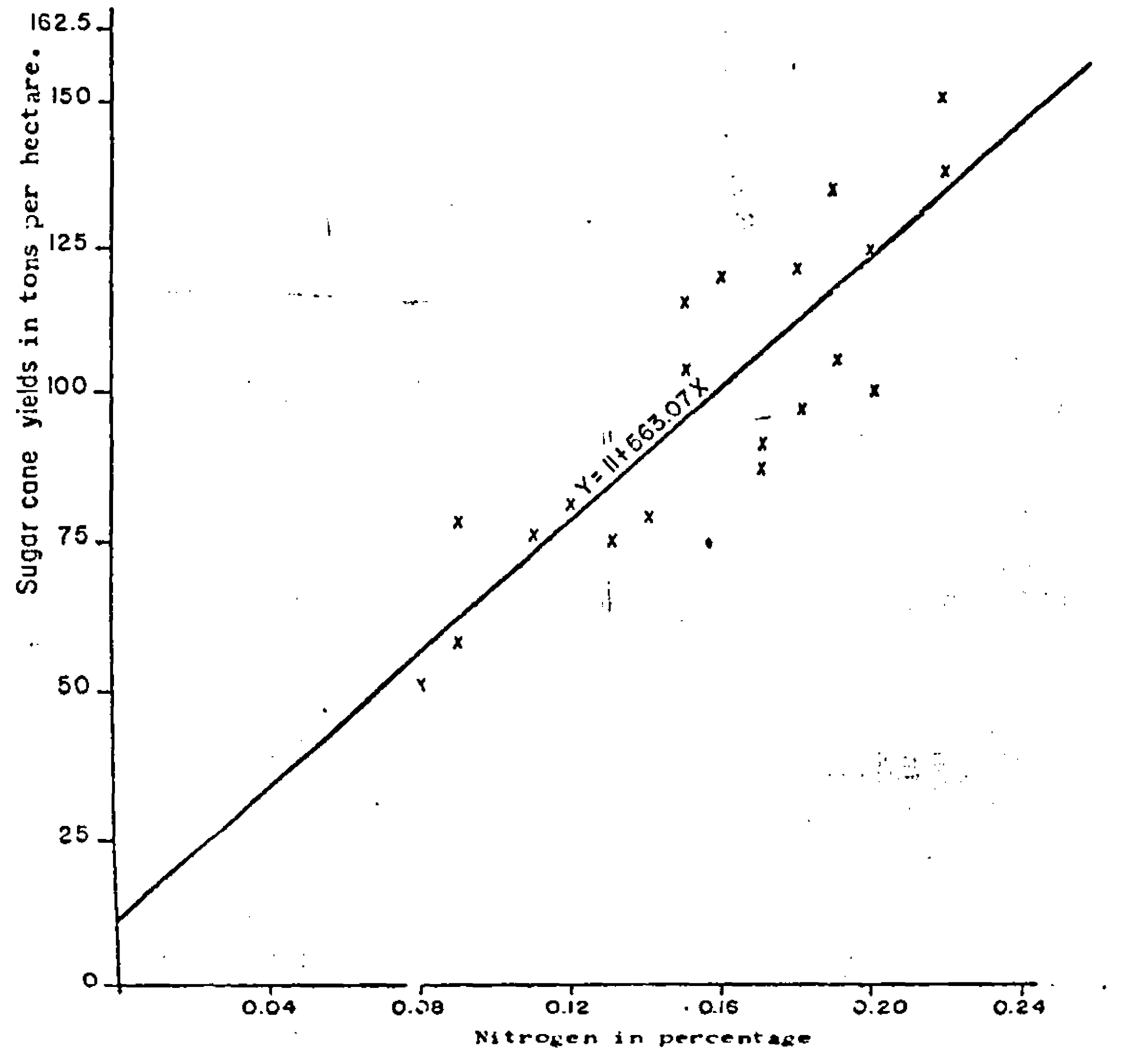
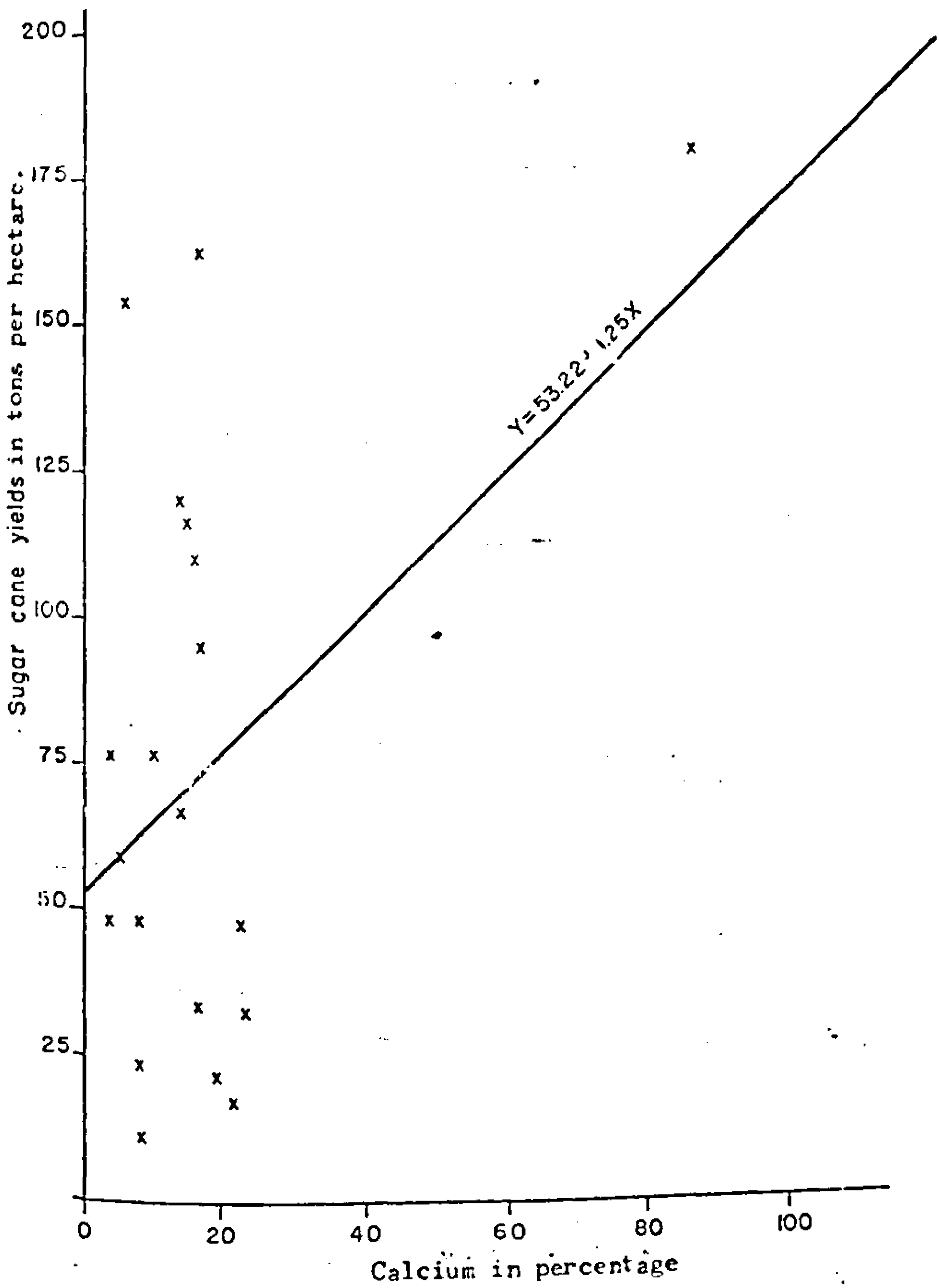


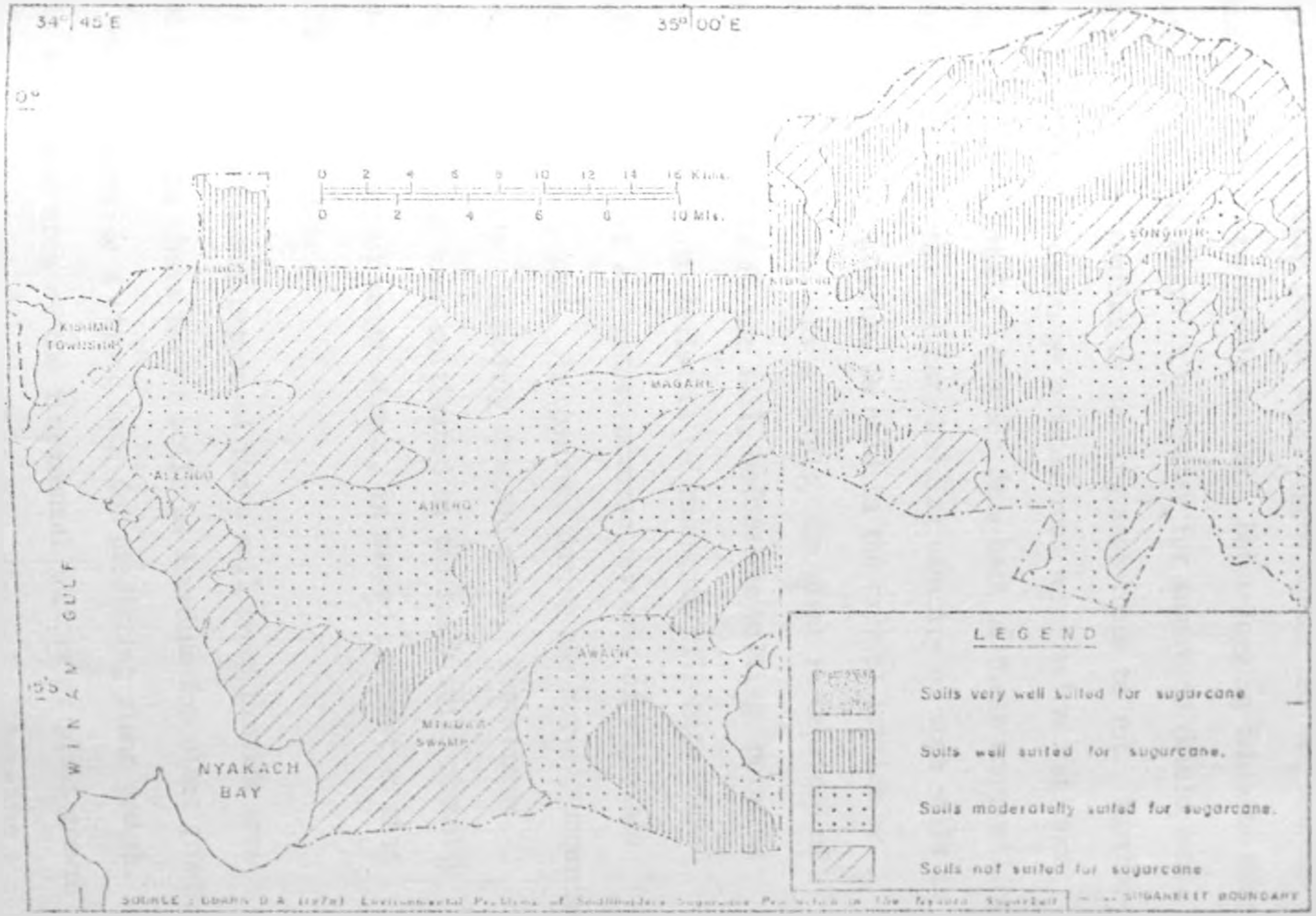
FIG.5f: SCATTERGRAM SHOWING THE RELATIONSHIP BETWEEN CALCIUM AND SUGAR CANE YIELDS IN MUMIAS SUGAR BELT



from the area was carried out. The results of the analysis are shown in the appendix A-2a + b.

The results indicate that the soils of the area are dominated by the clay fraction. Together with these, a few pockets of sandy clay loams and sandy clays also occur in the area as shown by the analysed soil results. The soils of the area therefore fall within ranges suitable for sugarcane cultivation (Map 9).

SOIL MINERALOGY. Further analysis of these soil samples has shown that although clay is the dominant soil type in the area, the Mumias clays are mainly of Kaolinite type while those of Nyanza are dominated by montmorillonites. These results closely agree with previous findings obtained in the area. The latter studies were carried out by Agronomists in Mumias area, while those of Nyanza Sugar belts were conducted by Hill, G.C. (1963). Thus, the difference between the two types of clay soils is that, the Kaolinite clay soils are easy to work, despite the low cation exchange capacity which results from bounded space between the silica alumina crystals. This limited space only makes it possible for ionic exchange to occur at the crystals' edges. These soils, therefore, tend to have poor reserves of plant nutrients, such as calcium and potassium as shown in the appendix A - 3a and b. Frequent application of fertilizers is therefore necessary. Alternatively, the black and grey montmorillonite clays of the Nyanza sugar belts, also commonly referred to as "black cotton" soils are very difficult to work. These type



MAP 9 NYANZA SUGARBELT SOIL SUITABILITY FOR SUGARCANE

of clay soils usually become waterlogged during the wet seasons because of their impermeable nature. Water-logging inhibits entry of atmospheric O_2, which is necessary for sugarcane development. This also hinders rooting by causing some roots to rot. Furthermore, this impeded drainage reduces root respiration and hence retards nutrient uptake. Another draw back of these montmorillonites is that, although the moisture holding capacity of such soils is high, most of the moisture is held in the crystal lattice by physico-chemical bonds. As a result, the plant is deprived of the available water in the soil, before the wilting point is reached. These characteristics of the montmorillonite clays explain the unusual and rather adverse features of sugarcane development in the area. As observed during the survey, sugarcane usually turns yellow in poorly drained areas. Furthermore, paradoxically, the cane cultivated on the sandy soils normally show lesser signs of water-stress, in marked contrast to that on the black clays.

Although evaluation of these soil types provide some insight into the character of soils as a medium for plant growth, it does not provide a strong base for predicting plant growth. This is because none of the fundamental factors of plant growth are measured directly. The following discussion therefore indicates other factors of the soil environment which are more likely to affect sugarcane productivity in the area.

SOIL ACIDITY

It has been observed by Obara (1976)[3] that sugarcane which grows on acid or alkaline soils tolerates a wide range of soil types, having a variation of pH from 4 to 8. However, the ideal soils for cane optimum growth should have a relatively narrow pH range of 6 - 7. The latter range is very broadly, though not closely comparable with the pH values of 5.3 - 6.7 obtained from the soils of Nyanza sugar belts. On the other hand, the pH values of 4.5 - 5.9 from Mumias sugar belt are more acidic, compared to those required for cane optimum growth, see (Appendix A - 3a and b). Although the range of acidity in Nyanza sugar belts is shown in this analysis to fall between slightly acid (pH 5.3) to near neutral (pH 6.7), other analysis, such as that conducted by Obara (1976) in Nyanza sugar belt, have indicated a range of pH 5.2 - 8.1 values. This shows that slightly alkaline soils exist in the area. On the other hand, those conducted in Mumias by Agronomists have revealed a range of pH values from 4 to 6. These results show that the Mumias soils are moderately to strongly acid, while those of the Nyanza are slightly acid to mildly alkaline. However, since sugarcane development requires more neutral soils, as shown above, the application of agricultural lime in most affected areas may increase yields. The determination of pH is therefore a vital measure of the degree of alkalinity or base saturation, salinity, acidity and neutrality which are all

[3]Obara, D.A. 1976 - Environmental Problems of Smallholder Sugarcane Production in the Nyanza Sugar Belt. MSc. Thesis, University of Nairobi. pp. 104.

important soil properties which merit consideration in sugar-cane production.

SOIL NUTRIENTS.

TABLE 10

CHEMICAL TESTS AND SOIL SAMPLES RECORDED AS DEFICIENT, SUFFICIENT AND RICH IN SOIL NUTRIENTS FOR SUGARCANE PRODUCTION.

SOIL NUTRIENTS	CLASSIFICATION OF SOIL NUTRIENTS						
	DEFFICIENT			SUFFICIENT		RICH	
	STANDARD	SAMPLE NO. OF FARMERS		STANDARD	SAMPLE NO. OF FARMERS	STANDARD	SAMPLE OF FAR[illegible] RS
		NYA-NZA	MUMI-AS		NYA-N[illegible]		NYA[illegible]
Na m.e.%	Seldom applies	0	0	0-1.99			
K m.e.%	0-0.19	0	19	0.2-1.5			
Ca m.e.%	0-1.99	0	18	2.0-10.0			
Mg m.e.%	0-0.99	1	4	1.0-3.0			
P m.e.%	0-19.99	6	17	20.0-80.[illegible]			
N %	0-0.19	15	16	0.2-1.0			

Source: Field research data.

The above illustrated results of the soil nutrients in the sugarzone indicate that the soils from Nyanza are at least well supplied with all the soil nutrients tested, except nitrogen (N), where 75% of the soil samples tested had a deficiency. On the other hand, the soil samples from Mumias sugar belt had deficiencies in all the nutrients, except Mg. In the later case, 65% of the soil samples tested had sufficient Mg. nutrient (table 10). This nutrients' deficiency in soils from Mumias area may be related to the low ionic exchange capacity which usually occurs in Kaolinite clay soils, as stated earlier.

The relationship between sugarcane yields and soil nutrients of both Nyanza and Mumias sugar belts have been statistically tested using a correlation coefficient analysis. The results indicate that the correlation between sugarcane yields and the soil nutrients Na, K,Ca, Mg, and P in both areas is insignificant (tables 11a + b). It is only between Nitrogen (N) and sugarcane yields that a significant relationship has been established. This has been further clarified through a regression analysis, Figs - 5a - f. The relationship between the two variables (Nitrogen and sugarcane yields) has been established at 99% level of probability, tested by "student's t distribution test". Furthermore, a correlation coefficient $r = 0.83$ and the coefficient of determination $r^2 = 0.70$ have been statistically determined to exist between Nitrogen and sugarcane yields in Nyanza sugar belts. This coefficient of determination indicates that 70% of the variation in sugarcane yields is explained by co-variation with the Nitrogen. Similarly, the resu from Mumias indicate a correlation coefficient $r = 0.87$ and the coefficient o determination $r^2 = 0.76$. The latter shows that 76% of the sugarcane yields in Mumias area are determined by Nitrogen. Consequently, the correlation between the sugarcane yields and either Na, K, Ca, Mg, P show no significant relationship at 99% level of probability. These analyses indicate that, of the soil nutrients tested, only Nitrogen has some significant relationship with the sugarcane yields in the area. It can therefore be noted that its deficiency in the soil is likely to result in low sugarcane yields.

Although it has been statistically proved that no significant relationship exists between the remaining soil nutrients and sugarcane yields (tables 11a + b), they have been found to be quite useful in sugarcane growth. For instance, phosphorus (P), not only promotes root growth and tillering, but also increases the height and thickness of the cane, the length of the internodes and hastens ripening. Potassuim (K), on the other hand, improves juice quality by speeding up photosynthesis and movement of sugars from the leaves to storage tissues in the stalks. Thus a defficiency in phosphorus could be corrected by applying along the furrows at planting time 500 Kg/ha. single super-phosphate, while that of potassuim requires an application of 200 Kg/ha. sulphate of potash. Applying manure or compost together with the phosphate will increase its uptake. It is also essential to topdress with 400 Kg/ha calcium ammonium nitrate in three splits within three months of planting, especially where nitrogen defficiency is prevalent. At this stage, the cane plant can absorb large quantities of nitrogen which will later be used for growth. The fertilizer should be applied at the base of the cane stool.

The ratoon crop will need less phosphate since there is a residual effect from the previous application but more nitorgen and potash will be required. Therefore 250 Kg/ha. single superphosphate, 300 Kg/ha sulphate of potash and 600 Kg/ha. Calcium ammonium nitrate should be applied. Mulching the ratoon crop with cane trash will raise the soil organic matter and increase the efficiency of applied fertilizers.

4:3. SOCIAL FACTORS.

4:3:1 DEMOGRAPHIC FACTORS.

The Western Kenya sugar industry is located in one of the most densely populated parts of Kenya. For instance, the estimated Kenyan population for 1978 was 14,875,000, while that of Nyanza and Western Provinces was 4,828,000 or 32.5% of the 1978 total population of Kenya.[4] Out of this, Nyanza's total population estimate was 2,958,000 (or 19.9%), while that of Western Province was 1,870,000 (or 12.6%) of the national total population. Population distribution in the two Provinces varies, although only a slight difference occurs between the population densities. For instance, the population density for Nyanza in 1978 was 236.2 persons per Km^2; while that of Western Province was 22.7 persons per Km^2 (table 12). Despite this, a variation in population distribution and density exist

[4] Records from Central Bereau of Statistics.

Table 11a.

RESULTS OF THE SIMPLE CORRELATION ANALYSIS OF Na, K, Ca, Mg, P, N, TO SUGARCANE YIELDS IN NYANZA AND MUMIAS SUGAR BELTS

NYANZA SUGAR BELTS

Independent Variable	r	r^2	Significance 't' test at 99% level of Probability		Statistical Significance
			Observed 't' value	Tabulated 't' value	
Na	0.0468	0.002	0.199	2.31	NO
K	0.006	0.00003	0.025	2.31	NO
Ca	0.433	0.197	2.049	2.31	NO
Mg	0.178	0.032	0.767	2.31	NO
P	0.277	0.076	1.22	2.31	NO
N	0.833	0.695	7.53	2.31	YES

Table 11b.

Mumias Sugar belt

Independent Variable	r	r^2	Significance 't' test at 99% level of Probability		Statistical Significance
			Observed "t' value	tabulated 't' value	
Na	0.146	0.021	0.626	2.31	NO
K	0.100	0.010	0.426	2.31	NO
Ca	-0.068	0.005	-0.288	2.31	NO
Mg	0.010	0.0001	0.042	2.31	NO
P	0.100	0.010	0.424	2.31	NO
N	0.87	0.76	7.53	2.31	YES

Source: Analysis from results of the soil samples collected during the survey.

among the districts in Nyanza and Western Provinces. Kakamega district in Western Province has the highest population density of 311.4 persons per Km^2; followed by Kisumu district in Nyanza Province with 275.3 persons per Km^2. On the other hand Busia district in Western Province had a density of population of only 159 persons per Km^2 in 1978, and therefore had the lowest population density, as shown in the table below. With the current high population growth rate of 3.5% being experienced in the country, the population density of each district is expected to rise.

These aspects of population are examined here with special reference to labour supply and available land for sugar-cane cultivation." The establishment of the sugar factories in the area has brought about a high demand for labour," both at the factories and on outgrower farms, together with the related services (such as trade and transport) which have been developed in the area. Thus the densely populated parts of Nyanza and Western Provinces form important labour reservoirs for the sugar factories in the area. In spite of this, employment in the area, especially at the factories is not limited to the working population in Nyanza and Western Provinces, but is nationwide as explained in the next chapter. The local labour demand, not-with-standing outmigration, is still a dominant factor in the area. This may be explained in two different ways. Either the available employment opportunities offered at the sugar factories can not yet meet the demand of the working population, or most of the school leavers, who generally, do not

Table: 12.

POPULATION DISTRIBUTION AND DENSITY IN NYANZA AND WESTERN PROVINCES: 1978

PROVINCE DISTRICT	POPULATION IN'000	AREA IN KM^2	POPULATION DENSITY
South Nyanza	944	5,714	165.2
Kisii	926	2,196	421.8
Kisumu	573	2,081	275.3
Siaya	515	2,534	203.2
Total: Nyanza Province	2,958	12,525	236.2
Kakamega	1,096	3,520	311.4
Bungoma	514	3,074	167.2
Busia	260	1,629	159.0
Total: Western Province	1,870	8,223	227.4
Total: Nyanza and Western Provinces	4,828	20,748	232.7

Source: Central Bureau of Statistics: 1978.

find pleasure in working in the rural areas, are not satisfied with employment offered either at the factories or on outgrower farms. As a result of this, they usually migrate to urban areas where non-farm and better paying jobs seem to be available. These factors therefore indicate that the high population found in the area is not actually an important factor influencing the location of the sugar industry in the area.

Although the question of labour supply is considered as an insignificant factor in the location of the sugar industry in the area, it is important to point out that the high population densities in some parts of the area are likely to affect the development of the industry. This is bound to cause pressure on the available arable land. The two Provinces have been classified as "medium and high potential land available for small scale farming"[5]. However, as shown in table 12, the overall population densities range between 150 - 400 persons per Km^2. It should be noted, however, that there are localities such as Vihiga division in Kakamega district where population densities of about 800 persons per Km^2 occur. It may therefore be observed that the major problem facing the farmers in the area is that of land scarcity since the available land has to be subdivided into small holdings which cannot support both subsistence

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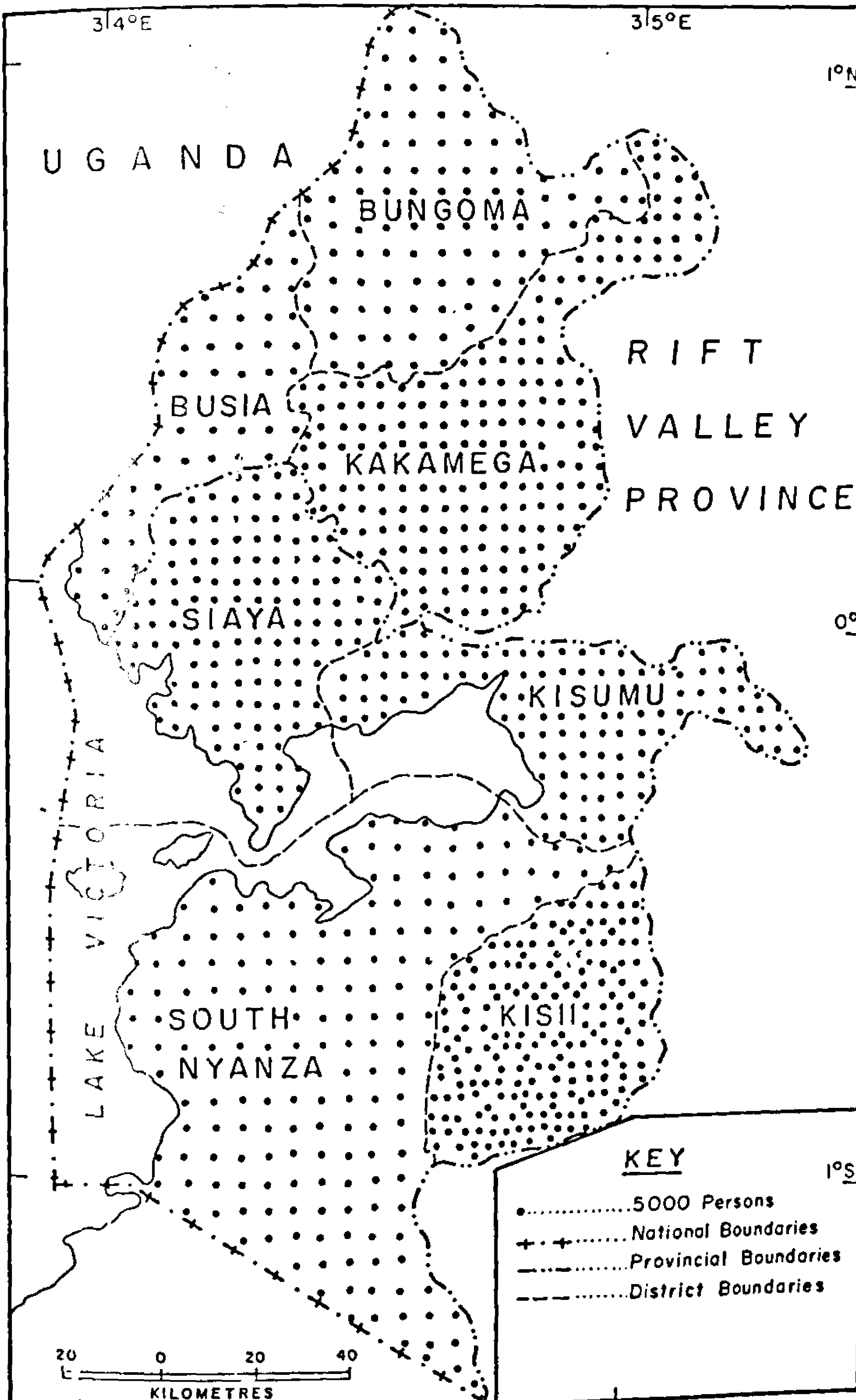
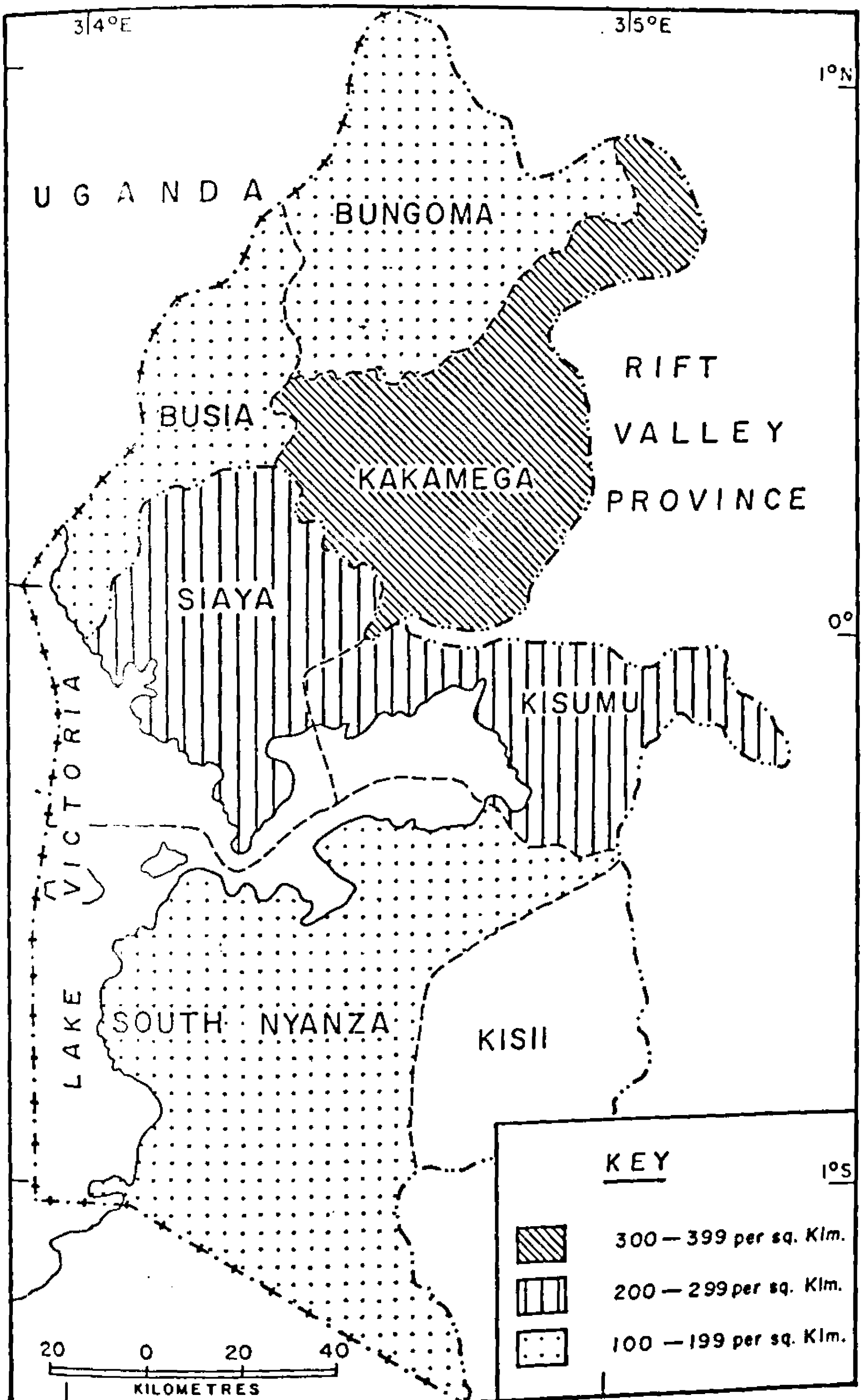
[5] Kenya: Into Second Decade;/ (1975) World Bank Country Economic Report. The John Hopkins University press Baltimore and London. pp. 454.



MAP 10 POPULATION DISTRIBUTION IN NYANZA AND WESTERN PROVINCES (1978).



MAP II POPULATION DENSITY IN THE SUGAR ZONE and commercial farming. However, sugarcane cultivation requires large plantations where mechanization can be easily applied. In view of the rapid increase in population, the existing farm holdings still have to be further divided among the individual sons in each family. This will further reduce the existing farm sizes into smaller plots which will be unsuitable for cane cultivation, hence, there is a serious problem facing future development of the sugar industry in the area.

4:3:2 THE ROLE OF THE GOVERNMENT.

The development of the sugar industry in Kenya was formerly not directly the concern of the government, but rather of private firms. It was only after independence that the government showed an interest in the sugar industry. Thus, the new factories such as those at Muhoroni, Chemelil, Mumias, Nzoia and Awendo have received considerable support from the government, hence the latter has had much say in the determination of the location of such factories. The government's influence in the location of these factories in Western Kenya has taken forms such as making the necessary land available to the foreign investors. It was discovered during the survey, that the factory premises and the Nucleus Estates which both occupy land ranging between 3,000 - 5,000 ha. are on land which has been leased by the government to the respective sugar companies. The government therefore plays an important role in providing the necessary land required for the development of the sugar industry.

The industry is heavily dependent on a good physical infrastructure, such as good farm roads and the allied transport facilities. The government has also played a very important part in establishing and developing the existing infrastructural facilities in the sugar areas. This has been a form of incentive used by the government to attract foreign investors to locate sugar factories in these areas, which have for a long time been undeveloped or underdeveloped. Moreover, all the major roads in the sugar zone were developed by the government in order to facilitate the transportation of sugarcane to and sugar from the factories. The government has also played an important role in establishing other infrastructural facilities, for instance, the provision of electricity, through arrangements with the East African Power & Lighting Co. controlled by the Government.

