

The input - output ratio is as follows.

Coffee beans -----> Instant coffee  
 2.6 MT (Spray Dry Method) 1.0 MT

The initial investment for the plant equipment is estimated to be 1.5 billion Japanese yen (or about K£7.5 million) (Source: AJINOMOTO General Foods Co., Ltd., Japan).

#### Location

In order to minimize transportation cost of raw materials, the candidate locations may be found close to the district boundaries between Kakamega, Busia and Bungoma districts.

#### Projected output

Assuming that the production of 5,000 tons of Robusta coffee will start in 1995, the production plan for the instant coffee is projected as follows:

<u>Year</u>	<u>Production Value (K£ 1,000)</u>
1995	28,850
2000	89,660
2005	200,000

#### **(3) Cotton made final Products**

##### Market

The Region imports the hygiene products and non-woven cloth. There is no data on the amount of these products consumed in the Region.

##### Raw materials

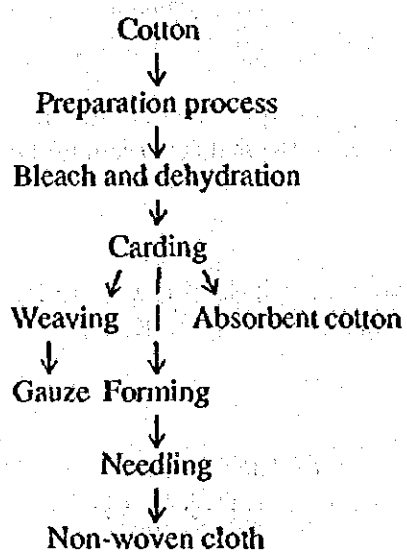
Projected production volume of cotton in the Region up to the year 2005 is as follows.

	(Unit: 1,000 tons)	
	1985	2005
Kisumu	2	7
Siaya	3	8
South Nyanza	7	22
Bungoma	2	4
Busia	1	3
Others	0	1
Total	5	45

Source : (Chapter 1, Sector Report)

### Production process and initial investment

The production process is illustrated as follows.



The input-output ratio is as follows.

Raw Cotton	----->	Absorbent Cotton
1 MT		0.9MT

The initial investment is roughly estimated and summarized below.

Finished Product	Cost of Equipment and Facilities (million Japanese yen)
Absorbent Cotton	30
Gauze	35
Non-Woven Cloth	35

(Source : Iwamoto Seisakusho Co., Ltd., Japan)

#### Location

In order to minimize transportation costs of raw materials, the best locations for the plant will be found in South Nyanza and Siaya districts.

#### Projected output

Assuming that K£1.0 million of production will start in 1990 and that the Region will satisfy all the domestic demand which is supposed to grow at 3.7% per year, the projected production of cotton made final products is as follows:

Year	Production Value(thousand K£)
1990	1,000
1995	4,458
2000	5,346
2005	6,411

#### (4) Fruit and vegetable canning

#### Market

The export price of passion fruit is more than twice as high as those of pineapple juice as shown below:

	Export prices(K£/MT)	
	1983	1984
Passion Fruit Juice	1,939	1,831
Pineapple Juice	586	726

(Source : Annual Trade Report, Custom and Excise Department)

The price of canned pineapple is higher than the fresh pineapple.

### Raw materials

The following are projected production volume of fruits and vegetables in the Region.

	(Unit: 1,000 tons)	
	1985	2005
Kisii	11	80
Kakamega	11	40
Kericho	11	141
Other districts	40	342
Total	73	603

(Source : Chapter 1, Sector Report)

Production process consists of selection of fruits, washing, peeling, squeezing and canning.

The input-output ratio for passion fruit processing is as follows:

Passion fruit -----> Passion fruit juice  
1 MT                                      0.25 MT

The FOB price in 1979 of pineapple fruit canning plant with a capacity of 5,000 cans per day was US\$120,000 or Japanese Yen 19,350,000 (Source : Hokkai Can Co., Ltd., Japan).

### Location

Suitable location will be found in areas having high potential of production of fruits. Kericho district will be the best because of its central position in relation to those areas with high potential for fruit production.

### Projected output

The output is projected as follows:

Year	Output of Juice (Unit: MT)
1990	500
1995	1,000
2000	1,300
2005	1,500

### **(5) Fish fillet and waste process for feed**

The processing of fish fillet is important for fully utilizing the current fish production and to be implemented in the nearest future because it will provide raw materials required for the

proposed animal and fish feed factory. This project is described in more detail in Chapter 3, Report on Preparatory Study.

### Market

The present interregional market for fish fillet is not large due to lack of sufficient and efficient cold storage facilities. About 60% of the fish catch from the Lake is smoked and sun-dried for distribution in the Region. Increased availability of cold storage facilities will expand the market. The present high prices of fillet in Nairobi indicate that the existing and potential market is large in urban centres. At the moment only a small volume of fish feed is used in the Region. However, with the on-going and planned programme of fish cultivation in the Region it is expected that large quantity of fish feeds will be required in future. The future production volume of cultivated fish in the Region will depend on the supply of fish feed.

### Raw material

According to the sector report on fishery about 90,000 tons of fish will be produced by the year 2005 (Chapter 3, Sector Report). Of this, about 30,000 tons may be used for production of 12,000 tons of fish fillet, 3,000 tons of fish meal and 600 tons of fish oil.

The potential production volume of raw materials for the meat and bone meal from animals is projected as follows:

Year	Production Volume (Wet base metric tons)
1985	17,100
1990	18,440
1995	19,870
2000	21,430
2005	23,100

(Source: Chapter 2, Sector Report))

### Production process

The production process for fish fillet is labour intensive involving washing, cutting, weighing and packing.

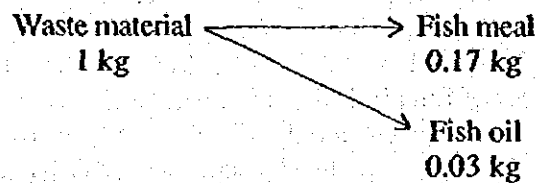
The input-output ratio is as follows:

Fresh fish .....> Fish fillet  
1 kg                                      0.4 kg

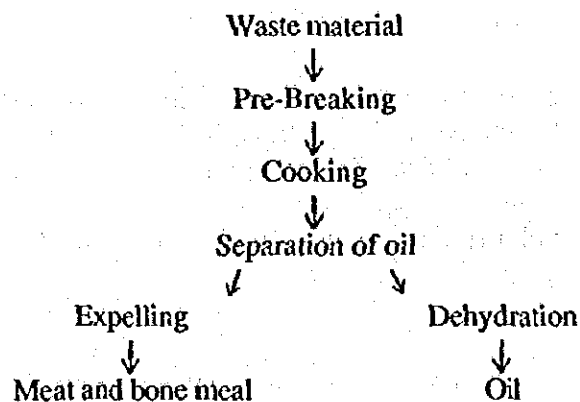
Capital investment for a fish filleting plant (excluding trawlers boats) may be relatively small, including cutting and weighing equipment, storage facilities, and factory building.

The production process for fish meal includes the collection of waste material from fish filleting plant, cooking, compressing, dehydrating, grinding and packing. The fish oil will be removed at the compression stage.

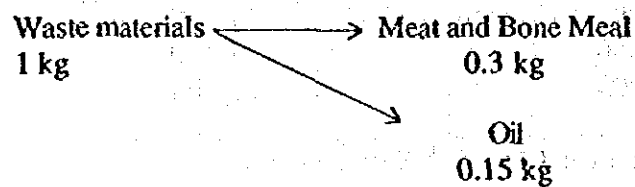
The input - output ratios are as follows:



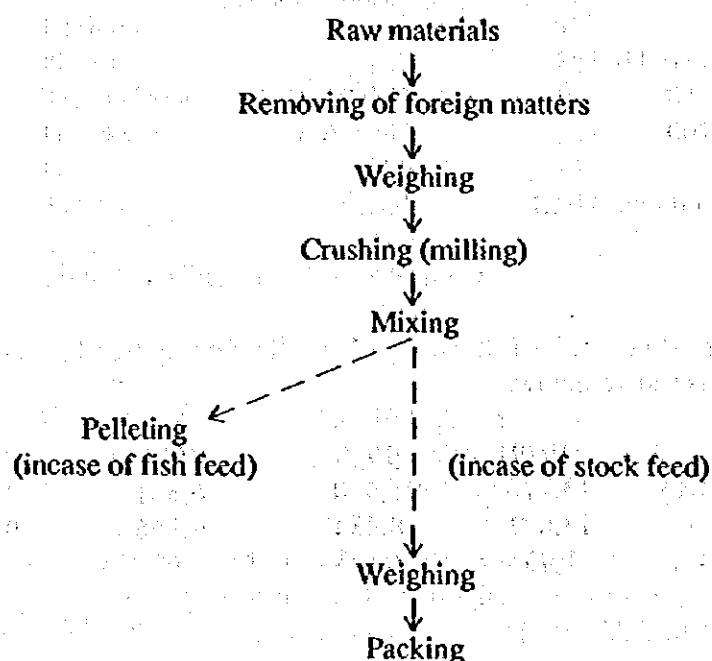
The production process for meat and bone meal is illustrated below.



The input - output ratio is as follows:



The compounding process is to mix outputs from fish meal and meat and bone meal processes to make animal feed as shown below.



The input - output ratio for this process is as follows.

Raw material -----> Fish and animal feed  
1 MT 1MT  
Initial investment

The initial investment for fish filleting and fish meal is roughly estimated as follows, including effluent water treatment facility but excluding a factory building:

Capacity (tons/day )	Investment cost
Raw material base	
50	US\$ 1.6 million
200	US\$ 2.5 million

The cost of the meat and bone meal plant excluding boiler and factory building is estimated as follows.

Capacity (tons/day )	Estimated cost (million US\$)
Volume of raw material	
50	1.25
200	1.60

The cost of compounding plant is estimated as follows:

Capacity (tons/month )	Investment cost (million US\$)
Raw material base	
50	9.0 - 12.5
200	6.3

#### (6) Hides and skin products

##### Market

The export of undressed raw hides from Kenya has a decreasing trend in terms of value, quantities and price, as shown below.

