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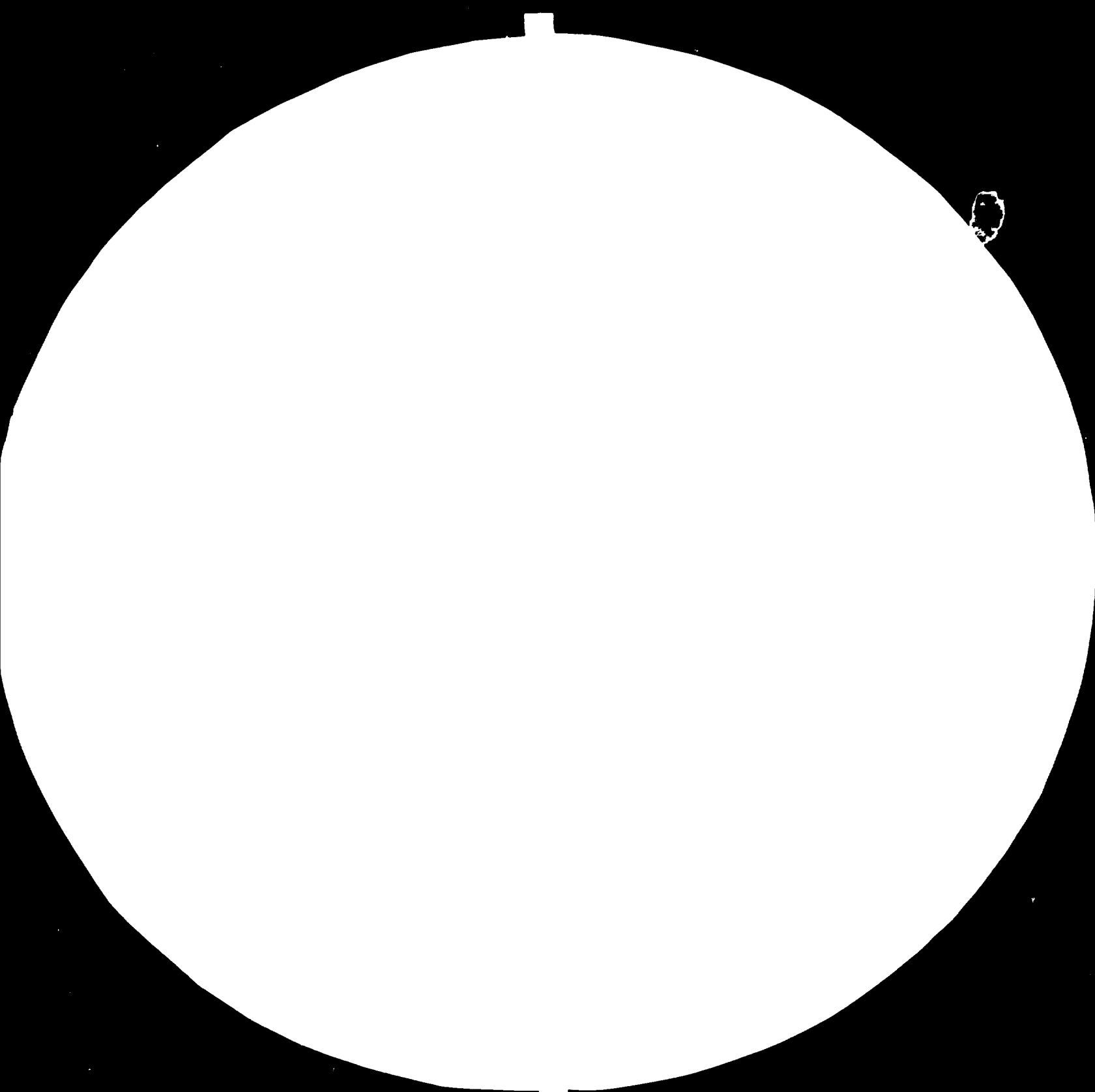
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MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS
1963-A REFERENCE MATERIAL
ANSI Z39.18-1963 TEST CHART NO. 1

13449

UNITED NATIONS
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A STUDY AND EVALUATION OF THE COCONUT INDUSTRY IN KENYA*

US/GLO/80/005

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V.84-83628

ABSTRACT

Title of project: A Study and Evaluation of the Coconut Industry in Kenya

Duty station: Nairobi, Kenya

Duration of study: fifteen days (1 to 15 November 1983)

Purpose of study: To study and evaluate the situation of the coconut industry with regard to all aspects of coconut processing and to make proposals for appropriate coconut industry development action.

Findings: The immediate needs of the coconut industry are to maximize production from existing coconut plantations and processing facilities. The long-term needs are to achieve national self-sufficiency in edible oils and to improve and expand processing facilities.

Recommendations: To meet the short-term needs, it is recommended that suitable copra making facilities be installed and that rehabilitation of coconut farms with low production be undertaken. For the long-term needs, recommendation calls for planting of 100,000 hectares of suitable land to coconuts and the installation of more efficient and larger capacity processing plants. An oil refinery is also recommended to be set-up in Mombasa to be able to increase the prices of copra and supply the refined oil needs of Coast Province and neighbouring provinces.

Currency conversion: US\$ 1 = K Shillings 13.40 (31 November 1983)

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INTRODUCTION

Realizing the importance of the coconut industry from both the view of rural development and the supply of the local markets of a variety of coconut products, and as an export industry as well, special attention is being paid by the authorities of the Kenya Government to the development of the coconut industry.

UNIDO, on the other hand, within the framework of its Coconut Industry Evaluation Services, is in a position to make available relevant documentation and information based on Asian experience.

The Government of Kenya has requested for the services of a coconut processing expert to carry out an assessment of the country's coconut industries sector and then advise on appropriate development. The expert is expected to carry out the following duties in co-operation with the authorities.