Through the Kenya Sugar Authority (which came into being in 1973), the government has taken further interest in developing the sugar industry. The Authority has taken positive initiative in regulating and co-ordinating the general running of the sugar industry. The Kenya Sugar Authority also monitors trends in the sugar industry, both locally and internationally. Thus, to ensure a base for future prosperity, the authority has hired services of four Phillipinos, one as an agronomist, another as a sugar technologist, a third as a planner and a fourth as a financial analyst, to advise on the general direction

The Authority also has tried to restructure the various activities pertaining to the industry, such as arranging for government assistance to farmers to improve cane yields, transport and production in general. The Authority has therefore tried to improve on production of both sugarcane and sugar, by trying to abolish the old system where the producer, the transporter and manufacturers all functioned as separate entities. As a result of this, both production and transportation are now the responsibility of the manufacturer, especially in newly established factories such as Mumias and Nzoia. Through the Kenya Sugar Authority the government has already embarked on both the rehabilitation and expansion - cum - modernization programmes.

In this way, the government has not only played an important role in determining the location of the sugar industry in Western Kenya but continues to take a great interest in its development, either directly or indirectly.

4:4: ECONOMIC FACTORS.

4:4:1 LAND

From the view point of manufacturing industry, Pearson, D.S., (1969)[6] considers land as the physical space on which industrial activity can be operated, as opposed to the qualitative aspects, such as soil fertility or the presence of mineral deposits. Alternatively, Smith, D.M. (1971) has argued that "the need for land goes far beyond simply requiring ground on which to build the factory. Land is also needed for such purposes

[6] Pearson, D.S. 1969. Industrial development in East Africa. Oxford University Press. p.81.

as the storage of materials and finished products, the parking of cars and tructs, and internal vehicular circulation."[7] The qualitative aspects of land which should be taken into consideration include, smooth levelland capable of supporting buildings and equipment. This, therefore, rules out mountainous and swampy sites. Other aspects of land which should be accounted for, according to D.M. Smith are, access to water for use in industrial processes and proximity to a river or a lake into which effluence can be deposited. In addition to this, services such as sewers, electricity supplies, and good road access should also be regarded as desirable physical attributes of land. These aspects of land, are very important in the location of the sugar industry. It was, therefore, observed during the survey that all the sugar factories are located, very close or along large rivers. For example, the Mumias sugar factory is located along the Nzoia River.

Land costs are usually higher in more industrialized areas, since this is associated with a wider range of alternative uses, such as residential and or for commercial activities. On the other hand, in non-industrialized rural areas, land is mainly valued for agricultural purposes. However, as already noted earlier, the land occupied by the respective sugar factories in Western Kenya, except that for Miwani sugar factory, is owned by the Government of Kenya. This was bought from the former residents of those areas and is now leased to the respective sugar companied by the government. Unfortunately, none of the factory proprietors was willing to reveal the financial expenditure on any aspect, although they stated that land is not considered to have any locational significance. This statement may be supported by earlier findings by Smith D.M. (1971), which indicate that "although the cost of land is often a major item in the initial expenditure involved in setting up a factory, it is insignificant in most industries when costed over along period or when rent is expressed as a proportion of total production costs."

4:4:2. CAPITAL.

Pearson, D.S. (1969) has argued that the term "capital" may be interpreted in its strict "economic sense of capital goods" or in "the financial sense of funds for investment."[8] In the latter sense it is necessary to distinguish between fixed capital (the funds required for the purchase of fixed capital goods), and working capital (the funds required to cover the expenditure on salaries, wages and input materials). Ogendo R.B.,(1972) has, however, argued that "in different parts of Kenya, capital for industrial development has a bearing on industrial location, especially when viewed in the light of the availability and cost of the capital, firstly, to organization(s) establishing the manufacturing and service industries, and secondly to the consumer and suppliers of the organization(s) locating the industries."[9] Generally speaking, the availability of capital is a relatively

[8] op cit pp 127 No.6.

[9] Op cit pp 10. No. 1.

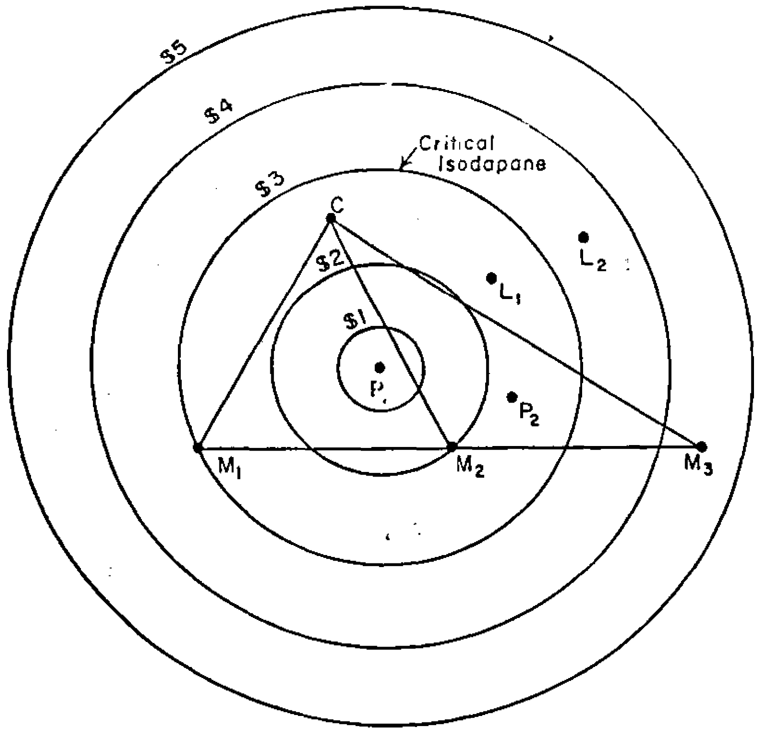
insignificant determining factor in the location decisions of the larger companies, especially those with financially strong overseas association(s). But in certain cases, such large industrial firms may be influenced indirectly in their location decisions by the availability of capital to their consumers and suppliers. As for the smaller firms, especially the local ones, the availability of loan capital is often a limiting factor in plant location, and may be even more important than the relatively high interest rates normally charged.

On the whole, the establishment of the sugar factories in the area, requires considerable capital. This has, therefore called for large financial aid from foreign investors, which has resulted in much greater participation of the Bookers Company in Mumias and Chemelil Sugar factories; the French in Nzoia; the Mehta group in Muhoroni and in Awendo, while the Miwani Sugar Company, which has been operating since the early 1920s, is personally owned by the Hindocha family. Despite this, raising the necessary capital from interested foreign investors has had no influence on the choice of the location of any of the sugar factories in the area. Availability of working capital is considered differently from the initial capital required to set up the sugar plants. This is because it fluctuates annually, and it would therefore be inconvenient for these firms to borrow and repay funds to their overseas head offices. Thus in all these cases, the running costs are catered for by the income obtained from the sugar production (table 13). Therefore, capital as a whole, has not been considered as a major determinant factor in the location of the sugar industry in Western Kenya, although it is relatively important compared to other cost factors.

4:4:3. LABOUR AND MANAGERIAL SKILL

Labour is needed to operate any industrial plant, but the amount and type required vary from industry to industry and from firm to firm. Some industries need a highly skilled labour force, some a large clerical and managerial staff and others need many unskilled manual workers. In some industries the labour input is a large cost item, while for others it may be of only minor importance. Thus, Weber, A. (1929) in his models of industrial location, argued that a place at which labour costs are relatively cheap would divert the location of the factory from the least-transport-cost location. According to him, this would take place if the saving in labour costs exceeds the additional transport costs. He illustrated the effect of cheap-labour location, by using isodapanes, or lines which can be drawn around the least-transport-cost location joining places of equal additional transport costs as shown in figure 6.[10]

10 Ibid. Smith D.M. 1971, pp.116.



$P_1 + P_2$ Least Transport Cost Locations.
$L_1 + L_2$ Sources of Cheap Labour
$M_1 + M_2 + M_3$ Source of Material Deposits
C Market.
\$1 – \$5 Transport Cost from P_1

SOURCE : SMITH D. M. (1971) — — INDUSTRIAL LOCATION FIG. 6.2, pp. 117.

FIG. 6 THE EFFECT OF A CHEAP-LABOUR LOCATION, ILLUSTRATED IN WEBER'S ISODAPANE FRAMEWORK

Table 13

INCOME AND COST EXPENDITURES FROM MUMIAS SUGAR FACTORY IN 1973 AND 1974 SHOWING ANNUAL FLUCTUATIONS.

	INCOME AND COSTS IN K(£)		FLUCTUATIONS	
	1973	1974	%INCREASE	%DECREAS
INCOME				
Sales of bagged sugar	1,468,452	4,639,715	216	
Additional cane price adjustment	-	32,000	-	
Molasses sales minus freight	29	135,428	466,893.1	
Saundry income	1,601	3,740	133.6	
Changes in stock values	79,880	35,070		56
TOTAL INCOME	1,549,962	4,345,943	212.6	
EXPENDITURES				
Excise duty	462,046	1,241,019	168.6	-
Cost of cane	340.053	1,047,310	208.0	-
Factory costs	389,584	1,135,173	191.4	-
Accommodation and Administration costs	58,443	171.311	193.1	
Personnel and training	55,610	152,145	173,6	-
General and Administration Cost	37,243	47,149	214.5	-
Interest Charges	59,741	99,564	66.7	-
Amortazation pre-operating expenditure	30,150	60,000	99.0	-
TOTAL EXPENDITURE	1,432,870	4,023,671	180.8	-
Net Profit before tax	117,092	822,272	602.2	

Source: Tate & Lyle Technical services Ltd. - Government of Kenya, Kenya sugar industry expansion study, Nyanza sugar belt improvement project May 1976. Vol.1V pp.75

As illustrated in figure 5, P_1 is the least cost location in relation to the market at C and material deposits at M_1 and M_2. The circles centred on P_1 are isodapanes, indicating how transport costs rise away from P_1 (say in shillings per unit of production). At L_1, there is a source of cheap labour, the use of which would reduce labour costs by Ksh.25 per unit of production. Since L_1 is nearer to P_1 than is the KSh.25 isodapane, a movement from P_1 to L_1 would incur less than Ksh.25 of additional transport costs. As a result of this, total costs will be lower at L_1. Weber terms the isodapane which has the same value as the savings in labour cost, the critical isodapane. Thus, if the cheap labour location is within the critical isodapane (L_1), it is a more profitable location than the least transport-cost site at P_1. Alternatively, if it is outside as at L_2 where the labour cost saving is still Ksh.25 then P_1 will remain the best location.[11]

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[11] Ibid. Smith D.M. 1971, pp.118.

However, as shown above, movement to a cheap-labour location may introduce further complications. Deposits of materials previously too far from the point of production may now be brought into use. As shown, M_3 is a deposit of the same material as is found at M_1 and it is obvious that a factory at L_1 will prefer to use M_3. A new locational triangle will therefore be formed (M_2, M_3, C) and a new transport - cost situation will arise, including a new set of isodapanes. A new least-transport-cost point (at P_2) will emerge which might be a better location than L_1.[12]

Turning our attention to the sugar industry, it may be pointed out that abundant unskilled labour is required in the sugar industry, as shown in chapter 5, table 15. One might therefore expect that the supply and cost of labour would be a significant locational factor of the sugar industry in Western Kenya. Although it was discovered during the survey that most of the unskilled labourers come from the surrounding areas, the managers interviewed said that they would obtain such labour from any part of the country. This is because of unemployment problem currently prevalent in the whole country. It has also been observed that those unskilled workers prefer working at the factory, rather than on outgrower farms in the surrounding areas. This is because of relatively higher income paid at the factory as opposed to that earned from outgrower farmers. The daily

12 Ibid Smith D.M. 1971, pp. 116.

turnover of job seekers at the factory, is therefore, quite high. Despite this, the employers at each of the factories are not indifferent to the quality of this unskilled labour available to them. Therefore, some degree of skill is necessary to any worker (irrespective of the type of work), if he is to be of use to the firm. For this reason employers are usually on the look-out for those employees who are likely to acquire a high degree of skill in the shortest possible time. On the whole, it was observed that availability of unskilled labour in the area has not played any role in determining the location of the industry in Western Kenya. Weber's least-labour-cost location assumptions explained above do not apply to the location of the sugar industry in Western Kenya, in relation to labour availability in the area.

Apart from this, the industry requires considerable managerial skill, involving systematic organization in both the proper application of capital in the sugar farms and labour supervision. Despite this, availability of managerial staff has not been considered to be a locational determinant factor of any importance. It was only considered to be secondary to more important factors such as the physical factors. This is because the managerial staff is usually imported from abroad, especially where local managerial skills are not available in Kenya. In due course, local manpower with good prospects are sent abroad for further training. Furthermore, all the sugar companies train their labour on the job, and therefore consider the larger part of their labourforce to be semi-skilled rather than skilled.

Labour turnover, also has not been considered to be of significant problem among the sugar factories. This ranged between 1-3% during 1978 in all the factories. The stability of the labourforce in the sugar industry may be related to the favourable benefits, such as free housing or house allowance, free water supply, subsidized electricity, free educational and medical facilities offered by all the sugar companies studied, to all their employees. Furthermore, those at the managerial level have extra fringe benefits such as free car allowance, life insurance, and retirement benefits. Besides these benefits, the problem of unemployment in the country does not encourage any person already employed to leave his job. It may, therefore, be noted as a conclusion that in general, neither labour supply, nor labour costs are important determinants of the location of the sugar industry in Western Kenya.

4:4:4. INDUSTRIAL RAW MATERIALS

These are mainly of two types, organic and inorganic industrial raw materials. The former are derived from agriculture, while the latter are mostly minerals. In this study, we are concerned with organic industrial raw material, namely sugarcane. This is widely grown in Western Kenya in sugar belts. These sugar belts are composed of the Nucleus Estates owned by the sugar companies and sugarcane outgrower farmers. Each sugar factory is therefore conveniently supplied by sugarcane from its own sugar belt.

The influence of sugarcane on the location of the sugar industry has been examined below with reference to transport costs.

4:4:5. TRANSPORT

Transportation determines the location of an industry through the cost of transport and the types of services offered. In those industries where differentials in transport costs outweigh differences in production costs, the tendency is towards the decentralization of such industries. Hence, the higher the cost of transfer, the greater the degree of dispersion.

Transport costs are fundamentally determined by weight transported and distance covered as shown in table: 14. The comparative cost of transporting raw materials and finished products is therefore very important because this is a major item in the total cost-structure of the industries in question. There are those industries which experience loss of weight or bulk of their raw material during the industrial process. While there are those industries which experience gain in weight during the production process. The former are usually located in areas where raw-material is produced, while the latter are located in the areas of consumption or market centres, in order to minimize transport costs. The former, are therefore, usually referred to as raw-material orientated industries, while the latter are known as market-orientated industries. "Weber clearly explains the circumstances in which an industry will be material orientated or market orientated. He introduces the "material index" of an industry, which is the proportion of the weight of localized material used to the weight of the product. A material index of greater than '1' indicates material orientation if the weight of localized materials used exceeds the weight of the finished product. But if the weight of the finished product is greater than that of the localized materials (that is a material index of less than '1'), then the industry should locate at the market."[13] Following this argument, the sugar industry should be raw material orientated as its "material index" exceeds '1', usually ranging between '8.5' and '11' in Western Kenya. As a result of this, all the sugar factories in the area are located within their respective sugar-belts, from where sugarcane can be cheaply supplied to each of the factories.

In all the sugar factories, transportation costs are paid by the farmers themselves. In factories, such as Mumias and Nzoia, the company transports the cane for the farmers and the costs incurred, depending on the distance and tonnage of cane transported, are deducted from the farmers gross income.

13 Ibid. - Smith, D.M. 1971, pp. 115.

The following transportation rates are charged according to the Kenya Sugar Authority directives.

Table:14.

SUGARCANE TRANSPORT CHARGES FROM OUTGROWER FARMS TO THE FACTORY.

Distance from the factory (in Km)	Charges (KShs./ton)
0-8	33.00
9-16	36.00
17-24	39.00
25+	41.00

Source: Field Research data.

It is important to note that beyond 32Km. from the factory, it is left to the farmer to decide whether or not it is economic to produce cane in relation to transport costs. Alternatively in factories such as Chemelil, Muhoroni and Miwani, transport facilities are limited and therefore farmers have to make their own transport arrangements. A few farmers, especially, the large-scale farmers have their own transporting vehicles, while the rest, especially the small scale farmers have to hire, either from the factories or other transporting firms in the area.

Similarly, the respective sugar companies are not responsible for transporting sugar from the factory to areas of consumption. All the sugar produced is purchased by the Ministry of Commerce and Industry which sends out directives to the sugar factories instructing them how much sugar must be sent to each station on the railway line. The cost of transport to these stations is compensated for by the Ministry. For instance, the cost of transporting 1 bag of sugar by lorry from Mumias to Bungoma railway station, by January 1979 was Ksh.1.45. From these stations, the sugar is then sold by the Ministry to the Kenya National Trading Corporation (K.N.T.C.) which, together with its sub-agents, takes care of the rest of the transportation costs.

It is clear that neither the transport of raw material to the factory, nor that of the sugar from the factory to centres of consumption are responsibilities of the sugar producing companies. Thus, transport costs are not a major determinant factor to each factory located in the area, although these have to be taken into consideration.

An important factor which should be taken into account is that the sugar industry is heavily dependent on good farm roads and the allied transport facilities. These should therefore be properly co-ordinated with country-wide market links, especially in terms of the major consumption points, usually the principal urban centres. As noted earlier, most of the sugar factories, if not all, are located a long or very close to the railway system (map 6). This facilitates the transportation, not only of sugar from the factories to various parts of the country, but also the transportation of the necessary inputs, such as fertilizers, to the factory. Furthermore, a well constructed feeder road network is essential in the transportation of cane to the factory. Similar findings have been made by earlier writers who have indicated that transport costs are reduced due to a well developed transportation network. For example, Nixson (1973) has pointed out that "In the Western industrialized countries, transport costs have been of decreasing importance for the past 30 years, due to both the development of road transport (which has reduced the relative cost of moving high value goods) and charges in the nature of products.[10] Despite this, it was observed during the survey that the road network is quite underdeveloped in certain parts of the sugar-zone. For example, in Nyanza, the feeder roads are still in very poor state, as their development and maintenance are the farmer's responsibility. As a result, farmers in these areas experience a lot of problems when transporting their cane along these roads. Alternatively, feeder roads in Mumias sugar belt are relatively better developed, although parts of the major roads are also in very poor condition(s).

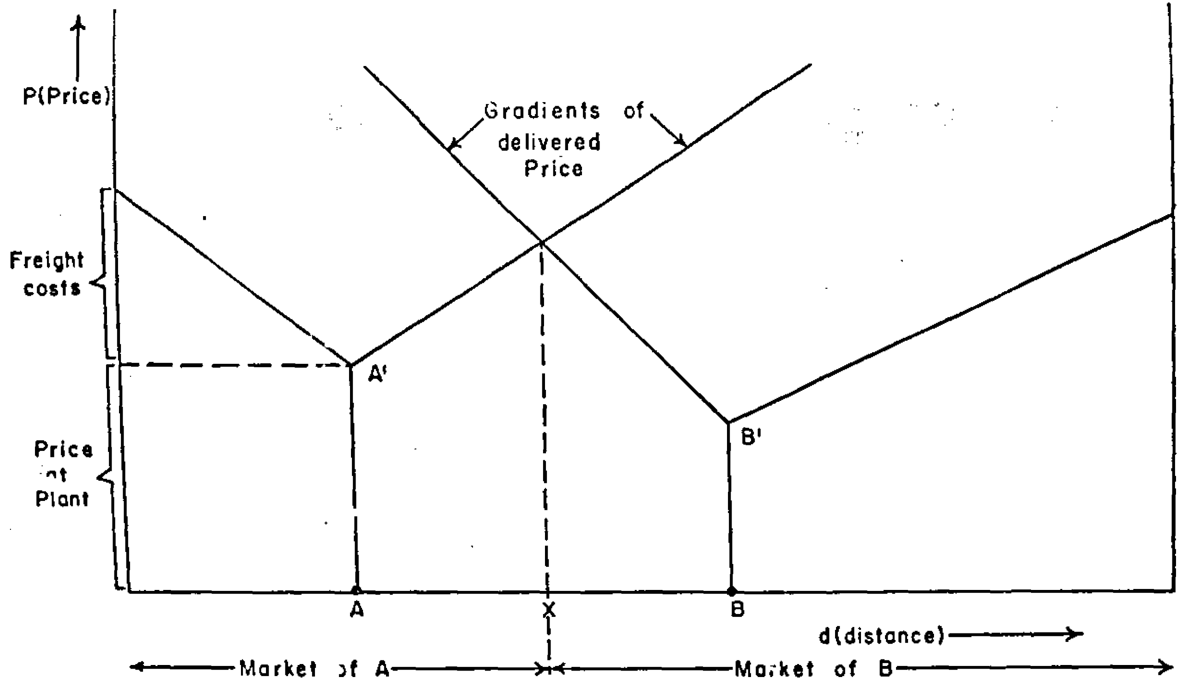
4:4:6. MARKET ATTRACTION

The transport cost of the finished products and marketing are closely associated, and therefore, any industry whose product(s) gain weight during the manufacturing process is usually located in the market area. On the other hand, as stated

[10] Op cit. pp. 19. No. 2

in the previous section on "transportation", the sugar industry does not fall in this category. This is because the weight of the raw material is far much higher than that of the final product. It is therefore a raw-material-orientated industry.

Secondly, the market, as a factor affecting the location of industries has been examined in terms of competition from two or more firms producing the same product. This is a theme which has been largely dealt with by early writers, such as Palander, T. (1935); Hoover, E.M., (1937) and Losch, A. (1954) in their theories of industrial location. They argued that the delivered price to any buyer will be the cost of the extraction plus transport costs from the firm. Thus, the buyer; will obtain the commodity from the source that offers the lowest delivered price, as illustrated in fig. 7 due to poor organization in the transportation of sugar. Looking at it from this point of view, better organization in sugar transportation, especially to the rural areas should increase the rate of sugar consumption in the country, hence need for high factory sugar output and therefore need for higher cane output.



SOURCE: SMITH. D.M. (1971). INDUSTRIAL LOCATION. WILEY. — pp 120. fig. 8.4
(from Palander, 1935, pp. 224. fig. 39).

FIG. 7 DERIVATION OF A BOUNDARY BETWEEN THE MARKET AREAS OF TWO COMPETING FIRMS

4:4:7. POWER

The major sources of power in the country are wood fuel, direct water power, mineral oil fuels and electricity. However, the major source of power at the sugar factories is bagasse, a by-product of the sugar industry. Once the juice has been extracted from the cane, the cane fibre is usually left behind and this waste is burnt at the factory to produce the necessary steam power used in sugar processing. This is usually subsidized by power from the companies' private generators, using diesel. Furthermore, the power used for domestic purposes at the factory residential areas is mainly electricity from East African Power and Lighting. The residents are usually charged at half-rates, and the rest is paid by the sugar companies. Therefore, when questioned whether power is an important determinant factor in the location of the sugar industry in the area, the factory managers interviewed, said it was insignificant. It should, however, be noted that what is stated as insignificant is only the cost of power from the East African Power and Lighting, which is more than subsidized by the power produced from bagasse. The sole use of power from East African Power and Lighting, both at the factory and residential areas, would definitely result in high power cost charges.

4:4:8. TAXATION.

Governments of newly independent countries experiencing high demands for increased services which they cannot possibly meet from their limited resources, have been granting short-period tax exemption or tax reduction in order to attract foreign investment. However, if a firm encounters great losses, it should only be taxed on profits, when these have been fully recovered. On the other hand, if a firm is able to make profits from the first year of its production, then there is no point why it should not be taxed as the realized profit alone is a sufficient attraction to other investors. The government should also share the benefits of this development.

Of the sugar factories located in Western Kenya, only the newly established ones, such as Mumias and Nzoia have been exempted from paying tax for a period of two years. This is actually a form of incentive, recently set up by the government to attract foreign investors into the country. Apart from these two factories, none of the remaining sugar companies stated that they had been on tax - holiday. These include factories, such as, Chemelil, Muhoroni and Miwani, established before the tax-holiday act. All the same, it was clearly indicated that the totol taxation costs are quite insignificant, compared to other production costs, and therefore cannot in any way be considered as a locational factor.

4:4:9. PERSONAL CONSIDERATION(S)

Personal consideration factors may influence industrial location by indirectly affecting cost, or by partially determining demand, or on the basis of purely personal consideration(s). An entrepreneur may therefore seek a location near to a particular raw material supplier or banker because he believes or knows that friendship will influence the availability of materials or funds.

From the personal consideration(s) viewpoint, only one of the sugar factories in Western Kenya may be considered to be partly located in its present locality because of personal consideration. This is Miwani sugar factory, which is privately owned by Hindocha family. This family initially lived in Kisumu town, trading in jaggery. These Asians, however, discovered that the land east of Kisumu, in Miwani area was suitable for sugarcane cultivation. Following this discovery, a decision was made, and a mill-white sugar factory was located at Miwani, to utilize the sugarcane grown in the area. Such a decision may have been encouraged by the friendly connections the Hindocha family might have established with bank-owners and other related institutions in Kisumu. From these connections, financial and other necessary assistance would be made available to the Hindocha family. The attraction of home environment may therefore be considered to have had considerable influence in the location of the sugar industry at Miwani.

4:4:10. COST-STRUCTURE

The cost-structure analysis of industries originates from Rawstron's (1958) formulation of the principle of "economic restriction"[11] "The cost-structure approach in industrial location embodies the concept of spatial margins" or "profitability" where costs become too great for industries to be economically viable. Rawstron, in his analysis, considers expenditure on labour, materials, land, marketing and capital as components of a firm's cost structure. Unlike most writers he does not identify transport as a separate cost factor, but views it as "contributing to spatial variations in the cost of other items". Expenditure on each component will vary from place to place and the sum of the costs arising from the choice of location is termed as the "Locational cost". This spatial variations in production costs usually impose limits or margins to the areas where viable operation is possible These margins usually arise from variations in total costs, although they may also reflect the cost of one component. Despite these indications, it is necessary to point out that these variations in cost-structure at different locations can only be detected after the plant has been in operation for sometime. For this reason, cost-structu cannot be considered as a location factor of that particular firm in the initial development stages. This is, however, a useful indicator to future investors, interested in establishing a firm at different locatio The cost-structure of a firm at different locations will therefore illustrate the most economically viable location. Thus entrepreneurs will tend to locate their firms in areas where they are sure to make more profit and meet less costs.

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[11] Rawstron E.M. (1958). "Three Principles of Industrial location" Transactions and papers IBG, Vol.25,pp.132-142.

The above discussed cost-structure has not been found useful in this study. This is because of the profit maximization motive of these sugar companies, which has resulted in mere exploitation of the farmers in the area. In actual industrial location theory, all the factory expenditures are supposed to be met by the investors so that a true picture of the operational costs are revealed. However in this case, cost-structure components, such as land transport and marketing are entirely the responsibility of the outgrower farmers themselves and the government. Furthermore most of the industrial power is produced from bagasse, a by-product of the sugar industry. Similarly, most of the labour constitutes the low paid unskilled workers. As a result of these exploitations the sugar companies only experience minimal operational costs, especially where they are highly subsidized. These therefore distort the true picture of the cost-structure that would have been expected to exist in the sugar industry.

4:5. SUMMARY.

So far, this chapter has attempted to examine the physical, social and economic factors, likely to affect the location of the sugar industry in Western Kenya. With reference to physical factors, variations have been noted in the distribution of rainfall in the sugar zone. This has tended to affect sugarcane production in the area. It has also been observed that the chances of receiving the optimum rainfall required for sugarcane production are higher at Mumias and Nzoia sugar factories than at Chemelil, Muhoroni, Miwani and Awendo. This factor may also be considered to account for better yields obtained in the former than the latter factories. In relation to soils, very low correlation coefficients were found to exist between sugarcane yields and soil nutrients in both areas. The only exception was found to exist between Nitrogen and sugarcane yields, where a high positive correlation was statistically established. In relation to this statistical analysis between the yields and the above mentioned variables, it is necessary to point out that the sugarcane yields used in the analyses were obtained from secondary sources, which are liable to errors. This would possibly result in the low correlation coefficients obtained from the analyses for nutrients other nitrogen.

Despite the low correlation coefficients established statistically, it was clearly indicated by the factory representatives interviewed during the survey that rainfall is the most important factor, which has influenced the location of the industry in the area. Although the rainfall received at Chemelil, Muhoroni and Miwani is below the optimum level required for sugarcane development, the sugar factories located in these areas have not yet experienced very serious droughts which have completely retarded the growth of sugarcane. This rainfall factor, accompanied by higher temperatures and varied types of clay soils found in the area have influenced the location of the sugar factories, and still continues to attract more factories (such as those to be located at Yala River Swamp and at Busia) in the area.

Social and economic factors have been considered by the sugar companies to have had little influence in the location of the sugar industry in the area. This is because most of these factors, if not all, can be obtained or be made available, anywhere in the country. Of the cost factors studied, only capital has been considered to be of some significant in the development of the sugar industry, although it was not considered as a determinant factor. It may be noted that although the cost factors have been considered as insignificant in the location of the sugar industry in the area, all the sugar companies are highly subsidized either by the farmers or by the government. For this reason, cost factors do not apparently play an important role in the development of the sugar industry.

In any industrial development, the investors are expected to meet all their operational costs, but in this study, the alternative has been discovered. For instance, while the respective sugar companies are expected to transport their own raw-material (sugarcane) to the factories, it is the farmers themselves who are responsible for their own transportation costs. These include the transportation of sugarcane to the factories and inputs such as fertilizers, cane seeds, pesticides and herbicides to the farms. This may be considered as mere exploitation of the farmers because in actual sense, the development of an industry in such underdeveloped or undeveloped areas is supposed to assist the farmers in raising their income, and hence the overall development of the surrounding areas. On the other hand, such exploitation does not only reduce the farmers income from the cane, but also results in slow development of the areas within which these sugar factories are located.

Likewise, the transportation of sugar to the market is not a responsibility of sugar companies, but of the government. In this case, the companies are not only saved from distribution costs but the market is also made available right at the factory. The normal market competition outlined in the location theory does not, therefore apply in this study.

Similarly, power costs have also been considered to be insignificant because most of the industrial power utilized at the sugar factories is produced from bagasse, a by-product of the sugar industry. The only power costs encountered by each sugar company are those from East African Power and Lighting, used at the factory residential areas. However, part of these power costs are usually paid by the factory residents themselves. It should therefore be noted that power costs would definitely be of some significance, if all the power used by each of the sugar companies were obtained from East African Power and Lighting or private generators where the sugar companies had to meet the costs. The use of power from other alternative sources would release bagasse for other uses such as the development of anxillary industries utilizing this by-product as their raw material. These would be beneficial to the people from the surrounding areas, as such industries would not only provide more employment opportunities in the area, but would also utilize the cane, usually rejected at the factory.

With reference to labour costs, most of the factory employees from the surrounding areas are unskilled workers whose monthly income range between KShs.350 - 450. On the other hand, the highly paid manpower is usually from abroad, especially in newly established factories. For this reason, most of the money from the industry is repatriated back to the company's mother land. In a sence, this is mere exploitation of the people from the surrounding areas, since very little money (in terms of wages and salaries) from the sugar factories finds its way into the surrounding rural areas.

From this summary, it has been observed that economic factors of industrial location explained above deviate from those formulated in the classic theories of industrial location. This is due to the exploitive nature of the sugar companies, where most of the operation costs (as explained above) are either paid by the farmers or the government. As a result of these distortions, economic factors have been found to have little or no influence in the location of the sugar industry in the area. We may therefore, comply with our findings that the location of the sugar industry in the area is determined, mainly by physical rather than economic factors, although the normal operation of the cost - structure would have possibly resulted in a different conclusion. From these findings, the hypothesis that "The location of the sugar processing industry in Western Kenya is determined mainly by economic rather than physical factors" has been discarded.

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CHAPTER 5

THE ROLE OF THE WESTERN KENYA SUGAR INDUSTRY IN THE KENYAN ECONOMY

5:1 INTRODUCTION

This chapter aims at testing the hypothesis that "The industry is beneficial not only to Western Kenya, but also to the Kenyan Nation as a whole". The major points for discussion therefore include employment opportunities arising from the Western Kenya sugar industry, and the production of sugar in Western Kenya. These are to be looked at, both, on a regional and national bases. Regionally, the sugar factories being raw material orientated, are located within the areas of sugarcane production. Thus, employment opportunities are created in areas where they have been non-existent. Furthermore, this employment opportunities have also been found to be nationwide, since employment at the factory is not only restricted to the surrounding areas. Moreover, the sugar produced from the factories located in Western Kenya is not only consumed within the areas of production, but it is distributed all over the country. From these points of view, the benefits arising from the Western Kenya sugar industry have been considered to be nationwide, rather than regional.

5:2. EMPLOYMENT IN THE WESTERN KENYA SUGAR INDUSTRY.

It has been clearly stated in Kenya's Fourth Development plan that one of the government's main objectives in industrial development "is the creation of a large number of employment opportunities, both in the rural and urban areas[1]. In Kenya, as in most developing countries, the population is growing very fast at a rate of 3.5% per annum, and the resultant effect is that alot of pressure is being imposed on the natural resources, without compensating improvements in technology and capital. This has reduced the marginal productivity of labour in traditional agriculture to very low levels. In addition, education has diverted the interest of the growing number of young people coming out of school, away from agricultural employment. This has been clearly stated by Harbison (1966) that "once a farmer's son has completed five or six years of primary school where the curriculum is almost exclusively orientated to the modern sector, he will not want to sentence himself to a life of digging yams on the family plot".[2] Thus, the increasing numbers of the population seeking non-agricultural employment can only be employed in manufacturing industry and the related commercial activities. For this reason, it is necessary to expand the industrial sector, especially, those which are labour intensive in order to create more employment opportunities in the country.

