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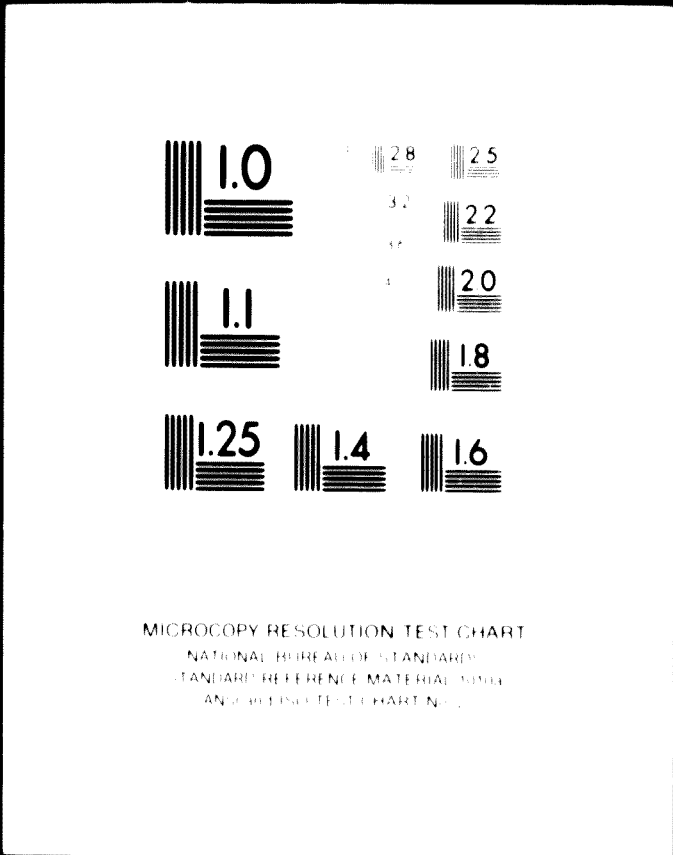
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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

VIENNA

FEASIBILITY STUDY

on

INDUSTRIAL UTILIZATION OF CORN

in

KENYA

(DRAFT)

(December 1969 - March 1970)

This Report has not been cleared with the United Nations Industrial Development Organization which does not therefore necessarily share the views expressed.

ALEKSIC KOSTA - Engineering and Marketing Expert

Pancevo - Yugoslavia



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1. INTRODUCTION

"Corn is the most important agricultural crop in Kenya and is also the country's staple diet. As a result of recent technical advances, the yield per acre is increasing and the costs of production decreasing. The country has increasing surpluses of corn. The industrial processing of corn would bring many benefits to the country, improving the quality of human diet and animal food while adding more value and export possibilities to the country's most important crop" (I).

2. GENERAL INFORMATION - KENYA

| | |
|---|---------------|
| Total area | 502,600 sq.km |
| Population: | |
| 9,097,000 Africans | |
| 166,000 Asians | |
| 41,000 Europeans | |
| 37,000 Arabs | |
| 4,000 Others | |
| Total 1967 | 9,365,000 |
| estimated in 1974 | 12,400,000 |
| Population growth rate | 3% per year |
| total non agricultural employment (1968) | 620,600 |
| total non agricultural employment (1974) | 850,000 |
| wage employment (1968) | 500,300 |
| wage employment (1974) | 700,000 |
| agricultural employment (1968) | 3,679,000 |
| agricultural employment (1974) | 4,300,000 |
| agricultural wage employment (1968) | 556,600 |
| agricultural wage employment (1974) | 725,000 |
| income per capita - no information | |
| projected composition of the growth in the monetary Gross Domestic Product (1970 - 1974) | |
| Agriculture | 13% |
| Manufacturing | 18% |
| Trade and Transport | 26% |
| General Government | 19% |
| Other sectors | <u>24%</u> |
| Total | <u>100</u> |

3. METHOD OF APPROACH AND SCOPE OF WORK

Kenya has increasing surpluses of corn. To solve this problem it is expected a corn processing on industrial basis. According to the mentioned statements it is proposed the following scope of work:

- to find the availability of raw material
- to make a marketing survey in Kenya, Uganda, Tanzania and Zambia
- according to marketing survey to make a proposal for main assortment of goods based on corn processing
- after completing the list of main assortment and quantities, to make a proposal for a corn milling industry.
- to make calculations for profitability of proposed corn milling industry and determine the prices for the main assortment of goods
- to contact the would be customers in order to get agreement for proposed prices and quantities.

4. CORN IN KENYA

4.1 Quality.

Kenya is producing many varieties of corn as -

Hybrid 611 and 611B

Hybrid 612

Hybrid 613 and 613B

Hybrid 622

Hybrid 632 and 632B

Hybrid 511

Hybrid 512

Maratha

Katumani composite B (see file No.122)

The national Agricultural Research Station in Kitale started already in 1966 to breed the corn with higher amounts of lysine and Tryptophane but with a negligible changing of total protein content in corn. The research station has now a full time employee for this job and they are crossing Kenya corn with corn obtained from U.S.A. in order to obtain as much as possible tryptophan and Lysine (III).

Very much is done in the last few years in increasing the corn production and the most important aspects are as follows

- An effective breeding programme which produced hybrids with a superiority of 30-80% over local varieties, depending on altitude.
- An agronomic research programme which found out where and how to grow these hybrids in order to obtain their maximum potentiality.
- An active field extension staff which organized a campaign to place a demonstration plot of properly grown hybrid maize in each locality within walking distance of most farmers.
- A commercial seed firm which organised the production and distribution of high quality hybrid seed at a reasonable cost (Ministry of Agriculture)

Maize and Produce Board is buying the corn only from big farmers and in grades 1, 11 and F.A.Q. (fair average quality). They don't analyse the corn but check only the grade.

4.1.1. Grades

Class: sec maize

Description
 To be sound dry, plumb and well cleaned with a maximum of 1 per cent by weight other coloured, discoloured and defective grain.

Class: flat which No.1 yellow No.1

Description
 To be sound, dry, free from earth and contain not more than 0.5 per cent by weight foreign matter or 8 per cent by weight defective, other coloured grain and foreign matter, provided that not more than 3 per cent by weight shall be of other coloured grain. Grains may be of irregular size.

| | Description |
|---------------------------------------|--|
| Class: flat white No.2 yellow No.2 | To be sound, dry free from earth and contain not more than 1 per cent by weight foreign matter or 13 per cent by weight defective, other coloured grain and foreign matter, provided that not more than 5 per cent shall be other coloured grain. Grains may be of irregular size and shape. |

| | Description |
|---------------------------------------|--|
| Class: flat white No.3 yellow No.3 | To be in dry condition, free from earth and contain not more than 1.5 per cent by weight foreign matter or 20 per cent by weight defective grains and foreign matter, provided that not more than 8 per cent shall be other coloured grains. |

| | Description |
|--|---|
| Class: flat white No.4 (slightly infested) yellow No.4 slightly infested) | Slightly infested but in other respects conforming to to description of No.4 above. |

| | Description |
|--------------|---|
| Class: mixed | To be sound, dry, free from earth and contain not more than 1 per cent foreign matter or 10 per cent by weight defective grains and foreign matter. |

| | Description |
|-------------------------------------|---|
| Class: mixed (slightly infested) | Slightly infested but in other respects conforming to description of mixed above. |

Provided that any maize which has been treated for the destruction of insects shall be marked in accordance with regulation 22(3) and (4), and any grains which have been infested shall be calculated as defective.

Note.

Any certificate issued shall state whether the maize is white, yellow or mixed (IV).

4.1.2 Analysis.

Maize and Produce Board is supplying customers stating the grade and yellow or white maize. Analysis are given to customers.

The National Agricultural Laboratories are given the average chemical composition of corn produced in Kenya (see file No.120)

| | White Maize | Yellow maize |
|---------|-------------|--------------|
| Protein | 8.9% | 11.26% |
| Oil | 4.52% | 5.92% |
| Fibre | 1.9 | 1.9% |
| Starch | 73.24% | 79.58% |

Note.

The **yield** of different products in this report will not be based on these analysis, because the corn produced in the future should have another chemical composition (see 12.9)

4.1.3. Recommendation

It is recommended to start the production of high-protein corn. For example the TROJAN'S normal hybrids has about 8% protein, compared with 12% for the Opaque - 2 hybrids. The difference is due to the higher lysine and Tryptophan content. Opaque - 2 corn contains around 0.49% lysine, compared with 0.24% in normal corn, and 0.15% tryptophan, compared with 0.09% (see Well Street Journal, September, 19, 1968).

For more information in this field suggest to contact:-

DR. EARL R. LEMG,
ASSISTANT DIRECTOR
INTERNATIONAL AGRICULTURAL PROGRAMS,
UNIVERSITY OF ILLINOIS
URBANA, ILLINOIS (U.S.A.).

The price for non modified corn starch in Europe is about \$90 per ton compared with the price of corn gluten with over \$ 160 per ton. The chemical composition of corn has a very big influence on the revenue in a corn processing factory.

Contd/.....

4.2 Quantity produced.

Maize and Produce Board calculates the year from 1st August to 31st July next year due to the crop. Therefore, all figures are given for the period ending 31st July.

4.2.1 Last five years (V).

| Year | bags | ton | value |
|---------|-----------|---------|-----------|
| 1964/64 | 1,170,351 | 106,150 | 2,045,379 |
| 1965/66 | 1,474,343 | 133,722 | 2,852,744 |
| 1966/67 | 2,500,581 | 277,528 | 4,997,883 |
| 1967/68 | 3,501,561 | 324,847 | 5,698,053 |
| 1968/69 | 3,245,687 | 294,303 | 5,032,570 |

4.2.2. Future - estimated quantity (V).

| Year | bags | ton |
|---------|-----------|---------|
| 1969/70 | 2,000,000 | 181,400 |
| 1970/71 | 2,500,000 | 226,750 |
| 1971/72 | 3,500,000 | 317,450 |
| 1972/73 | 4,000,000 | 362,800 |
| 1973/74 | 5,000,000 | 453,500 |
| 1974/75 | 5,000,000 | 453,500 |

Note:

These figures represent only quantities of corn dealt with by Maize and Produce Board. The real corn production in the country is many times higher and is consumed by the producers or sold locally.

4.3 Quantity used (V):

4.3.1 for direct human consumption

| Year | bags | ton | value |
|---------|-----------|---------|-----------|
| 1964/65 | 1,781,689 | 161,599 | 3,723,322 |
| 1965/66 | 1,587,822 | 144,015 | 3,820,082 |
| 1966/67 | 1,530,358 | 138,803 | 3,969,490 |
| 1967/68 | 992,804 | 90,047 | 2,573,116 |
| 1968/69 | 1,165,122 | 105,676 | 2,587,523 |

Contd/.....

These figures represent the total sale of Maize and Produce Board for human consumption. About 90% is used in dry mills and the rest is sold in grain to local people (V)

Dry mills are supplied with corn only from Maize and Produce Board. It is interesting to note that when the crop is greater human consumption decreases because local people obtain the corn from small farms where it is cheaper (V).

4.3.2. for animal feed

| Year | bags | ton | value £ |
|---------|---------|--------|---------|
| 1964/65 | 23,879 | 2,166 | 30,150 |
| 1965/66 | 12,293 | 1,115 | 23,163 |
| 1966/67 | 147,348 | 13,364 | 216,550 |
| 1967/68 | 86,095 | 7,809 | 120,533 |
| 1968/69 | 119,053 | 10,798 | 157,210 |

Maize and Produce Board is selling the corn to dry millers and farmers. About 70% of the corn is milled and the rest sold to farmers. (V).

4.3.3. Others (V).

As up to now there does not exist a corn processing factory or industry using corn (except dry millers), here are stated figures for exported corn (Maize and Produce Board).

| Year | bags | ton | value £ |
|---------|-----------|---------|-----------|
| 1964/65 | 11,467 | 1,040 | 21,378 |
| 1965/66 | - | - | - |
| 1966/67 | 694,338 | 62,976 | 1,178,906 |
| 1967/68 | 2,985,764 | 270,809 | 4,747,312 |
| 1968/69 | 2,715,374 | 246,284 | 4,585,730 |

4.4 Price (V)

Maize and Produce Board in Kenya is the only supplier of corn for industry. For that reason are given only data of sales in last five years (according to 4.3.)

Contd/....

| Year | for human consumption \$/ton | for animal feed \$/ton | Export \$/ton |
|---------|---------------------------------|---------------------------|------------------|
| 1964/65 | 65.89 | 39.81 | 53.77 |
| 1965/66 | 75.85 | 59.40 | - |
| 1966/67 | 81.80 | 46.33 | 53.54 |
| 1967/68 | 81.71 | 44.13 | 50.14 |
| 1968/69 | 70.01 | 41.64 | 53.25 |

Note.

The future price for the proposed corn processing factory was discussed in the Ministry of Agriculture and Maize and Produce Board. It was agreed that from 1973 on the proposed factory will get the corn for Shs. 24/- per bag (\$ 37.80 per ton) F.O.R. Eldoret and shs. 25 per bag (39.37 \$ per ton) F.O.R. Nairobi (letter from the Ministry of Agriculture see file No.112).

In the calculation of production costs and raw material - corn will be \$ 40 per ton. This is about 1.6% higher than the F.O.R. price in Nairobi and represents a normal loss during cleaning the corn.

4.5 Present corn processing industry in Kenya (VI).

The only corn processing industry in Kenya is dry milling. The dry milling industry is producing four main products:

4.5.1 Posho:

This is straight milled corn with the extraction rate of 100%. Posho is mainly produced in hammer mills without cleaning. Many operate only on co-operate basis. It is estimated that Kenya has 1,500 - 2,000 hammer mills. The largest amount of posho is produced this way and there are no figures for the amount of corn milled for posho.