	1979	1980	1983	1984
Value (1,000 K£)	13,770	95,470	6,331	7,122
Quantity(MT)	13,081	8,484	9,156	9,055
Price (K£/MT)	1,053	1,125	691	787

(Source : Statistical Abstract)

Leather is classified into three types: viz. upper leather, sole leather and case leather. Upper leather from skin is used for upper part of shoes and handbags. Sole leather from hide is for sole part of shoes. Case leather which is intermediate slim and hide is used for handbags and knapsacks. The demand for upper leather is higher in developed countries.

The apparent decreasing trend in export of hides and skins is due to the defect at breeding stage, small size of cattle in comparison to those from other countries, and the often damaged surface of the skin.

The export market of Kenya leather subsector will be improved by the following measures:

- The present policy on livestock with emphasis on zero grazing which will improve quality of cattle and lead to production of good quality hides and skins;
- Improved slaughtering methods;
- The proposed pig industry which will increase the production of pig skin highly demanded in Japan, USA and Taiwan; and
- Enhancement of leather and footwear subsector that will produce goods of internationally acceptable standards.

##### Raw materials

Projected livestock population in the Region is as follows.



	(Unit: 1,000 Heads)	
	1985	2005
South Nyanza	538	542
Kakamega	268	268
Kericho	460	533
Nandi	237	264
Trans Nzoia	144	190
Uasin Gishu	302	339
Others	2,355	2,461
Total	4,304	4,607

(Source : Chapter 2, Sector Report)

The average weight of raw leather is assumed as follows:

Cattle	13 - 16 kg/head
Sheep	2 - 3 kg/head
Pig	4 - 5 kg/head

Slaughtering rates are assumed 10% for cattle, 80% for sheep and 150% for pig. The collection ratio is assumed to be 65%. Thus the leather production is estimated at 7,980 tons in 1985, which will increase to 9,360 tons in 2005.

#### Production process and initial investment

The production process is illustrated by the following:

Raw leather → Washing → Soaking (lime water) → Dehairing → Soaking (tannic acid, chrome acid) → Washing → Preventive treatment → Drying in shed → Rolling press → Drying in shed

The initial investment for civil works is estimated as follows.

Capacity	Investment cost
300 - 400 hides and skins/day	US\$ 400 - 500 thousand
(Quotation by Japan Tanners Association)	

#### Location

The following conditions should be taken into account in selecting the location:

- Availability and easy acquisition of raw materials; and
- Availability of plenty of water and complete effluent water treatment facilities.

Candidate locations are:

- Kericho
- Kisii/South Nyanza (one place)
- Nandi/Uasin Gishu (one place)

- Busia/Siaya/Kakamega (one place)

### Projected output

The output is projected as follows:

<u>Year</u>	<u>Output (1,000 K£)</u>
1990	20,760
1995	21,610
2000	22,490
2005	23,400

### **(7) Pulp and paper**

#### Market

Kenya import of paper and paper board is estimated at K£12 - 13 million per year and exports are valued at K£4 - 5 million. The domestic market of paper products is expanding and therefore the expansion of the pulp and paper subsector will play an important role in import substitution.

The raw materials for this subsector will be mainly of non-wood type due to the Government protection policy of forest resources.

#### Raw materials

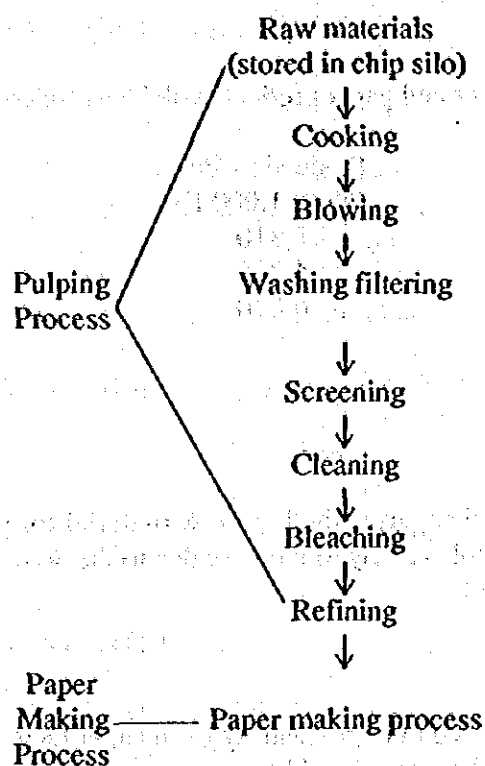
Raw materials is classified according to characteristics and application.

<u>Classification</u>	<u>Advantages and disadvantages</u>	<u>Application</u>
Wood system	-high quality and value -delicate pulping process -large investment	high quality paper
Non-wood system	-small investment -low quality fibre -shorter preservation period	middle and low quality paper

Raw materials for non-wood system available in the Region are bamboo, wheat straw, basasse and papyrus.

#### Production process and initial investment

The production process is illustrated below.



The initial investment is roughly estimated as follows.

(Unit : billion Japanese Yen)

Raw Material	Cost of Pulping Process Plant	Total Cost of Plant
Wood system	5.0	5.0 - 6.0
Non-wood system	<1.0	about 1.0
	Small scale 0.2 - 1.0	

(Excluding bleaching process)

(Source: Japanese Technical Association of Pulp and Paper Industry)

### Location

Conditions to be considered in selecting the location are availability and easy acquisition of raw materials, and availability of plenty of industrial water. Candidate locations are Webuye (expansion of the existing paper plant), and anywhere along Nzoia River in Kakamega district.

### Projected output

In the year 2005, the value of paper and paper products will be as follows:

Year	Production Value (Unit: 1,000 K£)
1995	2,810
2000	4,390
2005	6,870

### **(8) Power alcohol**

#### Market

Molasses, a by-product of refined sugar, is the base raw material for power alcohol. The domestic demand for power alcohol is likely to increase due to the demand for an alternative substitute of the imported crude oil.

#### Raw materials

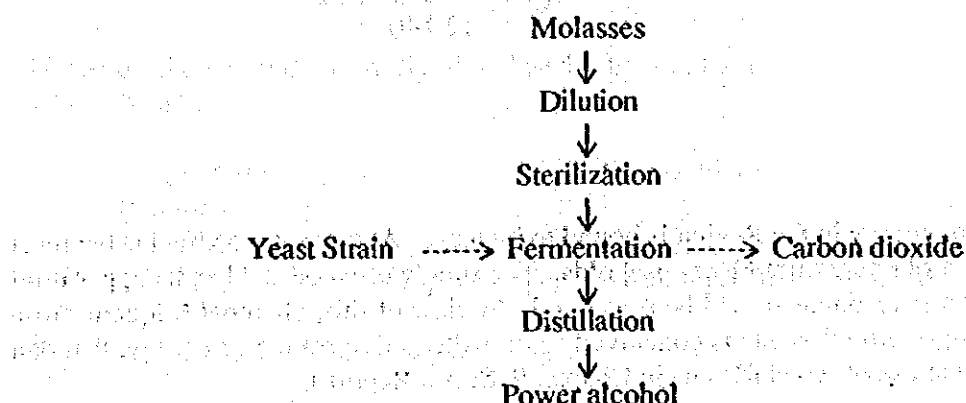
Molasses is currently being produced in large quantity from sugar factories located in South Nyanza, Kisumu and Kakamega districts. In addition, numerous jaggery factories scattered within the Region producing jaggery sugar which can also be used in the manufacture of power alcohol.

The projected production of molasses in the Region is as follows:

Year	Production (MT)
1985	61,040
1990	77,890
1995	99,380
2000	126,810
2005	161,800

### Production process and initial investment

The production process is illustrated below.



The input-output ratio is as follows.

Molasses -----> Power alcohol  
4,000 kg                      1 kl

The cost of the plant excluding factory building and effluent water treatment facilities is estimated as follows.

Capacity (Kilo-litre/day)	Cost of Plant (billion Japanese Yen)
20	2.0
40	3.0
100	5.0

(Source: Kyowa Hakko Co., Ltd)

The minimum plant capacity is 20 kl/day

### Location

The location must be selected close to an effluent water treatment facilities and ample water source and within reach of the raw materials. The best location will therefore be within the sugarcane zone of Kakamega district.

### Projected output

The projected production of power alcohol up to the year 2005 is as follows:

Year	Production (1,000 K£)
1995	7,450
2000	9,510
2005	12,140

#### (9) Sawdust briquetting

##### Market

The demand for energy in the Region is bound to increase. At present woodfuel is the most common source of energy used by households. The supply of woodfuel has its upper limit because the forest resource should be preserved. In view of this, charcoal briquette from saw dust and agricultural waste is conceived as one alternative source of energy, that can partly replace the use of wood (details in Chapter 9, Sector Report ).

##### Raw materials

About 100,000 tons of saw dust and other forest wastes are available in the Region as raw materials in the production of briquette. These raw materials consist of the following:

Sawdust	12,300 tons
Log waste	49,200 tons
Forest waste	38,500 tons
<b>Total</b>	<b>100,000 tons</b>

In addition to forest wastes, rice husks from rice milling plants and coffee husks can also be utilized in the production of briquette.

##### Production process and initial investment

The production process is illustrated below.

Sawdust (wet)



Screening



Drying



Grinding



Briquetting



Carbonizing



Packing

The input-output ratio is as follows:

Sawdust -----> Briquetted sawdust  
1 MT (after drying)      0.9 MT

Based on the study done by Nyeri Industrial Estate, the estimated cost of the plant is as shown below:

Capacity (Briquette base)	Cost of Plant
225 MT/month	Japanese Yen 30 million (US\$190 thousand)

This cost does not include factory buildings.

#### Location

The following locations are recommended on the basis of easy acquisition of raw materials:

- Kakamega and Nandi districts which have Kakamega and Nandi forests.
- Uasin Gishu district to utilize waste dust from the existing saw mills.

#### Projected output

The output value is projected to be K£ 51 thousand through the year 2005.

#### (10) Cement

##### Market

The domestic demand for cement is estimated at between 350,000 - 500,000 tons per year, based on production volume and export as shown below.

	(Unit: 1000 tons)	
	1982	1983
Production volume	1,082	1,238
Export	737	736
Domestic consumption	345	502

Applying the ratio of GRDP of the Region to GDP of Kenya, the size of the cement market in the Region is estimated to be in the range of 87,000 - 120,000 MT per year.