The sugar industry, upon which our interest lies in this study is labour intensive, and being raw material orientated, the government has made efforts to establish the factories in densely populated areas of Western Kenya where there is plenty of unskilled labour. This has been quite beneficial in terms of supplying employment in the

1. Kenya's Fourth Development Plan 1979-1983, Government Printers, Nairobi pp.329.
2. Op cit pp.28 No.5.

area. The population from the surrounding areas can now find employment either at the factory, become self-employe as outgrower farmers or conduct some related business. Thus, a monetary economy which was very limited, in some parts of the area, has been well established. Additionally, the government is partly trying to solve the migration problem which is at the moment causing a lot of problems in both urban and rural areas. This migration problem has become a nationwide concern because it removes younger members of the population from the rural to urban areas, where employment opportunities, apparently, appear to be bright. The rural areas are thus left with old conservativ population who, being less progressive, are incapable of adopting new development ideas.

It is therefore, clear that by establishing some of these labour intensive industries, of which sugar industry is one in the rural areas, the government is actua trying to create employment opportunities which are likely to retain ideal population of younger people or attract migrants into these areas. The main question related to these employment opportunities may be put as follows: are employment opportunities limited only to areas of producti or are they nationwide, and to what extent? In this sectio we will therefore attempt to look at the main sources of employment opportunities, in the sugar processing industry in Western Kenya. We will also examine the origin of the labour force in the Western Kenya sugar industry, together with the related commercial activities.

The establishment of the sugar factories in Western Kenya has resulted in the creation of a lot of employment opportunities in the area. These include employment at the factory, and self-employment on outgrower farms. In addition, many services (such as educational, medical and trade which offer employment opportunities) have also be established in the area. By the end of 1978, about 10,462 people were employed in the six sugar factories designed to produce mill-white sugar in Western Kenya (table 15). It is however shown that the highest employment was at Mumias sugar factory, with 3527 (or 33.4%) of the total employees, while the lowest was at Muhoroni with only 960 (or 9.1%) of the total employment in

Table 15.

EMPLOYMENT AT THE SIX FACTORIES PROCESSING MILL WHITE SUGAR IN WESTERN KENYA (1978).

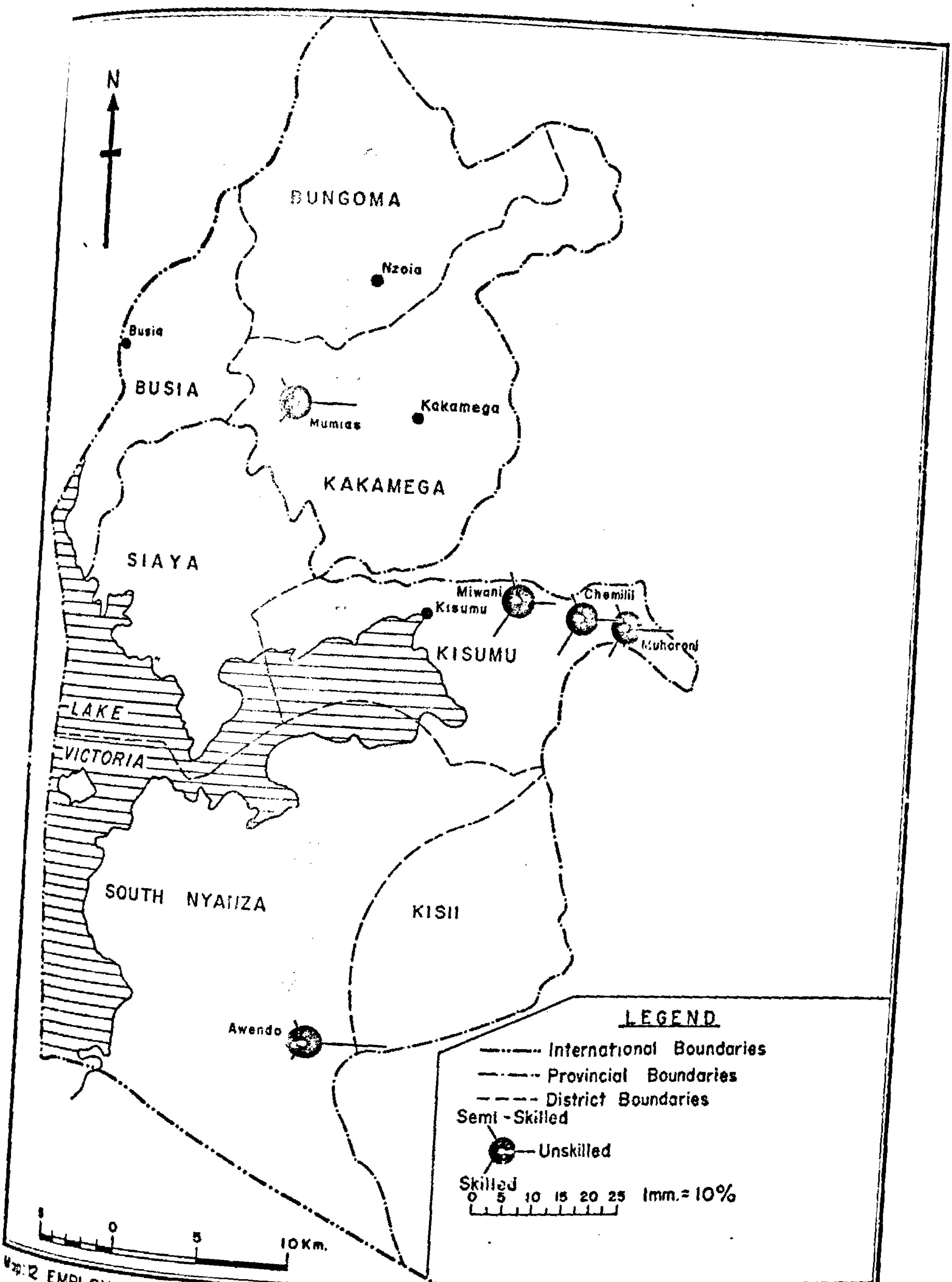
Cartegory of Factory employees.	Mumias	Nzoia	Chemeli
Unskilled	2,494	N.A.	
Semi-skilled	825	N.A.	
Skilled	208	N.A.	
	3,527	1,700	

* the number of employees is more than that indicated

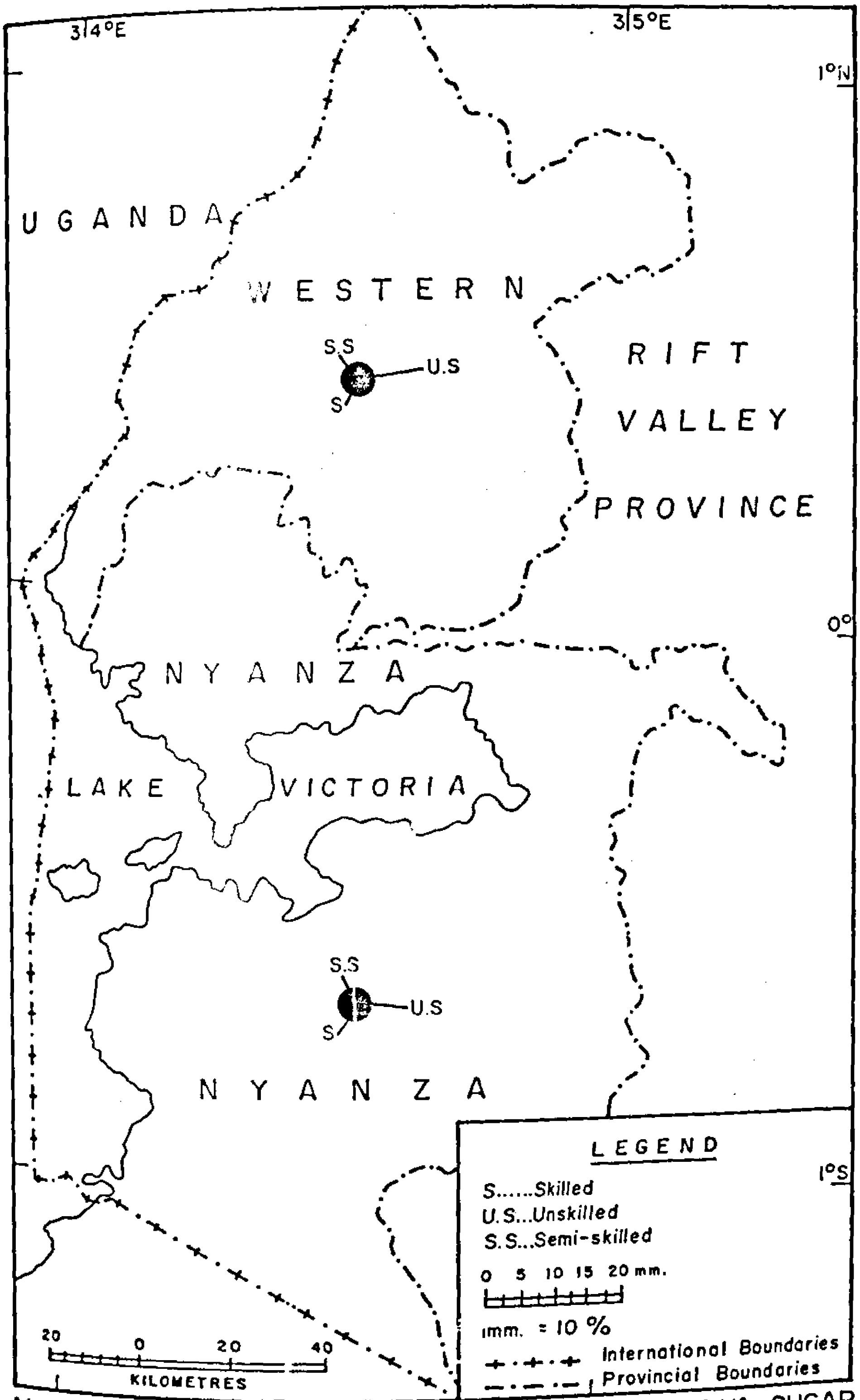
Source - Field research data.

the Western Kenya sugar industry during that year (Map 12). Alternatively, when viewed from the Provincial level, the total number of people employed in the sugar industry in Nyanza Province, exceeds those in Western Province (Map 13). Moreover, employment at Awendo is expected to rise next year (1980) when the factory starts operating, as more labourforce will be required. Besides this, the 10% increase in employment throughout Kenya authorized by the President is also expected to increase the number of employees in these sugar factories. Thus an increase in the overall employment in the Western Kenya sugar industry is expected.

It should be noted that employment at these factories is not only limited to the surrounding areas, but extends to the whole Nation, although it was impossible to get the data indicating the employment hinterland for each factory. Despite this, it was clearly stated from all the factories that most of the unskilled manpower comes from the surrounding areas, in each case mainly from the district within which the factory is located. That is, most of the unskilled manpower at Mumias sugar factory comes from Kakamega district, while those of Nzoia come from Bungoma district and those of Chemelil, Muhoroni and Miwani come from Kisumu, Kericho and Nandi districts. The major reason given by the factory employers is that such unskilled labourers usually find it more economical to work close to their homes, since their incomes are quite low. This is because they can



Map 12 EMPLOYMENT IN THE WESTERN KENYA SUGAR INDUSTRY BY FACTORY



MAP 13 EMPLOYMENT IN THE WESTERN KENYA SUGAR INDUSTRY, BY PROVINCE - 1978

easily get most of their necessary requirements from home, and those whose homes are very near the factories prefer staying at home, rather than residing at the residential houses at the factory. Furthermore, it is usually quite uneconomic for a person let us say from central province to be employed as a sweeper or cleaner at Mumias sugar factory. His limited income does not offer him the chance of frequenting his home as almost all of it will be spent on fare, while he needs it for more important things, such as paying school fees. Thus, such unskilled labour will always look for employment near their homes, although failure to get a job close to their homes has forced them to seek employment in urban centres located very far from their homes. Semi-skilled labourforce, on the other hand, is usually employed from any part of the country, although preference may sometimes be given to the qualified people within the province. But skilled manpower, especially professional staff, is employed from all over the country. This is because the required skills may not be available from the surrounding areas. Furthermore,most of the manpower who have acquired some skills usually prefer to work in Urban centres where most of their social and economic requirements can be easily met. Thus, most of them migrate to Urban areas, leaving the rural areas where the sugar factory are located. However, there are cases where employer's are quite disatisfied with the available local skills, in such circumstances, expatriates are imported from other parts of the world, while local manpower is send overseas for further training. We can therefore, conclude from these findings that since employment at the sugar factory is nationwide, the Western Kenya Sugar Industry is not only beneficial to Western Kenya region, but to the whole Kenya Nation.

The above table also shows that most of the employment at all the sugar factories is dominated by unskilled workers whose average monthly pay is only about Shs.366, followed by semi-skilled labour with an average income of Shs.413 per month, and finally the skilled labour with an average monthly pay of Shs. 1182, although most professional staff earn more than 5,000/= per month. However, as indicated above, employment from the surrounding areas is mainly dominated by unskilled workers whose monthly pay is very low. Thus despite the production of sugarcane in the area, only a small amount of money (a part from that earned by sugarcane outgrowers) is utilized in the area. Alternatively, the better paid manpower comes from all over the country and this implies that income from the sugar industry usually finds its way to many parts of the country. This is because most people are fond of sending part of their income to their home areas, either for development projects in the area, school fees or for other daily uses. Furthermore, the factory managers and some professional staff are usually from abroad and these repatriate part of their income to their motherlands. Moreover,such employees usually do most of their shopping in the big urban centres where most of their requirements are available. The few things purchased from the local area are mostly foodstuffs, such as milk, vegetables, flour and so on, which are usually less costly in the rural areas. As a result only a small proportion of their monthly income circulates in the area. This reason explains why very little other development has taken place in the sugar areas, as most of the people who try to set up some of the projects are outgrower farmers, who earn an income from their cane once in two or three years. This argument further supports the formulated hypothesis that the Western Kenya sugar industry is beneficial not only to Western Kenya, but to the whole Kenya Nation.

Out of the above 10,562 people employed in the six factories at the end of 1978, only 3381 employees were directly employed in the factories (table 16). The respective number of factory employees for 1976 was 2,800 people. These are known as manufacturing operatives. From these (manufacturing operatives), an index of industrial concentration known as the Location quotient has been calculated as shown below, using 1976 data.

A	-	All manufacturing operatives in Western Kenya	- 8,800
B	-	All manufacturing operatives in Kenya	- 89,600
X	-	Western Kenya's manufacturing operatives in sugar industry	- 2,800
Y	-	Kenya's manufacturing operatives in sugar industry	- 3,400

The percentage of Western Kenya's manufacturing operatives is derived as follows:

$$\frac{A}{B} \quad \text{or} \quad \frac{8,800}{89,600} \times 100 = 9.82\%$$

while the percentage of Western Kenya's manufacturing operatives in the sugar industry is:

$$\frac{X}{Y} \quad \text{or} \quad \frac{2,800}{3,400} \times 100\% = 82.35\%$$

Thus the location quotient is derived from these percentages as shown below:

$$\text{L.Q.} = \frac{82.35\%}{9.82\%} = 8.39$$

This index measures the degree to which the specified region or area has more or less than its national share of a given industry. The above value of 8.39., therefore indicates that Western Kenya has more than its share of the sugar industry, since an index of less than '1' indicates that an area has less than its share of the specified industry, while an index of more than '1' indicates that an area has more than its share of the specified industry.

According to this measure of industrial concentration, the more you move away from '1' with values greater than '1', the more concentrated the industry is, in a given area. And the further you move away from '1' towards '0' the less concentrated an industry becomes in a given area. Thus, this index can be quite useful in planning, especially where the decentralization of industries is required. Furthermore, it draws our attention to factors of industrial location which may have attracted the location of industry in that particular region. Hence, possible ways through which such an industry can be decentralized to other parts of the country in order to avoid concentration in the already congested areas, can be thought of. But in the above analysis, the concentration of the sugar industry in Western Kenya is attributed to several factors of industrial location which have determined the location of almost all the sugar factories in Western Kenya. It has been observed that the major determinant factors are physical factors which can not be altered (especially rainfall). The decentralization of this industry to other parts of the country other than Western Kenya itself and limited parts of the Coast Province is therefore almost impossible.

Apart from the 10,562 people employed at the factory, more than 34,000 farmers were self-employed as outgrower farmers by the end of 1978. These outgrower farmers, usually employ permanent or casual labour as cane weeders or cutters. Thus the number of people employed on outgrower farms is more than 34,000 people. In general, over 45,000 people, both employed at the factory and on the outgrower farms, together with their families earn a livelihood from the Western Kenya Sugar Industry.

Besides the above mentioned sources of employment opportunities originating from the Western Kenya Sugar Industry, several thousands of people are indirectly employed within the

Table 16

WESTERN KENYA'S MANUFACTURING OPERATIVES IN THE SUGAR INDUSTRY (1978).

Name of Factory	No. of Manufacturing operatives in each factory	Other factory employees	Total Employment
Chemelil	808	641	1449
Mumias	782	2745	3527
Miwani	737	923	1660
Muhoroni	654	306	960
Nzoia	400	1300	1700
Awendo (Sony)	-	1266	1266
Total	3381	7181	10562

Source: - Field Research data.

industry as business-men. Some of them own shops hotels and bars which are either rented or individually owned. Similarly, a number of them now own "matatus" some which have been bought from cane income. These new establishments increase employment opportunities as shopkeepers, waiters, barmaids and drivers are needed to run these businesses. In addition to these, very many people, both men and women are now engaged in some trade-in the area. These usually buy foodstuffs mainly outside the sugarbelt where the food types are still in plenty and they come to sell the food within the sugar areas (especially in the factory residential areas) where a food shortage is experienced as a result of too much concentration on sugarcane cultivation.

This development of employment opportunities in Western Kenya has resulted in increased cash income and hence an increase in the general wealth of the community. At least all the farmers interviewed, admitted that they are capable of purchasing important household items (such as cooking fat, sugar and washing soap) which they could not previously do. But it is unfortunate that this income only comes once in two or three years, thus if this income was more frequent say after 6 months or so, they would be more well off than they are at the moment.

5:3. SUGAR PRODUCTION

5:3:1 SUGAR PRODUCTION FROM THE WESTERN KENYA SUGAR INDUSTRY.

Through the development of the Western Kenya sugar industry, the government aims at achieving its major goal of self-sufficiency in sugar production. Supported by the available resources, especially in Western Kenya, the nation could ultimately produce its own sugar at a cheaper price relative to the rest of the world. By doing so, the government, does not only aim at substituting imported sugar by that produced locally, but also aims at producing surplus sugar for export in the long run. This will of course, be of great benefit to the nation, as it will earn the country some foreign currency.

During 1978, the total number of hectarage under cane in Western Kenya sugar zone was more than 61,026 ha., including the newly cultivated areas of South Nyanza and those which are privately owned by farmers supplying the small sugar factories of Yala and Kabras. Out of the above total, 15,096ha. (or 24.7%), belonged to the Nucleus sugar factory estates, while the remaining 45,930ha. (or 75.3%) were owned by sugarcane outgrower farmers.

Table 17 HECTARAGES UNDER SUGARCANE IN WESTERN KENYA BY FACTORY - 1978.

	NUCLEUS ESTATE		OUTGROWER FARMS	TOTAL	
Name of factory	Absolute Values (ha)	% of h under Nucleus Estate at each factory		bsolute values (ha.)	Total of eac factor
1.Mumias	3,300	17.1			
2.Chemelil	2,225	13.2			
3.Miwani	3,333	33.3			
4.Muhoroni	3,333	-			
5.Nzoia	2,905	35.2			
Total	15,096				

Source: Field research data.

Table 17, shows how the sugarcane hectarages were distributed in each of the five sugar processing factories in 1978. During this year, Mumias sugar factory had the highest number of hectarages under sugarcane (19,300 ha. or 28.1%) followed by Chemelil sugar factory with 16,800 ha. (24.4%) then Miwani with 13,333 ha. (19.4) Muhoroni with 11,022 ha. (16.0%) , and lastly Nzoia with 8,260 ha. (or 12.1%). In all the sugar factories shown, the hectarages of cane under the Nucleus Estate only account for a small percentage compared to that of outgrower farmers (table 17.). These clearly demonstrate the expansion programmes which have been taking place in the respective sugar belts, as these have involved an increase in outgrower farms, together with the number of outgrowers.

The Nucleus Estates are central sugarcane plantations owned by each factory. Their main purpose is to ensure a steady and reliable source of cane supply to the factories as it is assumed that total reliance on outgrowers for cane supply may lead to underutilization of the factory capacity. At the moment this assumption may be refuted as all the factories under operation, except Mumias and Nzoia, are operating below their designed capacity and yet they have Nucleus Estates. Thus, apart from cane shortages, under utilization of the factory is caused by many other factors such as inefficiency in the factory.

It should be noted that the above total hectarages under cane has already been exceeded by now,, following the recent expansion programme in Mumias which has involved an increment of the number of outgrowers to a radius of 21Km from the factory. Furthermore, sugar factories (such as Awendo which is still under construction and Nzoia which only started operating last year (1978)), keep on increasing their sugarbelts in order to meet the planned increase in the production capacity of the factories.

Table 13

THE WESTERN KENYA SUGARCANE AND SUGAR PRODUCTION IN 1978.

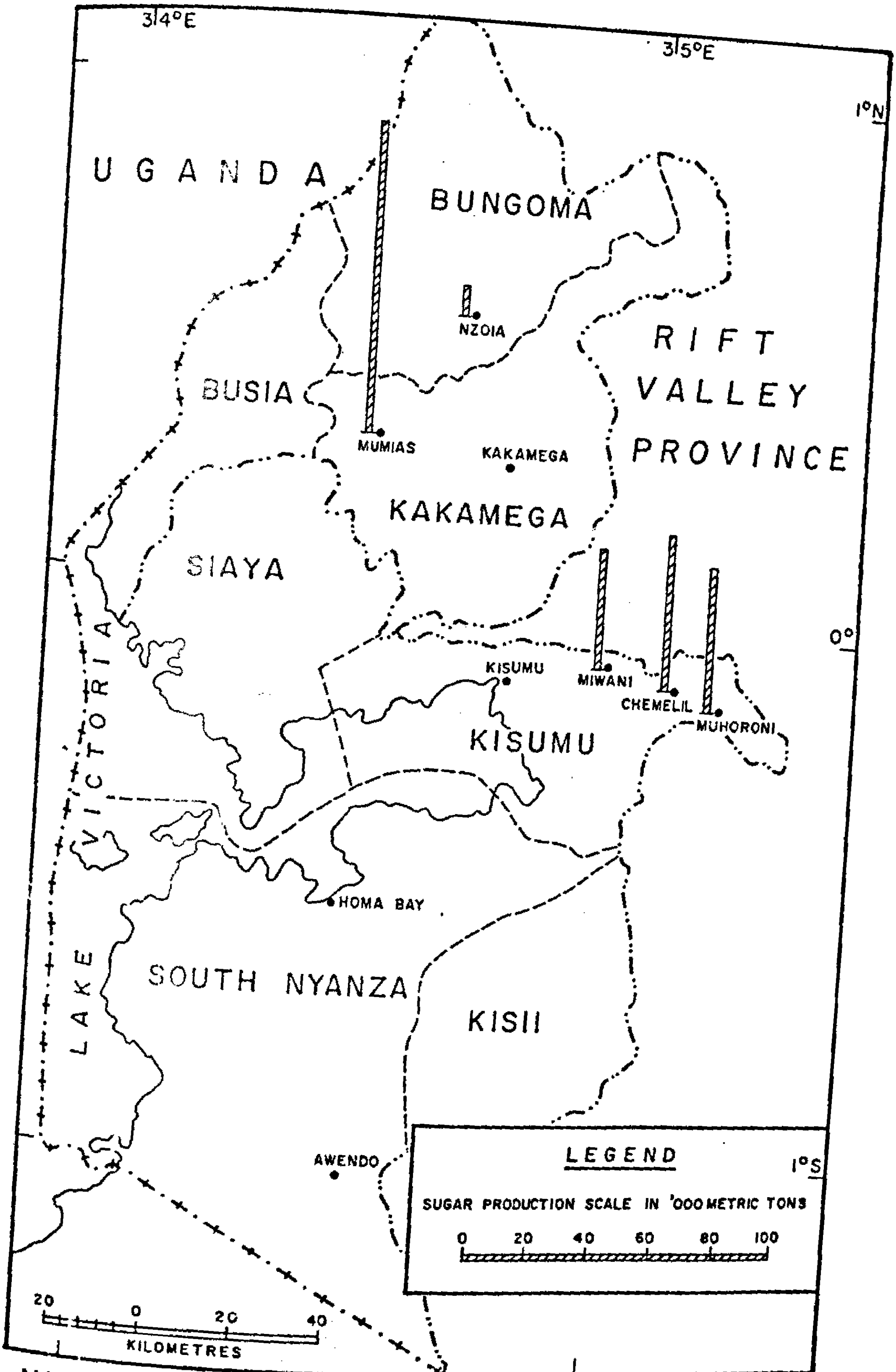
Name of Factory	Cane Production in tons	Sugar Production in tons	Ratio of Tonne Cane/ Tonne sugar (TC/TS)
Mumias	809,886	92,500.3	8.8
Chemelil	502,755	47,429.7	10.6
Muhoroni	444,654.6	42,348	10.5
Miwani	415,046.8	36,426.7	11.4
Nzoia*	65,646	7,294	9.0
Total	2,237,988.4	225,998.7	

* Three months sugar production.

Source: Field Research data.

The respective tonnage of cane harvested from the above hectarages are shown in table 18. It can still be observed that the highest tonnage of cane was received in Mumias sugar factory and this has some relationship with the high number of hectarage which was under cane ~~during~~ that year. The table also shows how many metric tons of cane are equivalent to '1' metric ton of sugar. It is clearly shown that factories (such as Mumias and Nzoia) located in Western Province require an average of about '9' metric tons of cane to produce '1' metric ton of mill-white sugar. On the other hand, about 11 metric tons of cane are required to produce '1' metric ton of sugar in factories (such as Chemelil, Muhoroni and Miwani) located in Nyanza Province. These differences can be explained in terms of different physical conditions (such as climate and soils) prevailing in the two provinces. Secondly the maintanance of cane in Mumias and Nzoia Sugar Belts is usually under the supervision of the Company as oppossed to that in Chemelil, Muhoroni and Miwani, which is left entirely to the farmer himself. This is bound to have some effect on the development of the cane which may in the end affect the sugar content in the cane.

The tonnage of sugar processed from the above tonnage of cane in each factory, is also given in the same table. Again Mumias sugar factory produced the highest tons of sugar (92,500.3 metric tons) in 1978. This was followed by Chemelil, which only produced about half the amount of sugar produced in Mumias (47,429.7tons)(Map 14). The high tonnage of cane harvested and



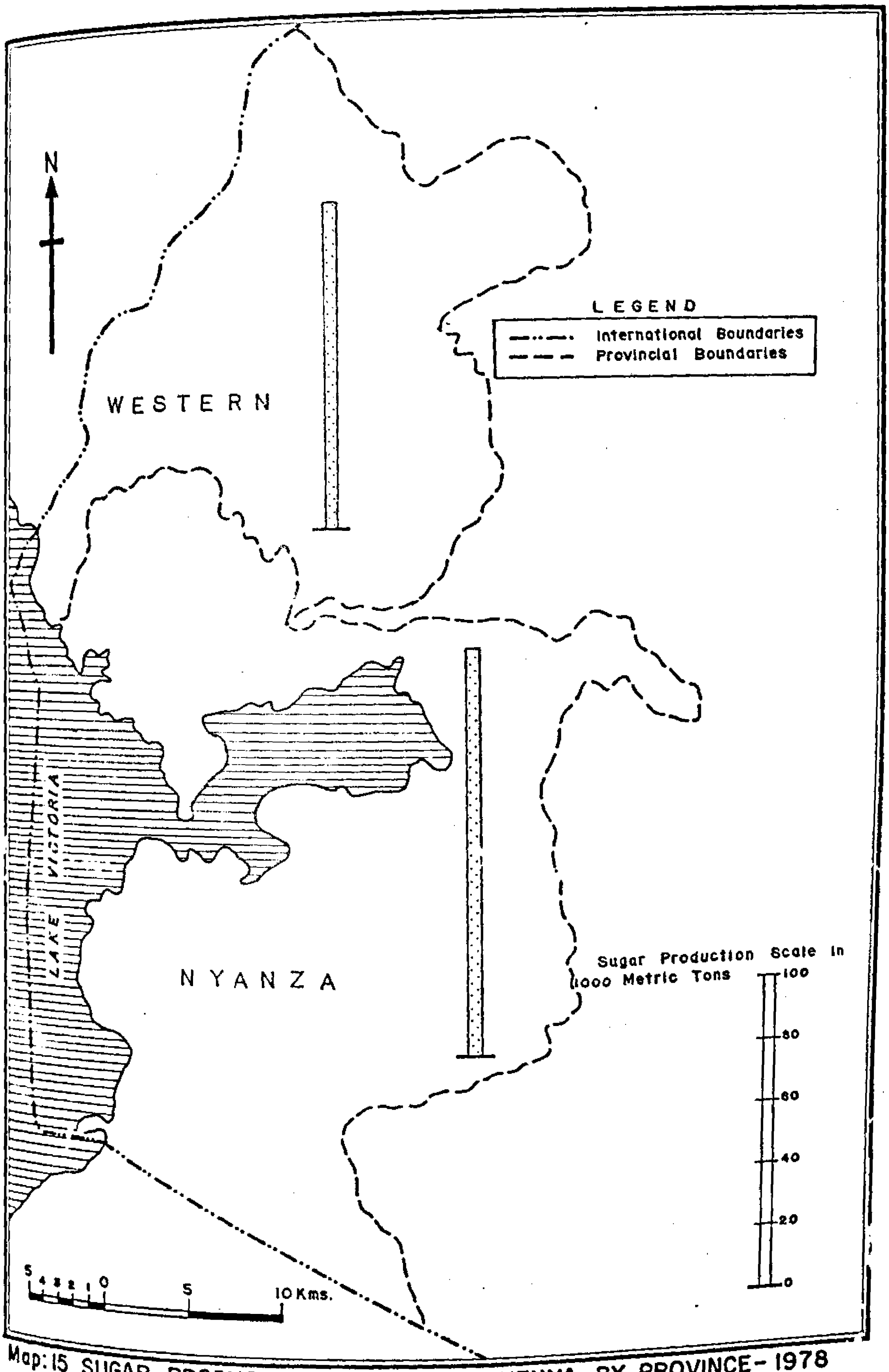
MAP 14 SUGAR PRODUCTION IN WESTERN KENYA BY FACTORY – 1978.

crushed in Mumias as well as the sugar content of the cane in the area compared to that in Muhoroni, Chemelil and Miwani areas accounted for its high sugar output in 1978.

Assuming that Nzoia sugar factory will keep to its estimated annual sugar production of 75,000 tons of sugar, then we are justified to conclude that the future sugar production in Western Province is likely to be higher than that of Nyanza Province although the current production of sugar in Nyanza Province exceeds that of Western Province (Map 15). This difference may be related to different factors such as, the crushing capacity of the factories and the sugar content in the sugarcane produced in the area. However, the production of sugarcane upon which the sugar industry depends is also determined by climatic and soil conditions, together with proper maintenance of sugarcane during the growing period. The average rainfall received in Mumias (1813.8mm) and Nzoia areas (1761.3mm) sugar factories is higher than that in Muhoroni (1317mm), Chemelil (1317mm) and Miwani (1341mm), hence the relatively low yields.

5:3:2 SUGAR PRODUCTION, CONSUMPTION AND IMPORTS IN KENYA.

The available data necessitated the above analysis to be carried out on a regional basis (that is on the Western Kenya Sugar Industry). Alternatively, the following analysis on National sugar production, consumption and imports from 1968 to 1978 will be carried out on a national level. This is because



Map: 15 SUGAR PRODUCTION IN WESTERN KENYA BY PROVINCE - 1978 one aims at looking at the national benefits arising from the Western Kenya Sugar Industry, as most of the sugar produced in the country (about 95.58% in 1978) comes from Western Kenya (table 19). Only one large factory, Ramisi at the coast, processing mill-white sugar has been excluded from the study and its annual contribution to the sugar produced in Kenya is quite small (table 19). At the same time, the available data on sugar consumption and imports is only applicable to the whole Nation, as this records are only available at the Ministry of Commerce and Industry on a National but not on a regional basis. Thus for easy analysis it has been more convenient to look at the whole of Kenya Nation.

Table 19 SUGAR PRODUCTION IN KENYA - 1978

Name of Factory	Sugar Production in tons	Sugar Production in %
Mumias	92500.3	39.12
Chemelil	47,429.7	20.06
Muhoroni	42,348	17.91
Miwani	36,426.7	15.41
Nzoia	7,294	3.08
SUB-TOTAL WESTERN KENYA	225,998.7	95.58
Ramisi	10,440.3	4.42
NATIONAL TOTAL	236.439	100.00

Sources: 1.Field Research data - Western Kenya Sugar Production.
2.Ministry of Commerce and Industry - National Production.

During the period between 1968 and 1978, a total of 1,547,039 tons of sugar were produced in Kenya. On the other hand, a total of 2,093,000 tons of sugar were consumed during the same period which indicates that the sugar produced in the country was far below the consumption level by 545,951 tons, and had to be met by imports from elsewhere. Thus during the same period, a total of 563,643 tons of sugar were imported to meet the local demand (table 20).