4.5.2 Granulated maize meal:

Here, the grain is cleaned before milling. This is also, almost 100% extraction and no by-products are separated. The corn grain is milled in rollers. In Kenya there exists 10-11 mills which are producing granulated maize meal.

4.5.3 Number 2 sifted maize meal:

This is the third main product from the dry milling industry. Here, the extraction rate is 85-90% the rest being bran and bran.

4.5.4 Number 1 sifted maize meal.

The extraction rate is 60%. This is the main product of better mills in Kenya. By-product is germ and bran and is sold locally or for export.

Note

All mentioned main products are used primarily for human consumption. Normally about 40% of by-products are used locally. Due to the shortage of corn in 1970 about 50% of by-products are being sold locally. The by-product-mixture is called "maize bran germ meal" and about 50% is exported to Europe.

4.5.5 Capacities (VI):

There are 13 mills for sifted maize meal. The total-peak-capacity of these mills is 189,000 bags per month = 17,142.3 ton per month or 105,707 tons per year (on 300 day basis). The peak capacity per month is given on basis of 24 hours per day milling, 7 days per week with only 6 hours break for maintenance and 2 hours per week cleaning. Actual output of these mills is about 120,000 bags per month = 10,884 tons per month or 130,608 tons per year. That means that the mills are running at 63.49% of the peak capacity.

4.5.6 Future Plans:

The mills in the dry milling industry in Kenya are not running at full capacity (see 4.5.5) and therefore have rather small plans for the future.

The intention is to install in some modern existing mills extra machines in order to separate corn germs and later to extract oil from separated germs. One step in this field has already been made in Unga Ltd mill in Eldoret but the results are not yet satisfactory. The future investment and adjustment of existing machines will get better results (VI).

5. INDUSTRIAL UTILIZATION OF CORN

5.1 Dry milling process

Dry milling process has mainly three ways to be proceeded.

straight milling of corn

milling with sifting and separation of germ and bran
milling the prepared and sifted corn grain in order
to separate the germ with high efficiency.

Straight milling of corn is not economical because the oil is not separated from corn and the milled goods become rancid and get a bad smell. Moreover the valuable corn oil is not extracted. The animal feed for pigs containing the goods from the whole corn gives bad results and the produced bacon has a low quality.

Milling with sifting and separation gives better goods which may be stored longer without getting rancid. The meal has a good quality and may be used for human consumption or as animal feed.

Milling the prepared corn grain gives the best results in the separation of oil containing corn germ. This separated corn germ is used as a raw material for corn oil production, the bran for animal feed and the corn meal for human consumption or animal feed. This milling requires a high investment in machinery.

Cattle feed is considered as a by-product of dry milling and the separated bran is not a complete animal feed. According to the technology of separation and the variety of corn used the separated bran may vary. Many additives in different proportions are added in order to get the best compound for cattle feed.

5.2 Wet Milling process.

Wet milling of corn is preceded with water in the whole process. The corn is at first soaked in water containing SO₂ and the soft kernel is ground and in a specific and completely integrated system the major components of the kernel are separated (see 13). This process is later in the report proposed as the main industrial utilization of corn in Kenya.

5.3 Other

5.3.1 Brewery grits.

Breweries in Kenya are not using corn in any form for the beer production. The main raw materials are malt and sugar. Some malt is still imported but intentions are to increase the local malt production and stop the import. Breweries intend to change the formula for beer production and to use a certain amount of wheat flour like in England. It is also suggested to replace 1/3 cane sugar with corn syrup (see 6.2.5).

As afore said reasons corn will not be used in breweries.

Contd/. ...

5.3.2 Alcohol.

Kenya has a surplus of molasses from cane sugar factories and this is a relatively cheap and good raw material for the production of alcohol. Import of alcohol into Kenya is rather small which makes even less sense to think of alcohol production on corn basis.

6. MARKETING SURVEY FOR CORN PRODUCTS:

6.1. Customers from the Dry Milling Process in Kenya

All products from the dry milling process in Kenya may be used for two main purposes:

- human consumption and
- for animal feed

Breweries are not using corn grits and are not intending to use them in the future. Alcohol production based on corn is in this country not recommended due to better and cheaper material available in Kenya - cane sugar molasses.

It has to be mentioned a small future customer for degenerated maize meal and this in the corn flakes industry which is planned to be established. However, this corn flakes industry will not influence the corn market in Kenya due to small capacity.

6.2 Customers from the Wet Milling Process in Kenya

6.2.1 Confectionery:

Corn syrup is used in varying proportions in many types of confections. Due to high price and duty (see 10.1) corn syrup is not so popular in Kenya. Now there are three factories using corn syrup for confectionery production

- Kenya sweets P.O. Box 733, Nairobi
- House of Manji P.O. Box 30395, Nairobi
- Mukisa Tabisco P.O. Box 7940, Nairobi

There are some smaller customers for corn syrup, like one confectionery in Thika, but they don't have a big influence on the market.

In the near future will start the production of chewing gum in the new factory, now under construction in Nairobi. The mentioned three factories used in 1969 740 tons.

According to expansion programme the need will be, in 1973 1,350 tons.

The new chewing gum factory will need in 1973 125 tons

Various small customers in Kenya used in 1969 ... 80 tons and will need in 1973 120 tons.

Calculating the annual expansion with 15% (this is not very optimistic for this industry in Kenya) the annual intake of syrup in Kenya will be:

| | | |
|---------------------|--------|------------|
| in 1969 | | 320 tons |
| in 1973 (estimated) | | 1,595 tons |
| in 1975 (estimated) | | 2,100 tons |

6.2.2 Soft drinks Industry:

In Kenya corn sweeteners are not used for the production of soft drinks. The soft drink industry is based on sucrose. Caramel colour is used for colouring, for coca cola production. In East Africa there are many production centres of Coca-Cola Company and the total import of caramel colouring in East African countries is 20 tons - imported from U.S.A. (VII). It could be expected the use of caramel colouring in breweries, but breweries in Kenya are not using it (VIII).

The marketing is covered by these factories

Pepsi cola P.O. Box 3866 Nairobi

Coca cola P.O. Box 30138 Nairobi

Erskine and Price P.O. Box 132 Nairobi

Pepsi cola P.O. Box 2024 Mombasa

Coca Cola . Mombasa

It is interesting to point out that the producers of soft drinks have a fixed technology and are not willing so easily to change the ingredients or proportions in the production.

6.2.3. Fruit Juices Industry:

There are few producers of fruit juices in Kenya but with rather small capacities. One factory (Erskine and Price) is using imported syrup from Belgium and caramel colouring from Belgium etc. Kenya Sunshine Products is the second fruit juice producer and is using only sucrose.

The marketing is done by the following factories:
Drskine and Price P.O. Box 132 Nairobi
Kenya Sunshine Products P.O.Box 786 Nairobi

The total consumption of sucrose in these factories is 100 tons per year.

The annual intake of syrup in marketing factories (1969) is 15 tons

These factories represent about 60% of fruit juices in Kenya and they would use syrup on better conditions.

It is estimated that the real intake of corn syrup will be:-

| | |
|----------------|---------|
| in 1969 | 25 tons |
| in 1973 | 40 tons |
| in 1975 | 55 tons |

Note:

The bigger fruit processing industries (like "Trufoods") have in their assortment fruit juices, but this is not counted here.

6.2.4. Biscuits and Crackers Industry

In Kenya, there are only two factories producing biscuits and crackers

- House of Manji and
- Mwisa Tabisco

These factories are using only few tons of corn syrup per year in the production of the mentioned products. This amount of syrup is calculated in marketing the confectionery industry.

6.2.5. Breweries:

Breweries in Kenya are not using corn starch or corn syrup for the production of beer. More or less, all breweries have a very similar technology except Njohi brewery which is rather small and produces popular beer from sugar cane, crystal sugar and honey. Big breweries have an average production of 80% malt and 20% cane sugar. Some breweries are using imported sugar.

The sugar price for breweries is very high - 142.24 shs. per bag of 40 203 \$ per ton. The marketing is covered by these breweries

DELTA Breweries - (Mbaraka brewery - Athiappan and

| | | | |
|------------------|---|----------------|---------|
| Taylor Products) | - | P.O. Box 1412 | Nairobi |
| Kenya Breweries | - | P.O. Box 30161 | Nairobi |
| Kenya Breweries | - | P.O. Box 5039 | Mombasa |
| City Brewery | - | P.O. Box 30144 | Nairobi |
| Ujohi Brewery | - | | Nairobi |

These breweries use cane sugar per year -

| | |
|---------------------------|------------------------------------|
| in 1969 | 1,600 tons |
| in 1973 (estimated) | 2,350 tons (10% per year increase) |

In many discussions with people from breweries, particularly with Mr. Taylor (Kenya Breweries), in the future the breweries would be willing to replace about 1/3 of cane sugar with corn syrup. In order to enable selling the corn syrup to the breweries it has to be much cheaper than cane sugar that is \$ 150 per ton (VIII).

Calculating this way, the annual intake of corn syrup would be:

| | |
|----------------|----------|
| in 1969 | 0 |
| in 1973 | 780 tons |
| in 1975 | 940 tons |

6.2.6. Canning Industry

Corn syrup is not used in this industry in Kenya. The main reason is the high price of corn syrup which is, due to duty, much higher than sugar.

The marketing is covered by these factories:-

| | | |
|-------------------------|---------------|----------|
| Trufood Limited | P.O. Box 1521 | Nairobi |
| Kabazi Canners | | Nakuru |
| Kenya Sunshine Products | P.O. Box 706 | Nairobi |
| Kenya Orchards Limited | | Nachakos |
| Kenya Cannery Limited | P.O. Box 147 | Thika |

These factories are only using sugar and the total annual intake is:

| | |
|--------------------------|-----------------------|
| in 1969 | 3,000 tons - sugar |
| in 1973 (proposed) | 8,000 " " |

It is supposed that the canning industry will start to use corn syrup.

Discussing this problem with technical managers in some factories, they agree that the proportion of syrup and sugar in canning industry in Kenya should be 80:20, i.e. 20% of sugar will be replaced with syrup.

This will make the total syrup consumption in canning industry:

| | |
|----------------|------------|
| in 1973 | 1,600 tons |
| in 1975 | 1,900 tons |

6.2.7. Ice Cream Industry

Marketing in ice cream production covers only one factory -

Lyons Maid (East Africa) Ltd. P.O.Box 2646, Nairobi

This factory has a total sales of 190,000 Imperial gallons per year of ice cream. Expansion can be calculated on 10% per year. Only in one formula is used a very small amount of corn syrup. The main raw material is milk in powder form.

| | |
|------------------------------------|---------|
| Annual intake of cane sugar | 22 tons |
| Annual intake of corn syrup | 0.7 ton |
| Estimated in 1973 | 2 tons |
| Estimated in 1975 | 5 tons |

6.2.8. Textile Industry:-

Starch is used in the textile industry for sizing the yarn and for finishing fabrics.

The marketing is covered by these factories:

- Nath Brothers Ltd. P.O. Box 120 Thika
- Acif Ltd., P.O. Box 2966 Thika
- Kenya Toray Mills P.O. Box 4534 Thika
- Kisumu Cotton Mills Ltd., P.O. Box 509, Kisumu
- Kenya Textile Mills P.O. Box 539 Nairobi
- Kenya Rayon Mills Ltd., P.O. Box 2476 Mombasa
- Sun Flag Textile Knitwear Mills Ltd. P.O.Box 1627 Nairobi
- Nakuru Industries Ltd., P.O. Box 22 Nakuru
- United Textile Industries Ltd. P.O. Box 394 Thika
- Kenwool Enterprises Ltd. P.O. Box 6019 Nairobi

The total annual intake of starch in these factories is:

| | |
|----------------|----------|
| in 1973 | 200 tons |
|----------------|----------|

It is interesting to note that some factories use cassava flour and mix with corn starch for sizing the yarn. This is due to low price of cassava flour. In many textile mills the technology of sizing may be improved using modified starch and adequate formula in sizing mixture.

It is proposed that in the future the majority of used starch in textile mill will be modified corn starch and the assortment with estimated figures would be:-

| | |
|----------------------------------|-----------------|
| in 1969 non modified corn starch | 180 tons |
| in 1969 modified corn starch | <u>80 tons</u> |
| total in 1969 | <u>260 tons</u> |
| in 1973 non modified corn starch | 100 tons |
| in 1973 modified corn starch | <u>250 tons</u> |
| total in 1973 | <u>350 tons</u> |
| in 1975 non modified corn starch | 100 tons |
| in 1975 modified corn starch | <u>320 tons</u> |
| Total in 1975 | <u>420 tons</u> |

6.2.9 Corrugated Paper Industry

Starch adhesives are used in corrugated paper industry in this country. This is a premixed starch imported already as a mixture. There is only cold water added and pumped to the corrugating machines.

The marketing is covered by these factories

East African Packaging Industry P.O. Box 30146 Nairobi

East African Packaging Industry P.O. Box 1142 Mombasa

The available steam pressure in the factory in Nairobi is now 150 lb. per square inch and in 1971 will be 175 lb per square inch. These two factories are now without competition in Kenya.

The total annual intake of starch in these factories will be:

| | |
|----------------------------|----------|
| in 1969 | 260 tons |
| in 1973 (estimated) | 350 tons |
| in 1975 (estimated) | 420 tons |

The total amount of this starch is calculated as modified and pre-clatinized starch.

6.2.10 Paper Industry:

Kenya has now only one paper mill in Thika, but in 1973 will start the big paper Mill in Broderick Falls with a total capacity of 45,000 tons of different papers. Other so called "paper mills" are using imported paper or paper from the mill in Thika for the production of different paper products.