The demand is expected to increase at 3 to 4% per year which is lower than the regional economic growth.

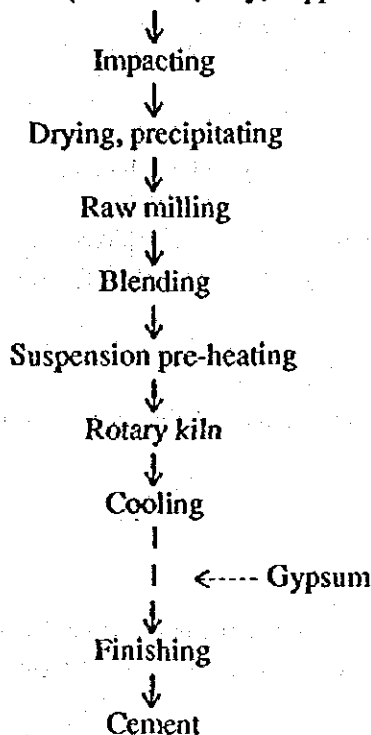
### Raw materials

The main raw material for cement manufacturing is lime. Other materials used for adjusting the property of finished products are calcareous, siliceous, argillaceous and ferriferous elements. The reserves of limestone in the Region are estimated to be approximately 65 million tons. This reserve is sufficient for a factory of a production capacity of 150,000 MT per year (Chapter 5, Sector Report).

### Production process and initial investment

The production process is illustrated below.

Raw materials (limestone, clay, copper slog)



The initial investment is roughly estimated as follows:

Capacity (tons of cement)	Cost of plant (Million US\$)
100,000	20
150,000	30

(Source: Mitsubishi Mining and Cement Co., Ltd.)

### Location

The location must have high quality raw material. The only location with this qualification is Koru in Kisumu district.



### Projected output

The plant of 150,000 tons per year capacity was proposed in a feasibility study which was carried out a few years ago. Assuming that the Koru plant will adopt a price of K£ 45 per ton and based on the demand for cement in the Region, the projected output to the year 2005 is as follows:

<u>Year</u>	<u>Volume (tons)</u>	<u>Value 1000 K£</u>
1995	128,800	5,800
2000	156,700	7,050
2005	190,600	8,580

The implementation should be in 1995 because the present idol capacity in existing factories have to be utilized first. The project will benefit the Region as follows:

- The Region will have a steady supply of cement;
- The Region will save costs involved in transporting cement to Kisumu, estimated at K£ 870 thousand per year;
- The Region will utilize the mineral resources endowed; and
- The plant will contribute to the increase in the income of the Region.

### (11) Ceramic products

#### Market

The ceramic products are divided into four categories viz: earthen ware, pottery, stone ware and porcelain.

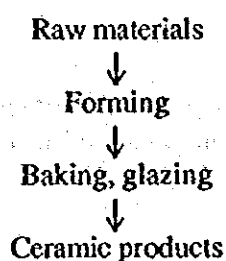
The demand for bricks and roofing tiles for houses and tableware of soft and hard pottery is forecasted to increase in the Region due to increase in income in general and due to demand of water supply and sewerage facilities in urban centres for pottery pipes.

#### Raw materials

The raw materials for ceramics products are clay earth, quartz, and feldspar. A small quantity of various minerals are also required. The Region is endowed with good clay for bricks and tiles for hard pottery, stone ware and porcelain (Chapter 5, Sector Report).

#### Production process and initial investment

The production process is as follows.



Initial investment is dependent on the types of products and volume desired.

#### Location

Availability of raw materials is the dominant factor for selecting locations. The factories for earthen ware can be scattered in the Region, as good clay materials abound, but the good locations for hard pottery and stoneware products are Kisii and Homa Bay.

#### Projected output

The proposed output growth is as follows.

Year	Output of earthen ware and soft pottery products (1000 K£ )	Output of hard pottery and stone ware products (1000 K£ )	Total output (1000 K£ )
1990	600	-	600
1995	800	1,000	1,800
2000	1,050	1,610	2,660
2005	1,400	2,590	3,990

#### **(12) Machinery and metal**

The machinery and metal subsectors (which includes the work subsector of the informal sector) have been selected as strategic subsectors for the industrial development in the Region. Main advantages of these sectors are:

- fosterage of Region's own skills and production techniques;
- big inducement power of backward and forward subsector industries; and
- contribution to the diversification of skills and production techniques.

#### Existing and potential market

The existing and potential demand for machinery and metal subsector works include agricultural implements, metal fixtures, machine tools, agricultural machines, machinery and equipment for manufacturing industry, and repair of all the above.

### Present situation and constraints

The informal manufacturing sector supplies mainly agricultural implements, metal fixtures and kitchen ware. However, the imported goods are preferred because of their uniformity in shape and quality compared to the locally manufactured products. The disadvantages of the locally manufactured products stems from the lack of uniformity of the raw materials, and poor processing of the raw materials due to lack of skills and machine tools.

### Development process

Three stages of development of the subsectors are envisaged. The first stage is characterized by spin-out, stabilization of the business and development. The market here for the informal sector will consist of repair market of agricultural tools, machines and vehicles, and provision of spare parts. The sector will endeavor to diversify their finished goods. The stage is expected to start in 1990. The second stage is characterized by severe competition and stabilization. The enterprises from the informal sector will compete with the spinned out enterprises from the formal sector and those located in the metropolitan area for the expansion of repairing market and provision of more complicated spare parts. This stage will start in the latter half of 1990's. The third stage is characterized by growth of enterprises concerned, spin-out of engineering enterprises, and the exploration and exploitation of new frontier markets. The engineering enterprises are expected to contribute to the industrial development in the neighbouring countries. This stage will start around 2010.

### Location

The suitable location for this sector will be found in Kisumu and Eldoret towns for the following reasons:

- The enterprises will be able to respond quickly to the demand of customers scattered all over the Region;
- They can benefit from the industrial agglomeration and public service; and
- It is easy to raise bulky and heavy raw materials using the convenient transportation means.

### Projection of output

The production of machinery and metal work subsector in the Region is estimated as below.

(Unit: 1000 K£)			
Year	Machinery	Metal works	Total
1985	1,350	-	-
1990	1,980	2,970	4,950
1995	5,150	7,730	12,880
2000	12,280	18,420	30,700
2005	29,300	43,950	73,250

For this subsector to develop in the direction planned, the public must get involved through the provision of information on market and technology, extension service on management and production skills, assistance to the informal sector enterprises, and provision of soft loans.

### (13) Fertilizer

The fertilizer manufacturing subsector is not recommended to be introduced in the Region at present for the following reasons:

- There is no plant in the Region producing ammonia gas which is a key ingredient of nitrogenous fertilizer; and
- Tanzania and Uganda have installed capacities sufficient to supply the Region with fertilizer.

## 4.5.3 Output, value-added and employment

### (1) Output

The total output of manufacturing industry is projected to increase to K£ 1,867 million in the year 2005 at 1985 constant price from K£ 417.7 million in 1985. The annual average growth will be 7.8%. The output of the subsector planned to be introduced by 1990 is projected to increase to K£ 455.2 million in year 2005 at annual growth rate of 14.9% (Table 4.12).

The main existing subsectors in 2005 will be miscellaneous foods, sugar and confectionery, canned vegetables, fish oil and fat and grain mill products. The total share of the four leading subsectors will increase from 59.7% 1985 to 66.2% in 2005. The total output of machinery and metal works subsector is projected to increase to K£ 73.3 million at 1985 constant price. Despite its small share, the manufacturing industry in the Region will have a leading impact on the overall development of the Region.

### (2) Value-added

The total value-added of the manufacturing industry in the Region is projected to increase to K£ 323.9 million in 2005, at an average growth rate of 7.6%. The value of the subsector to be introduced is projected to increase to K£ 118.9 million at a growth rate of 8.7% per

annum. The value-added of the informal manufacturing subsector is projected to increase to K£ 17.3 million or 4.6% of the total value-added by manufacturing industry in 2005 (Tables 4.13).

### (3) Employment

The total employment of the manufacturing industry in the Region is projected to increase to 95,140 workers in 2005 from 29,740 workers in 1985, at average annual growth rate of 6.0%. An annual increase of 1% in the labour productivity in all the manufacturing subsectors is assumed, resulting in the lower average growth rate than that of the output. The effect on employment of the informal manufacturing subsector is relatively large, and becomes larger as the sector develops. The share of the subsector in the total employment is expected to increase from 15.7% in 1985 to 19.1% in 2005. Along with the fact that the informal manufacturing subsector supplies basic commodities to the low income group in the Region, a great emphasis should be placed on the development of this subsector (Table 4.15 and 4.16).

#### 4.5.4 Environmental consideration

The development of manufacturing industries as envisaged by this Master Plan will have to be attained without causing adverse impact on natural environment. Environmental management is in fact an essential condition for sustained growth of the economy rather than something to be opposed to the development. Proper environmental management will increase productivity by reducing soil erosion, minimizing water pollution and protecting other factors of production from degradation.

To substantiate such an environmental consideration as presented above, the following points are reflected in formulating the industrial development plan:

- 1) Development of the manufacturing industries which utilize the waste materials;
- 2) Installation of waste water treatment facilities associated with the newly introduced or much enhanced industries; and
- 3) Industrial location that would allow the utilization of existing facilities for minimizing waste discharge or the avoidance of heavy concentration of potential polluters.

The animal feed and sawdust briquetting industries are in line with the first consideration of utilizing waste materials. The utilization of organic wastes to be generated from the fish filleting and pig industry projects formulated by the Master Plan will contribute to increasing productivity in two ways. First the products will be utilized to increase fish and livestock production, and second it will minimize the discharge of organic wastes into the water environment. Centralized slaughterhouses are also recommended to allow easier control of organic discharges (details in Chapters 2 and 3, Report on Preparatory Study). The sawdust briquetting industry will not only reduce the source of organic wastes but contribute to the protection of water catchment by reducing the demand for woodfuel. For

hides and skins, pulp and paper, food processing, and metal and machinery industries, the installation of effluent water treatment facilities is strongly suggested.