Although the overall sugar production during the period indicated falls below the consumption level, a large increase has occurred since independence. For instance, in 1968, only 80,130 tons of sugar were produced in Kenya, compared to 236,439 tons in 1978 which shows an increase of 195% over a period of 11 years. The highest increase in sugar production was noted between 1972 and 1973. In 1972 the production dropped from 124,073 tons of sugar in 1971 to only 92,284 tons, several reasons would account for this drastic fall, of which the most obvious one might be unfavourable physical conditions (such as low rainfall and poor soil conditions), which affected the production of cane and hence sugar production. This was followed by an increase of 45,651 tons (or 49.5% which was almost ½ the previous year's production) during the next year (1973). Thus a total of 137,935 tons of sugar were produced in 1973. This drastic increase may be attributed to the establishment of

Mumias sugar factory (in Kakamega district, Western Province), which came into production in 1973. Another drastic increase occurred between 1968 and 1969, when a total of 80,130 tons of sugar were produced in 1968, while 113,642 tons were produced in 1969. This shows an increase of 33,508 tons (or 41.8%) of sugar. This increase was also due to the establishment of a new sugar factory at Chemelil which started producing sugar at the end of 1968. If this trend is followed, high increase in sugar production is likely to occur this year, following the establishment of the Nzoia sugar factory in Bungoma district, Western Province, which started operating at the end of 1978. Besides these sharp increases and decreases in sugar production, a steady increase was experienced over the remaining years with an exception of the period between 1974 and 1975 when sugar production dropped by 4,667 tons (or 2.8%) from 164,308 tons in 1974 to 159,641 tons in 1975.

As in sugar production, a high increase in sugar consumption is notable during the period between 1968 - 1978, although the increase in consumption level exceeds that of production. In 1968, 130,345 tons of sugar were consumed compared to 250,557 tons in 1978, showing an increase of 92.2% over this period. This high increase in consumption level is related to the high population growth rate of 3.5% which is being experienced in Kenya. For instance, in 1968, Kenya's population was about 10.5m, while the estimated population for 1978 was 14.9m. Given the above values of sugar consumption level and the related population estimates for 1968 and 1978, per capita sugar consumption in 1968 was 12.41Kg; while that of 1978 was 16.82Kg. Thus the per capita increase in sugar consumption within the 11 years was 35.54% giving an annual per capita increase of 3.55%. Besides this, the high increase in sugar consumption may also be related to the development of those industrial activities which require sugar as their raw material. For example recent developments have occurred in the fruit and vegetable canning industry at Thika which requires refined non-local sugar as its raw material. Thus more sugar is required to meet the increased demand for sugar.

A steady increase in sugar consumption is notable from 1968 upto 1974. This was then followed by a very drastic drop from 223,611 tons of sugar consumed in 1974 to 193,712 tons in 1975. This reduction of 13.4% in sugar consumption may be related to an increase in the price of sugar which took place in 1975 from Kshs.3.60 per Kg. to the current sugar price of Kshs.4.50 per Kg. This somehow affected the buying capacity of the common man, hence a reduction in the national sugar consumption. In fact, a lower consumption level was experienced during the following year (1976), although an increase has occurred during the last two years.

Unlike sugar production and consumption, the amount of sugar imported into the country dropped from 52,801 metric tons in 1968 to 44,495 metric tons in 1978, a reduction of 15.7%.

Similarly, great variations took place in the amount of sugar imported into the country between 1968 and 1975. This variation depends on the demand and the amount of sugar produced in the country, which enables the Ministry of Commerce and Industry to determine the amount of sugar to be imported into the country in order to meet the local demand. Table 20 shows that the highest amount of sugar was imported in 1972 (113,617 metric tons), one of the years when production was quite low compared to the high level of consumption during that year. On the other hand, the least amount of sugar was imported in 1975 when consumption level dropped from 223,611 metric tons in 1974 to 193,712 tons in 1975. Apart from the reduced consumption level, the reduction in the amount of sugar imported into the country may be related to the world market increase in the price of sugar which took place in 1974. These fluctuations were then followed by a steady increase in the amount of sugar imported into the country during the last three years (1976 ± 1978) which reflects the increase in sugar consumption.

Table 21 shows the origins of the sugar imports into Kenya over the (1966-1974) period. Of the 731,804 metric tons imported by Kenya over this period, the shares of each source of origin were as follows in order; the listed countries of Western Europe, 35.70%; other countries (unspecified), 24.46%; Uganda, 15.94%; Poland 9.7%; Yugoslavia, 7.90%; Czechoslovakia, 5.01%; India 0.88%; and Hong Kong, 0.32%.

Table 20

SUGAR PRODUCTION, CONSUMPTION AND IMPORTS IN KENYA, (1968 - 1978) METRIC TONNES.

Year	Production	Consumption	Imports	End of Year stocks
1968	80,130	130,345	52,801	2586
1969	113,642	138,551	25,975	1066
1970	90,315	159,772	37,095	31,862
1971	124,073	182,758	59,087	402
1972	92,284	194,612	113,617	11,289
1973	137,935	217,417	75,973	3,509
1974	164,308	223,611	79,605	20,302
1975	159,641	193,712	9,500	-24,571
1976	167,081	177.467	31 851	21,429
1977	180,991	224,198	33,680	-9,527
1978	236,439	250,557	44,495	30,377
Total	1,547,039	2,093,000	563,643	

Source: Ministry of Commerce and Industry.

Table 21. ORIGINS OF SUGAR IMPORTS INTO KENYA 1966-1974

Sugar exporting Countries into Kenya	Kenya Sugar Imports (Metric tons)	% of Kenya's Sugar Imports from each country.
EEC*	137,328	18.76
United Kingdom	89,717	12.27
France	24,644	3.37
Belgium/Lux.	9,532	1.30
TOTAL WESTERN EUROPEAN COUNTRIES	261,221	35.70
Poland	71.665	9.79
Yugoslavia	57,839	7.90
Czechoslovakia	36,639	6.01
TOTAL EAST EUROPEAN COUNTRIES	166,143	22.70
Uganda	116,674	15.94
India	6,422	0.88
Hong-Kong	2,331	0.32
Others	179,013	24.46
GRAND TOTAL	731,804	100.00

Source: Ogendo, R.B. and - "The East African Sugar Industry"
Obiero; J.C.A.

*European Economic Community.

Although the table only indicates the origins of the sugar imports into Kenya over the (1966 - 1974) period, alot of sugar is still imported into the country (mainly from EEC countries). Previously, Uganda was one of the main sugar exporters into Kenya although it is no longer one of the sugar exporters. It was in 1970 when Kenya last imported 18,002 metric tons of sugar from Uganda. Since then, the surplus sugar which facilitated some net exports has been terminated by the mass expulsion of the Asians from Uganda in 1972 and the political instability which has been going on from 1971 - 1979.

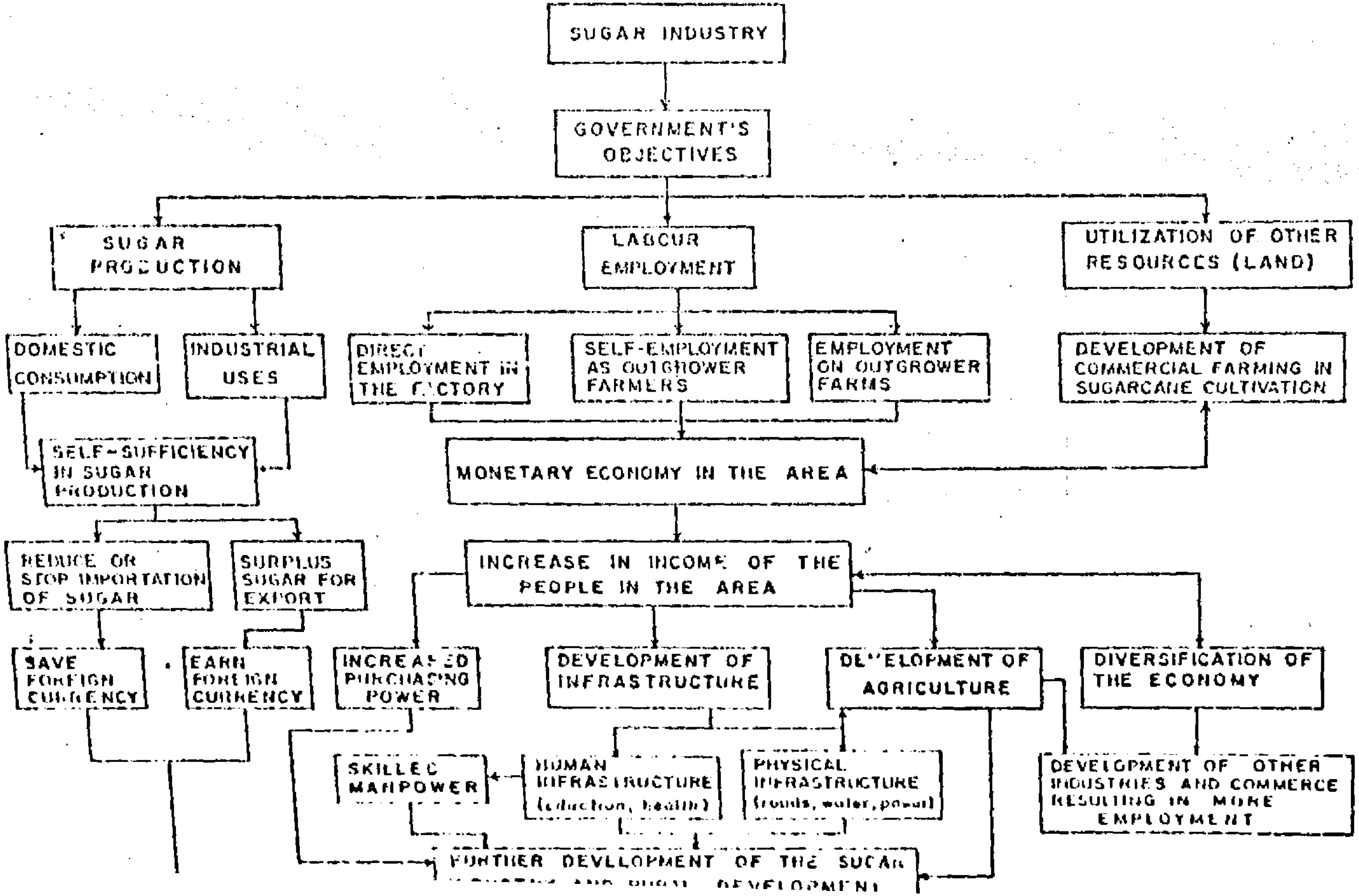
The above analysis indicates that despite the increase in sugar production, resulting from the establishment of new factories and the expansion of the existing ones in the country, still Kenya cannot meet its local demand. Thus more sugar has as yet to be imported into the country. Kenya has been anticipating to be self-sufficient in sugar production by 1978, but this could not be achieved because of various reasons, which include low rainfall and other problems within the factories. Despite these problems, Kenya still plans and is determined to increase its sugar production from last year's (1978) 236,439 metric tons to about 430,000 metric tons within the next three years, and hence become self-sufficient in sugar production. But it is of great significance to note that the sugar currently imported into the country is only refined sugar which is not at the moment produced in the country. Taking this into consideration, Kenya can only become self-sufficient in sugar ~~production by establishing new factories~~ to process refined sugar or by converting some of the existing ones into sugar refineries. However, as long as this country merely concentrates on the establishment and expansion of factories processing mill-white sugar (as is currently the case), self-sufficiency in sugar production will not be achieved in the near future. It is necessary that Kenya produces some refined sugar because certain industrial processes in the country require only refined white sugar instead of the mill-white sugar which is processed locally. A good example of such industries is the brewing industry where the use of local mill-white sugar results in bottled beer which cannot be preserved for long.

The most important development aspect about the sugar industry is its massive contribution to the national economy. This is realized, mainly in the form of import substitution. For instance, from the 236,439 tons of mill-white sugar Kenya produced locally in 1978, the country saved about £(K)49,652,190 given the current price of Shs.(K) 4,205 per ton of sugar. Out of this saving, the Western Kenya sugar industry contributed £(K)47,459,790 (or 95.58%) from the 225,998 tons of sugar produced in that part of the country during that year. The production of refined sugar in the country will therefore be of great benefit to the country. This will obviously reduce the amount of refined white sugar imported into the country and possibly in the long-run eliminate completely the importation of sugar into the country. In addition, this will, in turn, create new employment opportunities in the country. Apart from these benefits, ancillary industries related to sugar refining are likely to be established, thus boosting the Kenyan economy. Besides the need to expand sugar production to meet the country's requirements, surplus sugar would be produced for export. This would earn the country some foreign currency.

The above discussion on the role of the Western Kenya sugar industry in the Kenyan economy clearly illustrates the point that the Western Kenya sugar industry is beneficial to both regional and national economies in terms of employment, sugar production which is nationally consumed and in import substitution, although refined sugar is still imported. Thus, the hypothesis that "The industry is beneficial not only to Western Kenya, but to the Kenya Nation as a whole" is validated.

The model below summarizes the Government's objectives in developing the sugar industry as explained in this chapter. The model demonstrates the fact that the achievement of these objectives will result in further development of the sugar industry and the general development of the rural areas within the sugar zone.

FIG. 8 A MODEL ILLUSTRATING THE GOVERNMENT'S OBJECTIVES IN THE DEVELOPMENT OF THE SUGAR INDUSTRY



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CHAPTER 6

THE WESTERN KENYA SUGAR PLANTS AND THEIR RESPECTIVE SUGAR GROWING BELTS AS DEVELOPMENT UNITS IN REGIONAL PLANNING

6:1 INTRODUCTION

In this chapter, the whole of Western Kenya sugar zone has been considered as a development area, while the respective sugar plants, including their Nucleus Estates are viewed as development points. Within these development points, growth is expected to be optimal and should radiate into the surrounding less favoured peripheral areas. The growth inducing effects originating from these development points to the peripheral areas have been viewed as a complex set of processes through which absolute level of development of peripheral areas is increased due to spatial relation with core areas. The latter, in this study, are sugar processing plants and the related Nucleus Estates. Alternatively, the negative effects apply to a set of processes which result in a decrease of absolute level of development of a peripheral area. This analysis should therefore aim at either validating or discarding the hypothesis that "The sugar industry in the area has been responsible for negative effects and has had no growth inducing effects."

Because all the sugar processing plants are fortunately, raw material orientated, they are located in the rural areas where they form ideal development points in their relation to the sugar-cane outgrower farmers and the other inhabitants of the pertinent surrounding rural areas. Myrdal (1957) has argued that the establishment of such an industry in an area will result in the general development of that particular area. According to him, opportunities of employment and higher incomes are provided for those previously unemployed or for those who were originally employed in a less renumerative way. Furthermore, local businesses can flourish as the demand for their products and services increases. Similarly, the establishment of new businesses or enlargement of the old ones widens the market for others, as does generally the increase of incomes and demand. Moreover, rising profits increase savings, but at the same time investments also increase which, as a result, tend to raise the demand and the level of profits. The expansion processes therefore create external economies favourable for sustaining its continuation.

Apart from these growth inducing effects Myrdal has also examined negative effects, likely to arise from such an industry. In his argument, he has observed that the expansion of such an industry in one locality usually has negative effects in other localities. The localities and regions where economic activity is expanding will tend to attract net immigration from other parts of the country. As migration is always selective, at least with respect to the migrant's age, this movement by itself tends to favour the rapidly growing communities. This point is further supported by Moseley's (1974) argument which states that 'Migration robs the area of the youthful, ambitious and skilled elements of the community and so reduces the ability of the areas to attract new industry or to sustain the expansion of pre-existing establishment".[1]

Myrdal further argues that capital movement tends to have a similar effect of increasing inequality. In the centres of expansion, income and demand increase investments. Savings are likely to increase as a result of higher income obtained within these development areas. However, those savings would tend to lag behind investment as this capital would meet the demand for the latter. On the other hand, lack of new expansionary momentum in the other regions implies that demand for capital for investment would remain relatively weak, even compared to the supply of savings which are also low due to low incomes. If these regions without expansionary momentum, are left to themselves, they cannot for example, afford to maintain a good road system. Further-more, all their other public utilities would remain inferior, thus increasing their competetive disadvantages. These poorer regions can, therefore, hardly afford, say, adequate medical care and good education facilities. Their population would as a result, be less healthy and have lower productive efficiency.

Perroux (1955) in his "Growth Pole" concept also brought up similar arguments, based on the growth inducing and negative effects of a development centre or point. Perroux defined his Growth Pole in relation to abstract economic space which is in

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[1] Moseley M.J. (1974) - Growth Centres in Spatial Planning, Pergamon Press.

turn defined as a field of forces. He describes economic space as consisting of centres, poles or foci from which "centrifugal forces emanate and to which centripetal forces are attracted." Thus, each centre being a centre of attraction and repulsion has "its proper field which is set in the field(s) of other centres." The forces which Perroux conceives are essentially economic and the generators of these forces are basically firms and industries, which are both propulsive in nature. The major characteristics of a dynamic propulsive firm include its relatively large size, its ability to generate significant growth impulses and to innovate and finally its association with a fast growing sector.

From this theoretical background of the "Growth Pole" and "Growth Centre" concepts, it is conceived that both growth - inducing and negative effects are in operation at these points or centres of growth. But before we jump to any conclusion, it is necessary to examine whether this conforms to our findings on the Western Kenya Sugar Industry.

6:2. REGIONAL MULTIPLIER EFFECT FROM MUMIAS SUGAR INDUSTRY

The sugar industry in this study has been viewed as a growth inducing industry. Thus, the benefits arising from this industry into the area may be examined in terms of the money injected into the area in the form of outgrower farmers' income and in relation to wages and salaries paid to the factory employees.

Similarly, these benefits are also looked at in terms of the profits made by each company from the sugar industry, as the major objective of an entrepreneur in establishing any industry is to make profits. Finally, the government too receives direct benefits from the sugar industry in the form of tax. Although income data related to the above mentioned sources are very crucial in our present analysis, problems encountered during the research only made it possible to get some limited income data from some outgrower farmers in the Mumias sugarbelt. In addition to this, some secondary data on projected profits from Mumias sugar company has also been obtained from published sources. These data have been used in analysing the regional multiplier effect arising from the Mumias sugar industry. Although this might not be representative of all the factories located in Western Kenya, it enables us to make conclusions as to whether the establishment of sugar industry in an area has some growth inducing effects or not.

The regional multiplier model applied in this analysis assumes that an injection of a certain amount of money from the sugar industry will increase regional income, thus affecting an increase in consumer spending in the area. As shown in the appendix (table A.4), a total income of Shs.733,280 was earned by 45 outgrower farmers from the Mumias sugar factory in 1978. Out of that total income, Sh.274,009 (or 37.4%) was spent outside Kakamega District where the relevant sugar industry is located. Out of the sum of Sh.274,009, 238,414 (which is 87% of 274009/=) were spent on purchasing items (such as cooking oil, paraffin, soap, match boxes and so on), manufactured outside the district. The remaining Shs. 35,595(13%)was spent on school fees paid outside the region. The Shs. 274,009 have been considered in this analysis, as that part of the total income spend on imported goods, since the sum of money found its way outside the region. However, that part of the income spent on items such as vegetables, meat, charcoal and fresh milk produced in the area circulated within the sugar area. This also applies to that part of income spent on employed labourforce on outgrower farms and on the money spent on school fees within the area. Other expenditure included harambee project funds, ceremonial festival expenses, payment of dowry, which took place in the area. In total, the amount of money spent within the sugar area was Shs.259,695 (or 35.4%) of the total outgrowers income. This money is quite beneficial to the area, as it was utilized within the area and therefore likely to result in the overall development of the area. Apart from the money spent outside and within the area, Shs.199,526 (27.2%) of the total cane income was saved by the farmers during that year.

An important factor to note is that this regional multiplier effect is usually affected by several leakages. These include savi imports and taxation. But as noted during the survey, outgrower farmers in Mumias sugar belt are not taxed, and therefore this leakage does not affect our analysis. All the same, import and saving leakages have been incorporated into our multiplier model to make it more realistic. Thus a regional multiplier effect originating from Mumias sugar factory has been derived as follows:

$$K = \frac{A}{E \text{ or } (I + S)}$$

$$K = \frac{733230}{274009 + 199526}$$

$$K = \frac{733230}{473535}$$

$$K = 1.5$$

where

K = regional multiplier

A = Money initially injected by regional Industry.

S = Proportion of income saved.

I = Income spent on imports or items manufactured outside the region.

From this analysis, a regional multiplier effect of 1.5 has been derived. This is quite low as the money injected into the region from the industry is not yet capable of generating twice its own value through the multiplier effect. This indicates that, though the sugar industry has some growth inducing effects, its benefits to the area of production are still quite limited. As shown in the analysis, this is due to relatively high import and saving ratios which are not utilized within the region. The money spent on imports is not useful to the region as it creates wealth for other localities other than the area of production. It can therefore be assumed that a higher multiplier effect can only be realized in the region if a higher proportion of the money earned from the cane is spend within the region. But the likelihood of such a possibility in the near future, is still far from reality since most of the basic necessities, such as cooking oil, paraffin, soap,etc. are not manufactured within the region and therefore have to be imported into the region from other parts of the country. We must therefore keep in mind that,with such a low multiplier effect, attempts to solve regional problems are likely to be a long process. This low regional multiplier effect is further illustrated by the low development process of the development facilities in the area, since the establishment of the sugar factory in the area.

Although the above model clearly illustrates the level of regional development through the multiplier effect, its short-comings should not be overlooked. The method does not take into account other sources of income in the area which partly contribute to the overall expenditure in the area. Sugarcane income usually comes after 2 years or more. It is therefore very unlikely that a farmer who only earns 3000/= from his cane will meet all his expenses, and at the same time save part of it. In fact from Appendix A-4, it is shown that while some farmers had no savings, others incurred deficits, and this indicates that part of their expenditure deficits must have been covered by income from other

Table 22

MUMIAS OUTGROWER FARMERS' EXPENDITURE OUTSIDE THE REGION.

ITEM	EXPENDITURE IN K.SH.	% OF TOTAL EXPENDITURE
1. Clothing	35960	13.1
2. School fees spent outside the region	35,595	13.0
3. Cooking oil and fat	23,986	8.8
4, Bevarages	18,585	6.8
5. Washing Soap	18,300	6.7
6. Fish	17,170	6.3
7. Bathing soap	16,200	5.9
8. Cigarettes	12,180	4.4
9. Beddings	15,995	5.8
10.Beer	10,630	3.9
11.Powder + tinned milk	10,458	3.8
12.Paraffin	9,750	3.6
13.Bread	9,500	3.5
14.Matches	8,800	3.2
15.Medical care	7,670	2.8
16.Flour	6,550	2.4
17.Rice	5,980	2.2
18.Salt	5,700	2.0
19.Body and hair oil	5,000	1.8
TOTAL	274,009	100.0

Source: Field research data

Table 23

MUMIAS OUTGROWER FARMERS' EXPENDITURE WITHIN THE REGION

	ITEM	EXPENDITURE IN K.SH.	% OF TOTAL EXPENDITURE
1.	Labour	57,134	22.0
2.	School fees	43,045	16.6
3.	Dowry	39,000	15.0
4.	Harambee Projects	27,500	10.6
5.	Sugar	22,900	8.8
6.	Meat	20,500	7.9
7.	Ceremonies	16,097	6.2
8.	Maize	15,000	5.8
9.	Fresh milk	3,000	1.2
10.	Vegetables	2,500	0.96
11.	Beans	1,950	0.75
12.	Potatoes	1,750	0.67
13.	Fruits	1,719	0.66
14.	Chicken	1,600	0.61
15.	Bananas	1,500	0.58
16.	Charcoal	1,000	[illegible]
17.	Peas	800	0.30
18.	Fingermillet	650	0.25
19.	Millet	500	0.19
20.	Eggs	500	0.19
21	Casava	450	0.17
22.	Tomatoes	350	0.13
23.	Onions	250	0.09
Total		259,695	100.00

Table 24

MUMIAS CASH FLOW IN £K'000 BEFORE TAXATION

YEAR	CAPITAL EXPENDITURE	OPERATIONAL EXPENDITURE	TOTAL EXPENDITURE	REVENUE	SURPLUS OR (DEFICIT)
1970/71	819	227	1046	-	(-1,046)
1972	1,701	303	2004	-	(-2,004)
1973	2,174	891	3065	583	(-2,482)
1974	120	1,286	1406	1,751	345
1975	165	1,329	1494	2,110	616
1976	180	1,294	1474	2,229	755
1977	190	1,329	1519	2,261	742
1978	817	1,397	2146	2,242	28
1979	208	1,545	1753	2,448	695
1980	268	1,619	1887	2,689	802
1981	191	1,695	1886	3,049	1163
TOTAL	6,833	12,915	19748	19,362	(-386)

Source: Mumias Sugar Co. Final Feasibility Report Vol.I 1968.

sources. Thus, although the direct income from cane is primary data, it should be looked at critically and in relation to income realized in the area, other than from the sugar industry.

As already pointed out, the major objective of any entrepreneur in establishing an industry is to make profits. Unfortunately, it has not been possible to get the actual income and expenditure data from any of the sugar factories studied. All the same, the above data has been derived from published records. The table shows the projected cash flow of Mumias Sugar Company from 1970/71 to 1981. As shown in the table, during the first three years, expenditure at the factory was quite high. No profits were realized during these years, as the factory had not yet started operating. On the other hand, although the factory started operating during 1973, expenses incurred still exceeded the revenue and this resulted in very high loses amounting to £K. 2,482,000. It is also notable that during these three years of factory construction, capital expenses exceeded operational expenses. But as the factory came into operation after 1973, capital expenditure declined while operational expenses increased as shown in table 24. As a whole, gradual annual increases in expenditure have been projected during the 11 years, although an exceptionally high increase was predicted during 1978. The projected total increase in the overall expenditure is £K840,000 (or 80.3%), rising from £K1,046,000 in 1970/71 to £K1,886,000 in 1981.

The projected revenue is accounted for, by income from both mill-white sugar and molasses produced at the factory. It is clearly shown that a steady increase in the revenue has been expected to occur. In 1973 a revenue of £K583 was estimated, while that of £K3,049,00 is expected in 1981, which gives a total increase of 423% (or £K2,466,000). This increase in revenue is quite high compared to the overall percentage expenditure shown above.

From the available data on factory expenditure and revenue, it has been possible to derive income surpluses and deficits. It is clearly illustrated that during the first three years, there were no profits made at the factory. This was due to the high capital and operational expenses which were not counter-balanced by any revenue as the factory was still under construction. Although the factory started operating in mid- 1973, no profits were made this year as total expenditure still exceeded the income received from the factory. But since then, annual projections indicate that the revenues exceed expenditure and therefore profits have been made annually. An increase in profits is notable each year, apart from 1978 when profits made dropped by 96%, from £742,000 in 1977 to only £K28,000 in 1978. From the above projected figures profits are expected to increase by 237% between 1973 and 1981.

The analysis clearly illustrates that reasonable profits are being made by the Mumias Sugar Company from the sugar industry each year. But from the overall expenditure and revenue totals, a deficit of £K386,000 is to be expected by 1981. Despite this, we should note that these are just projections but not actual have been taking place at this sugar factory, actual profits may be higher than those projected.

We may therefore conclude that such industries which generate high profits are both beneficial, first directly to the entrepreneurs and secondly, indirectly to the local population in the surrounding areas. The profits made by entrepreneurs may be used to establish new industries in the area, especially those which are growth-inducing. Such new industries will not only benefit the entrepreneurs but will provide additional employment opportunities and (if properly planned and controlled by Government Policy, especially in the rural areas) should derive their raw materials from the surrounding areas. Thus more growth inducing effects will be introduced in the area, as more income will be injected in the area. Similarly, the incomes earned by the population in the area from the factory and from their farm produce should increase their earnings which may be invested in more development projects in the area.

6:3. DEVELOPMENT FACILITIES ORIGINATING FROM THE WESTERN KENYA SUGAR INDUSTRY.

Industrial development in any given area requires a well developed infrastructure which includes a good developed transport and communication network, cheap and efficient power supply and well developed social services. To facilitate industrial development in an area, the government may take the initiative in developing such facilities in the area, as these act as forms of incentives which attract investors especially in poorly developed areas. Moreover, some of these facilities may be developed further by the company or the people in the area, after the establishment of the industry in the area. It may be noted that the benefits arising from these developed facilities are not only limited to their initial purpose of serving the industry in question, but extend to the surrounding areas. These therefore form a good development base for the area in which the industry is located. As a result, they may be termed growth-inducing effects originating from the sugar industry.

In this section, we will try to examine some of the facilities that have been developed in the area, either by the Government, the Company or the farmers themselves, as a result of the establishment of the sugar industry in the area. In addition to this, we will also try to find out whether their development is beneficial to the population in the surrounding areas or not.

6:3:1 ROADS

It is essential that the main road system within the sugarzone should be such as to allow heavy road haulage units to operate continuously at all times of the year except during periods of peak rainfall when the factories close for maintenance. It is also necessary to provide improved access roads to enable construction materials and equipment to be transported to the factory site and to facilitate the transfer of sugar and by-products from the factory. To facilitate the transportation of these inputs and outputs, three different types of road network have been developed in the area. These are, main access roads, feeder roads and access tracks.

The main access roads are, First Class Gravel Standard. They are the main cane haulage roads used to transport cane from feeder roads up to the factory, in 12 ton capacity lorries (Plate 2). These are also used in transporting machinery, fertilizers and factory chemicals to the factory. In addition, outputs such as sugar and molasses leave the factory to the nearest railway station along these roads. Such roads are based on the existing road network and their development has been entirely the responsibility of the Government. Recently many of these have been up-graded into tarmac roads in Nyanza sugar complex, while in Mumias and Nzoia sugarbelt, the main road running from Webuye to Bungoma, and then to Mumias has also been tarmacked. A plan to tarmac that part of the road running from Mumias to Kakamega has also been made, in order to facilitate transportation along this route. The up-grading and improvement of these roads located in the sugar area has not only been beneficial to the sugar industry, but has been of general benefit to the economy of the area.

Feeder roads are used for hauling cane from outgrowers' farms to the main access roads. The standard of the feeder roads is, or is supposed to be equivalent to the Ministry of Works specification for Second Class Gravel roads. The development of

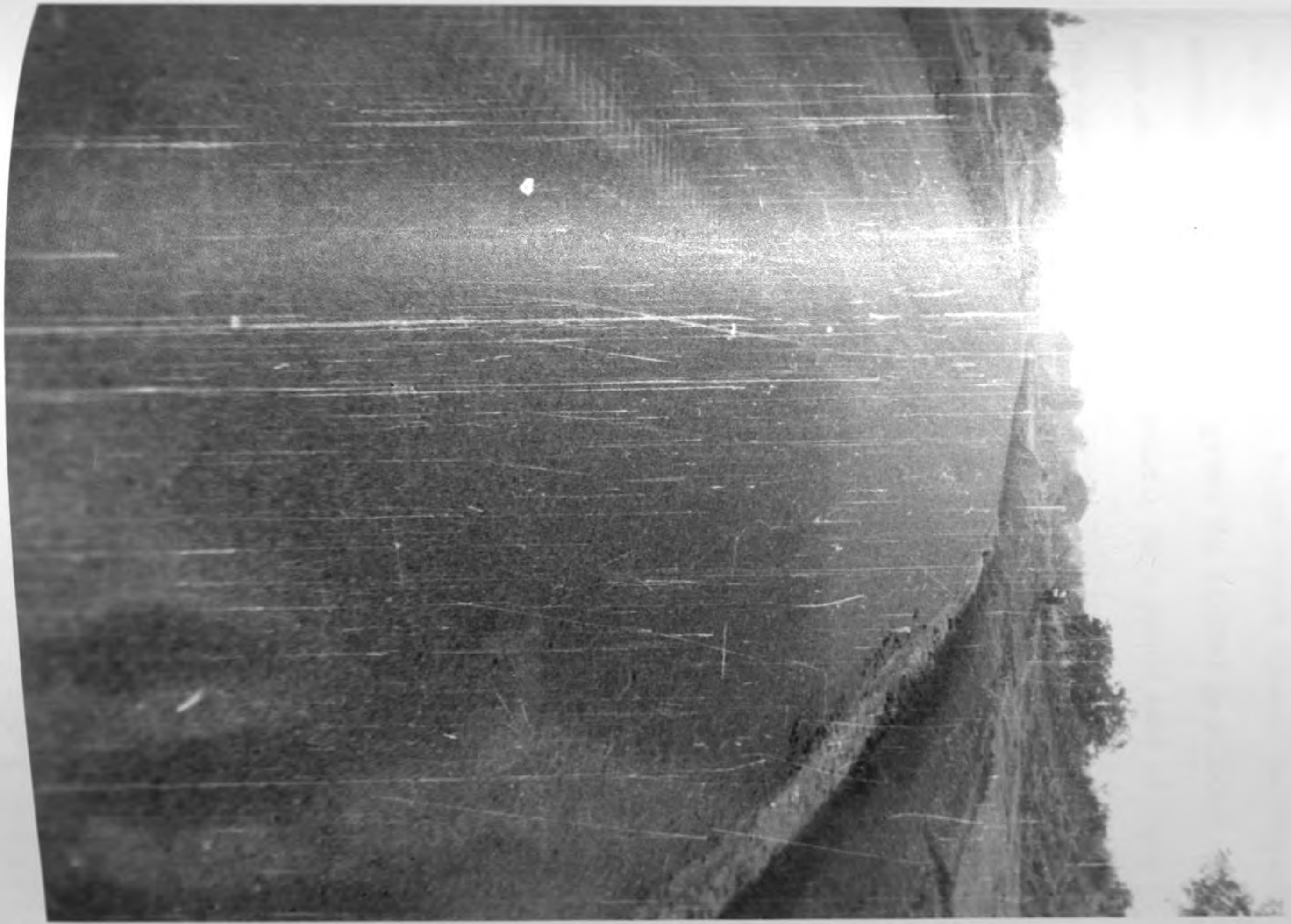


Plate 2. Main access road in Mumias Sugar Belt.

these roads has been a responsibility of the Companies in Mumias and Nzoia belts and that of the outgrower farmers themselves in Nyanza sugar belts. As a result, feeder roads in the former belts are better developed (Plate 3) compared to those of the Nyanza sugar belts (Plate 4). This is because the farmers in Nyanza sugar belts cannot finance the frequent maintenance of these roads, given the limited cane income which comes once in two to three years. As a result most of these roads have remained in very poor conditions, causing alot of problems when transporting the cane to the factory. This transportation problem is encountered almost throughout the year, due to the black cotton soils which become very sticky and almost impassable during the rainy season and very dusty during the dry season (Plate 5). This is therefore, one of the main problems facing outgrower farmers in transporting their cane to the factory.