The marketing is covered by these factories:

Kenya Paper Mills P.O. Box 390 Thika

Panafrik Paper mills E.A. Ltd. (in project)

Broderick Falls

Paper bags limited L.O. Box 6577 Nairobi

East African Paper Bag manufacturers Ltd P.O.Box1790

Mombasa.

Llyods Paper Industries P.O. Box 7502 Mombasa.

Mombasa Printing Works P.O. Box 481 Mombasa

Kenya Box Factory Mombasa

Kenya Paper Mill is using imported beater starch for wrapping paper production.

Paper Mill in Broderick Falls will produce:-

| | | |
|----------------|---|----------------------------|
| writing paper | } | Bleached and Unbleached |
| printing paper | | |
| packing paper | | |
| paper board | | |

Calculating the future need in starch, in this factory, on the safe side would be 0.5% based on 45,000 tons of paper. Manufacturers of paper products in Kenya are using imported dextrine and prepared glues on dextrine basis. The present consumption of dextrine in marketing factories is 65-90 tons per year but the future expansion will be very high. For that reason a production of dextrinus should be planned but for the present this is not taken into account.

The total annual intake of starch in these factories is:-

| | | | | | | |
|---------|-----|-----|-----|-----|-----|----------|
| in 1969 | ... | ... | ... | ... | ... | 25 tons |
| in 1973 | ... | ... | ... | ... | ... | 260 tons |
| in 1975 | ... | ... | ... | ... | ... | 300 tons |

It is proposed that in the future the only used starch will be modified corn starch.

6.2.11. Foundry Industry.

Starch and starch products are not used in foundries in this country. Nduma products in Gilgil imports a rather small amount of binder from England. Kenya has no big foundries where starch or dextrin glue may be used as a core binder. Foundries in Mombasa use bentonite and clay in a mixture with sand.

The marketing is covered by these factories -
Rubani Engineering Works P.O. Box 439 Nairobi
Nduma Products Ltd P.O. Box 62 Gilgil
African Marine and General Engineering Co. Ltd.
P.O. Box 120 Mombasa
Steel and Construction Petroleum Engineering Ltd.
P.O. Box 1226 Mombasa.

6.2.12. Pharmaceutical Industry:

Pharmaceutical Industries in Kenya are using corn starch and potato starch for production of tablets. There is no antibiotic factory or any user for corn syrup.

The imported corn starch has a grade B.P. (British Pharmacopoeia) and varies very much in price. For example Kenya Overseas Co. are importing corn starch from Holland or West Germany for \$133.57 per ton C.I.F. Mombasa whereas Sterling Products International import from West Germany the same B.P. grade corn starch for 257.14 \$ per ton landed in factory in Nairobi. This one proves, more that the market for starch products in this country is not well known.

Sterling Products International (IX) are intending to produce baby powder but they are not able to compete because imported corn starch is very expensive. In the case they could get the corn starch for about \$143 per ton (£50 Kenya), they would need 1,500,000-2,000,000 pounds (680-910 tons) of corn starch per year. They studied the market and there is a potential base for baby powder (IX).

The user of potato starch (Aspro - Nairobi) has potato starch in the production formula and claims that for his specific purposes potato starch is better. Aspro is importing potato starch from England for 243 \$ per ton and the amount is 7 tons per year.

The marketing is covered by these factories:-

- Kenya Overseas Company P.O. Box 2569 Nairobi
- Aspro Nicholas (E.A.) Ltd. P.O. Box 18194 Nairobi
- May and Baker Ltd. P.O. Box 30104 Nairobi
- Sterling products International P.O. Box 942, Nairobi
- Glaxo Allen Burys (E.A.) P.O. Box 8573 Nairobi

Calculating the average future need of corn starch for baby powder and eliminating imported potato starch, the annual intake will be:

| | | | | | |
|---------------------|-----|-----|-----|-----|----------|
| in 1969 | ... | ... | ... | ... | 21 tons |
| in 1973 (estimated) | .. | ... | ... | ... | 825 tons |
| in 1975 (estimated) | .. | ... | ... | ... | 990 tons |

6.2.13. Vegetable Oil Industry:

Kenya imports vegetable oils and oil seeds because the local production is low. The existing oil factories are not running with the full capacity due to lack of raw material. There was enough time to visit only ACIF Ltd oil mill in Nairobi and this mill is importing oil seeds for vegetable oil production. In 1969 Acif Ltd imported 4,500 tons of crude oil from overseas to process and sell in the local markets. Acif Ltd was able to import the above quantity as Uganda and Tanzania were short of cotton seed oil and were not in a position to supply Kenya market.

In 1970 Uganda and Tanzania started dumping the vegetable oil product in Kenya, because of surplus production affecting newly developed industry in Kenya (see letter file No.121)

The imports of oils seeds and vegetable oils are not regulated and very depending on the production in Uganda and Tanzania.

Given here are data of imports in 1967 and 1968 (According to: Annual Trade Report of Tanganyika, Uganda and Kenya): (Imports to Kenya).

Oil seeds, oil nuts and oil kernels

| | 1967 | | 1968 | |
|------------------|---------|--------------|---------|--------------|
| | centals | value £ K | centals | value £ K |
| Total import | 9960 | 26569 | - | - |
| Home consumption | 4493 | 12717 | - | - |

Linseed

| | | | | |
|------------------|------|------|----|------|
| Total import | 2755 | 6163 | 74 | 3686 |
| Home consumption | 2755 | 6163 | 74 | 3686 |

Oil seeds, oil nuts and oil kernels ncs+

| | | | | |
|------------------|-----|------|---|-------------|
| Total import | 990 | 2178 | 8 | 303 |
| home consumption | 990 | 2178 | | 5 Re-export |

+not elsewhere specified

| | 1967 | | 1968 | |
|--------------------------------------|----------|--------------|----------|-------------------|
| <u>Soyabean oil</u> | centrals | value £ K | centrals | value £ K |
| total import | 137 | 945 | 11828 | 64728 |
| home consumption | 137 | 945 | - | - |
| <u>Peanut oil</u> | | | | |
| Total import | 55 | 509 | 201 | 1367 |
| home consumption | 10 | 155 | - | - |
| <u>Olive oil</u> | | | | |
| total import | 625 | 10519 | 907 | 16085 |
| home consumption | 624 | 10496 | (12 | 310) re-export |
| <u>Sunflower seed oil:</u> | | | | |
| total import | 3 | 42 | 4418 | 16958 |
| home consumption | 3 | 42 | (1 | 39 re-export |
| <u>Rape, Colza and mustard oils:</u> | | | | |
| total import | 44 | 537 | - | - |
| home consumption | 44 | 537 | - | - |
| <u>Linseed oil</u> | | | | |
| total import | 3978 | 22148 | 7898 | 45976 |
| home consumption | 3978 | 22148 | (19 | 138) re-export |
| <u>Palm oil</u> | | | | |
| Total import | 47533 | 188448 | 138239 | 419065 |
| home consumption | 47533 | 188448 | - | - |
| <u>Cocconut (copra) oil</u> | | | | |
| Total import | 36303 | 170821 | 10086 | 57226 |
| home consumption | 33996 | 159129 | - | - |

Palm kernel oil

| | | | | |
|------------------|------|-------|------|------|
| total import | 7668 | 35243 | 1029 | 7774 |
| home consumption | 7668 | 35243 | - | - |

Castor oil

| | | | | |
|------------------|-----|------|------|------|
| total import | 848 | 6675 | 1003 | 8416 |
| home consumption | 848 | 6675 | - | - |

Fixed vegetable oils not elsewhere specified

| | | | | |
|------------------|-----|-------|------|-------|
| total import | 877 | 11608 | 1091 | 13468 |
| home consumption | 875 | 11588 | - | - |

Kenya has few oil mills as:-

Acif Ltd P.O. Box 2966, Nairobi

Voi Industries Ltd P.O. Box 45 Mombasa

East African Industries Ltd P.O. Box 30062; Nairobi

Nakuru Oil Mills Ltd P.O. Box 1164 Nakuru

Kibos Industries P.O. Box 44 Kisumu

Rift Valley Products Ltd P.O. Box 1023 Nakuru

The price of edible oil in Kenya is very high.

Acif sells to shops for shs. 42.85 Shs:50 per tin - 36 pounds
and this is \$375.5 -438.2 \$ per ton.

According to the import figures and the fact that the existing oil mills have not enough raw material for vegetable oil production, the proposed corn processing factory will have a very good market for corn germs. ACIF Ltd is willing to buy the whole production of corn germs either from 15,000 or from 30,000 tons of processed corn for \$ per ton (see letter No.107 in the file).

6.2.14 Animal Feed Industry

Corn gluten and hulls and grits from wet milling of corn are not known goods in Kenya. Therefore the potential market for this products may be given only approximately.

After visiting the animal feed factory in Nakuru (Unga Ltd) and many discussions with the agricultural adviser in Unga Ltd. Company (X), Kenya is short in proteins and may use the total amount of produced corn gluten for \$140 per ton (see file No.116) and about 2,250 tons of hulls and grits for \$28.6 per ton (20 cents per kg) - see file No.110.

Calculating the expansion of 10% per year, the annual intake will be:-

Corn gluten:

| | |
|----------------------------|------------|
| In 1973 (estimated) | 865 tons |
| In 1975 (estimated) | 1,730 tons |

Hulls and grits

| | |
|----------------------------|------------|
| in 1973 (estimated) | 2,250 tons |
| in 1975 (estimated) | 2,720 tons |

Note:

The total amount of corn gluten and hulls and grits from the proposed corn processing factory may be exported to Europe (see file No.108. 118, 119) for a relatively good prices, but the cost of freight to Europe is decreasing the profit in export. However, calculating on average of costs for freights and handling in Mombasa with \$ 23 per ton, and comparing with domestic prices, the data would be as follows:-

Corn gluten:

| | |
|------------------------------|----------------------|
| Domestic price | \$ 140 per ton |
| freight and handling | <u>\$ 23 per ton</u> |
| Total | \$ 163 per ton |

Comparing with export prices C.I.F. Geneva (Italy) \$162 - 165 per ton (see file No.108 and 109), the export of corn gluten will not cause any loss.

Hulls and grits:

| | |
|-----------------------------|------------------------|
| Domestic price | \$ 28,57 per ton |
| freight and handling | <u>\$ 23.0 per ton</u> |
| Total | \$ 51.57 per ton |

Comparing with export prices C.I.F. Geneva (Italy) 53-55 \$ per ton (see file No.108 and 109) the export of hulls and grits is profitable even with high costs of handling and freight.

Therefore the total amount of produced gluten, hulls and grits may be easy to market either in Kenya or for export.

6.2.15 Industry of Matches

Kenya has one match factory in Mombasa. This factory imports about 10 t of potato starch per year from West Germany. The price for imported starch is 180-185 \$/t.

The amount of potato starch for production of matches is not calculated in the market.

6.3 Customers from Wet Milling Process in Uganda:

Marketing in Uganda was based only on starch and syrup. A quite modern textile industry exists in Uganda. The textile industry in this country is using locally produced cassava starch and some imported starch. The tendency is to use only domestic starch in order to protect the starch factory in Lira. It was not possible to get data on starch and syrup consumption in Uganda.

Here are some data connected with the starch factory in Lira:

I. Price of Cassava:

- (a) 3 cents per lb. (\$ 95 per ton) for roots delivered to factory in Lira; share about 10% of total intake.
- (b) 2½ cents per lb (78.5 \$ per ton) for root collected by the starch factory in an area consisting of whole Lango district, which means that transportation expenses add another 2½ cents per lb, share about 90% intake.

II. Price of cassava starch:

1,200 shs. Uganda for 1 metric ton ex factory (\$172 per ton)

III Capacity of the starch factory in Lira

| | | | | | |
|---------------|-----|-----|-----|-----|---------------------|
| 2 Shifts | ... | ... | ... | ... | 1,000 tons per year |
| 3 Shifts | ... | ... | ... | ... | 1,500 tons per year |
| actual output | ... | ... | ... | ... | 800 tons per year |

300 tons in stock at the moment (February, 1970).

The factory in Lira is now not able to cut the starch price. A small unknown amount of cassava starch was imported to Uganda from Tanzania for \$143 per ton.

The starch factory in Lira produces a rather low quality of starch which is impossible to be used as a raw material for syrup production.

The investment for a starch rafination and hydrolysis into syrup is high and Uganda is not planning a syrup production in the future.

From this point of view Uganda is a very interesting market for corn syrup; The production of fruit juices and sweets in the canning industry is negligible and the real market for syrup is only in confectionery.

The confectionery "Muljubhai Madhvani" in Jinja is the biggest customer for corn syrup imported in (1969) 960 tons

"Makisa Tabisco" (head office in Nairebi) has a confectionery in Kampala and imports:-

(1969) 230 tons per year

Various small customers in Uganda imported in 1969 200 tons

Calculating the annual expansion with 15% of our expansion programme, the annual import of syrup in Uganda will be:

| | |
|----------------------------|------------|
| in 1969 | 1,390 tons |
| in 1973 (estimated) | 1,650 tons |
| in 1975 (estimated) | 2,110 tons |

6.4 Customers from the Wet Milling Process in Tanzania.

It was not possible to get data for the starch intake and starch production in this country. It is believed that a very small cassava starch producer exists in Tanzania.

Neglecting the potential canning and fruit juices industries in Tanzania, only confectioneries are taken into account. Tanzania has in Arusha one confectionery belonging to the same company as in Uganda, that is "Muljubhai Madhvani" "House of Manji" from Nairobi has also a confectionery in Arusha. There are some other 3-4 small confectioneries in Arusha and Moshi.