1. Review the present situation of Kenya's coconut industry with regard to coconut production and processing operations practiced and products produced.
2. Review the market for coconut products and by drawing conclusions from market investigations, specify those coconut products that would provide the basis for an expansion of the existing coconut processing industry and/or the setting-up of new industries.
3. Make available to the authorities, the UNIDO Coconut Processing Technology Information Documents on various coconut products and processes based on Asian experience and discuss and explain them if required.
4. In connexion with relevant improvement or expansion possibilities of the coconut industry, outline the measures to be taken by the authorities for appropriate development.
5. Prepare a detailed report on the situation in Kenya reflecting the assessments, their evaluation and the development recommendations resulting therefrom.

I. PURPOSE AND METHODOLOGY

A. Purpose of the Project

To study and evaluate the situation of the coconut industry with regard to all aspects of coconut processing involving all coconut products. Based on the result of the study work, elaborate proposals for appropriate coconut development action for consideration by authorities.

B. Methodology to be Used in Study

Considering the very limited time and the wide scope of the study work, the following methodology is deemed appropriate to achieve the objectives of the mission:

1. Review of available studies, statistics and other available literature on the coconut industry.
2. Review of available information on existing processing plants for oil seeds and vegetable oils.
3. Review of statistical data on consumption and importation of fats and oils.
4. Review previous studies on markets for refined oil, crude coconut oil, copra meal and various coconut and related products.
5. Field visits to the coconut farms, copra processing plants and vegetable oil processing plants to confirm, correct and up-date written information previously obtained.
6. Integrate and synthesize information from literature with field information into industry evaluations: and
7. Draw conclusions and propose recommendations from the industry evaluations.

II. STATUS OF THE COCONUT INDUSTRY

A. Coconut Production

Area and Location of Coconut Lands

The total land area under coconuts in Kenya is estimated at about 34,000 to 40,000 hectares. Coconuts are grown mainly in the coastal areas in the Coast Province. Table 1 shows the distribution of coconuts by districts.

Table 1 - Coconut Distribution in Coast Province

<u>Districts</u>	<u>Area Under Coconuts (hectares)</u>
Kilifi	18,818
Kwale	11,616
Mombasa	2,120
Lamu	1,011
Taita-Taveta	27
Tana River	548
Total	34,248

Estimates of Coconut Production

The average yield is estimated at 3,000 nuts per hectare per year. Based on a density of 130 trees per hectare, the productivity is 23 nuts per tree per year. Based on this estimate, production in the Coast Province is 102 million nuts per year. About 300 nuts are required to make 55 kilograms of copra which is equivalent to 5,460 nuts per ton. Using this conversion ratio, the copra production potential based on total nut production is about 18,700 tons per year. Assuming an oil extraction of 60 per cent, the potential oil production is 11,200 tons per year.

Physical Condition of Trees

A quick survey of the coconut farms from Mombasa to Msambweni (Kwale District), a stretch of about 50 kilometers, revealed the following conditions of coconut trees:

1. At least 50 per cent of trees are healthy and heavy-laden with fruits (70 to 100 nuts per tree).
2. There are some plantations where almost all of the trees have about 20 to 40 nuts per tree, possibly due to soil deficiency or lack of proper farm maintenance.
3. About 10 per cent of the trees are too old and approaching senility (10 to 20 nuts per tree).
4. There are wide empty spaces within the plantations (which probably were counted during the area survey).

According to information, the same situation exists in the Kilifi District.

According to information from the Ministry of Agriculture, except for recent plantings, the ages of the trees range from 40 to 70 years. No fertilizer is applied to the coconut trees and the farms are apparently neglected. Inter-cropping with trees and food crops is a common practice.

The main coconut pest is the rhinoceros beetle (Orcytes monoceros) which has caused deaths to a number of trees. Other minor pests include a weevil (Rhynohoporus phoenicus), and a coriet bug (Pseudotherantus wayi).

Tree Variety and Nut Quality

The coconut trees are generally of the "tall" variety, called locally as "niu kaffa". The bearing age, depending on soil condition, ranges from 5 to 7 years. The nuts are of medium size, weighing about 750 grams (without husk). Farm records show that about 300 nuts are required to produce 55 kilograms of copra or 5,460 nuts per ton copra. According to millers, the oil content of the copra delivered range from 60 to 65 per cent when well dried. The average composition of the whole fruit, as reported, is as follows: husks 35 per cent, shell 12 per cent, meat 28 per cent and water 25 per cent. The moisture content in the meat of mature nuts is about 45 to 50 per cent. Based on this composition, the oil content is about 10 per cent of the whole nut.

B. Coconut Utilization

There are no recent statistics on copra production. About 5,500 tons of copra were milled by seven oil mills in 1979, as shown in Table 2.

Table 2 - Copra Milled in 1979 (metric tons)

<u>Millers</u>	<u>Copra milled</u>
Eastern Oil Industries	2,180
Coast Manufacturers	1,644.5
Kisumuwala Oil Mills	834.5
MSA Soap and Oil Factory	517.6
Naushad Trading Co.	223.7
T.M. Abdulhusein	124.5
Lamu Oil Mills	8.1
Total:	5,532.8

Present production can be about 6,000 tons per year. At 5,500 nuts per ton of copra, about 33 million nuts are made into copra per year. Nuts sold in the market, as green as dry nuts is estimated at 5 million nuts. Assuming that 15 million nuts are consumed in the homes, the total number of nuts utilized is about 53 million per year. With an estimated production of 102 million nuts, it appears that some 49 million nuts are not collected per year which is about 1 nut per tree per month. About 9,000 tons of copra can be produced from 49 million nuts.