Access tracks connect areas of outgrowers' cane with the feeder road system. These roads are used only occasionally to transport relatively small tonnage of cane. As in the case of feeder roads the Mumias and Nzoia Sugar Companies provide motor graders to level off these tracts when they are required for cane haulage. But it should be noted that although the companies provide these services in Mumias and Nzoia sugar belts, the expenses involved are met by the farmers themselves. Such costs are usually deducted from their gross sugarcane income.

Plate 3. A feeder road in Mumias Sugar Belt.

Plate 4. A Feeder road in Nyanza Sugar Belts.

Plate 5. Untamarked dusty feeder road in Nyanza Sugar Belts.

Research findings indicate that all the farmers (150 of them) interviewed from Mumias Sugar Belt were quite satisfied with the overall development of the feeder roads, although parts of the main access roads were poorly developed. Most of these roads are untarmacked and therefore become very muddy during the rainy seasons. Alternatively, about 200 farmers out of the 220 farmers interviewed in Nyanza sugar belts were quite disatisfied with the condition of the feeder roads in the area. They, therefore asked for aid either from the respective sugar companies (that is, Chemelil, Muhoroni and Miwani), or from the Kenya Government. All the same, they were quite satisfied with the tarmacked main access roads.

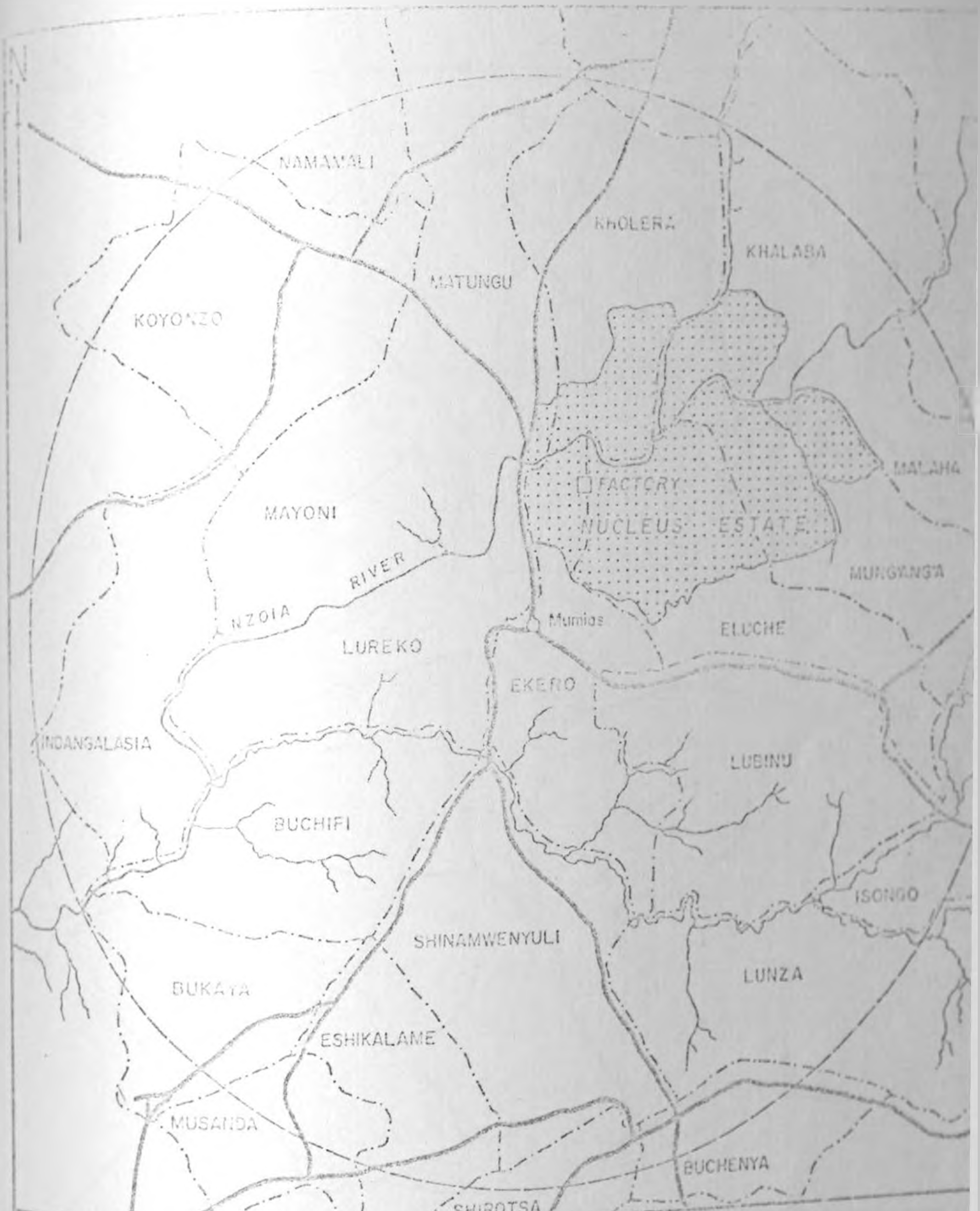
Despite the disatisfaction with the development of parts of the major or feeder roads by some farmers, several people in the area, both outgrower farmers and non-outgrower farmers, have bought "matatus" as a result of the developed road network (Plate 6). For example, of the 150 farmers interviewed in Mumias area, at least 10 outgrower farmers had bought "matatus" from their cane income, while 3 had bought cars. Similarly, all the 10 large scale farmers interviewed in Nyanza sugar belts owned cars which were bought after the establishment of the sugar factories in the area, while 7 of them owned "matatus". But it was observed that none of the small-scale farmers interviewed from Nyanza sugar belts, owned either a "matatu" or a car. According to them, although the general road development in the area acted as an incentive,

Plate 6. A "matatu" bought from sugarcane income.

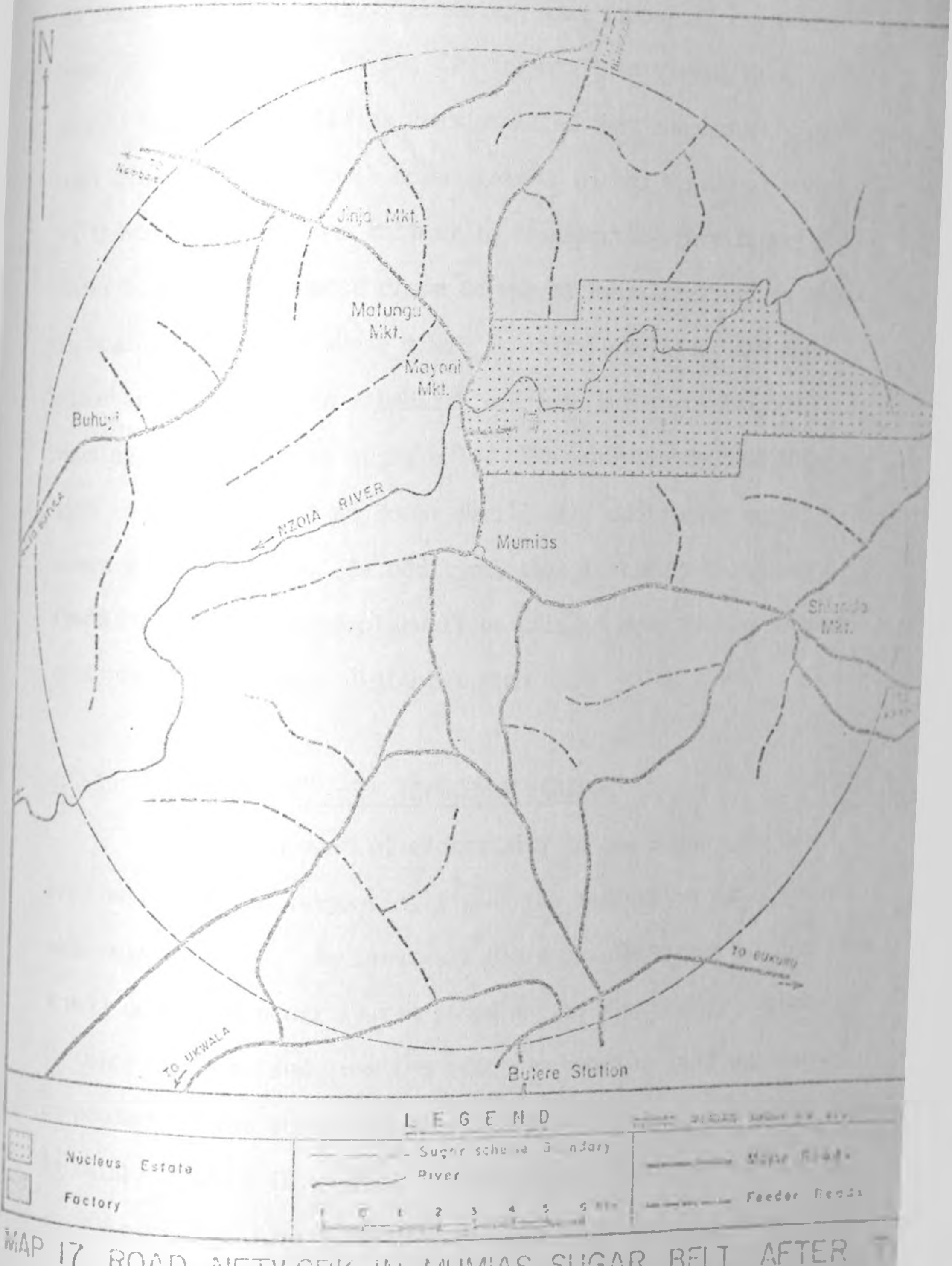
buying a "matatu" or a car was a luxury which they could not afford from their limited cane income. This implied that purchasing and maintaining such property required an extra source of income which was more regular than the intermittent cane harvests. This argument may be supported by a research finding that one of the farmers interviewed from Mumias sugar belt bought a car immediately after earning his cane income, but soon after spending all the money, he sold it because he could not maintain it. Besides buying these vehicles, it was noted that most farmers are quite satisfied with the general development of the road network in the area. They admitted that movement either on foot or by bicycle is now easier and faster than before these roads were improved. This has as a result, facilitated trade in the area. Maps 16 and 17, clearly illustrate the difference between the road network before and after the construction of the feeder road in Mumias sugar belt.

6:3:2. RAILWAYS

The main railway lines in the area were established before the development of the sugar industry. These are, the Nairobi - Kisumu line, which passes through Muhoroni, Chemelil and Miwani in Nyanza sugar complex and the Kenya - Uganda railway line which passes through Sudi, just next to Nzoia sugar factory. However, these railway lines have had some influence in attracting the location of the respective sugar factories in their present localities. These are very important in the transportation



MAP 16 ROAD NETWORK BEFORE CONSTRUCTION OF FEED ROADS IN MUMIAS SUGAR BELT



MAP 17 ROAD NETWORK IN MUMIAS SUGAR BELT AFTER THE CONSTRUCTION OF FEEDER ROADS.

of both inputs and outputs to and from the factories, as most of these are quite bulky. Moreover, rail transport is widely used in Nyanza area. Of the 220 farmers interviewed from Nyanza sugar belts, 144 farmers admitted that they usually use rail transport from their home areas to either Kisumu or Butere. Of these 20 of them use railway in transporting fertilizers to their home areas located close to the railway line. It is only in Mumias sugar belt where there is no railway line, although plans are under way to establish one from Butere to Bungoma, running through Mumias sugar belt. The establishment of this line in the area will no doubt facilitate additional easier movement in the area. In addition, this is likely to increase trade in the area as people will be able to move easily and more comfortably for longer distances with their bulky goods.

6:3:3. ELECTRICITY AND TELECOMMUNICATION

The development of electricity in the sugar zone has been basically the responsibility of the respective companies at each sugar factory. At least all the sugar factories studied have a well developed power system based on the electricity produced by using steam raised from the heat generated by burning the by-product of the sugar industry, known as bagasse. This electricity is mainly used in factories. However, this is subsidized by electricity from East African Power and Lighting or other private generators owned by the company.

As observed during the survey, the development of most of the electricity network is still confined to factory residential areas where the company caters for such expenses. This exception was only found among large scale farmers in the Nyanza sugar belts, who have either tapped their electricity from the nearest power lines, mainly running to the factory, or have developed their own private generators using diesel. On the other hand, only one farmer interviewed from Mumias sugar belt has a diesel generator. Usually, these are farmers whose cane income is quite regular and high compared to that of the small-scale outgrower farmers. Furthermore, these farmers have other sources of income from either private businesses or permanent employment. This combined with their cane income usually enable them to cater for expenses, such as those encountered in paying for electricity.

As in the case of electricity, a well developed telephone system is only found at the factory. Of the farmers interviewed, only some of the large scale farmers have telephones installed in their farms. Although these facilities are very essential in the general development of an area, they have been least developed in the surrounding areas. This is because of the expenses involved in both their establishment and every day maintenance which most of the small scale farmers cannot afford. Apart from these, most of the small scale farmers are not yet aware of the benefits that may result from these facilities. They are therefore considered as luxuries rather than necessities. On the whole, rural electrification is a very crucial factor in rural development. Its importance is not only in terms of lighting and cooking, but a well established power system is likely to result in the development of small-scale industries. These may include the establishment of small private sugar factories which may utilize privately owned cane, usually not sold at the large sugar factory. Similarly this would result in the establishment of flour mills and many other small-scale industries which require electricity. The development of such industries in the rural areas would obviously result in the overall development of rural economy as more employment opportunities would be created in the area. Hence an increase in cash income resulting in improved standard of living and development of new infrastructural facilities. This may therefore be considered as a regional multiplier effect induced by the development of the sugar industry in the rural areas.

We may therefore assume that in the course of time such facilities will be established in the surrounding outgrowers' areas. This may be expected when farmers realize their importance in rural development and at the same time increase their income to enable them to cater for such expenses.

6:3:4: WATER SUPPLY

This is one of the development facilities which has received little attention in the Western Kenya sugarzone. Piped water is mainly found in the factory residential areas where it has been developed by each respective sugar company. As in the case of electricity and telephones, all large scale farmers interviewed in Nyanza sugar complex have piped water from the nearest water pipes running to the factory. In addition to these, some of the small scale farmers in Nyanza sugar belts also have piped water in their home areas. The water has been piped from bore holes in the Nandi hills to storage tanks built in their sugar-belt home areas (Plate 7..), For easy accessibility, several tanks have been installed at strategic points where they serve several families. This water is mainly used for domestic purposes and livestock. Therefore, out of 210 small-scale farmers interviewed from Nyanza sugar belts, 48 of them had access to piped water. Moreover, they stated that it was through harambee spirit, especially by using their sugarcane income that they were able to put up such water tanks.

The rest of the farmers interviewed were quite disatisfied with their sources of water supply. The outgrower farmers from Mumias sugar belt usually draw their drinking water from wells. Such water is usually not quite pure, especially for drinking purposes. On the other hand, outgrower farmers in Nyanza sugar complex, especially those in the Muhoroni sugar belt, get their water from Nyando river into which all the factory pollutants are also discharged. Some of them get their water from standing water pools along the road. Generally, they are aware that this water is polluted but they have no other alternative, since they cannot afford to construct piped water. It was therefore their wish that the government or the sugar company concerned would assist them,

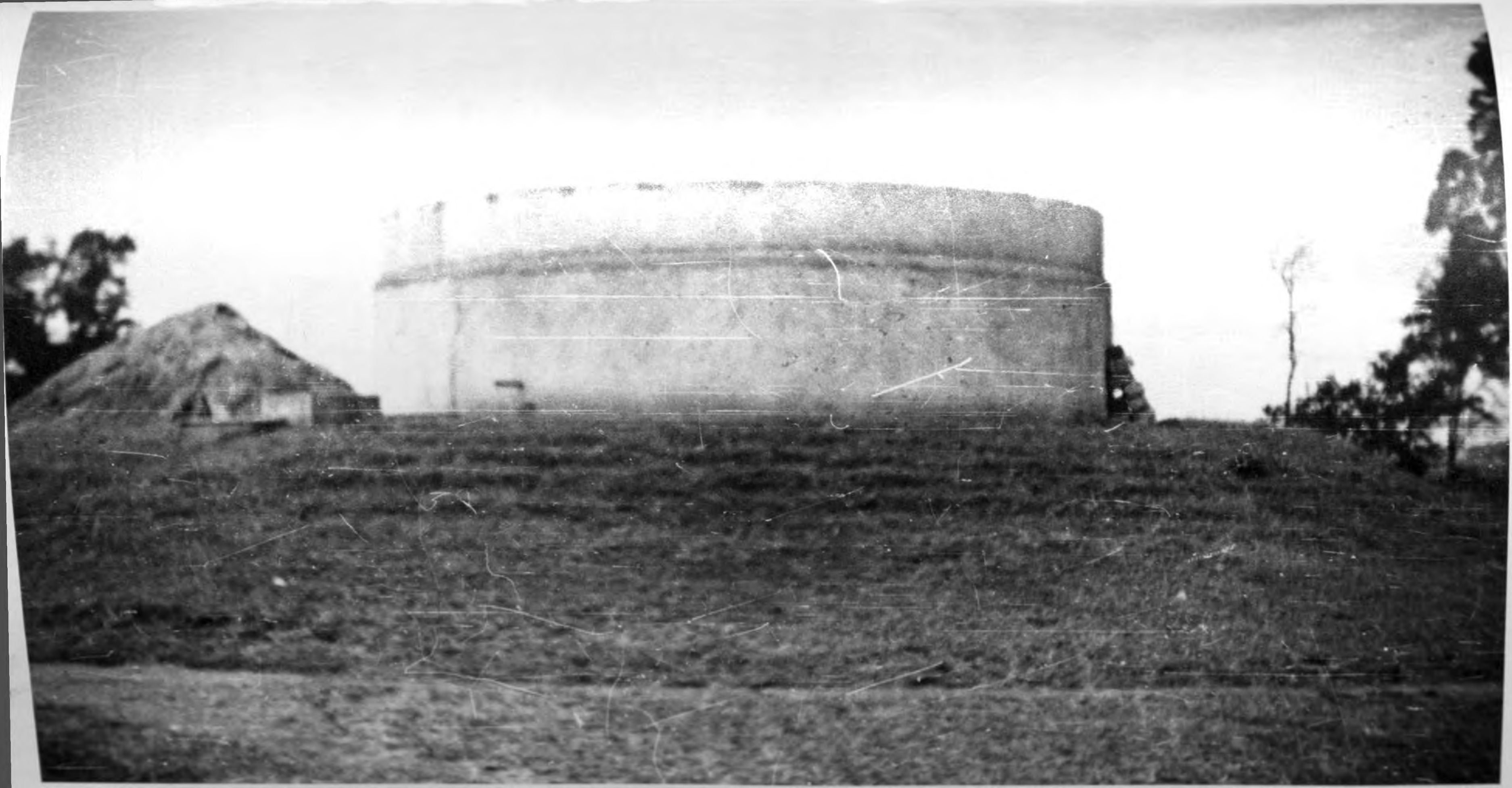


Plate 7: A water storage tank in Nyanza sugar belt, constructed from sugarcane income.

especially in constructing few water tanks in the area, from where they could draw some good water for domestic, especially drinking, purposes.

6:3:5. EDUCATIONAL SERVICES.

All the factories studied in Western Kenya have developed their own private educational facilities. These include nursery and primary schools which provide educational services for the children of all factory employees. In addition to these, each company takes the responsibility of training its manpower on the job, either at the factory or abroad whenever local training facilities are not available. For instance, technical studies in sugar development are usually undertaken in countries such as the Philippines, where sugar development has been in existence for a long time. It may be noted that although the main aim of each company is to train its manpower in order to improve its sugar production, the benefits achieved are nationwide. This is because after achieving the necessary skills, these employees are free to leave and work anywhere in the country, as long as they have fulfilled the bonding regulations laid down by the relevant company. From this point of view, it is worth observing that these sugar companies do not merely provide employment for their workers, but also take the responsibility of training some of their manpower on special jobs as this is one of the government's development policies.

Besides these educational services provided by the companies, several primary and secondary schools have been established in the sugar growing areas. These have been built by the farmers through harambee spirit (Plate 8 and 9). Out of 150 farmers interviewed from Mumias sugar belt, 24 farmers indicated that, the primary schools in their home areas were built after the establishment of the sugar factory. Similarly, 32 farmers out of 210 small-scale farmers from Nyanza sugar belts made the same observation.

Out of the 370 outgrower farmers interviewed, 300 (or 71%) of the farmers were quite satisfied with the number of schools in their home areas. However, some of the farmers were quite disatisfied with the type of teaching offered to their children in some of the harambee primary schools, despite the efforts they had made in building the schools. This also applies to many of the harambee secondary schools in the area, so that this shortcoming no doubt calls for aid from government officers to supervise the teachers, together with the teaching system offered to the children. Several farmers raised complaints that teachers are hardly in schools on time. This does not only waste the pupils time, 'but also the government's and parents' funds. It can thus be seen that the improvement of the education system in the area depends on the co-operation of both the teachers, parents and government officials.

Plate 8. A primary school in Mumias sugar belt constructed by the sugarcane outgrower farmers through harambee spirit.

Plate 9: Nzoia River High school in Mumias sugar belt constructed as a result of the Mumias sugar industry in the area.

The least developed educational services in the sugar-zone are the farmers' training centres and the village polytechnics. No farmers' training centre has yet been developed in the sugar-zone, since the sugar industry came into operation. Similarly there are only three village polytechnics in the area. These are Butula and Butunyi village Polytechnics in Mumias sugar belt, and Nyang'oma village polytechnic in Nyanza sugar complex. Only two farmers from Nyanza sugar belts have send their children to Nyang'oma Polytechnic school. Other farmers complained that these Polytechnic schools are located very far from their homes. While others felt they did not see the need for sending their children to such schools. In other words, they do not appreciate the type of education taught in these village Polytechnics. This therefore calls for rural education where farmers would be enlightened on the usefulness of the type of technical education obtained from such training centres.

From the above findings on educational facilities, it is clear that although the farmers are very keen in educating their children, using their cane income, they are still quite dis-atisfied with the teaching offered to their children especially in Primary and Harambee secondary schools. Secondly, it would be of great benefit to the farmers, if the farmers' training centres were established in the area. It is from such places that they could be enlightened on how to improve their farming techniques, as it is the latter that would enable them to increase their farm produce, both in sugarcane and other commercial and subsistence crops, hence an increase in their agricultural income. Thirdly, the development of Polytechnic schools is very important, especially to those school leavers who do not continue with further education, mainly after standard seven. It is at such places that they are taught how to build houses, construct roads, maintain machinery, cook, gain carpentry and many other skills. Such skills do not only offer an individual some form of employment, but may result in the overall development of the rural areas, as these enable them to establish and maintain some small-scale industries in the area. It should, therefore, be realized that provision of educational facilities in an area should not only be confined to primary and secondary schools, but should be extended to include such other facilities as farmers' training centres and village polytechnics, where adult education could be undertaken. Although both primary and secondary education provide(s) basic educational background, adult technical education is even more important because the people involved are made to deal directly with the problems affecting their daily performance.

6:3:6. MEDICAL SERVICES

Each sugar company has its own medical facilities (usually a dispensary and a maternity ward), which cater for their employees. On the whole, according to the farmers interviewed, very little medical development, especially improvement in medical facilities has occurred in government owned hospitals and dispensaries. About 110 farmers out of 150 interviewed in Mumias sugar belt and 172 out of 220 farmers interviewed in Nyanza sugar belts, were not satisfied with the development of medical services in the area.

At least, none of the farmers interviewed indicated any new medical facilities had been established in their relevant home areas, although they said that a clinic was under construction in Songhor area in the Kisumu district of Nyanza Province. As a result of this, most farmers have to walk for long distances before they can reach the nearest hospital or dispensary. It was generally observed during the survey, that the development of medical services in the area was still entirely in the hands of the government. The latter had done very little in developing the hospitals and dispensaries in the area.

Alternatively, medical assistants and doctors working privately in the area have increased. At least a medical officer or a doctor was found working at each market centre visited. This implied that the farmers' income had increased as a result of their cane-income, which consequently enabled them to cater for private treatment. In fact out of 370 farmers interviewed, 250 farmers had at least visited a private doctor. Having visited government owned dispensary or hospital before, most of the farmers involved preferred the treatment provided by private doctors. Despite free treatment offered at the public health service centres, the farmers still preferred private treatment because of the proper attention offered in such places.

It is important to note that the farmers visit these health centres and private doctors only when they are sick. When asked whether they go there for family planning instructions, they all said that such practices are not necessary. As a result most of the families interviewed had large families, each with more than 5 children (table 25..). Such large families tended to adversely affect the development of these areas, since a considerable proportion of their income had to be spend on the general welfare of the children. As already shown, quite a substantial amount of the cane income was spent on school fees. Furthermore, the same children had to be properly fed, medically cared for and dressed. Consequently, the money that would have been invested on rural development projects was mainly used in maintaining the children. Infrastructural facilities in Mumias and Nyanza sugarbelts are clearly illustrated on Maps 18 and 19.

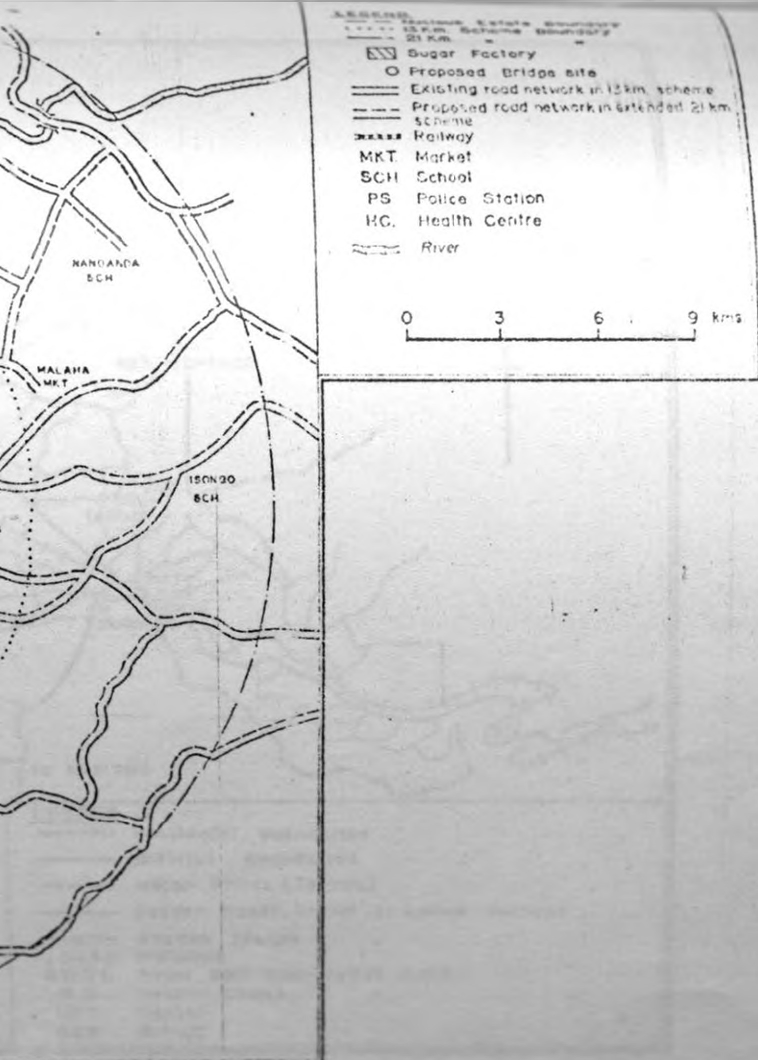
Table 25.

THE FARMERS' FAMILY SIZE IN THE SUGARZONE

Family size group	0-4	5-9	10-14	15-19	20+	Total
No of farmers	87	170	82	22	9	370

Source: Field research data.

INFRASTRUCTURE IN MUMIAS SUGAR BELT
Source - Mumias Sugar Co. Ltd


Sugar Factory
Proposed Bridge site
Existing road network in 13km. scheme
Proposed road network in extended 21 km. scheme
Railway
MKT. Market
SCH School
PS Police Station
HC. Health Centre
River
0 3 6 9 kms
NANDANDA SCH
MALAHA MKT
ISONGO SCH

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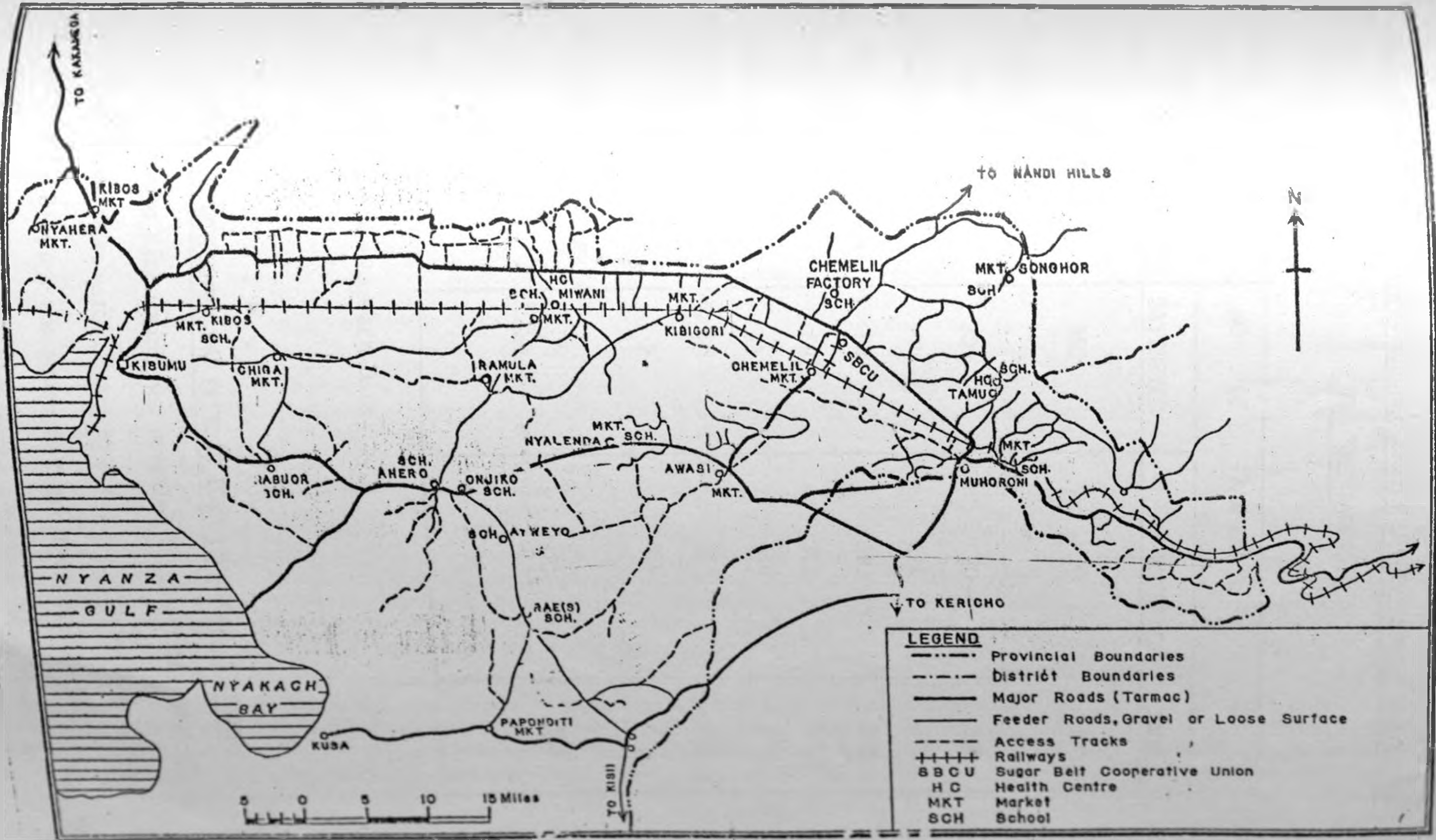


Map 19 Infrastructure in NYANZA SUGAR COMPLEX

Source:- Obara D.A. 1976 – Environmental Problems of small holder Sugarcane Production in the Nyanza Sugar-Belt

Table 26 OUTGROWER FARMERS' PERCEPTION OF DEVELOPMENT FACILITIES IN THE AREA.

Development Facilities	NO OF FARMERS		
	SATISFIED	DISATISFIED	TOTAL
(1) Roads	350	20	370
(2)Schools (Primary and Secondary)	300	70	370
(3)Railways	144	226	370
(4)Medical Services	88	282	370
(5)Piped Water	58	312	370
(6)Electricity	11	359	370
(7)Telephones	10	360	370
(8)Village Poly-technics	2	368	370
(9)Farmers Training Centre	-	370	370

Source - Field Reserach Data.