The total annual intake of corn syrup for these confectioneries would be (calculating expansion programme and about 15% increase per year):

| | |
|----------------|----------|
| in 1969 | 510 tons |
| in 1973 | 750 tons |
| in 1975 | 990 tons |

Note

The textile industry in Tanzania is expanding particularly the jute industry and it is claimed that only the jute industry in this country will need about 500 tons of starch annually. Nevertheless, the amount of starch to Tanzania is not calculated in the Report.

6.5 Customers from the Wet Milling Process in Zambia:

Zambia has a big and modern textile factory and few rather small confectioneries. It was not possible to get data on starch and syrup intake.

The amount of imported syrup is based on annual statement of external trade (1968):

Lusaka:

| | |
|---------------------------|----------|
| in 1968 | 354 tons |
| in 1969 (estimated) | 370 tons |
| in 1973 (estimated) | 400 tons |
| in 1975 (estimated) | 450 tons |

The main supplier is South Africa. Zambia had an intention to establish a wet milling factory and "Indeco" (The Industrial Development Corporation of Zambia Limited) had a feasibility report made by: Stanley Consultants, Inc. Muscatine, Iowa U.S.A. However, the prices of corn have been increasing every year and the surplus of corn is negligible. Contd/...

Besides the market in Zambia is small and the transportation for export is high. Taking these reasons into account, Zambia has no intention to establish a corn processing factory in the near future. Even if a factory would be established in the future, the production of corn syrup is not planned.

South Africa is a very big confectionary supplier for Zambia and it is planned to increase the rather small production of sweets in this country.

It is also planning a canning industry in this country.

Taking into account these matters, Zambia might be a very good customer for the proposed corn processing plant in Kenya.

Note

According to Annual Statement of External Trade (1968) Kenya imported in 1968 169 tons of starch (mainly from South Africa) but this will not be taken into account in marketing figures.

6.6 Customers from the wet milling process for overseas

By-products from a wet corn milling factory can be easily sold on the world market particularly in Europe. By-products: hulls and grits and corn gluten are very prominent raw materials for sweet production which is for Europe very important. For that reason these products have relatively high prices and even countries with existing corn processing factories are importing hulls and grits and corn gluten.

It is not easy to export starch to West Europe due to the high current and future tariffs on imports of agricultural products into E.E.C. (European Economic Community) However it is a potential market for starch products. One of the most important starch products in the near future will be the modified and pregelatinized (instant) starch which is used as a component for artificial milk production. This milk is used as a feed for so called "white meat" production primarily in Italy and Switzerland.

A newly born calf is taken from the mother cow and fed with artificial milk for about 100 days. During this period the calf gets 100 kg. (from 45 - 50 at the beginning to 150 kg. when finished) and is later marketed as "white meat". This meat has a very high price particularly in Italy and Italy will be in the near future a good customer for modified and pregelatinized starch.

For corn gluten, hulls and grits in a similar situation Italy, West Germany, Austria and Switzerland are importers of these goods and a letter was written to a big importer asking the confirmation for (see file No.106).-

| | <u>1500t/corn</u> | <u>30,000 tons corn per year</u> |
|-----------------|-------------------|----------------------------------|
| Corn gluten | 900 | 1,800 tons per year |
| instant starch | 5,000 | 10,000 tons per year |
| hulls and grits | 2,200 | 6,600 tons per year |

And with these prices C.I.F. GLEBOVA:

| | |
|------------------------|---------------|
| Corn gluten | § 165 per ton |
| instant starch | § 115 per ton |
| hulls and grits | § 55 per ton |

A confirmation is obtained from the firm in Switzerland (see file No.116) for the mentioned amounts and prices. In the meantime many possibilities were found to sell starch products - syrup, corn gluten, hulls and grits on the local market and therefore to decrease the obliged overseas export connected with the proposed capacities (15 respectively 30,000 tons of corn per year)

According to the unexpected big market in Kenya, Uganda, Tanzania and Zambia the export to overseas will be lower and this more secure the proposed corn processing factory.

7. PROPOSAL FOR ASSORTMENT OF GOODS

7.1 Dry Milling Process.

The present dry milling industry in Kenya (see 4.5 and 4.6) is running only with 63.49% of the peak capacity and this should be kept in mind when planning any investment in this field. The best would be to install in already running mills some extra machines in order to improve the present assortment.

These machines should be installed in the mills in Nairobi and Eldoret and will extract corn germs and bran. Corn oil may be obtained from separated germs and bran will be used as a raw material for cattle feed.

In order to change the present technology in the proposed way, many problems have to be solved such as -

- type, size and number of additional machines for separating germ and extraction of corn oil.
- price of raw material-corn which has to be low in order to compete with the granulated maize meal
- to stimulate the milling of corn with germ separation giving better conditions to mills separating the germ etc.

It is interesting to note that in Bulgaria where there is the state controlled industry straight milling of corn is not allowed. All the farmers and animal feed factories are obliged to separate at first the germ in mills and the germ is used for crude corn oil production. The crude or refined corn oil is sold to West Europe.

7.2 Wet Milling Process

Based on the marketing in Kenya as well as the possibilities for export to East African Countries and overseas, the following assortments of final products is recommended with a short explanation for application.

Corn Starch in powder non-modified

This will be used in the textile industry for food industry, in households etc. It will be shipped in 4 ply paper bags 50 kg. net.

Corn starch modified.

This will be used in textile industry, paper industry, food industry, starching in households etc. It will be shipped in 4 ply paper bags 50 kg. net.

Modified and Pregelatinized corn starches:

This will be used in corrugated paper industry, paper industry and for export. It will be shipped in 4 ply or plastic bags 50 kg. net

Corn GERMS

This contain ca 50% oil and only 3% moisture will serve as a raw material for existing oil factory in Nairobi for production of edible oil. Germs will be shipped in bulk in special trucks with pneumatic devices.

Corn gluten:

This will be used as a special component for food and for export. It contains 70% protein and is highly esteemed on the international market. Gluten will be shipped in 4 ply paper or plastic bags 50 kg. net.

Hulls and grits:

This will be used as a component for feed production and for export. They have 10-14% protein which expressed in figures is not much but, for instance, in milking cows they give excellent results which are better than any other component of food with considerably higher percentage of protein. For local customers hulls and grits will be shipped in bulk in special truck with pneumatic device, and for export in 3 ply paper bags 35 kg. net.

Corn syrup:

This will be used for production of various candies, sweets etc. It is used as an addition for production of juices, canned fruit, soft drinks, beer, leather industry, ingredient for glues etc. Corn syrup for big customers in Kenya will be transported in tankers in bulk, for smaller customers in returnable steel drums and for export in non-returnable steel drums (galvanized).

Dextrines

This will be used in the paper industry, textile industry foundries, different adhesives etc. Production of dextrins is planned for the future and will depend on the expansion of the mentioned industries.

7.3 Others:

Instant porridge and corn flakes. The market for prepared breakfast foods in Kenya has been expanding steadily but is still very small. However, the Kenyan corn milling industry is able to supply a suitable raw material for prepared breakfast production and this represents the majority in investment. It appears feasible to start the manufacturing of prepared breakfast cereals but only with low investment and rather small scale. This project is already under investigation in the Ministry of Commerce and Industry, but will not have any influence in solving the problem of surplus corn in Kenya.

7.4 Conclusion:

According to the marketing survey in Kenya, Uganda, Tanzania and Zambia as well as for export, the main proposed corn processing industry is the wet milling. For this reason the report will proceed and be based on the wet milling industry.

8. COMPETITION:

8.1 Production in Kenya:

Kenya has not got any corn processing or cassava processing factory. However, it was taken into consideration on cassava pellets production in Mombasa.

Wheat or wheat flour may be considered in a certain way as potential competitor to corn starch. Kenya is a relatively big wheat producer. Wheat is sold to mills for 56 shs. per bag - \$ 84.89 per ton. With this high price as a raw material for wheat flour, the mills are producing three main products.

1. 73 1/3% extraction rate wheat flour for \$159.51 per ton.
2. 85% extraction rate wheat flour for \$ 140.55 per ton.
3. 72% extraction rate only produced for export

The stated prices are very high and it is not anywhere indicated that they will drop considerably. Therefore from this side the proposed corn processing factory will not face any competition also.

8.2 Production in Uganda:

In Lira (Uganda) is a cassava starch factory. The claimed capacity of this factory is -

| | |
|--------------------|---------------------|
| 2 shifts | 1,000 tons per year |
| 3 shifts | 1,500 tons per year |

but the actual output is about 600 tons per year.

The produced cassava starch is not for export due to low quality and high price - more details, see 6.3

Up to now it is not known any intention to establish a wet milling factory in Uganda neither the production of syrup.

8.3 Production in Tanzania.

Tanzania does not have a wet milling factory for corn and it is not known for the production of cassava starch. As the production of non refined starch from cassava is relatively simple it is possible for the existence of a small local cassava starch production.

It is not planned an industry for cassava processing in Tanzania and Tanzania is a relatively high importer of starch and syrup.

For marketing (6.4) is taken into account only syrup.

8.4 Production in Zambia:

Zambia is not a starch or syrup producer due to lack of raw materials. This country imports starch and glucose primarily from South Africa and is willing to import these goods from Kenya provided the prices will be competitive.

8.5 Conclusion

Despite the existing cassava starch factory in Uganda the proposed corn processing factory in Kenya will not have any competition in this country. Confectioneries are obliged to import corn syrup for the production of different sweets. Textile mills and paper mills are in a similar position. They cannot produce without starch.

Corn germ, corn gluten and hulls and grits are not known on this market but the total corn gluten and germs will be easily marketed (see 6.2.13 and 6.2.14) whereas about 2 of the produced hulls and grits will find the place on Kenya Market.

Uganda has a cassava starch factory which has a high cost of production. The present price for cassava starch in Uganda is \$60 per ton - 172 ₤ per ton and due to high production costs it is not believed that this factory may compete with the proposed Kenya corn starch factory and in Tanzania or Zambia.

It is believed that Tanzania has a very small cassava starch production but this can not be competitive with the proposed corn processing factory in Kenya.

According to available information Tanzania is not intending to build a large scale starch factory. The existing textile mills need starch for sizing and this starch is imported from overseas.

Zambia has not any starch or syrup factory and imports these goods primarily from South Africa. In the near future Zambia will not have her own starch or syrup production due to increasing prices and shortage of corn. Cassava is not well introduced in Zambia and therefore Zambia will not compete in the near future with the proposed Kenyan factory.

In short words, the new factory in Kenya will not have any competition in the country, and will export without difficulties corn syrup to neighbour countries and even not compete with the Uganda's cassava starch factory, Tanzania and Zambia.

2. IMPORT DUTIES, EXCISE DUTIES AND SALES TAXES

2.1.1. Import duties - Kenya, Uganda and Tanzania.

| | |
|---|------------------------------------|
| wheat flour | 50% |
| other cereal flours | 30% |
| maize meal | 50% |
| other cereal groats | 30% |
| manioc (cassava) flour | 50% |
| sago, arrowroot flour | 30% |
| corn flakes and similar products | 50% |
| starches | free |
| gluten and gluten flour | 30% |
| beet sugar and cane sugar | |
| Kenya | shs.441 per ton = \$ 63 per ton |
| Uganda | shs.507 per ton = \$ 72.43 per ton |
| Tanzania | shs.463 per ton = \$ 66.14 per ton |
| sugar syrup, artificial honey | 50% |
| sugar confectionery, not containing cocoa | 50% |
| flavoured or coloured sugars | 50% |
| oil seeds: soya beans, copra | |
| palm kernels, mafura nuts | 37.5% |
| linseed | free |
| other oil seeds | 30% |
| linseed oil, hempseed oil, palm oil, coconut oil, palm kernel oil and castor oil | free |
| olive oil | 50% |
| other oils | 30% |
| preparations of flour, meal, starch or malt extract, of a kind used as infant food or dietetic or culinary purposes, containing less than fifty per cent by weight of cocoa | 50% |

Tapioca and sago, tapioca and sago substitutes obtained from potato or other starches 50%

9.1.2. Import duties - Zambia
- no information

9.2. Excise duties:

Kenya

Sugar shs.440.90 per ton = 62.99 \$ per ton

Uganda

Sugar shs.507.10 per ton = 72.44 \$ per ton

Tanzania

Sugar shs.462.90 per ton = 66.13 \$ per ton

Zambia

no information

Note:

It is important to note that there is no duty for any machine supposed to be installed in the proposed corn processing factory.

In order to protect the existing cassava starch factory in Lira, Uganda will impose duty for imported starch.

It is considered necessary to impose 30 - 40% duty in Kenya for imported starch in order to protect local production

9.3. Sales Taxes:

There are no sales taxes in Kenya. No information for Uganda, Tanzania and Zambia.