C. Coconut Processing

Copra Making

About 90 per cent of copra produced is dried by sun-drying. Msambweni Development Co. is the only firm known to have a copra factory which has copra kilns. Some farmers have small copra dryers which they use whenever sun-drying is not possible. Copra sold to the mills contain high moisture contents and contain significant quantities of immature nuts. The poor quality of copra is attributed to the systems of drying copra and harvesting of nuts. Harvesting is by plucking from the top of the trees, a system which allows harvesting of immature nuts.

Oil Milling

There are nine oil mills operating in Coast Province which can process both copra and cottonseeds. Most of the expellers used are small 5-ton units designed for low-oil materials. With copra, at least two pressings are required to reduce the residual oil in cake to less than 10 per cent. Average extraction can be assumed to be 60 per cent, based on well-dried copra (7 per cent moisture). The approximate capacities of the mills, based on copra, are shown in Table 3.

Table 3 - Copra-Milling Capacities of Oil Mills (tons per 24 hours)

<u>Oil Mills</u>	<u>Approximate Capacities</u>
Coast Manufacturers	40
Kisumuwala Oil Industries	40
Eastern Oil Industries	10
Mombasa Soap and Oil Manufacturers	10
Pwani Oil Mills	5
Kilifi Oil Mills	5
A.J. Pereria and Sons	5
Modern Soap Factory	5
T.M. Abulhusein	3
Total:	123

Based on 250 days per year, the milling capacity of the nine mills is about 30,000 tons with a potential production of 18,000 tons of oil. With only 6,000 tons of copra production, capacity utilization for copra is only 33 per cent.

Oil Refining and Soap Making

The larger oil mills have equipment for neutralizing and bleaching, but none for deodourization. The East Africa Industries in Nairobi has complete facilities for process-fats and oils into cooking oils, shortenings, margarines, and soaps, including hydrogenation. The firm purchases most of the coconut oil produced by the oil mills and imports fats and oils to fill the shortage in raw materials. There are several small soap manufacturers in Mombasa which use coconut oil. The annual soap production in Kenya is estimated at 35,000 tons.

Coir Industries

According to reports, there are seven firms engaged in production and/or processing of coconut fibers, with an estimated capacity of about 9,000 tons of mixed fibers per year. The names of the firms are as follows:

Msambweni Development Co.
M/s Dhalla Ismailia
Dinas Import and Export Agencies
J. Lalji Ltd.
Kenya Coir Industries
Mombasa Coir Industries
Harania Coir and Kapok Industries.

According to latest information, production of coir fibers have stopped due to market problems.

Coconut Shells

There is no industrial processing of coconut shells in Kenya. There are some reports of exportation of coconut shell. Shells sold to some factories in Mombasa are used as boiler fuel.

D. Markets for Coconut Products

Coconut Oil

Importation of fats and oils in 1983 is estimated at about 100,000 tons. About 60,000 tons are processed into edible products such as cooking fats, shortening, and margarines. These products are made from hydrogenated palm oil or cottonseed oil, tallow and liquid vegetable oils. Coconut oil content of these products can be about 85 per cent, if fully-hydrogenated cottonseed or palm oil is used. This means that the edible-oils products can absorb about 51,000 tons of coconut oil.

Annual soap production is estimated at 35,000 tons. Depending upon the relative prices of raw materials, the coconut oil content of soaps varies. An average coconut oil content in soap, both laundry and toilet, can be assumed at 60 per cent. The coconut oil consumption potential in soap manufacture is therefore, about 21,000 tons per year.

The total potential market for coconut oil for edible products and soap manufacturing is about 70,000 tons per year. This will require about 120,000 tons of copra.

Copra Meal

Copra meal or cake is the by-product in the extraction of oil from copra. It contains about 20 per cent protein, and is used in animal feed formulations. Copra meal content of various feed range from 5 to 20 per cent depending on the type of feeds and the price of copra cake. An average of 10 per cent may be assumed for this study. Annual consumption of animal feeds is estimated at about 140,000 tons. At ten per cent, the local market for copra meal in the feeds industry is 14,000 tons a year. There is a ready market for copra meal in Europe.

Coconut Shell

Coconut shell have high heating value (6,000-8,000) Btu per lb). In actual use, about 3-4 kg of coconut shell can be substituted for a liter of Bunker-C or diesel fuel. If local factories can be convinced to convert their steam boilers for coconut shell firing, there can be a substantial market for coconut shells. Bunker-C fuel costs about 3,000 shillings per ton while coconut shells may be obtained at 400 shillings per ton.

Coconut Husks

Due to high transport costs, industrial utilization of coconut husks should be geared for local or regional markets. There are two ways by which husks may be used profitably in industry. One as a raw material for the production of rubberized cushions for furnitures and automobile seats, and the other is as fuel for dendo-thermal power generation for the rural areas. Coconut husks have heating value of 5,000 to 6,000 Btu per lb. The fuel equivalent is 4 tons of husks to a ton of Bunker-C fuel.

E. Prices of Coconut Products (4 October 1983)

Copra (delivered to factory)

Grade 1 -	KShs 5.00 per kilo
Grade 2 -	4.00 per kilo
Grade 3 -	3.50 per kilo

There is no standard procedure for classifying copra. The grade and price is negotiated between supplier and buyer.

Coconut Oil (Ex-factory) per kilo

Crude Coconut Oil -	KShs 12.00 (E.A. Industries)
Semi-refined (RB)-	14.70 (net)
Deodourized (RBD) -	17.00 (net)

Copra Meal

Other Oil Products (Retail - Supermarket Prices)

Corn Oil, RBD, Elanto Brand - KShs 340.00 per 18 kg
(Mombasa)

Cooking Fat, Cowboy Brand - KShs 33.90 per 2 kg.
(Nairobi)

Coconut Shells - KShs 350 per ton at source
Msambweni Development Co.