Of all the potentially adverse environmental effects, water environment, especially of Winam Gulf may be most seriously affected by the industrial development for the following reasons. First, several factories are already discharging wastewater without sufficient treatment. Second, the Gulf is almost a closed water body due to the constriction at the mouth (the Rusinga channel), and the water quality in the Gulf is found to be already much more polluted than that in the main water body of the Lake. Third, some water-intensive industries are planned to be established or much enhanced, such as the expansion of paper mill at Webuye, and establishment of cotton products and fruits and vegetables processing and canning industries. Also increased sugar production and establishment of power alcohol and fish filleting industries present potential sources of water pollution.

In addition to the direct measures incorporated in the development projects as mentioned above, the following measures should be taken in order.

- 1) Intensification of monitoring of Lake water quality;
- 2) Establishment of a monitoring system for industrial effluents and ambient water quality; and
- 3) Introduction of discharge standards for industrial and municipal effluents, followed by regulations related to industrial location and urban land use.

## **4.6 Involvement of Public Organizations**

### **4.6.1 Need for public involvement**

#### **(1) Present situation in the Region**

The Region is far behind the national average in industrial development, facing various constraints, major ones being the lack of capital, technology, market information and entrepreneurship (Sections 4.1 and 4.2). The industrial structure dominated by agro-based industries poses another fundamental problem. Due to the low average income as well as other constraints, the market for manufactured goods is generally small.

The most crucial and fundamental constraint to the industrial development in the Region is the lack of entrepreneurship. Particularly the African entrepreneurship is weak in the Region due to a few characteristic factors of the Region as well as the less developed economy. These factors include risk-averse attitude of local residents owing partly to generally benevolent natural environment, and the social system working against mustering efforts and resources to overcome constraints (subsection 4.2.3).

#### **(2) Future directions of industrial development**

Given the present situation summarized above, very deliberate efforts will be required to develop the manufacturing sector in the Region. In particular, the existence of indigenous entrepreneurs is indispensable, if the Region should be self-reliant in industrial development with its own skills and technology for manufacturing a range of products demanded by local people (Section 4.3).

The national industrial policy, as stipulated by the Sessional Paper No.1 of 1986, is in the direction of adopting market-based incentive system and decentralizing industrial locations. Availability of funds from central Government organizations will become more limited, while increased efforts by local people and organizations are expected (subsection 4.1.4).

Therefore, the Region has to make its own efforts to foster the manufacturing industry by developing its own skills and technology, in principle with indigenous entrepreneurs and mostly with its own financial sources.

#### **(3) Need for public intervention**

The indigenous entrepreneurship in the Region is weak and not likely to develop on its own. Therefore, the public intervention would be necessary in order to encourage potential entrepreneurs by providing basic services. A few existing entrepreneurs are not highly motivated, well informed or with large capital, human and other resources. The public sector in the Region has more resources with respect to available capital and some educated and more disciplined personnel.

#### (4) Reservation

Industrial establishments are usually owned and operated by the private sector. Free and flexible management is suited to industrial production. Many public corporations in Kenya as well as in other countries are found inefficient, costly and too bureaucratic to respond to changing demands of the society. The lack of profit motive is often fatal for such organizations. Therefore, care has to be taken in devising appropriate forms of public involvement in the industrial development.

#### 4.6.2 Forms of public involvement

##### (1) Alternative schemes of public-private partnership

Various schemes are conceivable for public-private partnership. Except the extreme cases of total public ownership and operation and total private ownership and operation, possible schemes are presented below.

##### Public ownership-private operation scheme

All the production facilities will be owned by the public sector and leased to a private corporation. The private corporation will operate and manage the production activities within the constraints set by the leaser.

##### Hire-purchase scheme

In the beginning, this is identical to the scheme above, but the private operator is scheduled to purchase the shares of the public sector out of its profits. If this process goes on as scheduled, the entire ownership will be shifted to the operating private corporation.

##### Limited hire-purchase scheme

This is identical to the hire-purchase scheme, except that some part of the production facilities will remain in the public ownership. The part which will remain is usually the shell for direct productive facilities such as land and buildings.

##### Sunset mixed ownership scheme

Both the public and private sectors will provide capital and establish a corporation. Gradually shares held by the public sector will be purchased by the private sector and the public ownership will vanish in due course.

##### (2) Evaluation of alternatives

The following are important criteria to evaluate the alternative schemes of public-private partnership and especially their suitability to the Region:

- 1) Chance of inauguration,



- 2) Incentive to be efficient,
- 3) Chance of continued operation,
- 4) Ease of correcting mistakes, and
- 5) Development of indigenous entrepreneurship.

Evaluation results of the alternatives presented above and the two extreme cases of total public or private ownership and operation are summarized in Table 4.17.

As shown in Table 4.17, the chance of inauguration is naturally the best for the total public ownership and operation and the poorest for the other extreme. For other criteria evaluating operating characteristics, these extremes are inferior as a whole to the other four alternatives. Moreover, the alternative of public dominance will not serve the purpose of developing indigenous entrepreneurship as vitally required for industrial development in the Region. The other extreme of private dominance is clearly impractical, given the present situation outlined above.

Of the four mixed alternatives, the sunset mixed ownership scheme may suffer from the scarcity of private capital especially in the Region. The proportion of private shares will have to remain small so that the management of the corporation will be controlled by those provided by the public sector, and hence possible inefficient operation.

Which scheme is the best for the Region depends on the types of projects to be undertaken by the public-private partnership. For relatively profitable projects, the hire-purchase scheme would be most suitable. For those project requiring large costs for land and buildings (and other infrastructure), the limited hire-purchase scheme would be more appropriate. For marginal projects, the public ownership/private operation scheme would suit better.

#### 4.6.3 Measures for industrial development by the public/private

##### (1) Selection of indigenous entrepreneurs

For the above described partnership schemes to be successful, able and willing indigenous entrepreneur candidates will have to be recruited by the public sector. The first step is to produce a list of potential indigenous entrepreneurs. This will require cooperation of local councils. The information needed for each candidate is, in addition to routine information such as name, address, age and sex, education and business experience, willingness to participate in forthcoming public sector initiated projects and the amount of financial resources which can be devoted to a proposed venture.

Second, for each specific industrial establishment when its feasibility study is completed, an announcement will be made to all relevant candidates informing the invitation for applications. The information will contain the particular role of the corporation which would be represented by the successful candidate, the proposed contract terms and the results of the feasibility study. Subsequent steps will depend on the interview of applicants by the public agency and negotiation between them.

## **(2) Training of entrepreneurial candidates**

If the responsible public agency finds that the pool of candidates is short of the requirements, it should start training of candidates at its cost. The training course would consist of two parts. The first part would be a general industrial project management course such as the one offered by the Economic Development Institute of the World Bank, and the second part is a tour of similar establishments within and outside the country. In inspecting establishments in advanced countries, the instructor should remind the trainees that less capital intensive technologies would be more appropriate in Kenya.

## **(3) Organizational measures**

Relevant public agencies to be involved in the public-private partnership will be different depending on the types of specific projects, but existing public organizations with some modifications should play vital roles. In particular, the roles of LBDA and KIE will be most important and should be well coordinated.

In order to facilitate the implementation of the public-private schemes, the industrial division of LBDA may be consolidated by delegation of some functions of KIE with merger. In this way, objectives of the industrial development in the Region can be pursued consistently and in line with the overall development strategy of the Region based on the resource endowments. Also the ability and know-how of personnel from both organizations can be mustered in inaugurating new corporations.

## **(4) Other related measures**

In addition to such direct involvement of the public sector in industrial development in the Region, various facilitative measures can be taken by different public organizations for finance, technical education and training, extension service and others. For finance and technical education/training, existing institutions would generally be adequate as vehicles for transmitting services, but their operations should be improved and made more effective and efficient. Extension of soft loans to small scale manufacturing enterprises and informal sector enterprises would be most essential. ICDC small loans programme should be directed more to small scale manufacturing enterprises. Youth polytechnics and secondary technical schools would be particularly useful in promoting application-oriented technology as advocated by this Master Plan.

Market information service should be initiated possibly by the industrial division of LBDA, covering the following:

- demand/supply of agricultural products that can be processed in the Region;
- foreign and domestic markets for manufactured products; and
- technology available.

Also consultation may be provided at the same division, concerning new business opportunities, production techniques and management technology, and required procedures such as import/export licensing. Organization of seminars, as being done at KIE's, is another effective way of disseminating extension information.

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**Table 4.1 Manufacturing Establishments by Subsector in 1985  
in LBDA Region and Kenya**

Subsector	LBDA region <sup>1/</sup>	Kenya <sup>2/</sup>	Region's share (%)
1. Meat and dairy products	9	44	20.5
2. Canned vegetables, fish oil and fats	5	34	14.7
3. Grain mill products	31	170	18.2
4. Bakery products	31	127	24.4
5. Sugar and confectionery	32	36	88.9
6. Miscellaneous foods	35	105	33.3
7. Beverage and tobacco	4	36	11.1
8. Textile	7	210	3.3
9. Clothing	18	407	4.4
10. Leather and footwear	4	96	4.2
11. Wood and cork products	37	154	24.0
12. Furniture and fixtures	51	274	18.6
13. Paper and paper products	3	61	4.9
14. Printing and publishing	20	206	9.7
15. Basic industrial chemicals	3	143	2.1
16. Petroleum and other products	0	1	0.0
17. Rubber products	0	36	0.0
18. Plastic products	1	41	2.4
19. Clay and glass products	1	19	5.3
20. Non-metallic minerals	0	36	0.0
21. Metal products	31	356	8.7
22. Non-electrical machinery	0	62	0.0
23. Electrical equipment	0	42	0.0
24. Transport equipment	2	158	1.3
25. Miscellaneous manufacturing	2	121	1.6
Total	327	2,975	11.0

Notes: <sup>1/</sup> Figures for the Region do not include informal enterprises, while those for Kenya do.

<sup>2/</sup> Estimated based on the output estimated and output per unit calculated from data in source (2) below.

Sources: (1) JICA Study Team

(2) Statistical Abstract 1985.