NOTE:

Source for Import Duties and Excise Duties "East African Community - East African Customs and Excise Tariffs" - January 1970

10. PRICES FOR CORN PRODUCTS (WET MILLING)

10.1 Domestic prices - Present

Corn starch in powder non-modified C.I.F. Mombasa.

| | | | | | |
|--|-----|-----|-----|-----|---------------------------|
| Minimum | ... | ... | ... | ... | \$ 107 per ton |
| Maximum | ... | ... | ... | ... | \$ 130 per ton |
| Average | ... | ... | ... | ... | \$ 118.3 per ton |
| corn starch modified | ... | ... | ... | ... | \$ 250 per ton |
| corn starch - modified and pregelatinized | ... | ... | ... | ... | \$ 232 per ton |
| Corn germs | ... | ... | ... | ... | - not known on the market |
| Corn gluten | ... | ... | ... | ... | - not known on the market |
| hulls and grits | ... | ... | ... | ... | - not known on the market |

Corn syrup in steel drums C.I.F. Mombasa

| | |
|---------|--------------|
| minimum | 122 \$ / ton |
| maximum | 130 \$ / ton |
| average | 130 \$ / ton |

10.2 Domestic prices - Proposed from the new factory:

| | |
|--|---------------|
| corn starch in powder (non modified) | 150 \$ / ton |
| corn starch modified | 200 \$ / ton |
| modified and pregelatinized | |
| corn starch | 230 \$ / ton |
| corn germs (see file No.102) | 175 \$ / ton |
| corn gluten (see file No. 116) | 140 \$ / ton |
| hulls and grits (see file No.110) | 28.6 \$ / ton |
| corn syrup (except confectioneries) | 150 \$ / ton |
| corn syrup in returnable drums - abandoned | |
| corn syrup for confectioneries | 200 \$ / ton |

10.3 Export prices - proposed:

| | |
|---|-------------|
| Corn starch in powder | 90 \$ / ton |
| modified and pregelatinized corn starch | 112 \$ / t |

| | | | | | |
|-------------------------------|-----|-----|-----|-----|------------|
| corn gluten | ... | ... | ... | ... | 162 \$ / t |
| hulls and grits | ... | ... | ... | ... | 53 \$ / t |
| corn syrup in debies | | | | | |
| (Uganda, Tanzania and Zambia) | ... | | | ... | 140 \$ / t |

NOTE:

The real price for corn syrup for confectioneries in Kenya is about 220 \$ / t due to import duties. Confectioneries will get a cheaper syrup from the proposed factory.

The price for imported syrup is increasing, therefore it will be possible to market in export syrup with proposed price starting in 1973.

11. CAPACITY OF THE WET MILLING FACTORY

Planned capacity of the factory is 100 tons per day corn processing based on cleaned corn with 13.5 humidity (see file No.113). For the first two years the intake of corn is planned at the level of 15,000 tons and the full capacity of 30,000 tons per year is supposed to be in 3 - 4 years. In this way the following output of corn processing shall be obtained:

- I Stage (1973 - 1974) - 15,000 tons/year
- II Stage (1975 on) - 300 working days 30,000 tons/year

The aforesaid proposed capacity and break-down of the output is recommended due to following reasons:

- In 1973 will the market in Kenya and for export need goods based on 15,000 tons/year milling. This capacity can after starting, reach a factory with enough reserve in machinery.
- running - in of the machines and all other production lines.
- training of the staff to operate the machines and to working requirements.
- introduction of new products on the market.
- investment for the machinery for 30,000 tons/year corn capacity is low comparing with the investment for 15,000 tons/year (based on 300 working days).
- to start with a smaller size factory (15,000 tons/year) would demand for future expansion much more investment than the real difference comparing the total price for machinery from 15,000 to 30,000 tons/year.
- the bigger size factory (100 tons/day) has a "bottled-up" system and corn steep evaporation which enables a total yield at about 98% on dry basis compared with a lower size with total yield of about 91%.
- The bigger size factory can have a most modern technology which enables the production of competitive final products for export.

Contd/....

12. QUANTITIES OF FINAL PRODUCTS

The calculations of quantities are based on supposing that the corn processing factory will start the production in 1973.

The quantities from 1975 are given assuming the yearly increase at 10%-15%. This is not a high percentage comparing the increase of food industry in Kenya, Uganda, Tanzania and Zambia.

The quantities for overseas are based on the known market in Europe and on the importer willing to buy all stated quantities for export (see file No.118 and 119). The data for export are only ^{the} difference from the total capacity and the domestic market, because it is supposed that only the surplus will be exported.

12.1 For domestic market

Quantities for domestic market are based on marketing (6.2.1 to 6.2.14) in Kenya and are given as summary in 12.6 (see table 12.6).

12.2 For Uganda

According to 6.3 the estimated annual intake will be:

| | | |
|----------------------|---|------------|
| - corn syrup in 1969 | - | 1,390 tons |
| - corn syrup in 1973 | - | 1,650 tons |
| - corn syrup in 1975 | - | 2,110 tons |

12.3 for Tanzania

According to 6.4 the estimated annual intake will be:

| | | |
|----------------------|---|----------|
| - Corn syrup in 1969 | - | 510 tons |
| - corn syrup in 1973 | - | 750 tons |
| - corn syrup in 1975 | - | 990 tons |

12.4 for Zambia

According to 6.5 the estimated annual intake will be:

| | | |
|----------------------------------|---|----------|
| - corn syrup in 1969 (estimated) | - | 370 tons |
| - corn syrup in 1973 | - | 400 tons |
| - corn syrup in 1975 | - | 450 tons |

12.5 for Overseas

As stated in 12, only the surplus of non marketed goods is proposed for export to overseas and according to 12.1 - 12.4 there will be these quantities:

| | In 1973 | in 1975 |
|------------------------------------|----------|----------|
| modified and pregelatinized starch | 1,187 t. | 8,485 t. |
| ... | 944 t. | 3,768 t. |

12.6 SUMMARY DOMESTIC MARKET

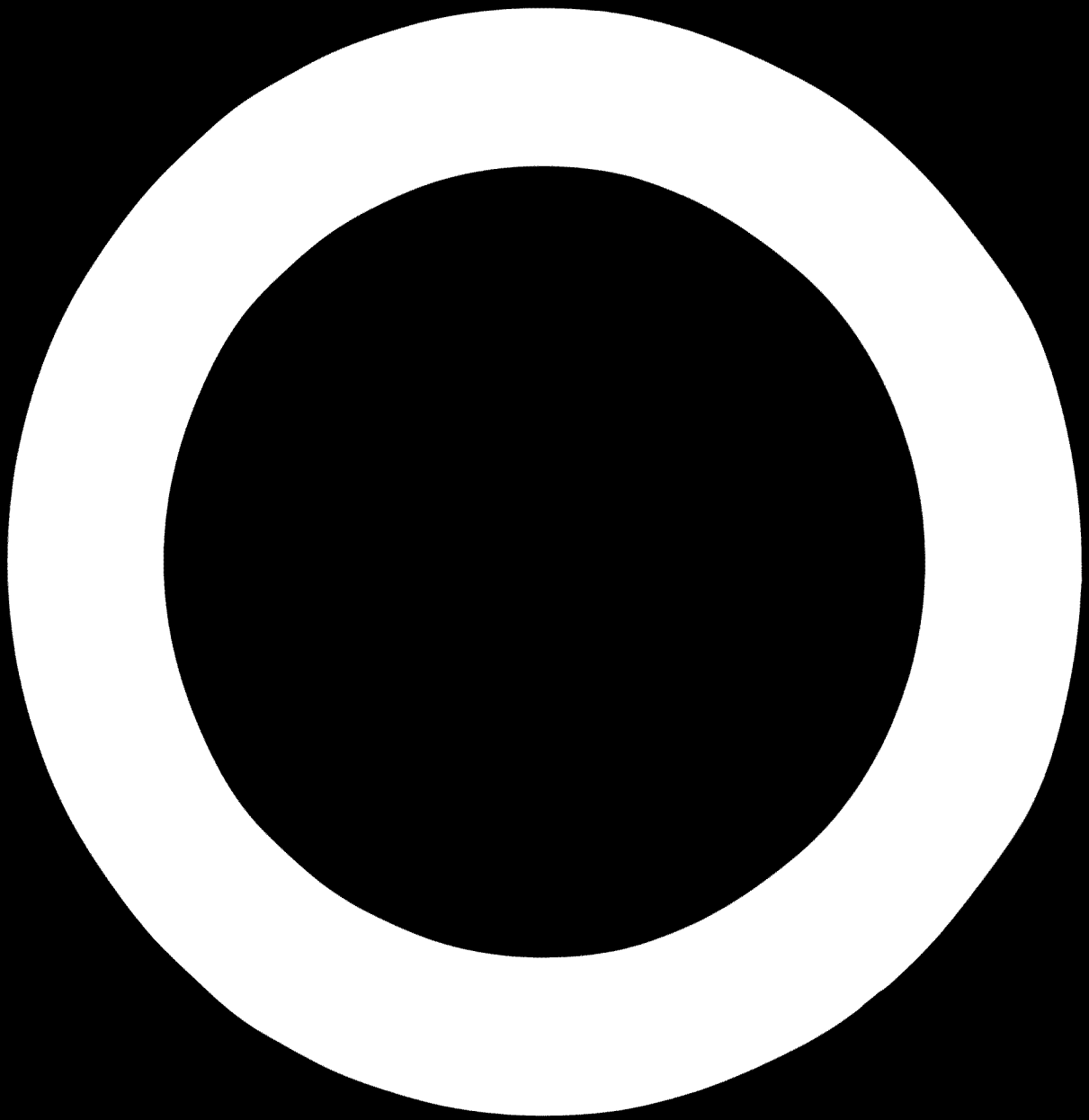
| SOURCE | Corn Starch non modif. | | | Corn Starch modified | | | Modified and pregelatinized starch | | | Corn syrup | | | Corn germ | | | Corn gluten | | | Hulls and grits | | |
|--------|------------------------|-----|------|----------------------|-----|-----|------------------------------------|------|------|------------|------|------|-----------|------|------|-------------|-----|------|-----------------|------|------|
| | 69 | 73 | 75 | 69 | 73 | 75 | 69 | 73 | 75 | 69 | 73 | 75 | 69 | 73 | 75 | 69 | 73 | 75 | | | |
| 6.2.1 | - | - | - | - | - | - | 820 | 1595 | 2100 | - | - | - | - | - | - | - | - | - | | | |
| 6.2.2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.3 | - | - | - | - | - | - | 25 | 40 | 55 | - | - | - | - | - | - | - | - | - | | | |
| 6.2.4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.5 | - | - | - | - | - | - | 780 | 940 | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.6 | - | - | - | - | - | - | 1600 | 1900 | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.7 | - | - | - | - | - | - | 0.7 | 2 | 5 | - | - | - | - | - | - | - | - | - | | | |
| 6.2.8 | 180 | 100 | 100 | 80 | 250 | 320 | - | - | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.9 | - | - | - | - | - | - | 260 | 350 | 420 | - | - | - | - | - | - | - | - | - | | | |
| 6.2.10 | 25 | - | - | - | 260 | 300 | - | - | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.12 | 21 | 825 | 990 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.13 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | |
| 6.2.14 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | |
| TOTAL | 225 | 925 | 1090 | 80 | 510 | 620 | 260 | 350 | 420 | 845.7 | 4017 | 5000 | - | 8026 | 1605 | - | 865 | 1730 | - | 2250 | 2720 |

12.7 SUMMARY EXPORT

| SOURCE | Corn starch non modified | Corn starch modified | Modified and pregelatinized corn starch | Corn syrup | Corn germs | Corn gluten | Hulls and grits |
|--------|-----------------------------|-------------------------|---|----------------|------------|-------------|-----------------|
| 12.2 | 1969 73 75 | 69 73 75 | 69 73 75 | 69 73 75 | 69 73 75 | 69 73 75 | 69 73 75 |
| | - | - | - | 1390 1650 2110 | - | - | - |
| 12.3 | - | - | - | 510 750 990 | - | - | - |
| 12.4 | - | - | - | 370 400 450 | - | - | - |
| 12.5 | - | - | 1187 8485 | - | - | - | 944 3758 |
| TOTAL | - | - | 1187 8485 | 2270 2800 3550 | - | - | 3244 6468 |

12.8 TOTAL DOMESTIC AND EXPORT SALES

| | Corn starch non modified | Corn starch modified | Modified and pregelatinized corn starch | Corn syrup | Corn germs | Corn gluten | Hulls and Grits |
|----------|-----------------------------|-------------------------|---|------------------|--------------|-------------|-----------------|
| | 1969 73 75 | 69 73 75 | 69 73 75 | 69 73 75 | 69 73 75 | 69 73 75 | 69 73 75 |
| DOMESTIC | 226 925 1090 | 80 510 620 | 260 350 420 | 845.7 4017 5000 | - 802.6 1605 | - 865 1730 | - 2250 2720 |
| EXPORT | - - - | - - - | - 1187 8485 | 2800 3550 | - - - | - - - | - 994 3768 |
| TOTAL | 226 925 1090 | 80 510 620 | 260 1537 8905 | 3115.7 6817 8550 | - 802.6 1605 | - 865 1730 | - 3244 5488 |



14. PRODUCTION COSTS

14.1 Process Data

| | I STAGE | II STAGE |
|-------------------------------------|---------------------------|-------------|
| Hours of operation: | 3600/year | 7200/year |
| Raw material-corn-input | 15,000 tons | 30,000 tons |
| Power KW (installed effect) | 1300 | |
| Water consumption | 15m ³ /hour | |
| Steam consumption | 12,5 tons/hour | |
| Oil consumption | 0,815m ³ /hour | |
| Sulphur consumption | 3kg/tons of corn | |
| Hydrochloric acid (36%) consumption | 6 kg/hour | |
| Soda ash | 3,5 kg/hour | |
| Bentonite | 6 kg/hour | |
| Activated carbon | 6 kg/hour | |
| Hydrated lime (for corn steep) | 25 kg/hour | |
| Cooling water consumption | 75m ³ /hour | |

14.2 Raw Material

| | | | | |
|----------|------------------|-------------|---|--------------|
| I Stage | 15,000 tons corn | @ 40¢/ton | = | 600,000 \$ |
| II Stage | 30,000 " | " @ 40¢/ton | = | 1,200,000 \$ |

Note:

Calculation is based upon the price given by the Ministry of Agriculture (File No.112) - see 4.3.

It is a very important fact to note that if the price would be lower by only 1 sh/bag that is 1.57¢/ton net profit shown in this study would be increased by:-

I Stage : 15,000 tons : 1.57¢/ton = 23,550¢/ton

II Stage : 30,000 tons : 1.57¢/ton = 47,100¢/ton.