III. LAND FOR COCONUT DEVELOPMENT

Land Requirement

To produce the projected coconut oil requirement of 70,000 tons per year, about 120,000 tons of copra will be required. Assuming a production of 1 ton of copra per hectare, the land requirement for oil production is about 120,000 hectares.

About 20 million nuts will be allocated for home consumption and nut sales. At 5,000 nuts per hectare, the land requirement is 4,000 hectares.

The total land requirement to meet the domestic needs for coconut oil is 124,000 hectares. If we deduct the present area of 40,000 and add 10,000 hectares to make up for senility, the net land requirement shall be about 94,000 hectares for new plantings.

Land Availability

About 370,000 hectares of high-potential land and 790,000 hectares of medium-potential land are available for oil-crops production in Coast Province. Assuming that 20 per cent of these are suitable for coconuts, the land available for coconut development is 226,000 hectares.

IV. CONCLUSIONS

The needs of the coconut industry in Kenya can be divided into short-term needs and long-term needs. Short-term needs are those which can be met within five years, while the long-term needs are those which can possibly be met in a period of about ten to twenty years.

Short-term Needs

1. To maximize coconut oil production from existing coconut plantations and processing facilities by:
 - increasing the number of nuts for copra making:
 - improving copra and oil yields.
2. To increase farm-level incomes in order to stimulate coconut and copra production by:
 - increasing coconut yields:
 - being able to increase copra prices

Long-term Needs

1. To achieve self-sufficiency in vegetable oils from the coconut industry by increasing land area for coconut production: and
2. To improve and expand processing facilities in order to improve the viability of the total industry and meet increasing processing needs as a result of increased coconut production.

V. RECOMMENDATIONS

Recommendations for Short-term Needs

1. Setting-up of suitable copra processing facilities to stimulate collection of nuts and minimize home consumption. Any of the following schemes may be adopted:
 - a) Mechanization of copra production in large coconut estates;
 - b) Setting-up of copra centrals which will buy and collect nuts from small farmers;
 - c) Setting-up of village or co-operative drying stations.
2. Launching of a coconut rehabilitation programme to:
 - a) Rehabilitate neglected coconut farms;
 - b) Fertilize coconut trees in poor soils;
 - c) Replant empty spaces within coconut plantations.
3. Establishment of a coconut oil refining plant in Mombasa to process oil productions from existing oil mills and supply the refined oil needs of Coast Province and neighbouring provinces. Savings from transportation costs and additional income from refining will provide for increase of copra prices.

Recommendations for Long-term Needs

1. Development of 100,000 hectares for coconut production, at the rate of 10,000 hectares per year for a period of ten years:
2. Phasing out of the old oil milling equipment to be replaced with more efficient and higher capacity equipment and setting of additional milling and refining capacities to provide for increasing coconut production.

Creation of a Coconut Development Authority

Considering the importance of and magnitude of investment in the coconut industry development, it is also recommended that a separate body such as a Coconut Development Authority, be created to take charge of the total development of the coconut industry.

Expected Results from Recommendations

1. Setting-up of Copra Dryers - increase of copra production from 6,000 tons to 15,000 tons per year within three years. Improve quality of copra:
2. Rehabilitation of Farms - doubling production of copra to 30,000 tons of copra within five years:
3. Establishment of a refinery in Mombasa - increase in price of copra and reduction of refined oil price in Coast Province.
4. Planting of 100,000 hectares with coconuts - production of copra enough to produce at least 60,000 tons of copra per year within 20 years;
5. Up-grading and expansion of processing plants - reduction in production costs, improving oil recoveries and increase in oil production.

ANNEX I - PRE-FEASIBILITY STUDY OF A MODEL COPRA CENTRAL IN THE COAST PROVINCE

A. Rationale of the Project

Source of Raw Materials (coconuts)

Estimated coconut production in the Coast Province is approximately 102 million nuts per year of which 33 million are made into copra, 20 million are sold or consumed as whole nuts and about 49 million presumably are uncollected. Experience in other countries prove that the collection of nuts can be increased considerably and coconut consumption can be reduced if there are suitable copra making facilities readily accessible to farmers. Assuming that 90 per cent of uncollected nuts or 44 million can further be recovered, a total of 77 million nuts are available for copra production. If rehabilitation and fertilization of coconut farms is started simultaneously with the setting-up of copra dryers an increase of at least 25 per cent or about 25 million nuts is expected after two years. Within three years, the coconut production is expected to increase to about 120 million nuts a year, about 90 million nuts will be available for copra production. About 15,000 tons of copra can be produced from 90 million nuts.

With a rehabilitation and fertilization programme, the coconut production is expected to increase to about 200 million in 5 years about 170 million will be available for copra production. This will produce about 30,000 tons copra.

Market for Copra

The existing oil mills in Mombasa have a total milling capacity of at least 30,000 tons per year. These mills will be able to process all the project copra production within five years.

Capacity of Copra Centrals

In order to minimize cost of transporting whole nuts from the farms to the centrals, the proposed capacity of a modular unit is 20,000 nuts per day. These can process coconut production from about 1000 hectares of coconut plantation. Assuming that there are 40,000 hectares now in coconuts, 40 coconut centrals are required at present. At this point, it should be realized that the weight of a whole nut, without husk, is about 4 times the weight of copra, which is a disadvantage for bigger copra centrals.

Advantages of Centralized Copra Production

The major impact of setting up copra centrals is that they will draw more coconuts into copra production. The centrals will provide an easy opportunity for the farmers to convert nuts into cash. This will have a double effect on coconut availability: 1) it will encourage the farmer to collect more coconuts and 2) it will discourage nut consumption in the homes. It is suspected that about 49 million nuts remain uncollected and about 20 million are consumed, a total of 69 million nuts. If converted to copra, these will mean about 12,000 tons of copra. If centralized copra production can draw out 75 per cent of this potential, copra production can be increased by 9,000 tons. This will be equivalent to an added revenue of KShs 45 million per year at KShs 5,000 per ton of copra, and will further increase as coconut production increases.