Table 4.2 Manufacturing Establishments by District in the Region in 1986

Province/district	Number of formal establishments	Province/district	Number of formal establishments
Nyanza	<u>112</u>	Rift Valley	<u>149</u>
Kisumu	71	West Pokot	5
Siaya	8	Trans Nzoia	27
South Nyanza	16	Elgeyo Marakwet	6
Kisii	17	Uasin Gishu	69
Western	<u>66</u>	Nandi	8
Busia	5	Kericho	23
Kakamega	38	Nakuru	11
Bungoma	23	Narok	0
		LBDA region	<u>327</u>

Source: JICA Study Team

Table 4.3 Manufacturing Establishments by Size and by Subsector in the Region in 1986

Subsector	Small 0-9 employees	Medium 10-50 employees	Large over 50 employees
1. Meat and dairy products	0	8	1
2. Canned vegetables, fish oil and fats	1	2	1
3. Grain mill products	19	8	4
4. Bakery products	22	8	1
5. Sugar and confectionery	16	14	2
6. Miscellaneous foods	12	17	6
7. Beverage and tobacco	0	1	3
8. Textile	0	1	6
9. Clothing	4	13	1
10. Leather and footwear	0	2	2
11. Wood and cork products	5	31	1
12. Furniture and fixtures	39	10	2
13. Paper and paper products	0	1	2
14. Printing and publishing	2	17	1
15. Basic industrial chemicals	0	0	3
16. Petroleum and other products	0	0	0
17. Rubber products	0	0	0
18. Plastic products	1	0	0
19. Clay and glass products	0	1	0
20. Non-metallic minerals	0	0	0
21. Metal products	29	1	1
22. Non-electrical machinery	0	0	0
23. Electrical equipment	0	0	0
24. Transport equipment	2	0	0
25. Miscellaneous manufacturing	0	1	0
Total	152	136	39

Source: JICA Study Team

Table 4.4 Manufacturing Establishments by Size and by Subsector in Kenya

Employment Group Subsector Industries	1983 (Unit: Establishment)			
	0-9	10-49	50 and over	Total
1. Meat and dairy products	7	15	20	42
2. Canned vegetables, fish oil and fats	12	7	13	32
3. Grain mill products	140	7	17	164
4. Bakery products	69	22	11	102
5. Sugar and confectionery	13	9	14	36
6. Miscellaneous foods	27	21	53	101
7. Beverage and tobacco	5	4	24	33
8. Textile	106	17	67	190
9. Clothing	281	72	40	393
10. Leather and footwear	79	7	8	94
11. Wood and cork products	54	48	48	150
12. Furniture and fixtures	216	43	15	274
13. Paper and paper products	21	19	18	58
14. Printing and publishing	106	73	18	197
15. Basic industrial chemicals	44	42	51	137
16. Petroleum and other products			1	1
17. Rubber products	16	11	7	34
18. Plastic products	14	9	16	39
19. Clay and glass products	7	2	10	19
20. Non-metallic minerals	18	10	8	36
21. Metal products	203	84	50	337
22. Non-electrical machinery	19	36	5	60
23. Electrical equipment	7	16	16	39
24. Transport equipment	31	69	57	157
25. Miscellaneous manufacturing	78	33	10	121
Total	1,573	676	597	2,846

Source: Statistical Abstract 1985

**Table 4.5 Manufacturing Establishments by Area and Main Town**

Main Town	No. of Establishments	No. of Establishments	1091-1978
Towns in LBDA region	216	219	1.01
Nyanza	88	94	1.07
Kisii	8	12	
Kisumu	68	69	
Homa-Bay	8	8	
Migori	4	5	
Western	30	32	1.07
Bungoma	8	11	
Webuye	6	8	
Kakamega	16	13	
Rift Valley	98	93	0.95
Kericho	15	18	
Kipkelion	4	3	
Londiani	5	4	
Kitale	21	17	
Eldoret	49	43	
Kapsabet	4	8	
Towns in other regions	1,569	1,598	1.02
Total establishments in urban areas in Kenya	1,785	1,817	1.02
Total establishments in rural areas in Kenya	451	768	1.70
All establishments in Kenya	2,236	2,585	1.16

Source: Employment and Earnings in Modern Sector



Table 4.6 Output of Manufacturing Sector in the Region by Subsector in 1985

(Unit: K£ 10<sup>3</sup> at 1985 price)

Subsector	LBDA region			Kenya Formal & Informl	Region's Share (%)
	Formal	Informal	Total		
1. Meat and dairy products	30,831	N.A	30,831	129,558	23.8
2. Canned vegetables, fish oil and fats	18,890	N.A	18,970	91,814	20.7
3. Grain mill products	47,501	N.A	47,501	214,090	22.2
4. Bakery products	21,512	N.A	21,512	70,882	30.4
5. Sugar and confectionery	52,673	N.A	52,673	81,034	65.0
6. Miscellaneous foods	127,142	N.A	127,142	605,159	21.0
7. Beverage and tobacco	20,820	N.A	20,820	160,474	13.0
8. Textile	27,071	N.A	27,071	105,153	25.7
9. Clothing	5,213	N.A	5,213	94,384	5.5
10. Leather and footwear	5,912	N.A	5,912	22,716	26.0
11. Wood and cork products	9,968	N.A	9,968	42,426	23.5
12. Furniture and fixtures	3,295	N.A	3,295	18,483	17.8
13. Paper and paper products	16,865	N.A	16,865	95,882	17.6
14. Printing and publishing	8,090	N.A	8,090	59,260	13.7
15. Basic industrial chemicals	4,968	N.A	4,968	112,045	4.4
16. Petroleum and other products		N.A		494,935	0
17. Rubber products		N.A		58,727	0
18. Plastic products	1,058	N.A	1,058	46,140	2.3
19. Clay and glass products	476	N.A	476	9,034	5.3
20. Non-metallic minerals		N.A		109,929	0
21. Metal products	8,534	N.A	8,534	202,500	4.2
22. Non-electrical machinery		N.A		17,531	0
23. Electrical equipment		N.A		113,766	0
24. Transport equipment	1,130	N.A	1,130	161,840	0.7
25. Miscellaneous manufacturing	361	N.A	361	12,430	2.9
Total	412,390	5,350	417,740	3,130,191	13.3

Source: JICA Study Team

Table 4.7 "Value Added Structure of Manufacturing Sector, LBDA Region and Kenya in 1985"

Subsector	LBDA Region			Share in Kenya (%)	Kenya		
	Value addd (K£ 10 <sup>6</sup> )	Constituent Ratio (%)	Value addd Ratio (%)		Value addd (K£ 10 <sup>6</sup> )	Constituent Ratio (%)	Value addd Ratio(%)
Agro-based	68.3	95.5	17.3	22.2	307.9	58.9	17.2
Chemical	1.3	1.8	20	1.3	99.6	19.1	12
Metal	1.8	2.5	18	1.6	115	22	22.6
Average/total	71.5	100	17.3	14.4	522.5	100	16.7

Sources: Statistical Abstract 1985 (Kenya)  
JICA Study Team (LBDA Region)

Table 4.8 Value Added of Manufacturing Sector in the Region by Subsector in 1985

(Unit: K£ 10<sup>3</sup> at 1985 price)

Subsector	LBDA region			Kenya Formal & Informal	Region's Share (%)
	Formal	Informal	Total		
1. Meat and dairy products	3,546	N.A	3,546	14,899	23.8
2. Canned vegetables, fish oil and fats	4,515	N.A	4,515	21,852	20.7
3. Grain mill products	2,708	N.A	2,708	12,203	22.2
4. Bakery products	1,742	N.A	1,742	5,741	30.3
5. Sugar and confectionery	17,698	N.A	17,698	40,841	43.3
6. Miscellaneous foods	8,773	N.A	8,733	38,730	22.7
7. Beverage and tobacco	7,662	N.A	7,662	59,054	13.0
8. Textile	8,554	N.A	8,554	33,649	25.4
9. Clothing	933	N.A	933	16,895	5.5
10. Leather and footwear	1,318	N.A	1,318	5,066	26.0
11. Wood and cork products	3,160	N.A	3,160	13,449	23.5
12. Furniture and fixtures	774	N.A	774	4,344	17.8
13. Paper and paper products	4,739	N.A	4,739	24,833	19.1
14. Printing and publishing	2,225	N.A	2,225	16,297	13.7
15. Basic industrial chemicals	899	N.A	899	15,350	5.9
16. Petroleum and other products		N.A		38,110	0
17. Rubber products		N.A		15,856	0
18. Plastic products	319	N.A	319	12,965	2.5
19. Clay and glass products	131	N.A	131	2,484	5.3
20. Non-metallic minerals		N.A		14,840	0
21. Metal products	1,442	N.A	1,442	34,225	4.2
22. Non-electrical machinery		N.A		4,418	0
23. Electrical equipment		N.A		35,723	0
24. Transport equipment	262	N.A	262	36,252	0.7
25. Miscellaneous manufacturing	128	N.A	128	4,400	2.9
Total	71,527	3,660	75,187	522,476	14.4

Source: JICA Study Team

Table 4.9 Employment in Manufacturing Sector in the Region by Subsector in 1985

(Unit: K£ 10<sup>3</sup> at 1985 price)

Subsector	LBDA region			Kenya Formal & Informal	Region's Share (%)
	Formal	Informal	Total		
1. Meat and dairy products	500	N.A	500	4,949	10.1
2. Canned vegetables, fish oil and fats	360	N.A	360	4,929	7.3
3. Grain mill products	1,500	N.A	1,500	4,028	37.2
4. Bakery products	1,088	N.A	1,088	3,132	34.7
5. Sugar and confectionery	4,185	N.A	4,185	8,610	48.6
6. Miscellaneous foods	4,124	N.A	4,124	14,770	27.9
7. Beverage and tobacco	1,089	N.A	1,089	7,611	14.3
8. Textile	6,782	N.A	6,782	13,667	49.6
9. Clothing	435	N.A	435	7,549	5.8
10. Leather and footwear	812	N.A	812	3,551	22.9
11. Wood and cork products	1,048	N.A	1,048	9,527	11.0
12. Furniture and fixtures	572	N.A	572	2,652	21.6
13. Paper and paper products	601	N.A	601	5,088	11.8
14. Printing and publishing	565	N.A	565	4,771	11.8
15. Basic industrial chemicals	754	N.A	754	10,196	7.4
16. Petroleum and other products	0	N.A	0	340	0
17. Rubber products	0	N.A	0	2,069	0
18. Plastic products	4	N.A	4	2,181	0.2
19. Clay and glass products	24	N.A	24	5,115	0.5
20. Non-metallic minerals	0	N.A	0	915	0
21. Metal products	210	N.A	210	13,244	1.6
22. Non-electrical machinery	0	N.A	0	1,409	0
23. Electrical equipment	0	N.A	0	2,256	0
24. Transport equipment	33	N.A	33	19,954	0.2
25. Miscellaneous manufacturing	386	N.A	386	1,787	21.6
<b>Total</b>	<b>25,071</b>	<b>4,670</b>	<b>29,741</b>	<b>154,300</b>	<b>19.3</b>

Source: JICA Study Team

**Table 4.10 Industrialization Process of the Region**

Phase/Stage	Characteristics	Term(year)
Phase 1 (Stage 1)	Development phase	1985-2000
	Enhancement and upgrading of the existing agro-based manufacturing subsectors	1985-
	Development of the subsectors which use the agricultural and natural resources endowed in the Region, including the waste materials	1990-
	Fosterage of the machinery and metal subsectors as strategic subsectors	1995-
Phase 2 (Stage 2)	First half growth phase	2000-2015
(Stage 3)	Second half growth phase	2015-
(Stage 4)	Development mature phase	?