6:4. OTHER GROWTH INDUCING EFFECTS FORM THE SUGAR INDUSTRY

The above discussion has revealed that certain development facilities have been established in the sugar zone as a result of the industry. Besides the government and the companies' initiatives, outgrower farmers in the area have also played an important role in establishing and maintaining some of [illegible] of the farmers' income from cane was spent on purchasing small household articles, such as beddings, clothing, household utensils and food stuffs which include sugar, tea, cooking oil, salt and many others (tables 22 & 23). Apart from these, several farmers had purchased farm machinery such as tractors, trailers and ox-ploughs. Out of 150 farmers interviewed from Mumias sugar belt, 5 farmers had bought tractors. Similarly in Nyanza sugar belts all the large scale farmers interviewed had bought tractors. These are farmers who own over 50 ha. of land under sugarcane. In addition, one of the co-operative societies in Nyanza sugar belts had also bought a tractor, and several other co-operative societies in the sugar belt, each planned to buy at least one tractor in the near future. It is therefore to be noted that the purchasing of expensive items such as tractors are only limited to those farmers whose incomes from cane was relatively regular and comparatively high. It may also be pointed out that 66 farmers out of the 370 farmers interviewed had bought ox-ploughs. Out of these 19 of them (7 from Nyanza and 12 from Mumias sugar belts) bought these machines from their cane income. The farm machinery, especially tractors are mainly used by the individual farmers who own them. For instance, tractors are used for ploughing and transporting sugarcane to the factories (Plates 10 and 11). However ox-ploughs owned by small scale farmers are usually hired out to other people (Plate 12). In this way, the small-scale farmers usually make an extra income from ploughing jobs over and above that obtained from

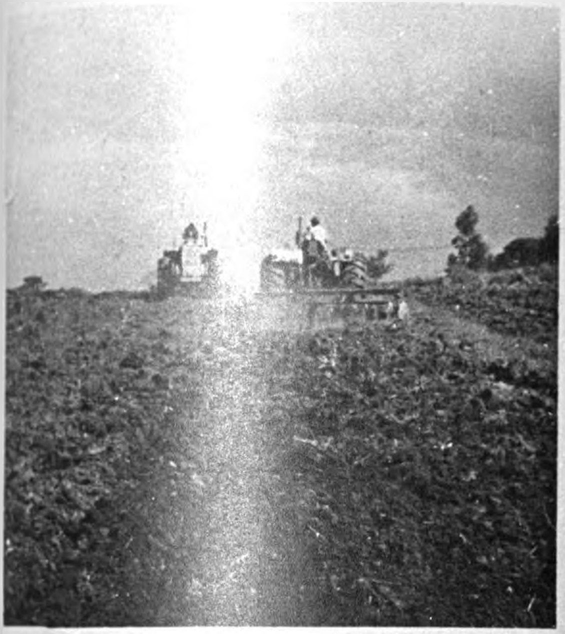


Plate 10: A sugarcane plantation being ploughed by tractors.

Plate 11: A tractor transporting sugarcane to the factory

... farm being ploughed by an ox-plough.

sugarcanes. The charges vary according to negotiations made between the owner of the ploughs and the hiring person. They usually fall between 80/= and 120/= per ha. in both Mumias and Nyanza sugar belts. Despite this, it was difficult to assess their monthly income from such activities, since the farmers did not know how many hectares are cultivated each day. Apart from the use of the listed agricultural machinery, at least all outgrower farmers in both sugar belts now appreciate the application of fertilizers, although the practical fertilizer application is mainly limited to sugarcane plantations. Other agricultural inputs, such as pesticides and herbicides have also been introduced in the area.

It can thus be argued that the establishment of these development points (sugar factories) has resulted in the introduction of new agricultural technology which may eventually result in greater improvement of agricultural outputs in the area. The efficiency of these ploughing machines allows the cultivation of large pieces of land compared to the traditional hoe. Similarly, the use of herbicides and pesticides results in the destruction of weeds and insects, respectively, which would otherwise ruin or reduce the productivity of crops. It may thus be concluded that the use of these new scientific techniques results in an increase in agricultural production, hence an increase in the farmers' income.

Over and above this, a few farmers own shops, bars and maize flour-mills. These are usually located in the market centres near the farmers' homes. Out of 22 shops built from the cane income, 12 were rented at a monthly rate of 50 - 150 /=, while 10 were personally owned. The chief items sold in these shops include, sugar, soap, cooking oil, matches, etc. It was not easy to assess the farmers' monthly income from their respective shops as none of them was willing to discuss his daily selling capacity of each item. All the same, it was noted that running the shop personally, was more profitable than renting it. This also applied to bar owners. It should be stated that out of the 6 bars built after the cane in both Nyanza and Mumias sugar belts, 4 of them were beer clubs for local brews (Plate 13). These have been closed down following the President's directive. The income from these beer clubs was quite attractive as the monthly income ranged from 1500/= to 3000/= . Those owning flour mills also find them to be quite profitable, although, they too refused to release their monthly income from the mills.

An important change which has occurred in the sugar zone is the construction of permanent houses, basically from the cane income. Of the farmers interviewed from Mumias sugar belt, at least 37 had built permanent houses from their cane income, while 15 had built semi-permanent houses with corrugated iron sheet roofs. Similarly, in Nyanza sugar belts, 41 farmers owned permanent houses while 22 had semi-permanent houses. This is a comparatively higher

Plate 13: Nabongo beer club constructed from sugarcane income.

response than in other development aspects discussed above. This finding can be supported by a statement made by Mugo N.M., (the General Manager of Nzoia Sugar Company)[2] that outgrower farmers have been able to built permanent and semi-permanent houses from their cane income. This indeed, is a mark of progress and prosperity, which is expected to improve with time as more farmers get a cash income from cane.

Table 27.

OUTGROWER FARMERS' PROPERTY OWNED BEFORE 1978

Name of item	No of Farmers		
	Purchased from cane income	Purchased from other sources of income	Total number of farmers
Tractor	16	-	16
Ox-ploughs Machine	19	47	66
Shop	22	9	31
Bar	6	7	13
Flour mill	3	3	6
Permanent house	78	43	121
Semi-Permanent Houses	37	26	65

Source - Field Research data.

[2] Mugo N.M. - "A tale of Continuous Growth (Helping farmers to help themselves) The Weekly Review 27th April 1979, pp 32.

6:5. IMPORTANCE OF THESE DEVELOPMENT POINTS IN REGIONAL PLANNING.

The major policy underlying the establishment of these development points in their present localities is to help to start and then accelerate the development of these areas. Thus, the relationship between these points and the hinterland is expected to be mutually beneficial, in that the growth of acentre or a point in time is to stimulate development in the surrounding area by facilitating, among other things, the development of most of the physical and social infrastructure. They are also expected to be the basis of rural industrialization, since most of the small-scale industrial activities such as, shoe repair, bicycle repair and flour milling are easier to establish at these points. From the hinterland, come the agricultural products, such as sugarcane and food stuffs which are sold in the produce markets located at these points. The money thus obtained by the farmers is spent on industrial goods such as "Unga", clothes, soap detergents cooking oil and kerosene. In other words, as Oiro. Obwa (1977) has remarked "the monetary economy is being encouraged in the rural areas thus expanding the monetary sector of the economy and considerably diminishing the traditional subsistence economy."[3]

However, it was observed in the field during the research period that the development of the above mentioned infrastructural facilities (such as water supply and electricity, with the exception of roads), are still confined within most of the development points and in the areas about them. This is particularly notable

[3] Oiro Obwa (1977) " The Effectiveness of Growth and Service Centres' Policy,as an instrument for Rural Development in Kenya, I.D.S. Working Paper No.317. .p11.

* The source of the model is indicated in figures 9a and b.

in newly established factories, such as Mumias sugar factory. Alternatively, in Nyanza sugar belts where the factories have been in operation for a longer period, the benefits of some of these facilities, such as water supply and electricity are being enjoyed by some of the farmers, who have managed in the course of time to tap them from the main lines leading to the factory. This is in line with Moseley's (1974) argument that growth-inducing effects emanating from development points normally outweigh negative effects. He has also noted that, with the passage of time, levels of development become spatially more even (fig. 9a) rather than more uneven (fig. 9 b).

This type of development being experienced in the sugar zone may also be illustrated further by Friedmann's (1966)* model which describes a sequence of regions with common prospects and problems emanating from the various "centre - periphery processes." These are:

(a) The core regions equivalent to the sugar plants and the related Nucleus Estates, with a high potential for economic growth.

(b) Upward transitional areas or outgrowers' areas whose "natural endowments and location relative to core regions suggest the possibility of greatly intensified use of resources." They are typified by increasing investment net migration and increasing capitalisation of agriculture.

(c) Downward transitional areas (that is areas surrounding outgrowers' region) which, according to Friedmann, are areas of old-established settlement whose essential rural economy is

* The source of the model is indicated in figures 9a and b.

Fig. 9 a.

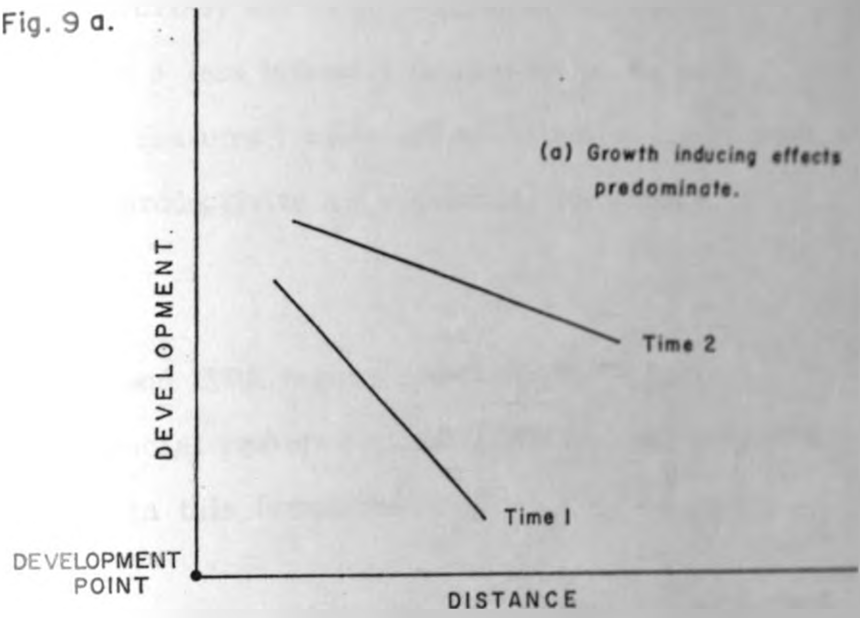
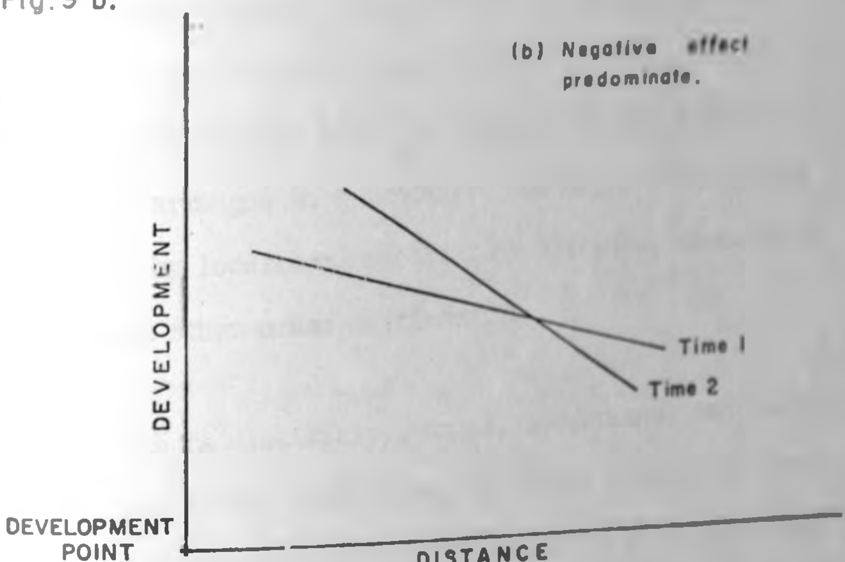


Fig. 9 b.



Source : Moseley. M. J. 1974 : Growth Centres in Spatial Planning : fig. 6·I. (a & b) pp. 120

FIG. 9a & 9b. GROWTH INDUCING AND NEGATIVE EFFECTS AROUND A DEVELOPMENT POINT.

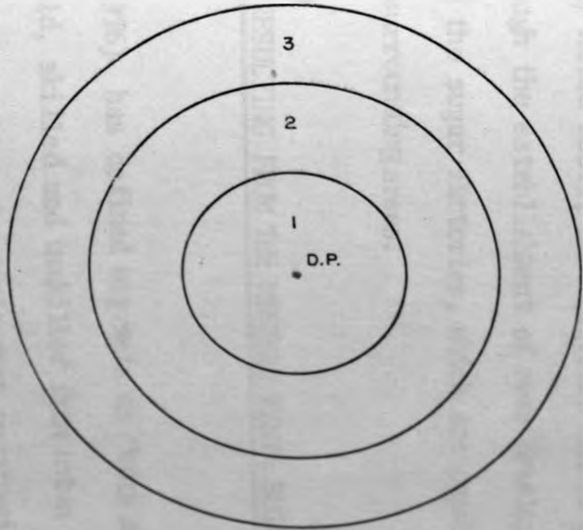
stagnant (or in decline) and whose peculiar combination of resources suggests a less intensive development in the past. Their distinctive features include net and selective outmigration, low agricultural productivity and a generally low standard of living.

The fourth and fifth regions identified as "Resource frontier" and "special problem regions" identified in Friedmann's model do not fit in this formulated model.

From the formulated model, based on Friedmann's study, there emerges the general hypothesis that around any given development centre or point, abroadly concentric series of regions might be expected. The major features being an "upward transition zone" close to the point where growth inducing effects are greater, and a "downward transitional zone" at the extreme end (fig. 10..) Such zones may be arranged in a concentric form. as shown, except where interrupted by localized resources or barriers, channels of communication, and other urban settlements.

Services such as electricity, water, educational and health facilities outlined above, form a very important part of the modern sector economy and profoundly affect the lives of the people they are provided for. They help to create a healthy nation with a well educated population. As a result, if the nation's policy is aimed at developing the rural areas where there is almost [illegible]

Fig.10: THE DEVELOPMENT OF CONCENTRIC REGIONS
POINT.



AROUND A DEVELOPMENT

KEY

D.P. Development Point.

1. Core Region.
2. Upward Transitional Zones.
3. Downward Transitional Zones.

absolute lack of such essential facilities, then the provision of such services is not only necessary but essential if development is to be achieved in the pertinent rural areas. But the question is how are these services to be availed to the greatest majority, if not to all the people in the rural areas, taking into account the fact that settlement patterns in the rural areas are not as dense as in development points where such services can be facilitated to the greatest number of people at relatively lower costs? As already noted above, such services can be provided in the rural areas through the establishment of more development points such as those of the sugar factories, which are capable of inducing growth in the surrounding areas.

6:6. NEGATIVE EFFECTS RESULTING FROM THE WESTERN KENYA SUGAR INDUSTRY.

6:6:1. MIGRATION

Gilbert,A. (1976) has defined migrants as "both male and female, young and old, skilled and unskilled from urban as well as rural areas usually seeking for employment opportunities".[4] Thus, migration may be considered as a two way process, that is from rural to urban and from urban to rural areas. In any case migration has its limitations in both areas. For instance, it usually results in underdevelopment or undevelopment of an area. This is because it removes that part of population, usually with relatively (but not always), the best brains from areas of origin to other areas. This assertion is apparently supported by Moseley's

4 Gilbert,A. (1976) - Development Planning and Spatial Structure, John Wiley and Sons. pp.54.

(1974) argument that "the development of our problem region is held back, at least, in part by a lack of skilled and professional manpower and in order to attract such people from their regions, the deliberate fostering of urban attractions by means of development centre policy is necessary."[5] On the other hand, problems experienced within the destination areas include, the cost of extending services to the ever-growing suburbs, the overloading of transportation facilities, water shortage and the development of slums around the outer periphery of the city. Thus a development point policy in an underdeveloped region should aim at generating employment opportunities to attract migrants from the major urban centres. This is because such development points are expected to encourage some peripherally located people to immigrate and to shift to a more productive occupation or industry established at these points.

As pointed out in the proceeding chapter, employment at each of the sugar factory in Western Kenya is nation-wide. This makes it obvious that in-migration is in progress at these development points. Furthermore, most permanent labourforce,as a whole, apart from the casual labourers,consists of residents at the factory. Out of the 10562 people employed at the factories, 6140 (or58.13%) of the total employment are residents (table 28.). These, therefore qualify to be termed as migrants, since change of

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[5] Op cit pp. 28 No.5.

residential area makes one become a migrant. Despite this, the majority, of the employees, (over 65.8%) of the total employment are unskilled and semi-skilled manpower mainly from the surrounding areas. These usually frequent their home areas during the weekend. Similarly, casual labourers are daily commuters, thus depopulation in these areas is not as serious as in large urban centres. These frequent visits to the migrants' home areas result in spending some of the income which would otherwise all be spent at the development points. This may be utilized in some of the development projects in the peripheral areas. Skilled manpower, consisting/relatively few [illegible] too frequent their homes as the sugar factories are located in

Table 28: RESIDENTIAL AND NON-RESIDENTIAL EMPLOYEES AT THE SIX MILL-WHITE SUGAR FACTORIES IN WESTERN KENYA.

NAME OF FACTORY	FACTORY EMPLOYEES		
	RESIDENTS	NONRESIDENTS	TOTAL
Mumias	2,500	1027	3527
Nzoia	546	1154	1700
Miwani	1334	326	1660
Chemelil	1000	449	1449
Awendo	160	1106	1266
Muhoroni	600	360	960
TOTAL	6140	4422	10562

Source: Field Research data.

the rural areas where social activities are in fact limited and not as attractive as in large urban centres. This, therefore, enables them to spent part of their income elsewhere, other than at the localities of the sugar factories. Myrdal's argument about this aspect of migration that in the centres of expansion, incomes and demand may increase investments may, in this particular case, be partly invalidated.

A more serious factor related to this problem of migration is the preference to work at the sugar factories rather than in other economic sectors in these rural areas. The resultant effect is that the surrounding outgrower areas are usually left with very little labour-force. Most of the working population (especially the youth) prefer to immigrate to the large urban centres. This usually results in farm labour shortage, especially during weeding periods. Out of the 370 outgrower farmers interviewed, at least 280 (or 75.7%) farmers pinpointed one of their major problem as lack of sufficient farm labour. It has become quite difficult to employ permanent labourers to work on outgrower farms, since they too demand a high income, as that paid to unskilled labour at the factory, namely 350/= per month. Unfortunately, most farmers cannot afford to pay their labourers such a high wage since their cane income is quite limited. As a result most farmers can only hire labour after booking in advance. These farmers have found hired labour just as expensive as permanent labour, as the charges per hectare range between 100/= and 150/=. All the same, they have no alternative since hired labour is more available than permanent labour. This is likely to affect the

the sugarcane yields, as better yields can only be expected when proper weeding is carried out throughout the growing period. This cost factor may not only reduce the farmers income from cane, but could also affect the quality and quantity of the sugar produced at the factory.

6:6:2. FOOD SHORTAGE AND OTHER PROBLEMS RELATED TO SUGARCANE CULTIVATION IN THE SUGARZONE.

The concentration of most of the outgrowers' land, capital and labour on sugarcane production is a notable feature which is already causing serious problems in the area. In doing this, farmers have tended to overlook the problems related to monocultural practice. The seriousness of this problem arises when crop failure occurs, or when there is a breakdown at the factory. The latter is a frequent phenomenon experienced by the Western Kenya sugar factories. This has often resulted in very serious waste of cane through which the farmers have incurred great losses in their cane income (Plate 14).

Similarly, incentives offered by the government in the form of loans and favourable cane prices compared to other cash crops, such as cotton, together with available market at the sugar factories have facilitated the over-cultivation of cane in the area, hence over production of cane. As this thesis is being presented, there is alot of mature and over-mature cane in the farms. This is because of lack of transport facilities or the already congested factories cannot accept extra cane for crushing. This has actually made most farmers angry and desperate

Plate 14: A heap of sugarcane rejected by a sugar company.

as cane is their major source of income. Some farmers have been thinking of uprooting the cane to replace it with other cash crops.

A most important negative factor concerns the relationship of sugarcane to other crops. At least in all sugar factories, it has been found to be more economic to consolidate the required land into a plantation and to produce the crop on a capital intensive basis with the advantage of centralized management. In practice, this "solution" is proving increasingly difficult to execute, since it involves the alienation of land already inhabited and normally cultivated by the farmers.

However this has not only left many people landless, but it has also forced several others to purchase land in the neighbouring outgrower areas. This has further reduced the available land owned by each farmer, as these outgrower farmers are expected to supply cane to the factory. The question, therefore, is how to reconcile the demands of cane growing with those of food crops. It should be noted that balanced cropping is not successfully maintained, especially when every farmer wants to earn as much as possible from the sugar industry. Even when land has been formally reserved for food crops, productivity in the subsistence sector may actually decline and planted acreages diminish. This is because other factors of production, particularly labour, has become increasingly costly and scarce. These problems are further complicated by the narrow focus of most sugar extension programmes in which the field supervisors concentrate exclusively on cane production, leaving other cropping activities to take care of themselves.

In this context, low productivity in the food crop is the resultant problem and this is currently being experienced in sugar areas such as Mumias, Chemelil, Muhoroni and Miwani sugar-belts. It is therefore important to stress that when sugarcane has been identified as an appropriate cash crop for a specified area, particular care must be taken by rural planners to support other sectors of agriculture as well. Thus the observed results in many sugar producing areas call for comprehensive planning, where food crop production should be considered just as seriously as cane production, if food shortage is to be avoided in the cane belts.

6:7. CONCLUSION.

From this core-periphery "analysis, it has been noted that development originates from centres and points of development which therefore constitute the cores. Likewise, Friedmann (1966) in his core-periphery model has raised similar observations. He has indicated that economic growth takes place in a matrix of urban centres or cores around which are areas lagging behind in levels of economic activity and development called the periphery. Thus, the process of development may be said to involve the economic and social integration of the periphery with the core. The periphery is dependent on the core and its development is largely determined by economic activities operating in the core. It has been noted that these core areas are the major points of employment. A monetary economy thus originates from these core areas as the income injected in the surrounding areas in the form of wages and salaries of the factory employees and outgrower farmers' cane income all come from these sugar factories which serve/ as the core areas. This income forms the backbome for the development of infrastructural facilities upon which the overall development of the surrounding areas depends. Moreover,new development ideas are also introduced in the areas as a result of the development of these points. This mainly applies to new agricultural technologies which originate from these points and eventually diffuse to the surrounding peripheral areas, depending on the interaction between the "core and periphery". Friedmann (1966) has further argued that "Innovations diffuse from cores to peripheries and lead to the modernization of the peripheral areas."

Alternatively, the existence of these core areas depend on the periphery. It is from the latter that the core areas derive most of their raw material(the sugarcane in this case), labour, and other essential requirements such us foodstuffs. Thus, a two-way relationship exists between the core and peripheral areas.

Research findings have indicated that a number of development facilities have been established in the areas as a result of the establishment of the sugar industry. These include infrastructural facilities such as roads, piped water supply, electricity, telephones, schools and medical services. It should be noted that the development of these infrastructural facilities has been concentrated within the core areas, with the exception of few facilities such as roads and railways which have spread more widely into the surrounding areas. Thus, as a conclusion, it may be said that development at the initial stages of the establishment of the core points only benefit that part of the population residing at these core areas. This may be related to the "Growth Centre Policy" which aims at concentrating the population in selected strategic points where these facilities can be utilized more efficiently. Furthermore, it has been realised that it is quite expensive to distribute some of these services to the surrounding rural areas once they have been established at the core areas. For instance, water points have been established in these core areas, but it is obvious that only the people staying near these water points and few others use the water. Otherwise, the people who live far from these communal water points have to pay for individual connections to their homes. However, the major problem, as stressed by most farmers is that they do not have enough income to afford individual connections. This is a case where the establishment of the sugar factories in an area has resulted in the development of piped water supply, although only a few individuals are the beneficiaries.

The conclusion is that, for the majority of the rural population, to benefit from such facilities, a more concentrated form of rural settlement around these points should be adopted so that these services can be provided more effectively. In fact, this policy should save more land for both sugarcane cultivation (which require large plantations) and other subsistence crops (which have been very much neglected in the sugarcane areas). The provision of these services in the surrounding areas should take place through the participation of both the people of the area and the government. Moreover, through a harambee spirit, supported by government aid, these facilities would easily be provided from the main points to these proposed settlements. In this case an individual would be spared the expense of paying for his own connections. Such dense settlement patterns would also greatly reduce the co[illegible] of providing such services by the government, since they will be directed from the main points to few clusters.

It has been realised that the slow development of some of these facilities in the surrounding areas is partly the fault of the population from the peripheral areas. In some cases once a farmer has received his cane income, he may disappear from his home to the nearest urban centre, where he would spent most of the money, if not all. This is actually misuse of scarce resources which are urgently.needed to develop the rural areas. Thus, the major problem is that most of the farmers, especially those who had never before handled large sums of money, do not know how to utilize their income. This is a shortcoming of many of the sugar farmers and calls for special training in handling money by government officials. Farmers should also be encouraged to invest their money in development projects which would help them earn an extra income instead of spending it in such uneconomic way.

It is clear that growth-inducing effects actually exist and originate from the sugar industry, although the major problem which has limited their spread into the surrounding areas is lack of proper planning. This therefore requires assistance from government officials and the respective sugar companies.

Apart from the growth inducing effects, negative effects also operate from, or as a result of these core areas. Migration has been partly considered as a negative effect. However, when examined from the employment point of view, it is a growth inducing effect, which arrests migration to large urban centres such as Nairobi and Mombasa, which are already congested. Alternatively, food shortage and the current over production of cane should be considered as major short-comings of the sugar industry in the areas considered. However, these problems arise as a result of lack of proper planning in each sugarbelt. Such problems could only be reduced by discouraging farmers from planting more cane, unless the bodies concerned are satisfied that they have enough land for other food crops. Although these problems are prevalent in the area, this researcher observed that farmers were still being encouraged to plant more sugarcane, irrespective of whether they had enough land for sugarcane and other crops or not. Such action by either the sugar company or the Government shows a sense of irresponsibility on their part and exploitation of the farmers.

Another problem related to the shortage of food and overproduction of cane is that most farmers are trying to maximize profits from their land which has been either laying fallow or has been mainly under unproductive subsistence crops.

This analysis of both growth-inducing and negative effects has clearly indicated that both processes are in operation in the sugarzone. In-order to make the final judgement as to which effect outweighs the other, more time is required so that further investigation may be carried out in future. Despite this, the hypothesis that "The sugar industry in the area has been responsible for negative effects and has had no growth inducing effects" is rejected.

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CHAPTER 7

THE POTENTIALITY OF WESTERN KENYA FOR EXTENDED SUGAR INDUSTRY AND ASSOCIATED ANCILLARY INDUSTRIES AND THE ROLE OF SUCH INDUSTRIES ON THE FUTURE REGIONAL DEVELOPMENT PLANNING.

7:1. INTRODUCTION.

The sugar industry has become one of Kenya's key money earners of considerable significance, thereby saving the country substantial foreign exchange. For instance, last year (1978) Kenya produced a record of 236,439 tons of mill-white sugar, netting more than £(K)36m. In realization of this, the Government has embarked on several national planning strategies closely related to the development of the sugar industry. However, it is clear that much still remains to be achieved in developing the Western Kenya sugar industry, since most of the factories are in their early development stages. For example all the sugar factories in Western Kenya (and in Kenya as a whole) merely produce mill-white sugar wholly consumed locally. Furthermore, some of the factories (such as Chemelil, Muhoroni and Miwani), are operating far below their designed production capacities. Further development of the sugar industry in Western Kenya may therefore be achieved through a variety of possible ways, which include both the expansion of existing plants and the establishment of new ones to process both mill-white and refined sugar. Moreover, further development of the sugar industry should facilitate the establishment of ancillary industries linked to sugar processing, consisting of those industries utilizing the by-products from the sugar industry.

7:2 THE POTENTIALITY OF THE WESTERN KENYA SUGAR INDUSTRY BASED ON EXPANSION AND ESTABLISHMENT OF THE SUGAR PLANTS.

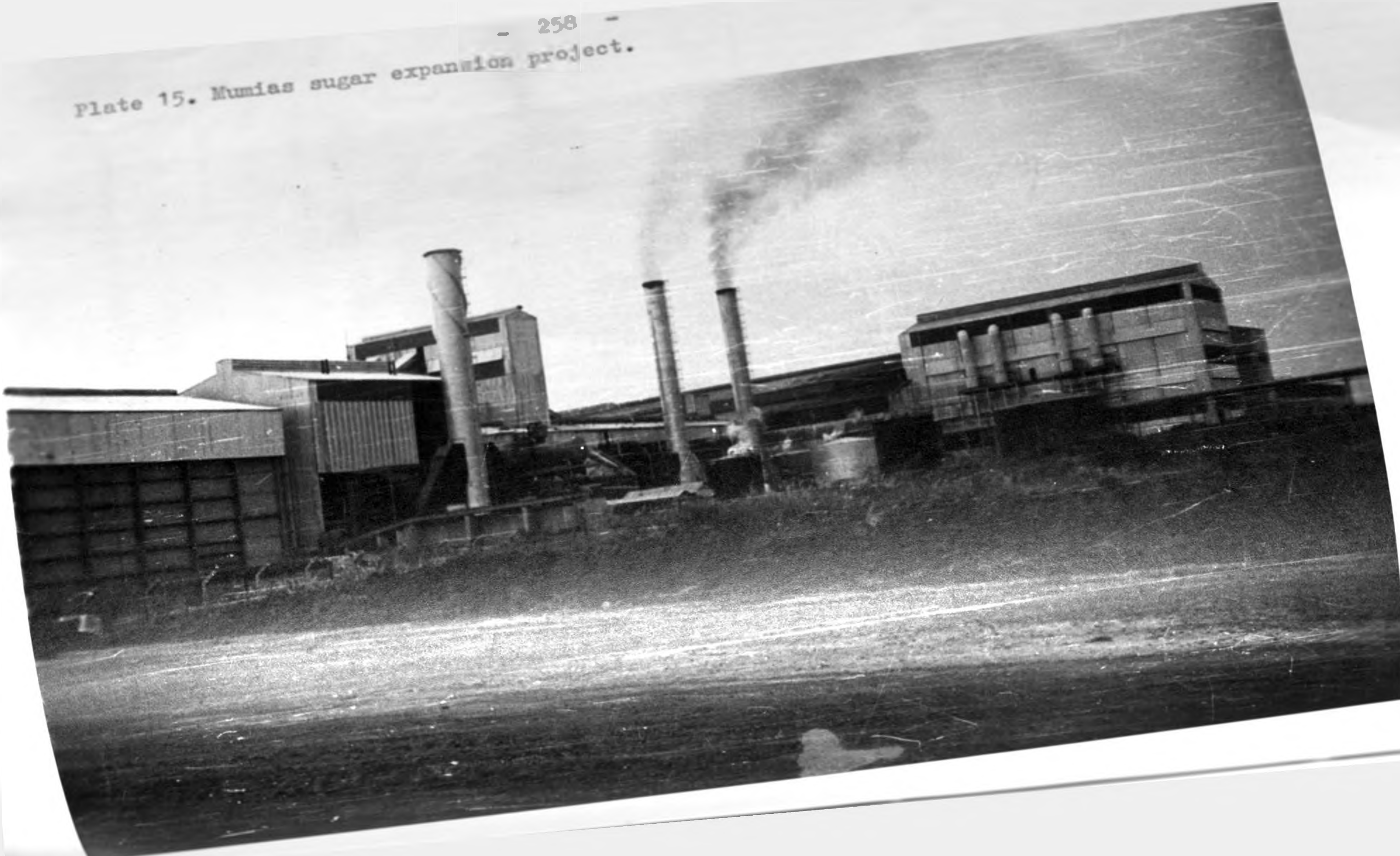
The country's present sugar policy is that aimed at self-sufficiency in sugar production, if possible, by the end of this year (1979) as revealed by the Chairman of the Kenya Sugar Authority, that "Kenya will have some surplus mill-white sugar amounting to 50,000 tons towards the end of this year (1979), which will be absorbed into strategic stocks to sustain self-sufficiency and whatever will be left will be exported."[1] Obviously the aim of the Government in sugar production is to meet, adequately in the near future, the rapidly growing demand of the Kenyan population for sugar, both in terms of the general domestic needs and for industrial purposes. As a result of such unsatisfied and fast growing needs, the Government has prepared a long term sugar development programme involving considerable capital investment, aimed either at the expansion of the existing sugar production complexes or at the establishment of new ones. Among the sugar factories already in production, the Government has embarked on a commendable rehabilitation programme under which millions of shillings from the World bank are already being spent on modernization and expansion of sugar plants. These include the factories at Mumias, Muhoroni and Miwani in Western Kenya (together with Ramisi at the Coast), to make these plants increase their sugar production. For instance, in Mumias Sugar Company, the Kenya Government has allocated about £(K) 4.7 millions

[1]The Standard, Thursday, May 17, 1979, pp.7.

for the purpose of bringing an additional 10,000 ha. under sugarcane, thence raising the number of the present sugarcane outgrowers from 11,000 to 17,000 by 1981. Thus, the present plan for the Mumias sugar complex is to increase its production capacity from 81,596 metric tons in 1977 to about 156,000 metric tons by 1979. Whether this target will be met by the end of the year (in view of the 1978 relatively low production of only 92,500.3 metric tons), still remains to be seen. On the other hand, it may be possible when the Mumias sugar expansion project, due to start this month (June 1979), begins the production of the mill-white sugar (Plate 15).

It has been realized, incidentally, that sugarcane is both the Nyanza and Western Provinces top money earner. Sugar production, especially by the outgrowers or by other individual private cane owners, is expanding very fast. This is because of the present favourable cane price of Shs. 133 per ton. Thus, the expansion of the existing factories will definitely increase the present capacity, despite the fact that most of them are mysteriously operating below their full production capacity. For instance, the plans for Muhoroni and Miwani is to increase the initially designed crushing capacity of 2180 tons to 3270 tons of sugarcane per day. The increament of the production capacity in these factories is quite ironic, since they have never achieved their initial designed crushing capacities, despite the over-production of cane in both areas, which should have fully supported their true production capacities. Similarly,

Plate 15. Mumias sugar expansion project.



although Awendo, in South Nyanyza, is still under construction it is planned to increase its designed production capacity of 2180 tons to 3270 tons of sugarcane per day. In all these sugar factories (as in Mumias sugar factory), the respective expansions will also involve an increase in the number of outgrower farmers, who will, of course, increase the amount of sugarcane produced in the area. These expansion programmes should lead to the adoption of new scientific devices which may result in full utilization of these factories. This, if properly planned, shall make it possible for the factories to absorb both mature and over-mature cane, which will obviously increase the amount of sugar produced from the Western Kenya sugar factories.