Another major advantage of centralized copra processing is the improvement of the quality of copra. With present copra making methods, the free-fatty acid content of coconut oil produced is as high as 6.9 per cent. If this oil is refined, the refining loss will be about ten per cent. Copra produced in copra centrals have free-fatty acid as low as 0.2 per cent or an average of 0.5 per cent. At this ffa value, the refining loss can be reduced to 2 per cent, a savings of 8 per cent. When the level of oil refining reaches 10,000 tons a year, 8 per cent loss will mean a loss of 800 tons or 9.6 million shillings, at 12,000 shillings per ton oil. Other processing costs will be reduced in terms of less chemical usage, lower steam and power consumption and reduced deodourizing time.

The Economic Constraints of Copra Production

Copra production is the weakest link but, nevertheless, the critical link in the chain of coconut processing. The viability of copra production is limited by low coconut oil price at one end and high nut price on the other end. Oil refiners can pass on the tax burden to oil millers, while the millers can pass on the tax burden to copra producers. Copra producers cannot pass on the tax burden to farmers since further reduction in farm income will discourage coconut production, thus depressing the total industry.

The pre-feasibility study will show that copra production is not viable unless it receives some support from the government, by any or a combination of the following schemes:

1. Exemption from income taxes;
2. Price subsidy on copra sales;
3. Levy on imported oils, to be able to increase the price of coconut oil.

The third option may have some social repercussions, thus tax exemption and price subsidy are more expedient. As will be shown in the financial study, it is proposed that the copra centrals should be income-tax exempted, and that a price subsidy of 5 per cent on sales be granted in order to be economically feasible. While this will reduce government revenues, the economic contribution of the project will still be substantial.

B. Financial Feasibility of Project

Basic Assumptions

1. Daily capacity of Central - 20,000 nuts
2. Area to be served - 1,000 hectares
3. Nuts required for 1 MT copra - 5,500
4. Price of nuts - KShs 0.60 (roadside)
5. Price of copra - KShs 5.00 (ex-factory)

Estimate of Project Cost (KShs 000)

Machinery and Equipment	1,100
1 - Copra dryer, forced-draft, coconut shell fuel	
1 - Mechanical nut-cracker	
2 - Nut carts	
1 - Portable bag closer	
1 - Platform Scale - 1,000 kg	
2 - 5-ton trucks, stake-back, diesel	
Miscellaneous tools	
Nut bin	
Copra bins	
Installation cost (10 %)	110
Installed Cost of Equipment	1,210
Buildings, including site preparation	2,000
Nut shed	
Dryer shed and copra storage	
Work shed for pre-drying operations	
Office, including office equipment	
Land (2000 sq.m.)	30
Total Fixed Capital Investment	3,240
Pre-Operating Expenses	100
Working Capital	120
Total Project Cost	3,460

Investment Services

Equity 25 per cent	860
Loan 75 per cent	2,600
Total	3,460

Loan Terms

Interest Rate - Since the total investment is less than 0.5 million shillings, the project qualifies as a small-scale industry. A 12 per cent interest on unpaid balance is assumed.

Repayment Terms - Ten years period with two years grace on amortization. Loan will be paid in 8 equal annual installments starting with year 3.

<u>Financial Plan</u> (KShs 000)	<u>Equity</u>	<u>Loan</u>	<u>Total</u>
<u>Year 1</u>			
Pre-operating expenses	100	-	100
Establishment Cost	740	2,500	3,240
Total	840	2,500	3,340
<u>Year 2</u>			
Working Capital	20	100	120
Totals	860	2,600	3,460

Interest and Amortization Schedule

<u>Year</u>	<u>Draw Down</u>	<u>Amortization</u>	<u>Interest</u>	<u>Principal</u>	<u>Balance</u>
1	2,500	-	-	-	2,500
2	100	-	300	-	2,900
3	-	590	350	240	2,660
4	-	590	320	270	2,390
5	-	590	290	300	2,090
6	-	590	250	340	1,750
7	-	590	210	380	1,370
8	-	590	160	430	940
9	-	590	120	470	470
10	-	590	60	530	-

Taxes

Income tax - exemption proposed (for ten years)

Sales tax - 15 per cent

Subsidy - 5 per cent on gross sales of copra (for ten years).

Daily Capacity and Copra Conversion

Daily capacity - 20,000 nuts per 24 hours operation

Conversion - 5,500 nuts per ton of copra

Annual Production Schedule

<u>Year</u>	<u>No of days Operation</u>	<u>Nuts Processed (000)</u>	<u>Copra Produced (Metric tons)</u>
1	120	2,400	440
2-10	240	4,800	880

<u>Annual Sales</u>	<u>Year 1</u>	<u>Year 2-10</u>
Copra Sales, MT	440	880
Price, KShs per MT	6,000	6,000
Value, KShs 000	2,640	5,280
<u>Raw Materials</u>		
Nuts, 000	2,400	4,800
Price, KShs per 1000	700	700
Value, KShs 000	1,680	3,360
<u>Supplies</u>		
Diesel Fuel, liters	9,000	18,000
Price, KShs per l	6	6
Value, KShs 000	54	108
Misc. Supplies KShs 000	20	40
Total Supplies, KShs 000	74	148
<u>Power</u>		
Electricity, KWH	16,000	32,000
Price, KShs	0.60	0.60
Value, KShs 000	10	20

Schedule of Salaries and Wages

Year 1 (1/2 year)