**Table 4.11 Manufacturing Subsectors to be Introduced/Enhanced**

Field	Product/Process	Criterion
Agricultural Product	Edible oil	Material
	Instant coffee	Income
	Cotton-made products	Material
	Canned fruits	Income
	Packing material	Income
	Hides and skin products	Income
	Alcohol	Material
	Pulp and paper	Material
Agricultural Input	Fertilizer compound	Self-sufficiency
	Animal feed	Material
Fishery	Fish filleting	Material
Forestry	Sawdust briquet	Material
Construction material	Cement	Material
	Ceramic products	Material
Metal/Machinery	Metal/machinery	Self-sufficiency

Note: For criteria, see the text.

Table 4.12 Projected Output of Manufacturing Sector in the Region (1/2)

(1) Existing industries

(Unit: K£ 10 <sup>3</sup> at 1985 price)				
Industrial classification	1985	2005	Annual growth rates (%) (1985-2005)	Remarks as to the growth rate
Meat and dairy products	30,831	71,560	4.3	Growth rate of livestock production
Canned vegetables, fish oil and fats	18,970	150,210	10.9	Growth rate of fruits and vegetables
Grain mill products	47,501	119,020	4.7	Growth rate of cereals production
Bakery products	21,521	69,020	6.0	Growth rate of income of this region (GRDP)
Sugar and confectionery	52,673	156,630	5.6	Average growth rate of sugarcane and GRDP
Miscellaneous foods	127,142	492,000	7.0	Average growth rate of coffee and tea production and GRDP
Beverage and tobacco	20,820	66,770	6.0	Growth rate of GRDP
Textile	27,071	86,820	6.0	Growth rate of GRDP
Clothing	5,213	16,720	6.0	Growth rate of GRDP
Leather and footwear	5,912	13,720	4.3	Growth rate of livestock production
Wood and cork products	9,968	9,970	0.	83/79 growth rate and forestry production policy
Furniture and fixtures	3,295	7,080	3.9	Average growth rate of GRDP and subsector of Wood products
Paper and paper products	16,865	54,090	6.0	Growth rate of GRDP
Printing and publishing	8,090	25,950	6.0	Growth rate of GRDP
Basic Industrial chemicals	4,968	13,690	5.2	Growth rate of whole Agricultural production
Petroleum and other products				
Rubber products				
Plastic products	1,058	2,920	5.2	Growth rate of whole agricultural production
Clay and glass products	476	1,530	6.0	Growth rate of GRDP
Non-metallic minerals				
Metal products	8,534	23,520	5.2	Growth rate of whole agricultural production
Non-electrical machinery				
Electrical equipment				
Transport equipment	1,130	3,620	6.0	Growth rate of GRDP
Miscellaneous manufacturing	361	1,150	6.0	Growth rate of GRDP
Total	412,390	1,386,020	6.2	

Table 4.12 Projected Output of Manufacturing Sector in the Region (2/2)

(2) Introduced/enhanced industry

(Unit: K£ 10<sup>6</sup> at 1985 price)

Industry	1990	1995	2000	2005
Edible oil	10.0	30.0	48.3	77.8
Canned fruits	1.0	1.9	2.5	2.9
Fish filleting, fish oil etc	13.3	13.4	14.3	14.5
Instant coffee		28.9	89.7	200.0
Animal feed	2.5	5.0	7.5	10.0
Cotton products	1.0	4.5	5.4	6.4
Hide and skin products	20.8	21.6	22.5	23.4
Briquettes	0.1	0.1	0.1	0.1
Pulp and paper		2.8	4.4	6.9
Printing	0.4	0.8	1.4	2.5
Power alcohol		7.5	9.5	12.1
Ceramic products	0.6	1.8	2.7	4.0
Cement		5.8	7.1	8.6
Machinery and metal works	5.0	12.9	30.7	73.3
Packing materials	1.9	6.0	7.0	12.7
Total	56.6	143.0	253.1	455.2

Source: JICA Study Team

Table 4.13 Projected Value-Added of Manufacturing Sector in the Region (Summary)

(Unit: K£ x 106, 1985 price; composition in parentheses)

Subsector	1985	1995	2005	Growth Rate (% per annum) 1985 - 2005
Existing manufacturing	71.5 (95.1)	116.5 (68.8)	204.1 (63.0)	5.4
Introduced/Enhanced manufacturing	- (26.5)	44.9 (31.9)	103.4	1995 - 2005 (8.7)
Informal manufacturing	3.7 (4.9)	7.8 (4.6)	16.4 (5.1)	7.7
Total	75.2 (100)	169.2 (100)	323.9 (100)	7.6

Source: JICA Study Team

Table 4.14 Value Added Ratio by Subsector

(Unit: %)

Subsector	Existing Industries (%)	Introduced/Enhanced Industries (assumed)
1. Meat and dairy products	11.5	
2. Canned vegetables, fish oil and fats	23.8	23.8
3. Grain mill products	5.7	23.8
4. Bakery products	8.1	75.0
5. Sugar and confectionery	33.6	
6. Miscellaneous foods	6.9	20.0
7. Beverage and tobacco	36.8	60.0
8. Textile	31.6	31.6
9. Clothing	17.9	
10. Leather and footwear	22.3	50.0
11. Wood and cork products	31.7	31.7
12. Furniture and fixtures	23.5	
13. Paper and paper products	28.1	28.1
14. Printing and publishing	27.5	28.1
15. Basic industrial chemicals	18.1	
16. Petroleum and other products		40.0
17. Rubber products		
18. Plastic products	30.1	
19. Clay and glass products	27.5	27.5
20. Non-metallic minerals		15.0
21. Metal products	16.9	16.9
22. Non-electrical machinery		25.2
23. Electrical equipment		
24. Transport equipment	23.2	
25. Miscellaneous manufacturing	35.4	35.4
Average	17.1	27.2

Note: The value-added ratios of the Introduced/enhanced industries correspond to the subsector industries in Table 4.12.

Source: Statistical Abstract 1985

Table 4.15 Projected Employment in Manufacturing Sector in the Region (Summary)

Sector	1985	1990	1995	2000	2005
Existing and Introduced/Enhanced Manufacturing	25,071	35,100	45,720	59,110	77,000
Informal Manufacturing	4,670	6,560	9,200	12,920	18,140
Total	29,741	41,660	54,920	72,030	95,140

	Composition ratio			Growth rate (%/Year)		
	1985	1995	2005	1985-1995	1995-2005	1985-2005
Existing and Introduced/Enhanced Manufacturing	84.3	83.2	80.9	6.2	5.4	5.8
Informal Manufacturing	15.7	16.8	19.1	7.0	7.0	7.0
Total	100.0	100.0	100.0	6.3	5.6	6.0

**Table 4.16 Projected Employment and Output per Worker in Manufacturing Sector in the Region - Existing and Introduced/Enhanced Subsectors**

Industrial Classification	1985	2005	Output per Worker (K£ 10 <sup>3</sup> )	Increasing Rate in Labour Productivity (%/Year)
1. Meat and dairy products	500	950	61.66	1.0
2. Canned vegetables, fish oil and fats	360	3,740	52.69	1.0
3. Grain mill products	1,500	3,080	31.67	1.0
4. Bakery products	1,088	2,860	19.77	1.0
5. Sugar and confectionery	4,185	10,200	12.59	1.0
6. Miscellaneous foods	4,124	18,820	30.83	1.0
7. Beverage and tobacco	1,089	2,860	19.12	1.0
8. Textile	6,782	19,150	3.99	1.0
9. Clothing	435	1,140	11.98	1.0
10. Leather and footwear	812	4,180	7.28	1.0
11. Wood and cork products	1,048	860	9.51	1.0
12. Furniture and fixtures	572	1,010	5.76	1.0
13. Paper and paper products	601	1,780	28.06	1.0
14. Printing and publishing	565	1,630	14.32	1.0
15. Basic industrial chemicals	754	1,700	6.59	1.0
16. Petroleum and other products		130	74.84	1.0
17. Rubber products				
18. Plastic products	4	10	264.50	1.0
19. Clay and glass products	24	230	19.83	1.0
20. Non-metallic minerals		50	153.53	1.0
21. Metal products	210	1,360	40.64	1.0
22. Non-electrical machinery		480	50.23	1.0
23. Electrical equipment				
24. Transport equipment	33	90	34.24	1.0
25. Miscellaneous manufacturing	386	690	16.45	1.0
<b>Total</b>	<b>25,071</b>	<b>77,000</b>	<b>23.68 (2005)</b>	

Note: Labour productivity is assumed to increase at 1% per annum in 1985 - 2005 for all the subsectors.