Apart from these expansion programmes, the Government also aims at encouraging the construction of smaller mill-white sugar factories and jaggery plants by individuals or groups of people to supplement existing factories' crushing power, in order to solve this problem of over production of cane. Another sound measure related to this problem of cane over-production, which the Government intends to implement is that of licensing cane outgrowers, which will streamline the growth of cane and possibly avoid undue over production.

Besides the planned expansion of the existing sugar producing factories, the Kenya Government still continues to carry out feasibility studies in a number of areas for possible additional sugar factories. These include the Yala River swamp in Siaya district of Nyanza Province and in Busia district of Western Province. These are proposed large sugar factories designed to produce mill-white sugar, although some of the sugar to be produced by the factory to be established in Busia district might be processed into refined sugar. Such a programme, aims not only at self-sufficiency in sugar production, but also at saving considerable sums of money in foreign currency, at present spent on significant quantities of imported sugar.

In addition to these large sugar factories, feasibility studies have been made for two small mill-white sugar factories in Kakamega district. This was recently stated by the Manager of the Kenya Industrial Estates, Kakamega branch.[2] It has been estimated that the total costs for the two factories are about K.Sh.10m. The two between them would have a crushing capacity of 1740 tons of sugarcane per day. Furthermore, the completion of these factories may result in 240 jobs.

In order to achieve the planned development targets in the expansion of the sugar industry, the Kenya Government has partly developed the essential infrastructure, or is partly in the process of establishing such infrastructure in the sugar growing areas. This includes either the construction of certain parts of the existing Kenya railway system or investing in new extensions to some of the remoter and more isolated sugar areas, as well as the

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[2] Langat I.K. - "Work on factories to start soon" Daily Nation, Wednesday, June 13,1979 pp.9.

development of roads, especially in the relevant sugar areas to serve as feeders to the existing rail-road network. These are intended to facilitate, not only the transportation of sugar-cane to the sugar processing plants, but even more important, to ensure prompt delivery of sugar to all the local markets, particularly to the principal urban areas, where consumption is relatively higher. It has been noted that although factories made record production, the offtake of sugar from them is quite slaggish due mainly to the shortage of rail wagons, a situation which should be corrected when projected rail development by Kenya Railways Corporation is implemented. The Government must also view seriously the complaints about the poor sugar distribution by the Kenya National Trading Corporation (K.N.T.C.) which does little to stimulate domestic sales of the sugar. It is obvious that unless the Government takes immediate measures to promote sales of sugar, the projected domestic consumption, estimated to rise at 7½% per annum is unlikely to be realised. Moreover, in view of the ravaged economy of neighbouring Uganda, now being reconstructed from scratch, most basic commodities from Kenya, including sugar, will invariably find their way into that country ofte causing shortages on the local market. Such shortages have already been experienced in the country, especially when smuggling was at its peak in early 1978. It is therefore, important that strict guidelines on the distribution of sugar be effected and adhered to by the Kenya National Trading Corporation.

Further, planned infrastructural developments should include the installation of the means of water and electricity supplies and the establishment of telephone network and other devices ensuring rapid means of communication in the sugar areas. Such infrastructure should also encourage and/or accelerate trade and other forms of rural development in the sugar areas by facilitating greater accessibility formerly non-existent there.

The production of refined sugar in Kenya is yet one of the aspects to be developed in the sugar industry, in future, since at present, all the factories in operation merely produce mill-white sugar. Only Miwani sugar factory is equipped to produce refined sugar but this has been impossible, because it has proved uneconomic to produce refined sugar in a situation of uniform sugar price. According to the management of Miwani sugar factory, they would be losing about 30% of the raw sugar equivalent by weight in the refinery. For instance, instead of producing 1000 bags of mill-whi sugar per day, they would be producing only 700 bags of refined sugar p day from the same quantity of cane. As a result of this, all the refined sugar consumed in the country is imported from other parts of the world as already indicated.

Thus ,if refined sugar industry were to be established in the country, especially in Western Kenya where most of the sugar is produced, it would not only enhance the status of the industry in the entire region, but it would also save a lot, if not all, of the much needed foreign currency at present allocated for buying imported refined sugar. This is because some of the local food processing industries require refined sugar.

7:3. ANCILLARY INDUSTRIES BASED ON THE SUGAR INDUSTRY

Amongst its other by-products, the sugar industry has three principal by-products of considerable commercial significance, namely molasses, bagasse and filter-cake. However, the range of utilization of these by-products of the sugar industry in the country is still limited. Thus, the economic importance of the industry is almost entirely dependent upon the sale of the mill-white sugar. The potentiality of the sugar industry in Western Kenya (or in Kenya as a whole) lies in the development of those industries utilizing by-products of the sugar industry.

7:3:1. MOLASSES.

Molasses constitutes one of the by-products and contains about 60% of fermentable sugars derived from the cane. A high proportion is sucrose, which cannot be recovered from the complex mixture. On the average, molasses production is the equivalent of $1/_4$ of the mill-white sugar produced. Although these sugars are paid for in the varied process of growing cane and sugar extraction, much of it is at present still wasted, apart from that exported (table 29). Plate 16 shows molasses being removed from storage tank to transporting tankers, for export. At present, some of it is sold locally as an ingredient in cattle feeds, while some is put on untarmacked dusty roads during the dry season. This is mainly put on roads in the factory residential areas, in order to reduce the dust (Plate 17). Most of the remainder is used in the processing of industrial alcohol(s). So far, only Miwani factory has a distillery for industrial alcohol, but its capacity is so limite

Plate 16. Molasses being removed from a storage tank to transporting tankers.

Plate 17. A road in the Mumias factory residential area covered with molasses inorder to reduce the dust.

that it cannot even process all the molasses from Miwani sugar factory alone. However, the distillery supplies enough spirits for the domestic market and a surplus for export. However, due to lack of enough storage and rail transport facilities, some of the molasses is run to waste. The table below shows production and export figures for molasses from 1967-75.

Table 29: PRODUCTION AND EXPORT OF MOLASSES 1967 - 1975.

YEAR	PRODUCTION (TONNES)	EXPORT (TONNES)	% OF TOTAL PRODUCTION	BALANCE (TONNES)	% OF TOTAL PRODUCTION
1967	24,200	14,570	60.2	9,630	39.8
1968	32,600	17,370	53.3	15,230	46.7
1969	46,200	35,200	76.2	11,000	23.8
1970	50,100	24,830	49.6	25,270	50.4
1971	46,600	29,260	62.8	17,340	37.2
1972	36,900	23,710	64.3	13,190	35.4
1973	55,200	32,400	56.7	22,800	43.3
1974	65,800	24,260	36.9	41,540	63.1
1975	63,840	38,750	60.7	25,090	39.3
TOTAL	421,440	240,350	57.03	181,090	42.97

Source: Odada, J.E.O. (1979). The Role of the Sugar Industry in Kenyan Economy: A case study of the Lake Victoria Basin. (I.D.S. No. 4).

The Kenya molasses is exported mainly to Britain and the United States of America at an average price of Shs.(K) 3[illegible]0 per tonne (f.o.b. Mombasa). Kenya has therefore earned £(K)3,[illegible] from a total of 240,350 tons produced and exported from 1967-75. Molasses is therefore a significant source of foreign exchange earnings to the country and provides additional incomes to the sugar factories.

However, there are many other ways in which molasses could be economically utilized in the country. This include, its application to farms as fertilizers, although this uses only the minerals present, leaving the sugar content to be wasted. Thus, the plant nutrients in Molasses can still be used as fertilizers after the sugar has been removed through further processing. Over and above these, molasses forms an excellent source of carbohydrates, and could be used in the manufacture of more cattle feeds. This by-product may also be fermented and processed into both cane gin (a popular alcoholic drink) and power alcohol (a fuel which could be a substitute for petrol). Another possible product from molasses is commercial yeast. At the moment, plans are underway to establish a multimillion giant molasses factory at Otonglo, 6 km from the centre of Kisumu town.[3] This is expected to be complete towards the middle of next year (1980).

The giant factory, which has attracted foreign government credits of 97m Swiss Francs from the Union Bank of Switzerland through the Chemap group has 51% Kenya Government ownership, while the rest of the shares are owned by the Madhvani Group of companies. [illegible]

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[3] Sirengo, W.: 1979 "Multi-million Chemical factory takes off: [illegible] created." The Standard, Thursday, [illegible]

completed, the molasses factory will produce alcohol (both industrial and potable), fresh yeast, dried activated baker's yeast, citric acid (food grade), Vinegar and methane gas, gypsum and ammonium sulphate. Other sophisticated products will be introduced during the second phase of the factory's development.

The new plant would alleviate the demand for products that are imported and hence save the country substantial foreign exchange. Secondly, products not sold locally would be exported to other countries with good market potential and this should earn the country more foreign currency. Finally, the power alcohol should provide a significant source of saving of foreign exchange currently being spent on petrol because it could be mixed with petrol (20% petrol and 80% power alcohol) to work just as well as pure petrol. This may enable the country to maintain a reasonable price level for petrol so that the sugar factories can use fuel power in their boilers and release bagasse for the manufacture of other industrial products. The completion of this proposed molasses plant will therefore be of great significance to the national economy.

In addition to these industrial enterprices planned for the near future, proper planning has been made to ensure that waste water from the huge complex will not pollute the surrounding areas, especially Lake Victoria. Instead, a sophisticated treatment plant costing more than Shs. 40m will be part of the molasses factory. The treatment of the molasses will therefore recover other valuable by-products of further economic value.

7:3:2. BAGASSE.

Bagasse, which is another by-product of the sugar industry, is the cane fibre, a waste, left when the sugar juice has been squeezed off bythe heavy roller-cane squeezers. Viewed as a waste, bagasse has traditionally been used as a factory fuel for raising steam either for factory general use in sugar processing or for generating electricity for use in the factory and the nucleus sugar estate. As a result of the constant increases in the price of petroleum products, especially the fuels used in sugar processing factories, the economic value of bagasse, as a fuel in sugar production, has increased. It is therefore likely that the high cost of replacing bagasse with fuel oil may retard the use of bagasse for industrial purposes.

On the other hand, bagasse, as a by-product of the sugar industry, has other industrial uses. It may be used as raw material in the pulp and paper industry. Thus, not only may Kraft paper be made from it, but also high quality paper provided economic quantities of bagasse could be ensured from the sugar factories. Bagasse may also be used in processing paper-board, although its natural properties make it merely suitable for a soft type of paper-board. However, new technology appears to have further promising possibilities in the paper-board and other building materials from this source.

Moreover, bagasse may also be used in the manufacture of furfural (a solvent, as well as, a raw material for the plastics industry). However, since the process must be carried out on a large-scale to be economic, it is not feasible at present. So far no plans have been made, either by the Government or by the respective companies processing sugar to utilize bagasse industrially.

7:3:3. FILTER-CAKE

In the process of purifying the dirty sugar juice into sugar syrup, a lot of fine organic matter from sugar mixed with soil becomes stuck on the rolling filtering drums in the factory. It is this type of sugar factory waste which is called filter-cake (Plate 18). As a by-product, filter-cake has considerable value as a soil conditioner and fertilizer. At present, it is often disposed off in the sugarcane fields at the replanting time (Plate 19). However, filter-cake could, perhaps be better developed in future as raw material for large-scale fertilizer industry. Although filter-cake could also be used as a source of wax, the latter could perhaps, be obtained much more cheaply both from other natural sources or, better still, from the petrochemical industry.

7:4. THE SIGNIFICANCE OF FUTURE DEVELOPMENT OF THE SUGAR INDUSTRY IN REGIONAL DEVELOPMENT PLANNING.

The sugar industry could, perhaps, be planned so that it acts as a trigger factor in much more comprehensive rural development planning, involving industrial, social and cultural aspects of development. Because all the sugar processing complexes in Western Kenya, and in Kenya as a whole are fortunately, material orientated being located as they are in the rural areas, they form almost ideal development points in their relation to the sugarcane out-growers and the other inhabitants of the pertinent surrounding rural areas to be developed. The growth inducing characteristics of the sugar processing complexes, (which include among others the

- [illegible] cake from the factory.

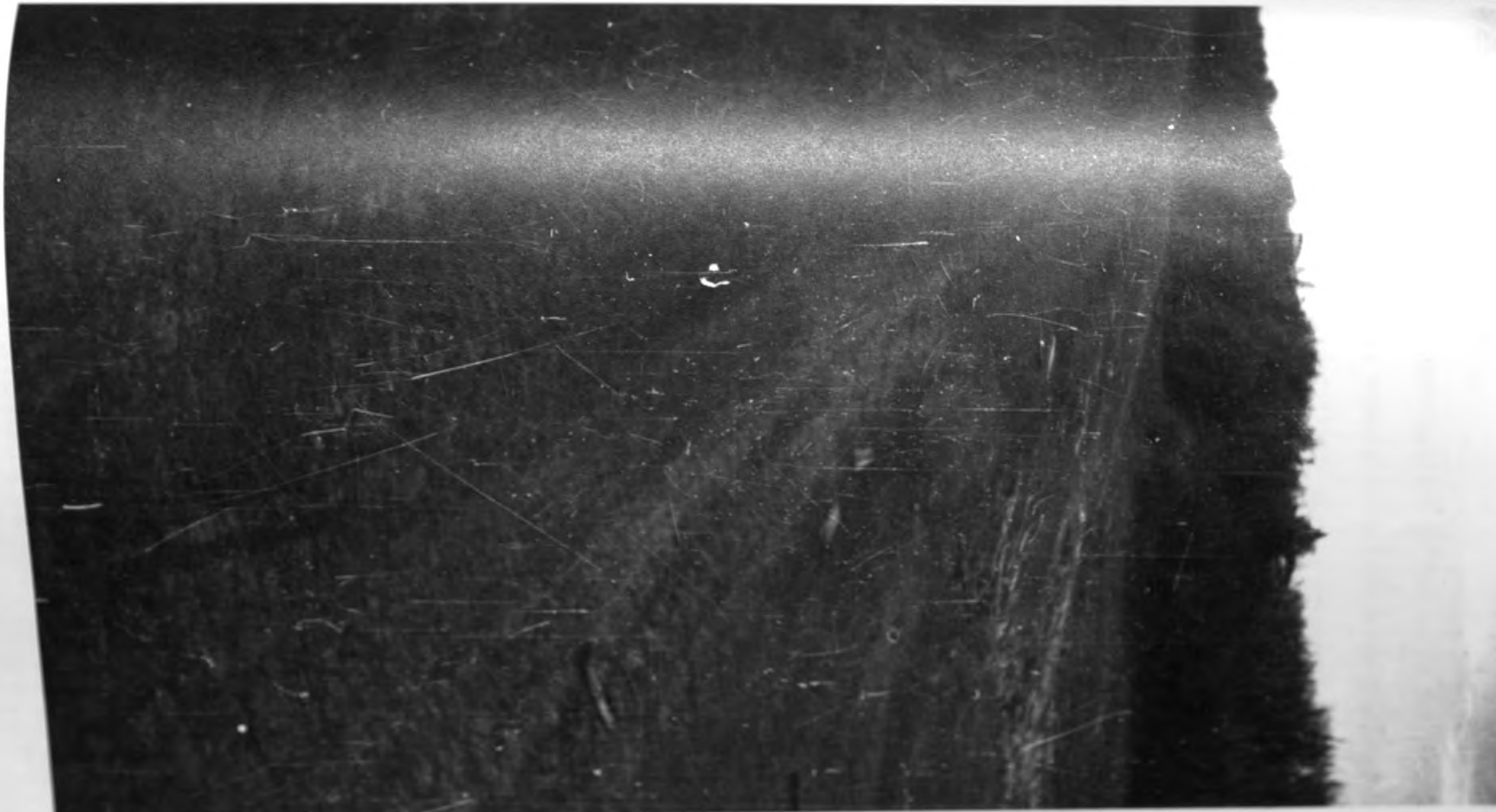


Plate 19. Sugarcane plantation covered with filter cake.

provision of employment opportunities in these areas and proper utilization of resources, especially land which was previously underdeveloped or even unutilized) greatly commend them as a type of ideal non-urban industrial cores to trigger industrialization in the rural areas. These are further likely to be reinforced by the development of ancillary industries drawing their raw materials from the by-products of sugar processing, or otherwise linked to the sugar industry. Such links are most feasible in the case of those food processing industries using considerable quantities of sugar and located in relatively small rural urban centres. Such dependent and hence linked industries would include, Fruit and Vegetable canning, Bakery products processing and the processing of soft drinks and carbonated water. Apart from the available sugar, they would possibly derive the remaining raw materials from the surrounding areas, which would lead to further development of the areas. Furthermore, the development of such industries in the rural areas would lead to the decentralization of these industries from urban centres where they tend at present, to be basically located. The sugar processing industry thus offers an excellent medium for linking the various economic activities in the surrounding rural areas both with the sugar processing complexes themselves and with the relevant established or establishable ancillary manufacturing industries.

The diffusion of new development ideas essential for improving agricultural yields are bound to play major modernizing and most beneficial roles in such areas. These include such ideas as the application of fertilizers, the use of herbicides and pesticides and the introduction of farm mechanization, involving appliances such as tractors and other agricultural machinery. The adoption and proper application of these innovations should, in the first place, increase sugarcane yields and secondly, help to raise the standard of living through higher per capita income, better housing and allied living conditions, more and better education and other social and cultural facilities such as better health provisions.

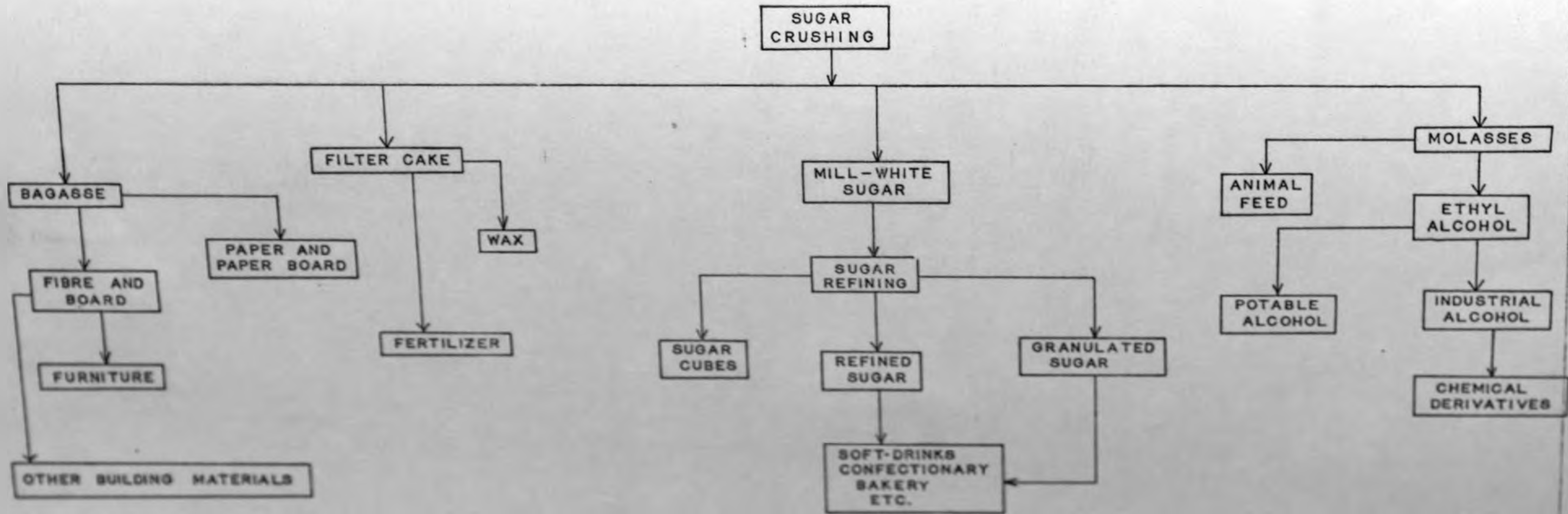
Apart from the benefits bestowed upon outgrower farmers in the surrounding rural areas, the establishment of the sugar processing factories and the related ancillary industries should ensure fairly large scale employment of local people, especially in sugar factories and to some extent, in the outgrower cane farms. Thus, if properly planned and carefully excuted, the sugar processing complexes should, within the rural areas involved, reduce polarization effects of the towns. As used in this thesis, the term polarization is the process whereby the rural non-employed, usually migrate to both neighbouring and other distant urban centres in search of employment opportunities, which are apparently rather limited even at such destinations. Thus polarization usually results in rural depopulation, on the one hand, and urban congestion on the other.

Besides the ancillary industries associated with the sugar processing industry, which are expected to be attracted to the nearby rural towns as noted above, several other economic activities are expected to be established in these rural areas.

These include, the development of the tertiary activities, especially, those relating to transportation and communications, education and health services, the establishment of financial institutions in the nearby rural urban centres to support rural development, the provision of other public utility services, and many other allied tertiary industries which are necessary in promoting rural development.

From this summary of benefits expected to follow the future development of sugar and the related ancillary industries, if properly planned, is likely to result in the overall development of the rural areas. This would not only benefit the rural areas directly involved, but should favourably affect the whole of Kenya nation, through the provision of new employment opportunities, production of more sugar and other related commodities currently imported. It would also positively influence the general development of the said rural areas which is currently one of the government's main objectives in its entire national development.

Fig. II: FORWARD LINKAGES FROM SUGAR CRUSHING MILLS (By-Product of the Sugar Industry).



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CHAPTER 8

SUMMARISED COMMENTS, RESEARCH FINDINGS AND RECOMMENDATIONS

8:1 SUMMARISED COMMENTS

In the preceeding chapters, a detailed economic development analysis of the Western Kenya sugar processing industry and its general impact on both regional and national economic development has been presented. The Western Kenya sugar industry comprises those factories located in Nyanza and Western Provinces. These are Chemelil,Muhoroni,Miwani and Awendo sugar factories located in Nyanza Province, and Mumias and Nzoia factories, located in Western Province, all of which are designed to process mill-white sugar in Western Kenya. Analysis of this study has revealed several economic aspects relating to the Western Kenya Sugar Industry. Thus,in this chapter,we will aim at summarizing the major research findings in view of the following formulated objectives and hypotheses. The main objectives underlying this study are:

Objective 1:To examine the physical factors affecting the location of sugar processing industry in Western Kenya.

Objective 2:To investigate into human factors influencing the location of the Western Kenya sugar industry.

Objective 3:To carry out a quantitative analysis of the concentration of the sugar industry in the area.

Objective 4:To investigate into possible growth inducing effects likely to be experienced in the area, as a result of a Western Kenya sugar industry.

Objective 5: To examine, if any, the negative effects that might have occurred in the area as a result of the sugar industry.

Objective 6: To find out the beneficial effects of the Western Kenya sugar industry to the Kenyan Nation.

Objective 7: To pinpoint the future short-comings of the Western Kenya sugar industry and hence make recommendations on how they should be corrected in the course of future planning.

Similarly, the hypotheses tested in this study are:

1. The location of the sugar processing industry in Western Kenya is determined mainly by economic rather than physical factors.

2. The sugar industry in the area has been responsible for negative effects and has had no growth inducing effects.

3. The industry is beneficial not only to Western Kenya, but to the Kenya Nation as a whole.

It is important to note at this stage that the research findings indicate that a lot still remains to be done about the sugar industry in Western Kenya. For this reason, recommendations have been made for scholars who would be interested in carrying out further research in this field of study. Apart from these, further recommendations have been specifically made for planners and policy makers, concerned with the future development of the sugar industry both in the area and elsewhere in the country, and even in other parts of the world.

8:2. RESEARCH FINDINGS

The first and second objectives of this study have been concerned with an examination of physical and human factors influencing the location of the sugar industry in Western Kenya. The results have indicated that the location of the sugar industry in the area has been mainly influenced by rainfall and soil conditions. Out of the six sugar companies interviewed, five of them identified rainfall as the most important factor.

Apart from this confirmation, our statistical analysis of the rainfall data has indicated that the rainfall mean values of the 6 sugar factories exceed 762mm(or 30") rainfall reliability which is essential for crop production. A further analysis of this rainfall data in relation to the optimum rainfall requirement for sugarcane cultivation (1524mm) has revealed that sugarcane can at its best be grown successfully in Mumias and Nzoia sugarbelts. These are the areas where the mean values exceed the optimum rainfall requirement for sugarcane (with 1813.8mm at Mumias and 1761.3mm at Nzoia sugar companies). Alternatively, the mean annual rainfall values at Chemelil (1317 mm) Muhoroni (1317mm) Miwani 1341 mm) and Awendo (1406.8mm) fall below 1524mm. These results have shown that there is a high likelihood that sugarcane will not do as well in these areas as in Mumias and Nzoia areas. Irrigation is therefore necessary in order to alleviate the rainfall inadequacy problem. This shows that the sugarbelts located in Western Province are more suitable for higher sugarcane production than those located in Nyanza Province.

Sugarcane is extensively grown in the sugarcane zone on a wide variety of soil types. It is therefore tempting to conclude that sugarcane cultivation is least affected by the nature of soils. However, it has been observed that clay loams are most suitable for sugarcane cultivation. Furthermore, lighter soils with adequate natural drainage are preferred. Our mechanical soil analysis has shown that the soils from Nyanza sugar complex are dominantly montmorillonite clays, while those of Mumias sugar belt are mainly Kaolinite clay soils. The former are very difficult to work because of their plastic and impermeable nature, hence less suitable for sugarcane production. Alternatively, the latter are easy to work and well drained, although they have poor reserves of plant nutrients. Thus, frequent application of fertilizers is necessary.

Chemical analysis has indicated that the soils from Nyanza sugar-belts are slightly acid to neutral with a pH range of 5.3 - 6.7, while those from Mumias sugar-belt are moderately to strongly acid with the pH ranging from 5.9-4.5. These pH values suitably fall within the range of pH 4.0 - 8.0 which sugarcane can tolerate, although the ideal soils for its optimum growth correspond to a pH of 6.0 - 7.0. From this view point, soils in Nyanza sugar belts are apparently more suitable for sugarcane cultivation than those in Mumias sugar-belt. The same analysis has revealed that the soils in Nyanza sugar belts are better supplied with most of the soil nutrients than those from Mumias sugar belt. However, Nitrogen was found to be deficient in both cases. A correlation analysis between Nitrogen and sugarcane yields indicated a high positive correlation with correlation coefficient values of $r = 0.87$ for Mumias and $r = 0.83$ for Nyanza sugar complex. This relationship was significant at 99% level of probability in both cases. Alternatively, the relationship between sugarcane yields and other nutrients analysed (that is, K;Na; Ca; Mg and P) was insignificant. We can therefore conclude that nitrogen defficiency in the soils results in low cane yields, compared to that of other soil nutrients. However, all these nutrients have been found necessary for purposes of general development of the cane. The application of fertilizers containing these plant nutrients is essential.

The demographic factors have been examined in relation to labour supply and availability of agricultural land for both sugarcane and other crops. Although the densely populated parts of Nyanza and Western Provinces form important labour reservoirs for the sugar industry, they have not been considered as a crucial factor in the location of this industry in the area. This is because of the high unemployment problem in the country. Alternatively, the high population densities found in the area are likely to affect the development of the sugar industry in the area, since these reduce the amount of land required for sugarcane cultivation.

The major government policy is that of self-sufficiency in sugar production, as soon as possible. It hopes to achieve this goal through the establishment of new sugar factories and expansion of the old ones. This is aimed at stopping the complete importation of sugar into the country, thereby saving the scarce foreign currency which, the country is badly in need of. This may, in the long-run earn more through sugar export.

In this study, several cost factors were expected to play an important role in determining the location of the sugar industry in the area. Apparently this has not been so, due to certain anomalies in the economic operation of the various established mill-white sugar factories. The sugar companies are being heavily subsidized both by the poor outgrower farmers, and the central government, especially in transportation costs of cane to the factories and processed sugar to the market. As a result of these, our findings deviate from the theories of industrial location which clearly indicate that cost factors play an important role in the location of any industry. Despite these distortions, the
location of the sugar processing industry in
formulated hypothesis that "The/Western Kenya is determined mainly by economic rather than physical factors" is hereby rejected.

A second aim of this study has been to investigate into possible growth inducing and negative effects likely to originate from the Western Kenya sugar industry. From our analysis, both effects exist in the sugar zone. The sugar industry is a raw-material orientated industry. It is therefore located in the rural areas where sugarcane (the raw material) is produced. Out-grower farmers are the major suppliers of sugarcane to the factories. As a result of this, a substantial part of the income from the sugar industry is spend on purchasing cane from the farmers. Thus, a reasonable amount of the money from this industry is channelledback into the rural areas where sugarcane is produced. The sugar industry has been therefore considered an important growth inducing industry.

Secondly, the location of the sugar factories in the rural areas has resulted in the provision of employment opportunities in such areas. Such opportunities are available at the factories on the Nucleus Estates, on outgrower farms and in local businesses which have flourished as a result of the sugar industry in the area. A monetary economy has been facilitated in the area, as people in the area, who in the past were either unemployed or under-employed now earn an income from this industry.

Thirdly, the establishment of the industry in the area has resulted in the development of several development facilities in the sugarzone. These facilities include, the establishment of roads, educational and medical institutions in many parts of the sugar zone. Furthermore, some of the farmers mainly large scale farmers, whose cane incomes are high and constant have also installed their own electric generators, piped water and telephones. The development of these infrastructural facilities in the area, is no doubt a growth-inducing effect.

Our findings also point to the fact that the spread of growth inducing effects into the peripheral areas is a gradual process. Thus,adequate time is required before the resultant effects can be fully noticed. This was revealed through a comparative study of facilities developed in both the Mumias and the Nyanza sugarbelts. In the former where the Mumias factory was only recently established most of the development facilities (such as electricity, water supply and telephones) were still restricted to the factory residential areas. However, in Nyanza sugar belts, where the development of the sugar industry took place much earlier, some of these facilities have been developed by a few outgrower farmers.

It was observed that although a substantial part of the money from the sugar industry is injected into the area, not much of it is utilized within the area. This has been shown by the low regional multiplier effect of only 1.5, calculated from cane income data from Mumias outgrower farmers. This shows that much of the money earned by outgrower farmers from the sugar industry is mainly spent on items produced outside the region. Besides this, it was noted that some farmers usually disappear from their homes immediately they earn their cane money. These only return home after all the money is spent. Such money is not utilised within the region into which it is injected by the factories. Such money is usually spent in a very crude way, which according to the present researcher is not development orientated. Despite this finding, it should be noted that the above index only takes into account the money injected into the region from the industry. This however, overlooks that part of the farmers' income received and/or earned from other sources. Thus a different index would be derived if these were incorporated into the regional multiplier analysis.

Negative effects experienced in the area due to the sugar industry include, migration and monocultural development of the cane. Migration as such, has not been considered to be a serious negative effect. This is because most of the people employed at the factories from peripheral areas frequent their home areas. Looked at from a different viewpoint, migration results in lack of cane weeders and cutters on outgrower farms. This is because of the more attractive income earned from the factories. As a result of this, only casual labourers are available on outgrower farms, and since their demand is high, they are very expensive. This is a serious problem which may sooner or later result in poor sugarcane yields due to lack of labour, since proper weeding is required in the development of sugarcane, if the best yields are to be expected. This is not only likely to reduce the farmers' cane income, but may also result in poor production of sugar.

Monocultural practice in the area has resulted in the devotion of most of the land, capital and labour on sugarcane development as opposed to other cash and food crops in the area. This has inevitably resulted in food shortage in many parts of the sugar zone. This is a serious problem facing most of the farmers since cane income is only earned after a long period of

These findings have pointed to the fact that both growth inducing and negative effects are being experienced in the sugar zone, hence the hypothesis that "the sugar industry in the area has been responsible for negative effects and has had no growth inducing effects" is rejected as it stands.

Lastly, this study has also attempted to find out the beneficial effects of the Western Kenya sugar industry to the Kenyan Nation. All the sugar factories processing mill-white sugar in Kenya except one, are located in Western Kenya. Thus, one would expect most of the benefits arising from these factories to be concentrated in this part of the country. Indeed, it has been observed through a location quotient analysis that there is a high concentration of the sugar industry in Western Kenya. Despite this, further examination of this aspect has revealed that the benefits arising from the industry are nonetheless nationwide.

An important aspect about the sugar industry is its massive contribution to the national economy. This came, mainly in the form of import substitution. For instance, from the 236,439 metric tons of mill-white sugar produced locally in 1978, the country saved about £(K)49,652,190 given the current price of Shs.(K)4,205 per ton of sugar. Out of this saving, 95.58% was from Western Kenya sugar industry. The production of refined sugar would therefore be of great benefit to the Nation.

Although most of the unskilled workers are employed mainly from the surrounding areas, semi-skilled and skilled workers are employed from any part of the country. The provision of employment opportunities at all the sugar factories is therefore nationwide. It was observed that such employment opportunities prevent the locals from migrating to other parts of the country, thus reducing the problem of migration which appears to be prevalent elsewhere in the country, where such employment opportunities are lacking.

These findings, together with the government's aim of achieving self-sufficiency in sugar production stated earlier, demonstrate that the Western Kenya sugar industry is beneficial to the whole nation. Thus, the formulated hypothesis that "The industry is beneficial not only to Western Kenya, but to the Kenya Nation as a whole" is validated.