Indirect Labour

<u>Position</u>	<u>No.</u>	<u>Rate</u>	<u>Months or days</u>	<u>Annual Salary</u>	<u>Total Salaries</u>
Manager	1	4,000	6	24,000	24,000
Bookkeeper	1	2,000	6	12,000	12,000
Clerk	1	1,000	6	6,000	6,000
Driver-Mechanic	1	2,000	6	12,000	12,000
Total:	4				54,000

Direct Labour

Dryer Operators	3	20	120	2,400	7,200
Copra Makers	6	15	120	1,800	10,800
Truck Helpers	3	15	120	1,800	5,400
Utilitymen	3	12	120	1,440	4,320
Total:	15				27,720

Year 2

Indirect Labour

Manager	1	4,000	12	48,000	48,000
Bookkeeper	1	2,000	12	24,000	24,000
Clerk	1	1,000	12	12,000	12,000
Driver-Mechanic	1	2,000	12	24,000	24,000
Total:	4				108,000

Direct Labour

Dryer Operators	3	20	240	4,800	7,200
Copra Makers	6	15	240	3,600	21,600
Truck Helpers	3	15	240	3,600	10,800
Utilitymen	3	12	240	2,880	8,640
Total:	15				55,440

Repair and Maintenance 2 % KShs 000

64

Depreciation 5 % KShs 000

162

Insurance 1 % KShs 000

32

Misc. Fixed Costs KShs 000

24

General Overhead KShs 000

30

Copra Contracts

Projected Income Statement (KShs 000)

	1	2	3	4	5	6	7	8	9	10
Sales Revenues										
Copra Sales	2,640	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280	5,280
Less: Sales Tax (5%)	396	792	792	792	792	792	792	792	792	792
Net Sales	2,244	4,488	4,488	4,488	4,488	4,488	4,488	4,488	4,488	4,488
Variable Costs										
Raw Materials (nuts)	1,680	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360	3,360
Direct Labor	28	56	56	56	56	56	56	56	56	56
Supplies	74	148	148	148	148	148	148	148	148	148
Power	10	20	20	20	20	20	20	20	20	20
Total Variable Cost	1,792	3,484	3,484	3,484	3,484	3,484	3,484	3,484	3,484	3,484
Fixed Costs										
Indirect Labor	54	108	108	108	108	108	108	108	108	108
Deprec. of Pre-Op. Exp.	10	10	10	10	10	10	10	10	10	10
Repair & Maintenance	64	64	64	64	64	64	64	64	64	64
Depreciation	162	162	162	162	162	162	162	162	162	162
Insurance	32	32	32	32	32	32	32	32	32	32
Misc. Fixed Costs	24	24	24	24	24	24	24	24	24	24
General Overhead	30	30	30	30	30	30	30	30	30	30
Total Fixed Costs	376	430	430	430	430	430	430	430	430	430
Total Costs	2,168	3,914	3,914	3,914	3,914	3,914	3,914	3,914	3,914	3,914
Gross Profit	76	574	574	574	574	574	574	574	574	574
Interests	-	300	350	320	200	270	210	150	120	50
Profit Before Tax (Tax Exempt)	76	274	224	254	284	324	364	414	454	514
Subsidy	132	264	264	264	264	264	264	264	264	264
Net Profit	208	538	488	518	548	588	628	678	718	778

ANNEX II - PRE-FEASIBILITY STUDY OF THE PROPOSED COCONUT OIL
REFINING PLANT FOR MOMBASA, COAST PROVINCE

A. Rationale of the Project

Source of Raw Material (Coconut Oil)

Present production is estimated at 6,000 tons of copra or 3,600 tons of coconut oil per year. If the short-term recommendations are implemented, productions are expected to increase to 15,000 tons of copra or 9,000 tons of oil within three years and to 30,000 tons of copra or 18,000 tons of oil within five years. The milling capacity of existing oil mills in Mombasa is about 30,000 tons of copra per year, twice the requirement of the refinery.

About 70 per cent of present coconut oil production is sold to East Africa Industries in Nairobi, about 500 kilometers from Mombasa, the rest are made into laundry soap and sold as crude or semi-refined oil in the local market.

Market for Refined Oil

The population of Coast Province is about 1.5 million while that of Eastern Province is about 3.0 million, or a combined population of about 4.5 million. At a per capita consumption of 3.5 kg per year, the projected consumption in the two provinces is about 16,000 tons of refined oil. There is no oil refinery in Coast Province. Since the two provinces have temperatures higher than 25^o, coconut oil will stay liquid and the marketing of refined coconut oil is convenient.

Capacity of Proposed Refinery

The plant is designed to process 30 metric tons of oil per 24 hours operation or 9,000 tons a year based on 300 days. However, it is scheduled to process 3,600 tons during its first year of operations and 7,200 tons of oil during the second year. Full operations will commence on the third year. At full operations, the plant will be processing 50 per cent of projected coconut oil production from existing coconut plantations.

The refined oil productions will be about 3,500 tons for the first year, 7,000 tons for the second year and 6,700 tons at full operation. The plant's maximum production is equivalent to about 54 per cent of the projected consumption of Coast and Easter provinces.

B. Financial Feasibility of the Project

Estimate of Project Cost (KShs 000)

Machinery and Equipment	3,600
Engineering and Installation, 15 per cent	540
Handling and shipping, 10 per cent	360
Installed Cost of Equipment	4,500
Buildings and factory site	770
Building and Office Equipment	120
Vehicles	240
Total Fixed Capital Investment	5,630
Pre-Operating Expenses	100
Working Capital	1,000
Total Project Cost	6,730

Investment Services

Equity 20 per cent	1,430
Loan 80 per cent	5,300
Total:	6,730

Loan Terms

Interest Rate - 16 per cent per annum on unpaid balance

Repayment terms - 12 years repayment period with 3 years grace period.