14.3 Salaries and Wages

It is recommended that only managing director and technical manager would be non-Kenyans, and they will be replaced with Kenyans in 3-4 years when Kenyans will take over these positions. Laboratory chief and at least 6 foremen are supposed to have a training for few months in a corn starch factory. For the start and a period of 3 - 6 months the need is for 6 foreign technicians.

In the following table are stated working points and numbers for the factory running with the full capacity. Workers for the construction period are not included and this is stated under investment - costs for erection.

| NO. | WORKING POINT | NUMBER | \$ PER YEAR |
|-----|-----------------------|--------|-------------|
| 1 | Managing director | 1 | 24,000 |
| 2 | Technical manager | 1 | 18,000 |
| 3 | Laboratory (chief) | 1 | 6,000 |
| 4 | Foremen | 10 | 24,000 |
| 5 | Technician - mechanic | 1 | 2,400 |
| 6 | Book-keeper | 1 | 3,600 |
| 7 | Cashier | 1 | 1,800 |
| 8 | Sale and supplies | 3 | 5,400 |
| 9 | Laboratory staff | 4 | 4,800 |
| 10 | Clerk grade I | 2 | 2,880 |
| 11 | Telephone operator | 1 | 720 |
| 12 | Store-keeper | 2 | 1,440 |
| 13 | Typist | 2 | 1,440 |
| 14 | Secretary | 1 | 840 |
| 15 | Cleaner | 3 | 1,080 |
| 16 | Electrician | 4 | 4,320 |
| 17 | Mechanic and fitters | 6 | 8,640 |
| 18 | Worker at the machine | 50 | 48,000 |

| NO. | WORKING POINT | NUMBER | \$ PER YEAR |
|-----|--|--------|-------------|
| 19 | Semi skilled labourer | 20 | 9,600 |
| 20 | Worker in boiler house and water treatment | 8 | 11,520 |
| 21 | Mechanic in maintenance shop | 6 | 7,200 |
| 22 | Non skilled labourer | 20 | 7,200 |
| 23 | Watchmen | 2 | 720 |
| 24 | Truck and fork lift drivers | 4 | 2,100 |
| | TOTAL | 157 | 197,700\$ |

Note:

Salaries from item 6 to 24 are based on: Republic of Kenya - Legal Notice No. 141 - The regulation of wages and conditions of employment act (1967). Salaries from mentioned Act are increased by 20% according to new contracts and here is included National Social Security Fund.

14.4 Packing

The finished products from the proposed corn processing factory will be shipped:-

- a. In paper bags 3 ply - size 65 x 112 cm for domestic market
 - hulls and grits
- b. in paper bags 4 ply - size 65 x 112 cm for domestic market
 - all starches
 - corn gluten
- c. in paper bags 4 ply - size 65 x 112 cm for export
 - hulls and grits
- d. in paper bags 4 ply - size 65 x 112 cm plus jute bags for export
 - modified and pregelatinized corn starch
- e. in lacquered steel drums for export
 - corn syrup
- f. in lacquered plain "T.O.X." type drums
 - corn syrup
- g. in bulk - tank trucks
 - corn syrup for big customers in Kenya, Uganda and eventually Tanzania.
- h. in bulk - RINFUSA - in trucks
 - corn germ

Calculations

Paper bags 3 ply (35 kg) for hulls and grits domestic Market

$$\frac{1000}{35} = 28,57 \text{ bags per ton}$$

Calculating the damage during handling:
30 bags/ton

According to quotation of "Paperbags" Ltd.

- Nairobi (see letter in file No. 115) the cost for packing will be:

$$30 \times 0,975\text{sh} = 29,25\text{sh} = 4,18\$/\text{ton}$$

Paper bags 4 ply (50 kg) for hulls and grits for export

$$\frac{1000}{35} = 28,57 \text{ bags per ton}$$

Calculating the damage during handling 30 bags/ton

According to quotation of "Paperbags" Ltd.

- Nairobi (see letter in the file No. 115) the cost for packing will be

$$30 \times 1,2 \text{ sh} = 36 \text{ sh} = 5,14\$/\text{ton}$$

Paper bags 4 ply (50 kg) for starches and corn gluten

$$\frac{1000}{50} = 20 \text{ bags per ton}$$

Calculating the damage during handling:

$$21 \text{ bags/ton}$$

According to quotation of "Paperbags" (the same as above) the packing will be:

$$21 \times 1,2 \text{ sh} = 25,2 \text{ sh} = 3,6\$/\text{ton.}$$

Paper bags 4 ply (50kg) + jute bags

ACIF Ltd. - Nairobi gave a quotation for jute bags size 65 x 115 for 2,60 sh/bag.

For 1 ton of produced goods would be:

$$3,6\% (\text{paper bag}) + 2,60 \text{ sh} \times 20 =$$

$$3,6\% + 7,43\% = 11,03\%/\text{ton}$$

Plain lacquered debies T.O.X. type
Capacity 4 gallons - 25kg corn syrup

$$\frac{1000}{25} = 40 \text{ debies per ton of syrup}$$

According to quotation "METAL BOX CO."

- Nairobi:

$$40 \times 4,5 \text{ sh} = 180 \text{ sh} = 25,71\$/\text{ton}$$

Steel drum lacquered for 300 kg syrup

$$\frac{1000}{300} = 3,33 \text{ drums per ton of corn syrup}$$

According to quotation of VAN LEER CONTAINERS (E.A.)- Mombasa

$$3,333 \times 70 \text{ sh} = 3,33 \times 10\% = 33,33\%/\text{ton}$$

Comparing this figure with cost of corn syrup

packing in debies, the packing in steel drum is

abandoned. Furthermore the customer will prefer

debies because he will be able to sell them for

about 1/2 price and have no special handling

Summary data

| | | |
|---|---|-----------|
| - corn starch non-modified | - | 3,50/ton |
| - corn starch modified | - | 3,53/ton |
| - corn starch modified and pregelatinized for export | - | 11,07/ton |
| - corn syrup in debies | - | 25,71/ton |
| - corn syrup in bulk | - | - |
| - corn germs in bulk | - | - |
| - corn gluten | - | 3,61/ton |
| - hulls and grits - domestic market | - | 4,13/ton |
| - hulls and grits for export | - | 5,14/ton |

| <u>Packing costs</u> | <u>1973</u> | <u>1975</u> |
|--|-------------------|-------------------|
| Corn starch non-modified | 3330,0 | 3924,0 |
| Corn starch modified | 1836,0 | 2232,0 |
| Corn starch modified) Export and pregelatinized) Domestic | 13022,6 1260,0 | 93589,5 1512,0 |
| Corn syrup - 70% in debies | 122618,1 | 153874,3 |
| Corn germs | - | - |
| Corn gluten | 3114,0 | 6228,0 |
| Hulls and grits - domestic | 9405,0 | 11369,6 |
| Hulls and grits - export | 5102,0 | 12367,5 |
| TOTAL | 159635 | 221097 |

14.5 Freights and Harbour Handling

Freights and Harbour Handling are calculated assuming the factory will be established in Nairobi.

14.5.1 Chemicals (from Mombasa to Nairobi RAILWAY)

| | Amount | | Scale | \$/t | £ | |
|-------------------|---------|----------|-------|-------|--------------|--------------|
| | I stage | II stage | | | I stage | II stage |
| Sulphur | 45 | 90 | 8 | 13,21 | 594 | 1,188 |
| Hydrochloric Acid | 21,6 | 43,2 | 2 | 20,0 | 432 | 864 |
| Bentonite | 21,6 | 43,2 | 8 | 13,21 | 285 | 570 |
| Activated Carbon | 21,6 | 43,2 | 10 | 10,43 | 225 | 450 |
| Hydrated Lime | 90 | 180 | 11 | 7,86 | 707 | 1,414 |
| TOTAL | | | | | 2,243 | 4,486 |

Note:

Scales and Freight Rates are given by Ministry of Power and Communications - MR. MOSKALEWICZ.

Freight for oil from Mombasa to Nairobi is included in the total price of oil.

14.5.2 Finished goods (only for export from Nairobi to Mombasa - RAILWAY)

| | Amount | | Scale | \$/t | £ | |
|---|---------|----------|-------|-------|---------------|---------------|
| | I stage | II stage | | | I stage | II stage |
| Modified and pregelatinized corn starch | 1187 | 3485 | 4 | 10,07 | 11,953 | 85,444 |
| Hulls and grits | 994 | 3768 | 13 | 3,64 | 3,618 | 13,715 |
| TOTAL | | | | | 15,571 | 99,159 |

Note:

Scales and Freight Rates are given by Ministry of Power and Communications - Mr. Moskalewicz.

- Here are only calculated goods for export to overseas - corn syrup will be exported by road and is calculated under "other deductions" (14.3).

14.5.2. Harbour handling and sea freights

| | Amount | | Harbour Handling | | Rate of Freight \$/ton | Freight Mombasa - Geneva | |
|---------------------------------------|--------|--------|------------------|--------|------------------------|--------------------------|--------|
| | I st. | II st. | I st. | II st. | | I st. | II st. |
| Modified & pregelatinised corn starch | 1187 | 6485 | 3561 | 25455 | 20,32 | 24120 | 172415 |
| Hulls and grits | 994 | 3768 | 2982 | 11303 | 19,32 | 19204 | 72798 |
| TOTAL | | | 6543 | 36759 | - | 43324 | 245213 |

| | Handling and Freights Total | |
|--------------------------|-----------------------------|----------|
| | I Stage | II Stage |
| Harbour handling | 6543 | 36759 |
| Freight Mombasa - Geneva | 43324 | 245213 |
| TOTAL | 49867 | 281972 |

Note:

Freight Rates and Harbour Handling are given by "DODWELL AND CO (E.A.) LTD. MR. G.S.O. MAYNE. The above rates are "CONFERENCE RATES" and "NON CONFERENCE RATES" are about 1\$/ton lower

14.5.4 Summary

| | I Stage | II Stage |
|---------|---------|----------|
| 14.5.1. | 2,243 | 4,486 |
| 14.5.2. | 15,571 | 29,159 |
| 14.5.3. | 49,867 | 281,972 |
| TOTAL | 67,681 | 385,617 |

14.6 Utilities

| | Price | I Stage | II Stage |
|-------------------|-----------------------|-----------------|-----------------|
| Water | 0,12/m | 5,400 | 10,800 |
| Oil | 44,312/m ³ | 100,005 | 260,011 |
| Sulphur | 71,432/t | 3,214 | 6,429 |
| Hydrochloric Acid | 214,288/t | 4,628 | 9,257 |
| Soda Ash | 2,800/t | 540 | 1,080 |
| Bentonite | 1502/t | 3,240 | 6,480 |
| Activated Carbon | 428,572/t | 9,257 | 18,514 |
| Hydrated Lime | 522/t | 4,680 | 9,360 |
| Cooling Water | 0,912/t | 2,700 | 5,400 |
| Power | - | 99,036 | 147,291 |
| | TOTAL | 262,7502 | 474,6228 |

Note:

- All prices are given assuming the factory will be established in Nairobi.
- The price for oil is given by "SHELL" MR. W.S.N. WANJOFU
- Prices for chemicals are given by "TWIGA CHEMICAL INDUSTRIES LTD." - see letter in the file No. 114. Chemicals are imported duty free except CALCIUM HYDROXIDE where is 30% duty and this is included in the price. All chemicals (except domestic soda ash) are given C.I.F. Mombasa and the cost of freights to Nairobi are given separately.
- The figures for power are given by E.A. POWER AND LIGHTING CO. LTD., MR. R.S. BROADFOOT - according to installed effect, power factor, maximum demand and hours under operation.
- It is not taken into account the extra cost for modifying the starch, therefore are all chemicals calculated very high and an extra saving will be in reduced price for oil.

14.7 Depreciations (I and II Stage)

| Kind of Investment | Price \$ | Lifetime Years | Depreciation % | U.S.\$ Per Year |
|--|-------------|-------------------|-------------------|--------------------|
| Land - 15,1 | 50,000 | 20 | 5 | 2,500 |
| Buildings - 15 | 429,000 | 20 | 5 | 21,450 |
| Production Equipment - 15,3 | 1,800,000 | 9 | 12,5 | 225,000 |
| Other investments 15,4 (except net current assets) | 320,000 | 8 | 12,5 | 27,500 |
| Net current assets 15,4 | 500,000 | - | 6 | 30,000 |
| TOTAL | | | | 306,450 |

14.8 Other Deductions (I and II Stage)

Spare parts and repairs

1,5% of equipment + buildings

$$\frac{2229,000 \times 1,5}{100} = 33,435\text{€}$$

Laboratory and office utensils

(estimated) - 8,000€

Running cost for

trucks (estimated) - 20,000€

rent and siding fee (11,1) - 2,750€

64,185€

14.9 Production Costs - Total

| | I Stage | II Stage |
|------------------------------------|-----------------|-----------|
| Raw Material 14,2 | 600,000 | 1,200,000 |
| Salaries and wages 14,3 | 197,700 | 197,700 |
| Packing 14,4 | 159,835 | 292,057 |
| Freights and Harbour Handling 14,5 | 67,381 | 385,517 |
| Utilities 14,6 | 202,750 | 474,500 |
| Depreciations 14,7 | 300,450 | 300,450 |
| Other deductions 14,8 | 64,185 | 64,185 |
| | TOTAL 1,658,601 | 2,920,671 |

15. INVESTMENTS

15.1 Land

Land = 20,000 sq. m. x 20 Sh = 400,000 Sh

Development Cost = 20,000 sq. m. x 12.5 Sh = 250,000 Sh.

Stand Premium = 400,000 = 80,000 Sh.

Rent = $\frac{80,000}{5} = 16,000$ Sh.

Siding Fee = 20,000 sq. m. x 0.15 Shs = 3,000 Sh.

Total = Stand Premium + Development Cost + Rent + Siding Fee

Total = 80,000 + 250,000 + 16,000 + 3,000 = 349,000 Sh.