Source: JICA Study Team



**Table 4.17 Evaluation of Alternative Public-Private Partnership Schemes**

Partnership Schemes	Evaluation Criteria				
	(a) Chance of Inaugura- tion	(b) Incentive to be Efficient	(c) Chance of Continued Operation	(d) Ease of Correcting Mistakes	(e) Development of Indigenous Entrepreneuership
1. Totally Public	Best	Weak	Good	Poor	Bad
2. Public Ownership/ Private Operation	Better	Strong	Medium	Great	Medium
3. Hire-Purchase	Good	Stronger	Medium	Great	Good
4. Limited Hire- Purchase	Better	Stronger	Good	Great	Good
5. Sunset Mixed Ownership	Good	Medium	Good	Poor	Good
6. Totally Private	Poor	Stronger	Poor	Mixed	Good



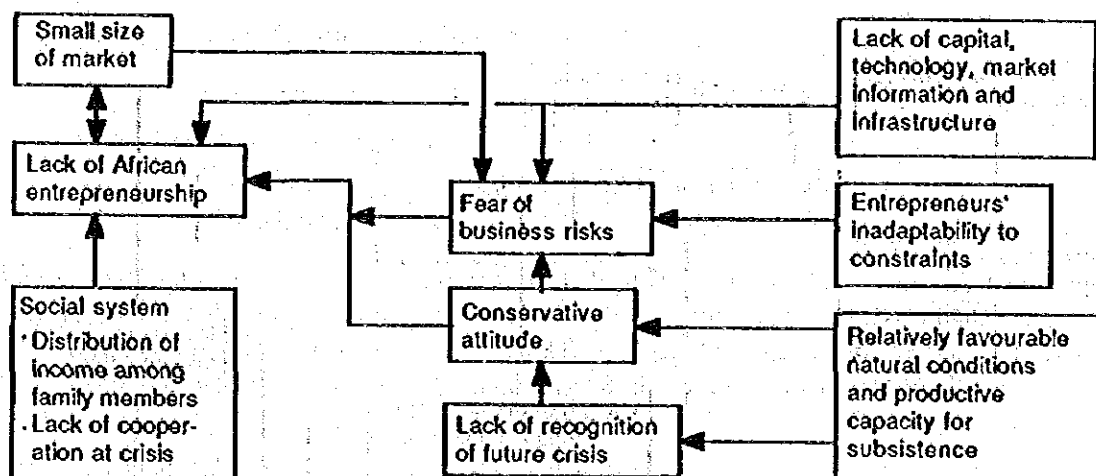


Figure 4.1 Relationships between the Lack of Entrepreneurship and Other Constraints and Related Elements

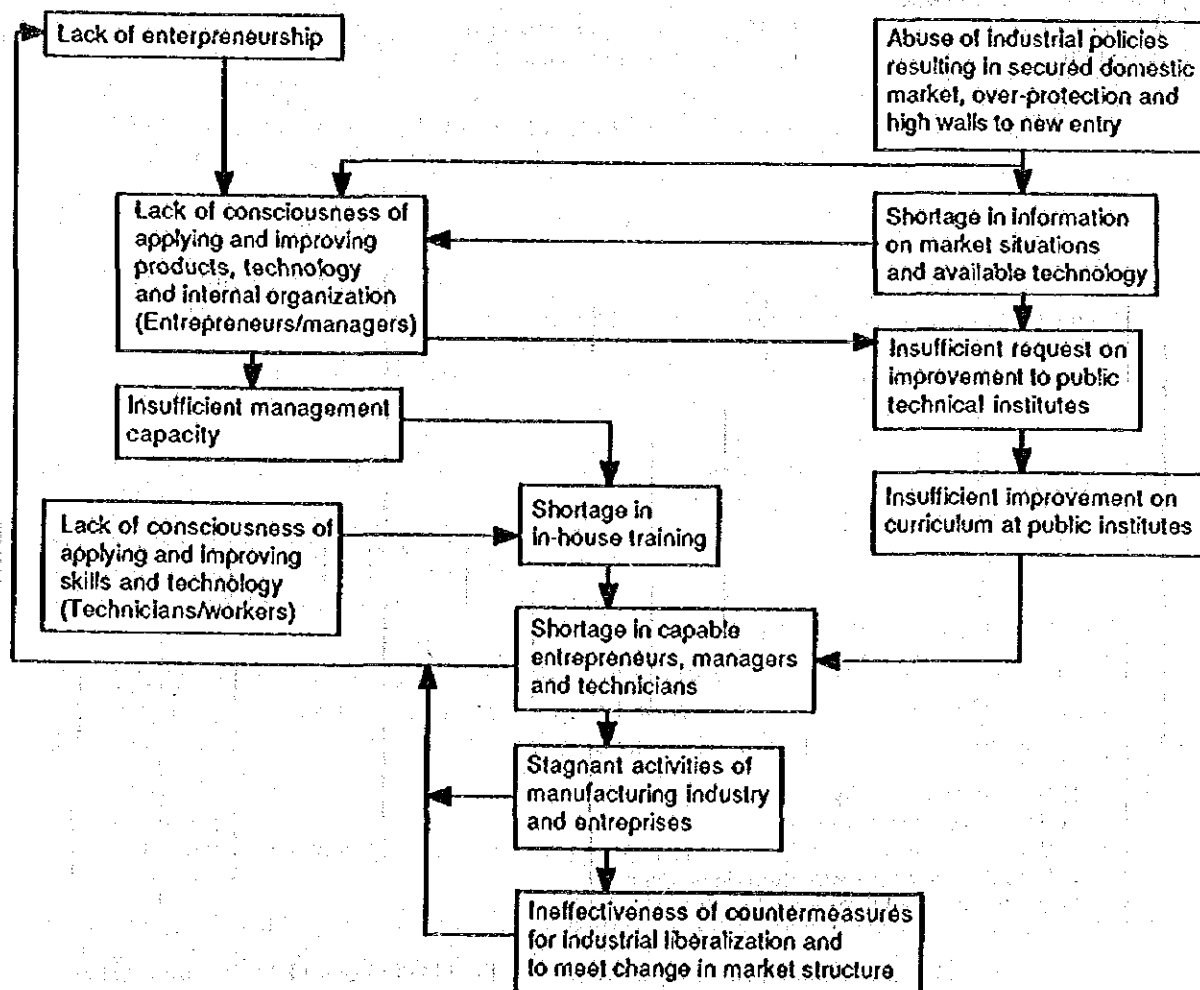


Figure 4.2 Problem Structure of Lack of Technology in the Region

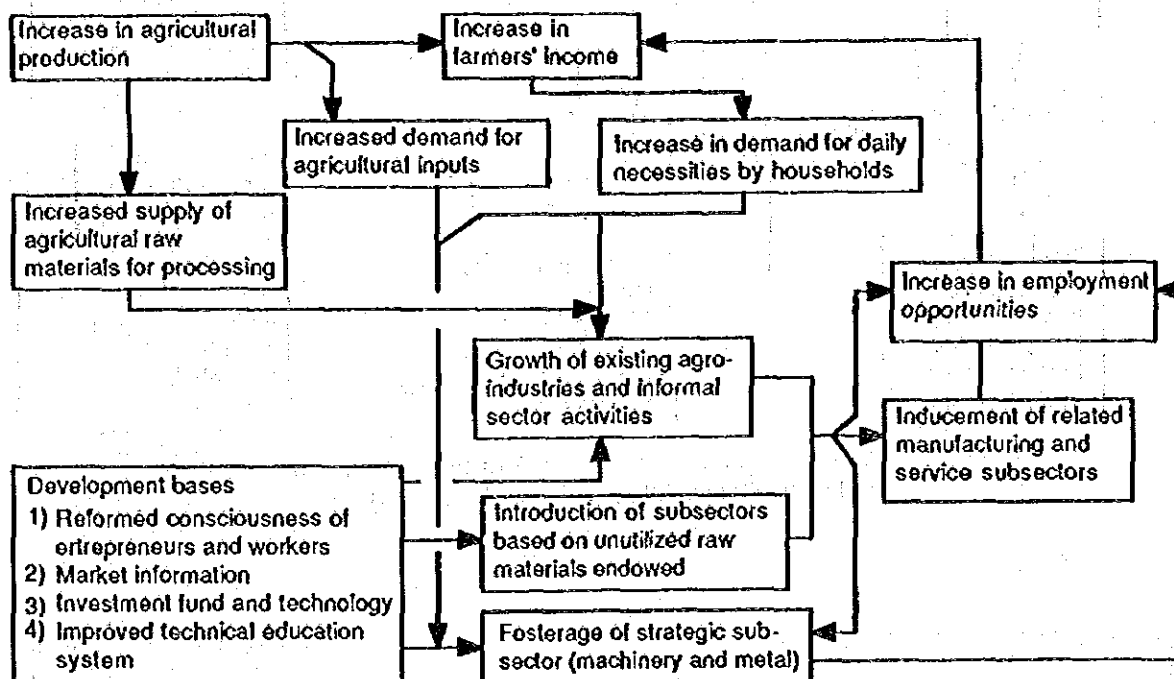


Figure 4.3 Industrial Development Process --- Development Phase (1985-2000)

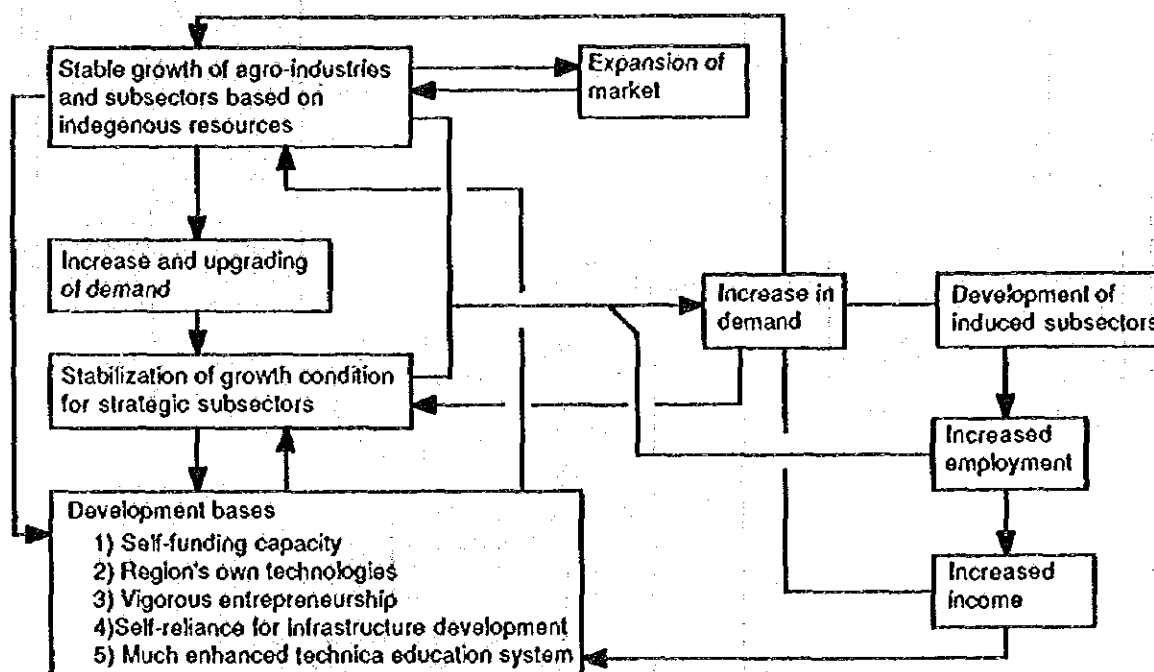


Figure 4.4 Industrial Development Process --- First Half Growth Phase (2000-2015)