Loan to be paid in nine equal annual installments, starting with year 4.

<u>Financial Plan (KShs 000)</u>	<u>Equity</u>	<u>Loan</u>	<u>Total</u>
<u>Year 1</u>			
Pre-Operating Expenses	100	-	100
Establishment Cost	1,130	4,500	5,630
<u>Year 2</u>			
Working Capital	200	800	1,000
Totals:	1,430	5,300	6,730

Interests and Amortization Schedule (KShs 000)

<u>Year</u>	<u>Draw Down</u>	<u>Amortization</u>	<u>Interest</u>	<u>Principal</u>	<u>Balance</u>
1	4,500	-	-	-	4,500
2	300	-	720	-	6,020
3	-	-	960	-	6,980
4	-	1,520	1,120	400	6,580
5	-	1,520	1,050	470	6,110
6	-	1,520	980	540	5,570
7	-	1,520	890	630	4,490
8	-	1,520	790	730	4,210
9	-	1,520	670	850	3,360
10	-	1,520	540	980	2,380
11	-	1,520	380	1,140	1,240
12	-	1,520	200	1,320	-

Taxes

Income Tax - 45 per cent of net profit.

Sales Tax - 15 per cent of sales, net of raw materials already taxed
(crude coconut oil)

Daily Capacity and Recovery

Daily Capacity - 30 metric tons crude coconut oil per 24 hours operation.

recovery - 96 per cent based on crude oil FFA of 2 per cent.

Annual Production Schedule

<u>Year</u>	<u>No. of days</u>	<u>Crude Oil MT</u>	<u>Refined Oil MT</u>
2	120	3,600	3,456
3	240	7,200	6,910
4 up	300	9,000	8,640

Sales Revenues (KShs 000)

	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Refined Oil Sales, MT	3,456	6,912	8,640
Price, KShs per MT	14,300	14,300	14,300
Value, KShs 000	49,421	98,842	123,552
Total Sales, KShs 000	49,421	98,842	123,552

Raw Materials

Crude Coconut Oil, MT	3,600	7,200	9,000
Price, KShs per MT	12,500	12,500	12,500
Value, KShs 000	45,000	90,000	112,000
Total Raw Materials, KShs 000	45,000	90,000	112,000

Supplies

Caustic Soda (95 %), MT	18	36	45
Price, KShs per MT	6,900	6,900	6,900
Value, KShs 000	124	248	311
Fullers Earth, MT	7.2	14.4	18
Price, KShs per MT	8,400	8,400	8,400
Value, KShs 000	61	121	151
Filter Cloth, Meters	384	768	960
Price KShs per M	200	200	200
Value, KShs 000	77	154	92
Salt (Industrial), MT	18	36	45
Price, KShs per MT	2,000	2,000	2,000
Value, KShs 000	36	72	90
Misc. Supplies, KShs 000	120	240	300
Total Supplies, KShs 000	418	835	1,044

Power Water and Fuel

Power, KWH	38,000	176,000	220,000
Price, KShs	0.60	0.60	0.60
Value, KShs 000	53	106	132
Water, Cu.M.	10,000	20,000	25,000
Price, KShs	4.40	4.40	4.40
Value, KShs 000	44	88	110

Fuel (coco shells), MT	300	600	750
Price, KShs 000	400	400	400
Value, KShs 000	120	240	300
Total P, W and F, KShs 000	201	402	502

Salaries and Wages

Year 2 and up

Indirect Labour

<u>Position</u>	<u>No.</u>	<u>Rate</u>	<u>Months or days</u>	<u>Annual Salary</u>	<u>Total Salary</u>
Manager	1	6,000	12	72,000	72,000
Accountant	1	3,000	12	36,000	36,000
Production Engineer	1	3,600	12	36,000	36,000
Chemist	1	3,600	12	36,000	36,000
Clerks	2	1,000	12	12,000	24,000
Total Indirect Labour, KShs 000					204

Year 2

Direct Labour

Foreman	3	50	120	6,000	18,000
Operators	9	30	120	3,600	32,400
Mechanics	2	30	120	3,600	7,200
Driver	1	30	120	3,600	3,600
Utilitymen	3	20	120	2,400	7,200
Total Direct Labour, KShs 000					68.4

Year 3 (2 x 68.4)

Direct Labour, KShs 000 136.8

Year 4 and up (2.5 x 68.4)

Direct Labour, KShs 000 171.0

Repair and Maintenance, 5 % of 5,630, KShs 000 280.0

Depreciation (15 years), KShs 000 375.0

Insurance (1 per cent of 6,630), KShs 000 66.3

General Overhead, KShs 000 120

Amortization of Pre-operating Expenses

(10 per cent of 100,000), KShs 000 10

Miscellaneous Fixed Costs, KShs 000 60

Oil Refinery for Dordam

Project Income Statement (KShs 000)