Total = 349,000 = 49,857\$

The land will be calculated as 50,000\$

Note:

The cost of land, development cost and siding fee is calculated according to: "A GUIDE TO INDUSTRIAL INVESTMENT - MINISTRY OF COMMERCE AND INDUSTRY and new Rates from MR. A.E. ARCHBOLD - ESTATE OFFICER, E.A.R. & H. P.O.Box 30079. The rates are taken very high as for CHANGAWE - MOMBASA.

Every year the rent and siding fee have to be paid. For this calculation the amount would be:

16,000 Sh + 3,000 Sh = 19,000 Sh = 2,714\$

The amount of 2,750 \$ per year will be calculated as under:

"Other DEDUCTIONS" in costs (14.8)

15.2 Buildings

Main production building

50 x 80 m = 4000 m²

Price per m² = 85\$

4,000 x 85 = 340,000 \$

Boiler house

10 x 20 m = 200 m²

price per m² = 65\$

200 x 65 = 13,000 \$

Storage for some raw material and final products

30 x 50 m = 1500 m²

price per m² = 40\$

1500 x 40 = 60,000 \$

Office

10 x 20 m = 200 m²

price per m² = 80\$

200 x 80 = 16,000 \$

TOTAL 429,000 \$

Note:

The cost of buildings is given by:

C.K.BUILDERS AND CONTRACTORS KENYA LTD.

MR. RAMJI P.O.Box 9194, Nairobi.

15.3 Production Equipment

| | |
|--|--------------|
| Machinery for the complete corn starch factory including steam plant, water treatment air compressor, C.I.F. Mombasa, railage, clearing etc. According to Alfa Laval Quotation FIA (Q) and Alfa Laval (Sweden) letter to MAIZE AND PRODUCE BOARD November 8th 1968 capacity 100t/day | 1,100,000 \$ |
| Not included items in Alfa Laval Quotation: steepwater evaporation, corn reception and cleaning, some tanks etc. (estimated) | 200,000 \$ |
| Complete syrup plant capacity 20t/day According to CONTINENTAL ENGINEERING N.V. AMSTERDAM HOLLAND QUOTATION No.1900C/316 C.I.F. MOMBASA | 330,000 \$ |
| Complete unit for modified starch and pregelatinized starch capacity 2t/h (estimated) C.I.F. Mombasa | 170,000 \$ |
| | <hr/> |
| Total production equipment | 1,800,000 \$ |
| | <hr/> |

15.4 Other Investments

| | |
|--|------------|
| Complete maintenance shop (estimated) | 40,000 \$ |
| Laboratory equipment (estimated) | 10,000 \$ |
| Water supply (estimated) | 10,000 \$ |
| Transformer (estimated) | 10,000 \$ |
| 2 tank trucks for glucose (estimated) | 20,000 \$ |
| 1 truck for bulk corn germ (estimated) | 7,000 \$ |
| 1 fork lift truck (estimated) | 3,000 \$ |
| Office equipment (estimated) | 20,000 \$ |
| Erection and Engineering (estimated) | 100,000 \$ |
| | <hr/> |
| | 220,000 \$ |
| + Net current assets | 500,000 \$ |
| | <hr/> |
| Total | 720,000 \$ |
| | <hr/> |

15.5 Total Investments

| | | |
|------|----------------------|---------------------|
| 15.1 | Land | 50,000 \$ |
| 15.2 | Buildings | 429,000 \$ |
| 15.3 | Production Equipment | 1,800,000 \$ |
| 15.4 | Other Investments | <u>720,000 \$</u> |
| | Total | <u>2,999,000 \$</u> |

1. REVENUES

According to Sales (12.8) and Prices (10.2 and 10.3)
the Revenues will be:

| | MINIMUM PRODUCTION | | Price \$/ton | \$ per year | |
|--|--------------------|----------|--------------|-------------|-----------|
| | I Stage | II Stage | | I Stage | II Stage |
| Corn starch non modified | 925 | 1090 | 150 | 138,750 | 163,500 |
| Corn starch modified | 510 | 620 | 200 | 102,000 | 124,000 |
| Modified and pregelatinized corn starch Export | 1127 | 3425 | 112 | 126,224 | 383,600 |
| Modified and pregelatinized corn starch Domestic | 350 | 420 | 230 | 80,500 | 96,600 |
| Corn syrup - Export | 2800 | 3550 | 140 | 392,000 | 497,000 |
| Corn syrup - domestic Only for confectioneries | 1595 | 2100 | 200 | 319,000 | 420,000 |
| Corn syrup - domestic Other customers | 2422 | 2900 | 150 | 363,300 | 435,000 |
| Corn Germs | 8026 | 1605 | 175 | 140,455 | 280,875 |
| Corn gluten | 865 | 1730 | 140 | 121,100 | 242,200 |
| Hulls and grits - Export | 994 | 3760 | 53 | 52,682 | 199,704 |
| Hulls and grits - Domestic | 2250 | 2720 | 286 | 64,350 | 77,792 |
| | | | TOTAL | 1,907,081 | 3,486,991 |

Revenues I stage - 1,907,081 \$

Revenues II stage - 3,486,991 \$

17. PROFIT MARGIN

The profit margin is based on a plant capacity of 15,000 t and 30,000 t of processed corn per year (I and II Stage).

I Stage

Revenues - Production Costs = Profit Margin

1,907,081 - 1,658,601 = 248,480 \$

Profit on Sales = 13.03%

II Stage

Revenues - Production Costs = Profit Margin

3,480,991 - 2,920,571 = 560,420 \$

Profit on Sales = 16.20%

18. PROFITABILITY

Profitability is based on a plant capacity of 15,000 t and 30,000 t of processed corn per year (I and II stage)

I Stage

$$\text{Annual return} = \frac{\text{Profit Margin}}{\text{Average investment}}$$

$$\text{Average investment} = \frac{\text{Fixed assets}}{2} + \text{net current assets}$$

$$\text{Fixed assets} = \text{total investment} - \text{net current assets}$$

$$\text{Fixed assets} = 2,999,000 - 500,000 = 2,499,000$$

$$\text{Average investment} = \frac{2,499,000}{2} + 500,000 = 1,749,500$$

$$\text{Annual return} = \frac{248,480}{1,749,500} = 14.20\%$$

$$\text{Pay-off period} = \frac{\text{Investments}}{\text{Profit margin \& depreciations}}$$

$$\text{Pay-off period} = \frac{2,999,000}{248,480 + 306,450} = \frac{2,999,000}{554,930}$$

$$\text{Pay-off period} = 5.4 \text{ years}$$

II Stage

$$\text{Annual return} = \frac{\text{Profit Margin}}{\text{Average investment}}$$

$$\text{Annual return} = \frac{566,320}{1,749,500} = 32.37\%$$

$$\text{Pay-off period} = \frac{\text{Investment}}{\text{Profit \& margin + depreciation}}$$

$$\text{Pay-off period} = \frac{2,999,000}{566,320 + 306,450} = \frac{2,999,000}{872,770}$$

$$\text{Pay-off period} = 3.4 \text{ years}$$

19. LOCATION OF THE FACTORY

The Ministry of Commerce and Industry has not decided the location of the proposed factory. For this decision many things have to be taken into account. There are three main propositions for the future factory:

- Eldoret
- Nairobi
- Mombasa

Even the microlocation for each town is not decided. For that reason it is not possible to make a detailed report and precise recommendation for the location.

Good water supply and sewage facilities are most important for a wet milling factory. It is supposed that Eldoret, Nairobi and Mombasa have good water supply, but sewage water may be a problem if the factory is located in Nairobi - industrial area - with a relatively poor sewage connections. There was not time to visit Eldoret but it is supposed that sewage would not be a problem there. In Mombasa - CHANGAMWE (see letter No. 111 in the file) exists a very good sewage connection with the sea with no limits in sewage water amounts and degree of pollution and this is very important for a wet milling factory.

Eldoret, Nairobi and Mombasa have very good road and railway connections, but Nairobi and Mombasa have better air connections. Mombasa has sea connections which is important for a factory in need for imported facilities and for export to overseas. Taking into account, transportation and communication facilities, the best location would be Mombasa.

The price of land has not in our decision a big influence. It is obvious that the price of land is higher in Nairobi and Mombasa than in Eldoret, but the total price of land is less than 50,000\$ (see 15.1). The difference for the investment for land may be compensated with the freight costs for the machinery from Mombasa to Nairobi or Eldoret. The weight of the total machinery is approx. 500 t and the railway scale is No. 8, that is 18,71¢/t from Mombasa to Eldoret and total would be:

$$18.71\text{¢/t} \times 500\text{t} = 9.355\text{¢}$$

This figure represents approx. the difference in price for land.

The biggest domestic market for corn products is Nairobi and the smallest Eldoret. Taking into account the domestic market location the best would be to locate the factory in Nairobi and the worst in Eldoret. As for export the best location would be Mombasa and the worst again Eldoret.

19.1 Freight Costs

19.1.1 Raw material - Corn

Railway freights for corn in bulk are:

Eldoret - Nairobi 33,0 sh/t = 4.71 \$/t

Eldoret - Mombasa 58.5 sh/t = 8.36 \$/t

The cost of railway freights for different locations will be:

| | | |
|-------------------|-----------|------------|
| Eldoret | _____ | - |
| Nairobi 30,000 t. | 4.71 \$/t | 141.300 \$ |
| Mombasa 30,000 t. | 8.36 \$/t | 250.800 \$ |

19.1.2 Final products

Quantities of final products

| | domestic | export |
|--|----------------|----------------|
| Non modified, modified and pregelatinized starches | 2130 | 8.85 |
| Corn syrup | 5000 | 3550 |
| Corn germs | 1605 | - |
| Corn gluten | 1730 | - |
| Hulls and grits | 2720 | 3766 |
| Total | 13.185t | 15.803t |

According to marketing approximately for domestic market can be stated that:

10% of starches, gluten, germs and grits will be marketed in Eldoret and neighbourhood.

60% of starches, gluten, germs, hulls and brits will be marketed in Nairobi and neighbourhood.

30% of starches, gluten, germs, hulls and brits will be marketed in Mombasa and neighbourhood.

For export would be:

All starches, hulls and brits and approximately 10% of syrup for export will be marketed through Mombasa harbour.

30% of syrup for export will have the best location Nairobi.

60% of syrup for export will have the best location Eldoret (for Uganda).

According to these statements the amounts of final goods for shipment will be:

| | Domestic T | Export T | Total T |
|-------------------------|---------------|-------------|------------|
| From Eldoret to Nairobi | 7911 | 1065 | 8976 |
| From " to Mombasa | 3955 | 12608 | 16563 |
| From Nairobi to Eldoret | 132 | 2130 | 2262 |
| From " to Mombasa | 3955 | 12608 | 16563 |
| From Mombasa to Nairobi | 7911 | 1065 | 8976 |
| From " to Eldoret | 132 | 2130 | 2262 |

Assuming the average freight for final goods will be:

| | |
|-------------------|--------|
| Eldoret - Nairobi | 10\$/t |
| Eldoret - Mombasa | 18\$/t |

- 2 -

Eldoret is a part of Kenya where the corn is grown. However the location of raw material has for a modern corn processing factory a small influence comparing with the location of customers. In Kenya the railway freights are almost 3 times higher for corn products than for raw material - corn in bulk. A modern corn processing factory has a total yield of 98% calculated on dry basis of corn. It is obviously cheaper and easier to handle and transport corn in bulk than the finished goods. Nevertheless taking into account only the location of the raw material the best would be to locate the factory in Eldoret.

Facilities for storage are quite important, for a wet milling factory. Eldoret and Mombasa have storage facilities for corn and storage would not be a problem for Eldoret and even for Mombasa.

Power supply will not influence the location of the factory. According to the statement of Mr. Bell - E.A. Power and Lighting Co. - the price for electricity will be the same for any proposed location and the company would be able to supply the electricity without difficulties to Eldoret, Nairobi or Mombasa.

The steam supply is connected with a boiler house and need for furnace oil. Furnace oil is produced in the oil refinery in Mombasa and according to furnace oil supply the best would be to locate the factory in Mombasa. It is interesting to point out that close to the oil refinery - CHANGAMWE is a huge godown where the corn processing factory could be installed. This godown is very close to oil refinery and the oil refinery is willing to supply with steam the proposed wet mill (see letter No. 111 in the file).

Salaries and wages are lower in Eldoret than in Nairobi or Mombasa but only for non skilled or low skilled labourer. The high skilled worker or employer will have the same salary in Eldoret as in Nairobi or Mombasa. (See Republic of Kenya - Legal Notice No. 141 - The regulation of wages and conditions of employment act (1967)).

As the above statements are given without any figures the calculation is done for the points where it is possible to compare with figures.

Nairobi - Eldoret 10¢/t
 Nairobi - Mombasa 3¢/t
 Mombasa - Nairobi 8¢/t
 Mombasa - Eldoret 18¢/t

The total cost of freights would be:

| Relation | Amount ton | ¢/t | Total |
|-------------------|---------------|-----|---------|
| Eldoret - Nairobi | 8976 | 10 | 89.760 |
| Eldoret - Mombasa | 16563 | 18 | 298.134 |
| | Total Eldoret | | 387.894 |
| Nairobi - Eldoret | 2231 | 10 | 22.320 |
| Nairobi - Mombasa | 16563 | 8 | 132.504 |
| | Total Nairobi | | 154.824 |
| Mombasa - Nairobi | 8976 | 8 | 71.808 |
| Mombasa - Eldoret | 2262 | 18 | 40.716 |
| | Total Mombasa | | 112.524 |

Freight costs for final goods:

Eldoret 387,894 \$

Nairobi 154,824 \$

Mombasa 112,524 \$

19.1.3 Chemicals

All chemicals for the corn processing factory have to be imported except soda ash, chemicals will be shipped from overseas to Mombasa.