8.3. <u>RECOMMENDATIONS.</u>

i. <u>TO SCHOLARS</u>

This study has made discoveries which either conform or deviate from past theoretical work. Some of these are nonetheless scholarly findings which interested scholars should find useful in terms of addition to knowledge and teaching where applicable. Such findings include:

(i) the insignificance of cost factors as opposed to physical factors in the operation of the sugar industry. This finding does not conform to the classic theories of industrial location which stress the importance of cost factors in the development of any industry. This deviation is due to certain anomalies in the economic operation of the sugar industry which scholars should carefully note in such studies.

(ii) the importance of development points as spatial growth inducing points. In the studies of regional development conducted by theorists such as Perroux, F. (1955), Myrdal, G. (1957); Friedmann, J. (1972), these development centres and points were perceived as urban industrialized centres capable of transmitting growth impulses to the surrounding areas. This study has however identified the sugar factories as such development points which if better organized could transform the economy of the surrounding areas. This is because the money generated by the sugar industry finds its way back to the surrounding areas.

2. TO PLANNERS AND POLICY MAKERS

(a). The mean annual rainfall experienced in Nyanza sugarbelts falls below the optimum requirement for sugarcane production. This however shows that there is a high likelihood of receiving less rainfall than expected, and hence possible crop failure. Irrigation is therefore necessary in such areas.

(b). Most of the soils in the sugar zone have a deficiency in certain soil nutrients. For better sugarcane yields, the farmers should be advised to apply, along the furrows at planting, 500Kg/ha. sulphate of potash. Applying manure or compost together with the phosphate will increase its uptake. The farmers should topdress with 400Kg/ha. calcium ammonium nitrate in three splits within three months of planting. At this stage the cane plant can absorb large quantities of nitrogen which will later be used for growth. The fertilizer should be applied at the base of the cane stool. Since some of the soils have been found to be quite acidic, it is advisable not to use sulphate of ammonia as this would destroy the crop.

The ratoon crop needs less phosphate (since there is a residual effec from the previous application), but more nitrogen and potash. Thus, 250Kg/h single superphosphate, 300Kg/ha. sulphate of potash and 600KG/ha. calcium ammonium nitrate should be applied. Mulching the ratoon crop with cane tras should raise the soil organic matter status and increase the efficiency of applied fertilizers.

(c). The sugar companies should meet their own production costs instead of being heavily subsidized both by the outgrower farmers, and the central government especially in transportation costs of cane to the factories and processed sugar to the markets.

(d). Several outgrower farmers have had their cane rejected at the weighing bridge. This has not only resulted in the loss of the farmers' income, but also delays the payment of the government's loan. It has been suggested in this study that the government should intervene and help the farmers by discouraging the sugar companies from rejecting any cane delivered at the factory.

(e) Although the sugar industry has been considered to be growth-inducing in this study, very little development seem to have taken place in the surrounding outgrower areas. This may be attributed to poor organisation and ignorance of the farmers. The Government should therefore try to assist the farmers by either giving advice or taking the initiative to establish and/or develop essential development facilities such as electricity and piped water in the outgrower sugarcane areas. Once these facilities have been established, the farmers will obviously utilise them. Proper utilisation of these facilities is likely to result in further development of the areas.

(g). There is high monocultural development of sugarcane inevitably resulting in food shortage and overproduction of sugarcane in the area. The farmers therefore require a lot of assistance in agricultural education both from the sugar companies and the government to reduce their problems of food shortage and cane overproduction. The government should also apply incentives which would attract the farmers' interest from wholy concentrating on sugarcane cultivation. This can possibly be done through providing loans to the farmers to develop food and other cash crops such as cotton. The government should also offer favourable prices and provide the necessary markets for such crops. Moreover the government may also help in ploughing the land for the farmers. Supported by such incentives, the farmers may be able to plant cash crops such as cotton which take shorter period to mature and be sold for cash as compared to sugarcane.

(h). Most sugarcane outgrower farmers are faced with the problem of labour shortage. This is because most of the labour migrates to sugar factories where incomes are higher than on outgrower farms. Lack of sufficient labour has therefore tended to affect sugarcane production in the area. It is therefore suggested in this study that:

(i) Sugarcane prices should be increased so that the farmers could cater for the expenses involved in labour employment.

(ii). The outgrower farmers should then try to improve labour wages on the farms so that they become more attractive to the labourers.

(i). Although efforts are being made to increase the amount of sugar produced in the country to satisfy local demand, most areas, especially the rural areas still lack or have very little sugar. It has been claimed that such shortages are due to the inefficiency of the distributin agents, who find it more profitable to sell the sugar close to the sugar depots in order to reduce transport costs. This is unfair way of distributing this essential commodity which the government should rectify immediately. Either the number of sugar depots in areas such as Western Province (only served by one depot at Kakamega), should be increased, or a more efficient way of distributing sugar to the rural areas should be introduced.

(j). The only type of sugar produced in the country is mill-white sugar. As a result, all the refined sugar required for industrial purposes has to be imported into the country. In order to reduce, and eventually stop complete importation of sugar, Kenya should establish some sugar refineries instead of concentrating only on the establishment of mill-white sugar factories. Furthermore, the government should aim at seeing to it that each sugar company adheres to the correct designed production capacity, instead of installing more sugar plants, while the established ones operate below their capacities.

3. TO RESEARCHERS:

For the purposes of further lines of research, the following suggestions have been made. Intensive survey should be conducted on the Kenyan sugar industry. This should include:

(i) all the large factories processing mill-white sugar,

(ii) small sugar factories processing mill-white sugar,

(iii) both small and large sugar factories planned to produce mill-white sugar,

(iv) the jaggery plants,

(v) other factories utilizing or planned to utilise the sugar by-products.

APPENDIX A: 1a - f

MEAN ANNUAL RAINFALL FOR THE SIX STATIONS.

1a. MUMIAS (30YRS)

YEAR	MEAN RAINFALL (MM)	YEAR	MEAN RAINFALL (MM)
1948	1510.0	1963	[illegible]
1949	1545.6	1964	[illegible]
1950	1622.8	1965	[illegible]
1951	/204.2	1966	[illegible]
1952	1989.8	1967	[illegible]
1953	1284.0	1968	[illegible]
1954	1534.9	1969	[illegible]
1955	1243.8	1970	[illegible]
1956	1220.7	1971	[illegible]
1957	1559.6	1972	[illegible]
1958	1632.6	1973	[illegible]
1959	1760.2	1974	[illegible]
1960	1885.7	1975	[illegible]
1961	2279.4	1976	[illegible]
1962	2163.3	1977	[illegible]

Source: Mumias Sugar Company

1b. NZOIA FOREST (16YRS)

YEAR	MEAN RAINFALL (MM)	YEAR	MEAN RAINFALL (MM)
1963	1981.4	1971	2739.7
1964	1644.6	1972	1962.8
1965	1374.1	1973	1570.9
1966	1626.3	1974	1516.0
1967	1955.2	1975	1730.6
1968	1744.2	1976	1409.4
1969	1665.6	1977	2093.7
1970	1882.[illegible]	1978	2130.6

Source: East African Meteorological Dept. (E.A.M.D.) Dagoretti, Nairobi.

MIGORI (AWENDO) (30 YRS)

YEAR	MEAN RAINFALL (MM)	YEAR	MEAN RAINFALL (MM)
1949	930.1	1964	1712.1
1950	1026.3	1965	1334.5
1951	1640.4	1966	1212.0
1952	1513.6	1967	1254.0
1953	1185.0	1968	1620.3
1954	1822.3	1969	1342.7
1955	1563.6	1970	1652.2
1956	1258.7	1971	1316.2
1957	1104.0	1972	1673.9
1958	894.3	1973	1325.8
1959	793.8	1974	1334.7
1960	1128.5	1975	1279.1
1961	2173.2	1976	1502.9
1962	1886.7	1977	1936.7
1963	1615.8	1978	1169.7

Source: East African Metereorological Dept. (E.A.M.D.)
Dagoretti, Nairobi.

1d. MIWANI (30 YRS)

YEAR	MEAN RAINFALL (MM)	YEAR	MEAN RAINFALL (MM)
1948	1225.8	1964	1530.1
1950	1111.0	1965	1198.6
1951	1621.0	1966	1319.4
1952	1438.4	1967	1420.7
1953	1366.6	1968	874.3
1954	1348.7	1969	1243.3
1955	1565.2	1970	1451.6
1956	1387.1	1971	1385.5
1957	1508.0	1972	1640.3
1958	1416.8	1973	1144.3
1959	1502.2	1974	1304.3
1960	1552.2	1975	1571.7
1961	1729.0	1976	1093.7
1962	1763.8	1977	1727.0
1963	1661.2	1978	1440.7

Source: Miwani Sugar Mills

CHEMELIL AND MUHORONI (30 YRS)

YEAR	MEAN RAINFALL (MM)	YEAR	MEAN RAINFALL (MM)
1949	1211.2	1964	1497.8
1950	1096.3	1965	1100.1
1951	1545.1	1966	1370.6
1952	1270.8	1967	1441.7
1953	[illegible]	1968	1371.9
1954	1232.5	1969	1410.8
1955	1260.9	1970	1404.1
1956	1304.0	1971	1370.8
1957	900.4	1972	1071.1
1958	960.1	1973	1278.9
1959	1316.1	1974	1197.9
1960	1324.1	1975	1104.2
1961	1444.7	1976	889.[illegible]
1962	1302.1	1977	1520.8
1963	1474.5	1978	1462.1

Source: Chemelil Sugar Company.

Appendix A - 2a

MECHANICAL ANALYSIS OF SOIL [illegible] FROM OUTGROWERS FARMS IN [illegible]

FIELD DESIGNATION	LAB. NO.	% SAND	% SILT	% CLAY	TEXTURE [illegible]
1	5531/79	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5532/79	32	[illegible]	66	C
3	5533/79	40	[illegible]	62	C
4	5534/79	[illegible]	[illegible]	62	C
5	5535/79	44	[illegible]	48	C
[illegible]	5536/79	64	[illegible]	26	SCL
7	5537/79	28	[illegible]	60	C
[illegible]	5538/79	[illegible]	[illegible]	52	C
[illegible]	5539/79	[illegible]	[illegible]	48	[illegible]
[illegible]	5540/79	[illegible]	[illegible]	58	C
[illegible]	5541/79	[illegible]	[illegible]	40	[illegible]
12	5542/79	[illegible]	[illegible]	52	C
13	5543/79	[illegible]	[illegible]	[illegible]	C
[illegible]	5544/79	[illegible]	[illegible]	62	C
15	5545/79	28	[illegible]	64	C
16	5546/79	32	[illegible]	60	C
17	5547/79	[illegible]	[illegible]	26	[illegible]
18	5548/79	44	[illegible]	46	C
19	[illegible]	[illegible]	[illegible]	34	[illegible]
20	5550/79	[illegible]	[illegible]	52	C

NB. C - Clay
S - Sand
L - Loam

[illegible]
[illegible]
SCL - Sandy Clay Loam

[illegible] Field Research data

Appendix A - 2b

MECHANICAL ANALYSIS OF SOIL [illegible]

FIELD DESIGNATION	LAB. NO.	% SAND	% SILT	% CLAY	TEXTURE GRADE
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	109.B	68	16	[illegible]	[illegible]
3	110.B	28	18	[illegible]	C
4	111.B	16	[illegible]	[illegible]	C
5	112.B	30	24	[illegible]	C
6	113.B	20	[illegible]	[illegible]	C
7	114.B	26	[illegible]	[illegible]	C
[illegible]	115.B	[illegible]	[illegible]	[illegible]	C
[illegible]	116.B	24	12	[illegible]	C
10	117.B	[illegible]	[illegible]	[illegible]	[illegible]
11	118.B	[illegible]	[illegible]	[illegible]	[illegible]
12	119.B	[illegible]	[illegible]	[illegible]	C
13	120.B	14	[illegible]	[illegible]	C
14	121.B	[illegible]	[illegible]	[illegible]	[illegible]
15	122.B	12	[illegible]	[illegible]	C
16	123.B	22	18	[illegible]	C
17	124 B	20	12	[illegible]	C
18	125.B	28	16	[illegible]	C
[illegible]	126.B	[illegible]	[illegible]	[illegible]	[illegible]
20	127.B	16	[illegible]	68	C

NB. C- Clay
S-Sand
SC- Sandy Clay
L-Loam
CL-Clay Loam
SL-Sandy Loam
SCL- Sandy Clay Loam

Source: Field Research [illegible]

Appendix [illegible]

[illegible] ANALYSIS OF SOIL SAMPLES FROM [illegible] SUGAR [illegible]

FIELD DESIG-NATION	LAB. No.	pH	[illegible] M.E.%	K m.e.%	Ca m.e.%	[illegible] m.e.%	[illegible]	[illegible]	[illegible] IN [illegible] PER ha.
1	[illegible]	5.9	[illegible]	[illegible]	3.1	5.3	[illegible]	[illegible].17	[illegible]
2	5532/79	5.1	0.18	0.14	Trace	2.2	[illegible]	0.2	102.00
3	5533/79	4.7	0.18	0.11	Trace	0.7	[illegible]	0.17	67.06
4	[illegible]/79	5.5	0.16	0.11	0.4	1.4.	18	0.18	[illegible]
5	5535/79	5.0	0.68	[illegible]	4.4	3.2	20	0.12	80.76
6	5536/79	4.8	0.12	0.12	Trace	1.0	7	0.09	67.63
7	5537/79	5.3	0.10	0.11	Trace	0.6	16	0.08	50.83
8	5538/79	4.5	0.11	0.19	Trace	1.2	12	0.11	75.96
9	5539/79	5.0	0.11	0.09	Trace	1.3	12	0.09	77.39
10	5540/79	5.0	0.16	0.30	Trace	1.6	14	0.22	138.15
11	5541/79	5.2	0.20	0.11	Trace	1.9	18	0.16	119.59
12	[illegible]	5.0	0.32	[illegible]	[illegible]	[illegible]	14	0.13	75.50

Appendix A - 3a (continued)

13	5543/79	5.0	0.40	0.11	1.8	1.9	18	0.22	150.4
14	5544/79	4.7	0.20	0.11	Trace	1.2	15	0.18	121.2
15	5545/79	5.3	0.16	0.11	Trace	1.6	12	0.19	135.8
16	5546/79	4.6	0.20	0.11	Trace	1.4	14	0.19	10[illegible].7
17	5547/79	5.2	0.22	0.07	Trace	0.9	10	0.15	115.[illegible]
18	5548/79	5.3	0.32	0.11	0.14	1.4	16	0.2	124.[illegible]
19	5549/79	5.0	0.42	0.11	Trace	1.0	16	0.15	10[illegible].
20	5550/79	5.4	0.10	0.04	1.4	0.7	20	0.14	78.

Source: Field Research data.

Appendix A - 3b

CHEMICAL ANALYSIS OF SOIL SAMPLES FROM NYANZA SUGAR - BELTS.

FIELD DESIG-NATION	LAB. NO.	pH	Na m.e %	K m.e%	Ca m.e%	Mg m.e%	Pppm	N %	CANE YIELDS IN TONS/ ha.
1	108B	5.4	0.14	0.61	3.95	1.40	44.5	0.18	76.63
2	109B	5.9	0.15	1.71	10.80	3.50	10.5	0.17	76.53
3	110B	6.0	0.43	2.36	15.95	6.40	27.0	0.20	109.32
4	111B	6.7	0.68	1.81	65.65	5.20	40.0	0.25	179.85
5	112B	5.7	0.20	2.38	14.05	5.70	27.5	0.19	66.78
6	113B	6.2	0.10	0.67	14.95	2.50	48.5	0.20	115.7
7	114B	5.5	0.15	0.57	3.50	0.80	13.0	0.18	48.16
8	115B	5.5	0.20	0.61	8.35	2.40	18.0	0.15	48.45
9	116B	6.2	0.50	1.38	23.07	7.25	53.5	0.14	32.45
10	117B	5.4	0.29	1.53	13.75	2.70	29.5	0.19	119.41
11	118B	5.9	0.07	2.84	21.60	4.35	59.0	0.05	16.96
12	119B	5.3	0.13	0.19	8.35	2.65	19.50	0.03	11.06
13	120B	4.9	0.09	0.61	16.50	1.05	16.50	0.23	162.26

14	1215	5.5	0.13	0.81	5.00	1.90	25.5	0.17	47.[illegible]
15	1225	6.5	0.13	1.01	6.75	1.55	33.5	0.25	113.[illegible]
16	1235	5.3	0.81	1.62	8.00	1.90	17.1	0.11	78.1[illegible]
17	1245	5.7	0.31	1.39	22.60	8.10	29.5	0.02	47.[illegible]
18	1255	5.8	0.42	1.80	15.61	5.42	38.0	0.15	94.6[illegible]
19	1265	5.4	0.42	1.71	13.26	5.70	29.5	0.01	71.6[illegible]
20	1275	5.9	0.58	1.62	16.61	6.35	21.5	0.15	73.07

Source: Field Research data.

Appendix [illegible]

[illegible] OUTGROWER [illegible] INCOME EXPENDITURE IN 197[illegible]

	CASH INCOME	EXPENDITURE ON IMPORTED ARTICLES	EXP. ON ARTICLES PRODUCED IN THE REGION	SCHOOL FEES PAID IN THE REGION	SCHOOL FEES PAID OUTSIDE THE REGION	EXPENDITURE ON LABOUR	OTHER EXPENDITURES	TOTAL	SAVINGS
	1	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	22,700.00	[illegible]	2,[illegible]	[illegible]	[illegible]	2000	845	[illegible]	[illegible]
2	10,734.00	[illegible]	1,200	[illegible]	–	1220	420	7,597	[illegible]
3	21,000.00	7,455	2,500	[illegible]	[illegible]	3250	1575	16,373	[illegible]
4	9,248.60	2,995	1,452	360.0	–	1850	1300	7,957	[illegible]
5	35,080.00	10,500	2,900	–	3620	3915	4750	25,685	9,39[illegible]
6	30,600.30	8,517	3,890	5355	[illegible]	3840	2050	27,102	3,49[illegible]
7	20,250.75	12,916	1,540	520	–	2500	2250	19,726	524
8	16,655.25	8,579	2,000	[illegible]	[illegible]	950	800	16,566	[illegible]
9	[illegible]	[illegible]	[illegible]			[illegible]	450	18,265	15,0[illegible]
10	3,[illegible].00	1,500	350	[illegible]	–	–	900	3,050	–

Appendix A - 4 (continued)

11	48,300.03	8,407	1,350	1280	4250	3000	2450	[illegible]	[illegible]
12	35,525.50	13,409	4,000	1500	850	2450	2000	24,818	10,612
13	12,050.15	4,107	1,400	2020	-	1080	780	9,[illegible]	[illegible]
14	22,185.15	6,992	2,715	60	-	2000	3195	14,[illegible]	[illegible]
15	22,075.85	5,300	2,000	1200	2300	1075	3450	15,721	[illegible]
16	44,255.50	17,000	3,150	2950	1455	4000	4800	34,[illegible]	10,[illegible]
17	8,756.60	3,000	750	1850	2000	-	1656	[illegible],566	[illegible]
18	31,481.25	8,731	2,800	1200	1955	2335	1020	18,041	[illegible]
19	5,482.55	1,253	546	400	-	500	2000	[illegible].698	[illegible]
20	15,067.00	3,450	1,011	220	--	2600	4800	12,081	2,[illegible]6
21	4,000.00	1,800	1,200	-	-	-	750	[illegible],700	3[illegible]
22	9,000.00	3,145	1,750	1500	-	-	1520	[illegible],915	1,085
23	13,700.45	1, 089	2,120	865	200	1670	2198	[illegible],142	-5,558.45
24	6,975.20	1,540	970	-	-	800	1100	[illegible],410	[illegible],565.20
25	5,021.60	3,200	857	322	-	-	281	[illegible],660	301.60
26	11,830.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-[illegible]
27	10,256.75	2,824	1,890	-	-	975	2000	7,[illegible]6[illegible]	[illegible],567.75

Appendix A - [illegible] ([illegible]

[illegible]	[illegible]	1,900	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	–
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	[illegible]	[illegible]	[illegible]
32	6,329.1[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	5,270.[illegible]	1,523	[illegible]	[illegible]
[illegible]	7,103.[illegible]5	2,000	[illegible]	[illegible]
[illegible]	7,769.90	[illegible]	[illegible]	[illegible]
[illegible]	26,976.[illegible]5	10,970	2750	–
37	23,150.0[illegible]	8,780	3970	–
38	13,000.0[illegible]	6,451	1258	[illegible]
39	14,975.80	4,700	1909	–
[illegible]	20,000.00	7,961	2450	–
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10,000.00	3,000	1200	[illegible]

[illegible]	–	[illegible]	[illegible]	[illegible]
[illegible]	–	885	[illegible]	[illegible]
[illegible]	800	1440	[illegible]	–
–	–	450	3,887	[illegible]
–	[illegible]	[illegible]	[illegible]	[illegible]
–	–	1325	5,174	
–	455	[illegible]	[illegible]	[illegible]
–	1000	2115	7,200	
–	1000	4050	18,770	[illegible]
–	655	3715	17,120	
–	959	7540	10,718	2,[illegible]
–	1325	1875	9,809	5,[illegible]
–	2015	3089	15,535	4,[illegible]
[illegible]	–	[illegible]	6,920	2,5[illegible]
–	700	1347	6,537	[illegible]

Appendix A - 4 (continued)

43	28,000.00	8,500	2010	-	1050	1780	2225	13,106	[illegible]
44	14,200.00	5,100	1350	62	-	305	55	5,342	[illegible]
45	15,017.35	4,570	2005	180	-	750	765	8,270	[illegible]
TOTAL	733,230.00	238,414	76,919	43,045	35,595	57,134	82,597	533,704	197[illegible]

Source: Field Research data.

APPENDIX B - 1

A QUESTIONNAIRE FOR OUTGROWER FARMERS [illegible]

1. Name ....

2. Age ....

3. (i) Married Yes .... No ....

(ii) If married, how many wives ....

(iii) How many are you in your family (including your children and you, the parents)? ....

4. (i) How many children go to: (i) Primary School ....

(ii) Secondary School ....

(ii) In which schools a) .... d) ....

b) .... e) ....

c) .... f) ....

5. (i) Is farming your sole occupation? Yes ....

No ....

(ii) If no, what are your other occupations?

a)........... d)...........

b)........... e)...........

c)........... f)...........

6. (i) How many hectares of [illegible] did you first plant?

....

(ii) How many do you now have? ....

(iii) How many [illegible] during the last harvest? ....

(iv) Was the last harvest the a). first ....
b). second ....
c). third ....

(i) Do you employ labourers for:

a) sugarcane farming Yes ....
No ....

b). for other crops Yes ....
No ....

(ii) If yes, are they a) permanent ....

b) casual

(iii) Are they .... local - [illegible] ....

non - local - [illegible] ....

(iv) How much [illegible] ....

[illegible] Approximately how much do you spend on the following per week or year?

ITEM	EXPENDITURE (in K.Sh.)	ITEM	EXPENDITURE (in K.Sh.)
Clothing	....	School fees (within the region)	———
School fees (outside the region)	....	Dowry	....
Cooking oil + fat	....	Ceremonies	....
Fish	....	[illegible]	......
[illegible]	....	[illegible]	......

ITEM	EXPENDITURE (in K.Sh.)	ITEM	EXPENDITURE (in K.Sh.)
Washing and bathing Soap	....	Maize	....
Beddings	....	Fresh milk	....
[illegible]	....	Vegetables	....
Water	....	Beans	....
Powder & tinned milk	....	Potatoes	....
Bread	....	Bananas	....
Matches	....	Fruits	....
Flour	....	Sukuma	....
Rice	....	Meat	....
		Tomatoes	....
Salt	....	Onions	....
Paraffin	....	Chicken	....
Medical case	....	Eggs	....
Body + hair oil	....	Finger millet	....
Millet	....	Charcoal	....

[illegible] (i) Which of the following do you own?

a). a permanent house ....

b). a shop ....

c). a bar ....

d). [illegible] ....

e). a bicycle ....

f). a motorcycle ....

g). a flour mill ....

h). a tractor-with a trailer ....

- with-out a trailer ....

i). a matatu ....

j). a bus ....

k). a car ....

m). a taxi ....

([illegible]) When did you start owning the above?

a) before planting the sugar cane ....

b) after planting the sugarcane ....

([illegible]) If you own a shop, where is it?

a). in a market centre - near your home ....

- none of the market ....

b). in a market centre - far from home ....

- none of the market ....

(i) which items do you sell in your shop?

a)............ b). .... c)............

b)............ e)............ h)............

d)............ f)............ i)............

(ii) How many of the above items are in one packet?

a)............ b)............ c)............

d)............ f)............ g)............

(iv) How many [illegible] of [illegible] do you [illegible] per day?

a)..................... c) ....

b). .... d)...................

e)................... f)...................

g)................... h)...................

i)...................

[illegible] (i) If you own a bar, from where do you buy your [illegible]?

....

(ii) How many crates do you buy per [illegible]? ....

(iii) How much do you [illegible] per bottle? ....

[illegible] (i) If you own a[n] [illegible] [illegible] [illegible] [illegible] [illegible]?

a). Yes ....

b). No ....

(ii) If no, how many days in a week is it [illegible]? ————

(iii) Approximately how many [illegible] of [illegible] [illegible] be ploughed in a day? ....

(iv) How much do you charge per [illegible]? ....

[illegible]. If you own a bicycle, what do you use it for?

a). transporting your farm produce to the market

....

b). when going to work ....

c). taking the children to school ....

[illegible]. If you own a motor-cycle, what do you use it for?

a). transporting your farm produce to the market

....

b). when going to work ....

c). taking the children to school ....

[illegible]. If you own a flour mill:

(i) about how many kilograms do you grind per day?

(ii) How much do you charge per kg?

[illegible]. (i) If you own a tractor, do you use it all alone?

Yes ....

No ....

(ii) If no, how many days in a week is it hired

(approximately) ....

(iii) Approximately how many hectares do you allow to be

ploughed in a year ....

(iv) How much do you charge per kilometre? ....

18. (i) If you own a matatu, between which areas does it operate? ....

(ii) What is the average [illegible] of people carried on the matatu? ....

(iii) How many "safaris" does it make per day? ....

(iv) How much do you charge per kilometre? ....

19. (i) if you own a bus, between which areas does it travel?

....

(ii) How many passengers does it carry per safari? ....

(iii) How many safaris does it make per day? ....

(iv) How much do you charge per kilometre? [illegible]

20. (i) If you own a car, do you use it for:

a). transporting your farm produce to the market?

....

b). taking your children to school? ....

c). when going to work? ....

21. Which of the following exist in your area?

a). road .... d). dispensary ....

b). railway .... e). telephone ....

c). electricity .... f). [illegible]

27. How do you benefit from each of the following?

(i) roads,

a). transporting [illegible] to the factory?

....

b). transporting other agricultural products to the market? ....

c). Is it because of developed roads that you decided to buy your vehicle or car? ....

(ii) Railways,

a). are they used in transporting fertilizers [illegible] from [illegible] to the farm?

....

b). do you personally travel by train to:

(i) [illegible] ....

(ii) Kisumu ....

(iii) Eldoret ....

(iii) Electricity,

a). do you use it for cooking? ....

b). do you use it for lighting? ....

c). do you use it for farm mill? ....

(iv) piped water,

a). do you use it for domestic purposes?

....

b). do you use it for irrigating the crops? [illegible] c). do your livestock use it for drinking..........

(v) Do you use a telephone?

a). Yes ....

b). No ....

23. If yes, then a). do you use it to contact the factory about the development of the sugarcane? ....

b). do you use it for other business? ....

24. Which of the following services are developed in your area?

a). medical services ....

b). primary schools ....

c). secondary schools ....

d). village polytechnics ....

c). Farmers' training centres ....

25. How do you benefit from the following?

(i) medical services;

(a) do you go there for treatment?

(b) do you go there for instructions about family planning?

(c) are you employed there?

(ii) Primary schools:

a). do your children learn there? ....

b). are you employed there? ....

c). do your children teach there? ....

(iii) Secondary schools:

(a) do your children learn there? ....

(b) are you employed there? ....

(iv) Village Polytechnics:

(a) do your children learn there? ....

(b) does your wife work there? ....

(c) are you employed there? ....

(v) Farmers' training centre:

(a) do you go there for instructions on how to improve your farming techniques? ....

(b) did you go there for a farmer's training course? ....

(c) is any of your children employed there? ....

Date of the interview ....

APPENDIX B - 2

A QUESTIONNAIRE FOR THE MANAGEMENTS OF THE MILL-WHITE SUGAR PROCESSING INDUSTRY IN WESTERN KENYA

1. (i) Name of the factory ....

   (ii) How did the company acquire the land for this Nucleus Estate? ....

   (iii) If bought how much did it cost? ....

2. (i) How many hectares of land did you start with? ....

   (ii) Of these, how many were:

   (a) under the Nucleus Farms? ....

   (b) under the outgrower farms? ....

   (iii) How many are now:

   (a) under the Nucleus Estate / farms? ....

   (b) under the outgrower farms? ....

3. What is the average tonnage of sugarcane per hectare from the:

   (a) Nucleus Estate ....

   (b) Outgrower farms? ....

4. (i) How many tons of sugarcane do you harvest per year? ....

   (ii) How many tons of cane are equivalent to one ton of (mill-white) sugar? ....

5. (i) How many people are employed (including the management staff) in this

    a). factory? ....

    b). Nucleus Estate? ....

  (ii) How many of these are:

    (a) residents in the factory residential areas?

    ....

    (b) non-residents? ....

6. Of these, how many are unskilled:

    (a) in the factory ....

    (b) in the nucleus estates? ....

  (ii) What is their pay range per month?

    a). minimum pay ....

    b). maximum pay ....

7. (i) How many are semi-skilled workers?

    a). in the factory ....

    b). in the Nucleus estate? ....

  (ii) What is their pay range?

    a). minimum ....

    b). maximum ....

8. (i) How many are skilled workers?

    a). in the factory ....

    b). in the nucleus estate ....

(ii) What is their pay range?

a). minimum ....

b). maximum ....

9. How many employees are wage earners? ....

10. (i) Do you offer your employees any fringe benefits?

a). Yes ....

b). No ....

(ii) If yes, to which of the following employees do you offer fringe benefits?

a). skilled ....

b). semi-skilled ....

c). unskilled ....

(iii) Which of the following benefits do you offer?

a). Housing-free ....

- Subsidised ....

b). Insurance - [illegible]

- others (life [illegible])........

c). Medical dispensary facilities ....

- hospital facilities ....

d). Training - local ....

- Overseas ....

e). education - nursery ....

- primary ....

- secondary ....

- adult ....

12 (i) Who is responsible for transporting the cane from farms
outgrowers to the factory?

a). the company ....

b). outgrower themselves ....

(ii) If the company is responsible, what is the average transport costs per Km - ton of cane? ....

(iii)Do you have any problems in transporting the cane from outgrower farms to the factory?

a). Yes ....

b). No ....

(iv) If yes, is it because of:

a). unsurfaced all-weather roads? ....

b). unsurfaced dry-weather roads? ....

c). lack of sufficient cane haulers ....

13.(i) Are you the official fertilizer suppliers to the sugarcane outgrowers?

a). Yes ....

b). No ....

(ii)If yes how many bags of fertilizers do you supply per hectare?

(iii)Who is responsible for transporting the fertilizers to outgrower farmers?

a). the company ....

b). outgrowers themselves ....

f). Security - retirement benefits ....
- watchman ....

g0 Water - free ....
- subsidised ....

h). Electricity - free ....
- subsidised ....

11. Which are your main (and/or minor) sources of the following types of employees?

(i) Unskilled labour

a). Western Province ....
b). Nyanza Province ....
c). Other parts of Kenya ....
e). Other parts of the world. ....

(ii) Semi-skilled labour

a). Western Province ....
b). Nyanza Province ....
c). Other parts of Kenya ....
d). Other parts of the world ....

(iii) Skilled manpower

a). Western Province ....
b). Nyanza Province ....
c). Other parts of Kenya ....
d). Other parts of the world ....

(iv) If the company is responsible, what are your annual transport costs? ....

(v) Do you have any problems in transporting the fertilizer?

a). Yes ....

b). No ....

(vi) If yes, are these problems the same as those affecting cane transportation? (12,iv)

a). Yes ....

b). No ....

(vii) If no, which ones are they?

a .... d ....

b .... e ....

c .... f ....

[illegible]. (i) Are you taking any measures to arrest these [illegible] problems? a). ....

b). ....

(ii) If yes, which measures are you undertaking?

a. ....

b. ....

c. ....

d. ....

15. (i) Do you own a power generator,

a). Yes

b). No

(ii) If yes, which of the following do you own?

a). bagasse thermal electric power plant ......

b). Petrol/diesel generator ....

c). Hydro-electric power plant ....

(iii) If no from where do you get your power?

a). East African Power&Lighting Company ....

b). Private generating plants in the area ....

(iv) What are the average monthly power units:

a). Non-company power

b). Company power

16. What future plans have been made about the development of the following infrastructural facilities in the area:

(i) by the company a). water supply ......

b). manpower ....

c). educational ....

d). medical ....

e). electricity ....

(ii) by the government:

a). roads ....

b). electricity...........

c). water supply ....

d). educational ....

e). medical ....

f). other means of communication (e.g.telephones) ....

17. (i) Which ancillary industries are possible from the sugar industry?

a. ....

b. ....

c. ....

d. ....

(ii)Which ones have been developed by the Company?

a). ....

b). ....

c). ....

d). ....

(iii)Which ones are planned?

a). ....

b). ....

c). ....

d). ....

18 (i) Do you have any plans for expanding this sugar factory?

a) Yes ....

b) No ....

(ii) If yes, in how many phases? ....

(iii) What will this expansion involve?

a). an increase in the creshing capacity of the plant? ....

b). an increase in the size of the Nucleus Estate farms............

c). an increase in the number of outgrowers ....

19. (i) Are you exempted from paying tax by the Government?

a) Yes ....

b). No ....

(ii) If yes, what reason makes the Government exempt you from taxation? ....
....

(iii) For how many years is tax exemption........

(iv) If no what are your annual taxation costs? ....

Date of the interview ....

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