	1	2	3	4	5	6	7	8	9	10	11	12
Sales Revenue												
Refined Oil Sales		49,421	98,842	123,552	123,552	123,552	123,552	123,552	123,552	123,552	123,552	123,552
Less: Raw Materials		45,000	90,000	112,500	112,500	112,500	112,500	112,500	112,500	112,500	112,500	112,500
Sales Subject to Tax		4,421	8,842	11,052	11,052	11,052	11,052	11,052	11,052	11,052	11,052	11,052
Sales Tax, 15%		663	1,326	1,658	1,658	1,658	1,658	1,658	1,658	1,658	1,658	1,658
Net Sales		48,758	97,516	121,894	121,894	121,894	121,894	121,894	121,894	121,894	121,894	121,894
Variable Costs												
Raw Materials (CNO)		45,000	90,000	112,500	112,500	112,500	112,500	112,500	112,500	112,500	112,500	112,500
Direct Labor		62	127	171	171	171	171	171	171	171	171	171
Supplies		526	1,051	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314
Power		53	106	132	132	132	132	132	132	132	132	132
Water		64	128	160	160	160	160	160	160	160	160	160
Fuel		120	240	300	300	300	300	300	300	300	300	300
Total Variable Costs		45,812	91,622	114,527	114,527	114,527	114,527	114,527	114,527	114,527	114,527	114,527
Fixed Costs												
Direct Labor		204	204	204	204	204	204	204	204	204	204	204
Dept. of Pre-Op. Exp.		10	10	10	10	10	10	10	10	10	10	10
Repair & Maintenance		280	280	280	280	280	280	280	280	280	280	280
Depreciation		375	375	375	375	375	375	375	375	375	375	375
Insurance		66	66	66	66	66	66	66	66	66	66	66
General Overhead		120	120	120	120	120	120	120	120	120	120	120
Misc. Fixed Costs		60	60	60	60	60	60	60	60	60	60	60
Total Fixed Costs		1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115	1,115
Total Costs		46,927	92,737	115,642	115,642	115,642	115,642	115,642	115,642	115,642	115,642	115,642
Operating Profit		1,831	4,773	6,253	6,253	6,253	6,253	6,253	6,253	6,253	6,253	6,253
Interest		720	500	1,120	1,050	900	800	700	500	300	200	200
Profit Before Tax		1,111	3,813	5,133	5,204	5,273	5,363	5,463	5,503	5,713	5,873	6,253
Income Tax		500	1,716	2,310	2,341	2,373	2,413	2,458	2,512	2,571	2,643	2,814
Net Profit		611	2,097	2,823	2,862	2,900	2,950	3,005	3,071	3,142	3,230	3,439

Oil Refinery for Nwabusa

Projected Cash Flow Statement (KShs 000)

	1	2	3	4	5	6	7	8	9	10	11	12
Sources of Income												
Net Income		611	2,097	2,823	2,862	2,900	2,950	3,005	3,071	3,142	3,230	3,439
Add Back:												
Interests		720	960	1,120	1,050	980	890	790	670	540	380	200
Depreciation		375	375	375	375	375	375	375	375	375	375	375
Total Internal Resources		1,706	3,432	4,138	4,287	4,255	4,215	4,170	4,116	4,057	3,985	4,014
Borrowings												
Loan	4,500	800										
Equity	1,230	200										
Total Borrowings	5,730	1,000										
Total Funds	5,730	2,706	3,432	4,138	4,287	4,255	4,215	4,170	4,116	4,057	3,985	4,014
Application of Funds												
Pre-Op. Expenses	100											
Establishment Cost	5,630											
Working Capital		1,000										
Amortization of Loan				1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520
Total Disbursements	5,730	1,000	-	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520	1,520
Cash Inflow/Outflow	-	1,706	3,432	2,618	2,767	2,735	2,695	2,650	2,596	2,537	2,465	2,494
Cash: Beginning	0	0	1,706	5,138	7,756	10,523	13,258	15,953	18,603	21,199	23,736	26,201
Ending	0	1,706	5,138	7,756	10,523	13,258	15,953	18,603	21,199	23,736	26,201	28,695
Debt Service Ratio				2.72	2.82	2.80	2.77	2.74	2.71	2.67	2.62	2.64

UNIDO PERSONNEL WHO ASSISTED IN THE MISSION

1. Mr. G. Bekele, Senior Industrial Development Field Adviser (SIDFA), Nairobi
2. Mr. S. S. Ali, Chief Technical Adviser (CTA)
3. Mr. E. Pedersen, Programme Officer, Nairobi
4. Mr. Thomas Abela, Industrial Economist
5. Ms. I. Unamboowe, Information Specialist

RESOURCE PERSONS

1. Dr. A. M. Muthee, Head, Project Studies Division, Ministry of Industry, Nairobi
2. Dr. Z. Worku, Fruit Specialist, FAO
3. Mr. P. Kimeria, Head, Industrial Crops Department, Ministry of Agriculture Nairobi
4. Mr. K. Bikwetti, Ministry of Industry, Nairobi.
5. Mr. E. K. Mureithi, Provincial Director of Agriculture, Mombasa
6. Mr. M. Mbinga, Provincial Crops Officer, Mombasa
7. Mr. K. Mwingi, Planning Officer, Ministry of Agriculture, Mombasa
8. Mr. H. C. Kibanda, District Trade Development Officer, Mombasa
9. Mr. E. Kingi, Manager, Msambweni Development Co.
10. Mr. K. M. Patel, Manager, Kisumuwalla Oil Industries, Mombasa
11. Mr. D. H. Farthing, Agricultural Adviser, Unga Feeds, Ltd.
12. Mr. V. D. Shah, Partner, Belfast Millers

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1. A Preliminary Report on the Study of Vegetable Oils and Related Industries, July 1983 - Ministry of Industry.
2. The Animal Industry in Kenya. A Preliminary Review, September 1983 - Ministry of Industry.
3. Coconut Utilization in Kenya, 1979 - Gathage M.J., Ministry of Commerce and Industry.
4. Extraction and Utilization of Coconut (Coir) Fibers in the Coast Province of Kenya, November 1976
5. Kenya 82-83 Yearbook - Kul Bhushan
6. Guidelines to Investors, November 1981 - Ministry of Trade.

FACTORIES AND FARMS VISITED

1. Coast Manufacturers, Mombasa - Oil Miller
2. Kisumuwalla Oil Industries, Ltd. - Oil Miller Soap Manufacturer
3. Msambweni Development Co. - Coconut Plantation, Copra Factory, Coir Factory
4. Unga Feeds, Ltd - Feeds Manufacturer
5. Belfast Millers - Feeds Manufacturer
6. Coconut Farms in Kwale District