The cost of railway freight will be (from Mombasa):

| Chemical | Amount ton | Scale | ¢/t | | Cost of freight | |
|-------------------|------------|-------|---------|---------|-----------------|---------|
| | | | Nairobi | Eldoret | Nairobi | Eldoret |
| Sulphur | 90 | 8 | 13.21 | 18.71 | 1188 | 1684 |
| Hydrochloric acid | 43.2 | 2 | 20.0 | 22.21 | 864 | 959 |
| Bentonite | 43.2 | 3 | 13.21 | 18.71 | 570 | 808 |
| Activated Carbon | 43.2 | 10 | 13.21 | 14.71 | 550 | 636 |
| Hydrated Lime | 180 | 11 | 7.36 | 11.36 | 1414 | 2045 |
| | | | Total | | 4.486 | 6.134 |

Mombasa - Nairobi - 4.486 \$

Mombasa - Eldoret - 6.134 \$

NOTE:

Scales and freight rates are given by Ministry of Power and Communications - Mr. Meskalevich.

19.1.1 Total Freight Costs

| | Mombasa | Nairobi | Eldoret |
|-------------------------|---------|---------|---------|
| Raw material (19.1.1) | 250.000 | 141.300 | - |
| Final Products (19.1.2) | 112.524 | 154.824 | 387.094 |
| Chemicals (19.1.3) | - | 4.336 | 6.134 |
| TOTAL | 362.524 | 300.460 | 393.228 |

19.2 Furnace Oil Price:

Here is taken into account only the difference in prices. Mr. Wanjitu (Shell Company) has given these prices for furnace oil.

| | | | | |
|---------|-------------|------------------------|----------|------------------------|
| Mombasa | Shs. 236.80 | per meter ³ | = 32.685 | per meter ³ |
| Nairobi | Shs. 310.20 | per meter ³ | = 44.315 | per meter ³ |
| Eldoret | Shs. 340.80 | per meter ³ | = 42.975 | per meter ³ |

For the total oil consumption of 0.815 meter³ per hour and 7,200 hours per year the amount will be (only difference):-

| | |
|---------|----------------------------------|
| Mombasa | - |
| Nairobi | 0.815 x 7200 = 5868 |
| | 5868 x (44.31 - 32.68) = 68,245 |
| Eldoret | 5868 x (42.97 - 32.68) = 101,450 |

19.3 Harbour Handling:

For harbour handling costs is taken into account only the final products for export to overseas. According to information given by Mr. G.S.O. Hayne - Dodwell and Co., - the average harbour handling costs for similar goods in bags is \$3 per ton.

According to export sales (see 12.7) the total export is (overseas):-

$$3.405 + 3.760 = 12.253 \text{ tons}$$

Assuming that the factory located in Mombasa will have her own storage, the saving can be \$3 per ton and the calculated amount for harbour handling would be:-

| | |
|---------|---------------------------------|
| Mombasa | - |
| Nairobi | 12.253 x 3\$ per ton = 36,759\$ |
| Eldoret | 12.253 x 3\$ per ton = 36,759\$ |

19.4 Summary - costs:

| | Hambasa | Hair Bi | Eldret |
|--------------------------|---------|---------|---------|
| Freight costs (19.1.4.) | 300,528 | 300,610 | 324,028 |
| Oil price (19.2.) | - | 58,245 | 101,458 |
| Harbour handling (19.3.) | - | 36,759 | 36,759 |
| | 300,528 | 405,614 | 532,245 |

Total costs:

| | | | | | |
|---------|-----|-----|-----|-----|------------|
| Hambasa | ... | ... | ... | ... | \$ 300,528 |
| Hair Bi | ... | ... | ... | ... | \$ 405,614 |
| Eldret | ... | ... | ... | ... | \$ 532,245 |

Note:

Mr. Miskalwicz indicated that the freights costs for corn in bulk will decrease and the total figure in favour to Hambasa will be greater.

Here are not calculated freights for paper bags, jute bags, delias etc. and also for rises from Hair Bi over Hambasa.

19.5 Recommendation:

According to the given statements and figures it is recommended the location of the corn processing factory in Hambasa. This location will have the following benefits:

- a) Big savings in freights
- b) Saving in storage fees (harbour handling)
- c) No investment and care for steam production
- d) No investment for sewage water
- e) No investment for raw material storage - silo
- f) Good telephone and telegraph connections
- g) Very good air and sea connections for spare parts from overseas.

20. CONCLUSION:

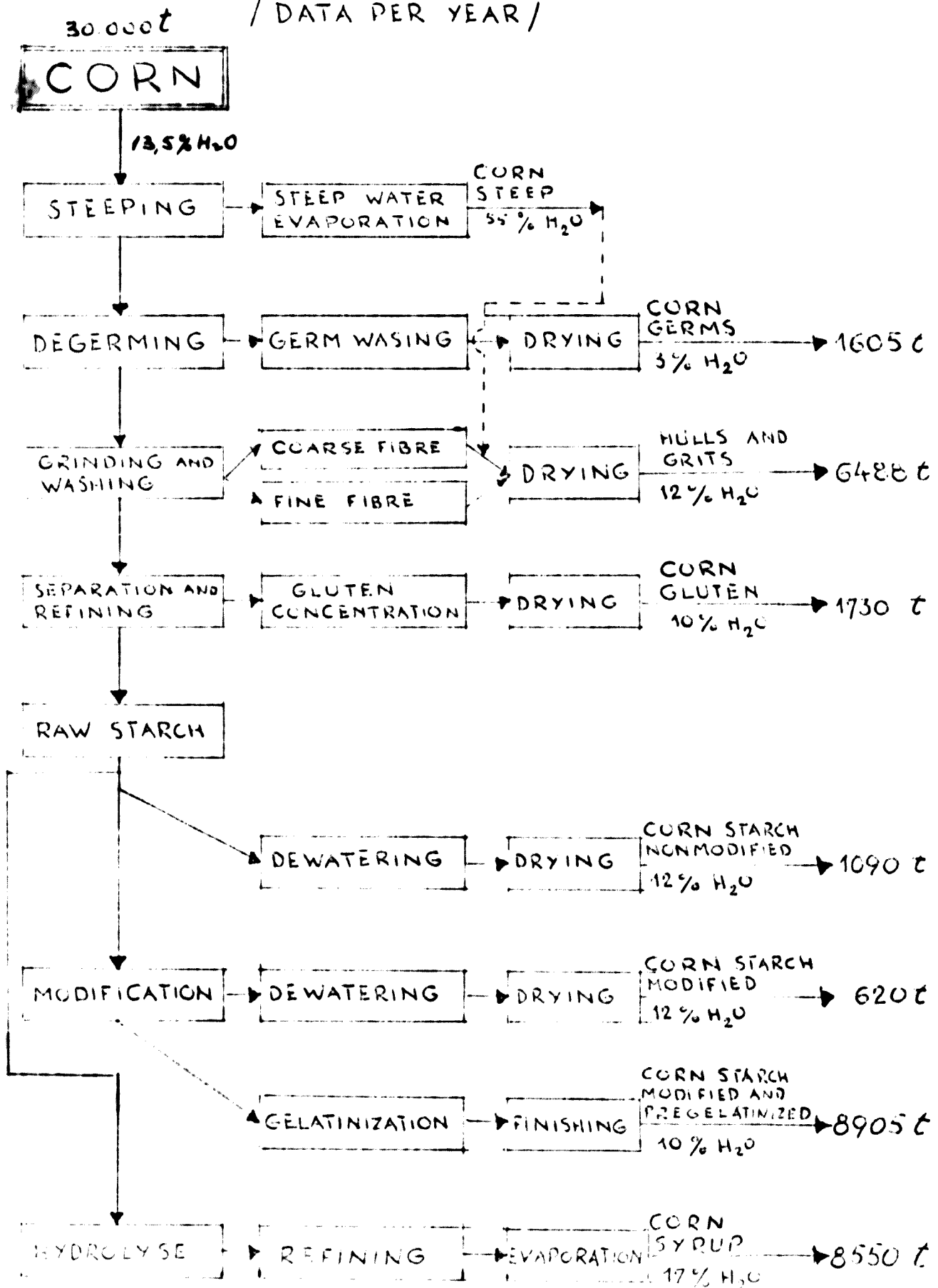
1. Start to grow new high protein corn
2. Reduce gradually straight milling of corn and increase dry milling with germ and bran extraction
3. Start corn oil extraction from dry milling separated corn germ
4. Start in a small scale production of instant porridge and corn flakes
5. Establish a wet corn milling factory which will create these benefits:
 - to cut down the surplus of corn in Kenya
 - export processed agricultural products - corn
 - to change the import structure stopping the import of corn syrup and starch
 - to cut down the considerable loss due to export of corn
 - to decrease the import of oil seeds and oil using corn germ for vegetable oil production
 - to decrease the import of protein rich components for animal feed using hulls and grits and gluten
 - the established corn processing industry will influence the expansion of allied industries: confectionery, textile, paper, oil, fruit juices, canning industry, animal feed (meat industry), paper bags and jute industry etc.

INFORMATION SOURCES

- I. Job Description - background information
- II. Republic of Kenya - Development Plan 1970 - 1974
- III. Mr. Festus Ogada - Senior Maize Research Officer
National Agriculture Research Station - Kitale
- IV. Maize Marketing - Ref. 1962 Cap. 338
- V. Maize and Produce Board - Mr. M.J. Pinto
- VI. Mr. J. Pollak - General Manager - Unga Ltd.
Nairobi
- VII. Mr. Semmes - Coca Cola Company Ltd. - Nairobi
- VIII. Mr. Taylor - Kenya Brewery - Nairobi
- IX. Mr. Arthur T. Cook - General Manager
Sterling Products International
- X. Mr. Watt - Unga Ltd. Nairobi

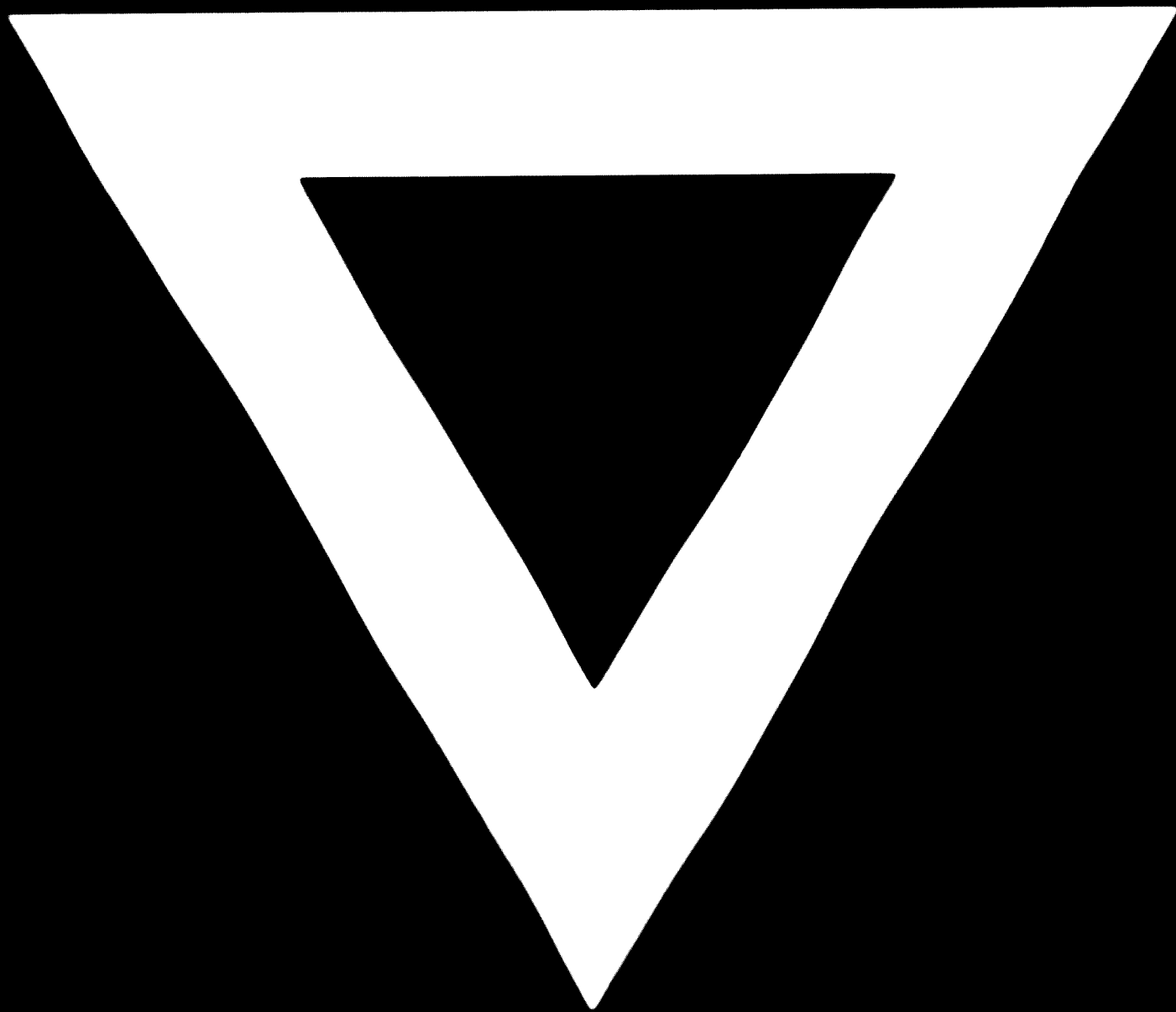
FLOW SHEET

/ DATA PER YEAR /



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