## Attachment to Chapter 4: Survey on Informal Sector

### 1. Characteristics of "Informality"

#### 1.1 Characteristics of "informality"

The dualistic nature of urban economy in developing countries has been recognized for many years in the development literature. The dualistic nature is characterised among others by existence of informal production sector and formal production sector. The characteristics of the both sectors enumerated in International Labour Office's report on Kenya are as follows.

Table A.1 Characteristics of Informal and Formal Production Sectors

Informal Sector	Formal Sector
1. Ease of entry	1. Difficult entry
2. Reliance on indigenous resources	2. Frequent reliance on overseas resources
3. Family ownership of enterprises	
4. Small scale operation	3. Large scale operation
5. Labour-intensive and adoptive technology	4. Capital-intensive and often imported technology
6. Skills acquired outside the formal school system	5. Formally acquired skills, often expatriate
7. Unregulated and competitive markets	6. Protected markets through tariffs, quotas and trade licences.

#### 1.2 Identification of informal sector enterprises

It is very difficult to identify precisely the enterprises or units which are classified into the informal sector with characteristics described above. No enterprise ledger exists covering the whole country. To estimate the number of such units, the related agencies set up the criteria as follows.

##### (1) Central Bureau of Statistics of Kenya (CBS)

CBS designates enterprises or units as informal sector enterprises/units which satisfy either or both of the following criteria:

- 1) All activities carried out in open area or in temporary structure, and
- 2) All units in municipal stalls.

The first criterion has been based on whether the enterprises/units have a postal box, and the second criterion has been added, taking into account the changes in business environment.

(2) ILO and Sessional Paper No. 1 of 1986

In "The Urban Informal Sector in Developing Countries" published by ILO and "Sessional Paper No. 1 of 1986" of Kenya Government, the informal sector enterprises are defined as:

*Enterprises with equal to or less than ten workers engaged, including the owner.*

It is assumed behind the criterion that an enterprise with more than ten workers requires a significant amount of capital and managerial skills and that an enterprise above this size, though small, is unlikely to have the orientation of an informal sector enterprise listed in the above table.

(3) Other criteria

Business or operation license is selected to be one of other criteria for extraction of informal sector enterprises. According to the "Nairobi Informal Sector" survey, 1977, the enterprises/units which satisfy the CBS criteria typically do not have licenses, while modern small scale enterprises have to acquire the licences. It is pointed out by many literatures, however, that they cannot unfortunately enjoy the benefit from the licences and only those enterprises having roughly more than thirty or forty workers can enjoy the benefit. Therefore, the criterion of business/operation licence is not an affirmable criterion for identifying informal sector enterprises.

2. Activities in Informal Sector and Its Role in the National Economy

2.1 Development trend of informal sector

Number of employees in unregistered firms (informal sector firms selected on the CBS criteria described above) in all towns having a population of 2,000 or more in 1969 plus a number of trading centers in the rural area was 76.2 thousands in 1974 and increased to 175.4 thousands in 1982, accounting for 16.8% of wage employment. It grew at annual rate of 11.0% from year 1974 to 1982, while the corresponding growth rate of wage employees in the whole country was 3.0%. Although the employment in the informal sector is relatively small in comparison with that in the formal sector, the absorption capacity of employment in the informal sector seems to be growing faster than that in the formal sector.

The employment in the informal manufacturing subsector accounts for 14 - 16% of the whole informal sector employment. The remaining portion of the employment is by the subsectors of repair and other service, retail trade and catering, and construction and transportation (Table A.2).

The share of retail trade and catering sub-sector in the whole employment has been staying at around 70%, that of manufacturing slightly rising in recent years, and that of repair and

other service decreasing. In future, the share of repair and other service will decrease and the share of manufacturing will rise, as the per capita income of the people increases and the people turn to new or high quality products. This in turn implies that the foreseeable change in the market and adoption ability of the informal manufacturing subsector will have to be properly taken into account in drawing up industrial development policies; otherwise the development of this subsector will slow down, undermining the employment generating capacity of this sector.

Table A.2 Employment in Unregistered (Informal) Firms by Subsector

	(Unit: 1000 workers)				
	Manufac- turing	Repair and other service	Retail trade & catering	Construction & transportation	Total
1974	10.9	12.2	51.9	1.2	76.2
1975	9.6	9.9	53.8	0.7	74.1
1976	13.9	12.3	58.2	0.5	84.9
1977	15.2	13.9	73.5	1.2	103.9
1978	17.0	15.7	80.0	1.2	113.9
1979	17.2	18.5	84.7	1.2	121.6
1980	18.2	17.0	86.3	1.7	123.2
1981	25.9	18.1	111.6	2.2	157.9
1982	28.8	20.1	124.0	2.5	175.4

	Composition Ratio (Unit: %)				
1974	14.3	16.0	68.1	2.6	100.0
1975	13.0	13.4	72.6	1.0	100.0
1976	16.4	14.5	68.6	0.6	100.0
1977	14.6	13.4	70.7	1.2	100.0
1978	14.9	13.8	70.2	1.1	100.0
1979	14.1	15.2	69.7	1.0	100.0
1980	14.8	13.8	70.0	1.4	100.0
1981	16.4	11.5	70.7	1.4	100.0
1982	16.4	11.5	70.7	1.4	100.0

Source: Central Bureau of Statistics, Survey of Informal Sector.

## 2.2 Market structure of informal sector

The goods and service provided by the informal sector enterprises typically include the following.

**Manufacturing subsector (open air)**

**Consumer's goods**      tile, flour, pot, pan, brush, paper, match, glass, soap, shoe, hide and skin products, box, furniture, copper products etc.

**Capital goods**          sickle, hoe, harness etc.

**Service sub-sector**      taxi, barber, laundry, shoe cleaning, repair shop (vehicle, bicycle, radio), restaurant etc.

**Retail trade subsector**   beverage, newspaper, daily necessities including the consumer's goods above.

As clearly seen from the kinds of the products and service enumerated above, the informal sector provides goods and service which the households, especially low income ones, demand daily.

It sometimes happens that for some kinds of manufactured goods, the formal manufacturing subsector takes over the market developed painstakingly by the informal sector. For the following reasons, however, such market taking-over is limited especially for manufactured goods and the informal sector can maintain or develop their own markets.

- 1) The small scale operation and labour intensive character of the informal sector industry tend to hinder the invasion of the formal sector, often resulting in market exclusion for the informal sector. These characteristics enable the informal sector enterprises to provide goods and services tailored to the individual needs and to some extent, needs from non-household units, such as repairs (vehicle, radio), trade, services tailoring etc.
- 2) As observed in some import substituting industries, small market does not offer any incentives to the formal sector to enter.
- 3) Certain service activities such as collection of waste materials/garbage are left to informal sector either because the local authorities can not offer the comparable service coverage or it is too labour intensive and expensive for the formal sector.
- 4) The formal sector may be unable to produce certain types of goods and services for the low and middle income groups, typically those made of substandard materials, using simple techniques.
- 5) The formal sector may seek the co-operation of the informal sector through subcontracting in obtaining intermediate inputs or marketing its outputs.



### 2.3 Efficiency of informal sector industry

According to Nairobi's Informal Sector Survey, 1977, labour productivity (average annual output per worker) of manufacturing subsector in the formal sector is more than three times higher than that in the informal sector (Table A.3).

Table A.3 Efficiency of Informal Sector Industry

Sub-industry	Capital per output (capital coefficient)	Informal Sector Capital per labour (K£)	Output per labour (K£/year)	Formal Sector Output per labour (K£/year)
Tailoring	1.6	248	342	1,080
Footwear	0.7	135	326	1,891
Furniture	0.7	133	362	992
Metal goods	0.2	135	577	1,916
All manufacturing	1.0	182	410	1,548
Retailing	2.7	283	583	n.a
Restaurants	0.4	101	607	n.a
Charcoal	0.1	59	480	n.a
All trade	0.9	176	727	n.a
Footwear repair	0.4	48	178	n.a
Vehicle repair	1.1	348	609	n.a
Clothes repair	1.0	137	242	n.a
Barbers	0.6	91	320	n.a
Shoeshine	0.1	10	260	n.a
All services	0.7	156	370	n.a

n.a: not available

Source: Nairobi's Informal Sector, William J. House

Tobin (1973) estimated capital-output ratios to be from 2.5 to 1.1 for Kenya's formal manufacturing sub-sector and from 2.9 to 1.2 for all the formal industries. The capital output ratio in the informal sector is estimated to be around 1.0 (Table A.3).

The capital-labour ratio for the formal non-agricultural/non-residential sector in 1977 is estimated at K£ 2,000, based on Powell's estimate, while that for the informal subsector is in the range of 150 - 200 (Nairobi's Informal Sector, 1977).

The difference in the capital-labour ratios for the informal and formal sector industries implies the following with respect to output and employment generation. If K£ 10,000 is invested in informal or formal manufacturing subsectors, the following would be induced:

Output:	Informal sector	about K£ 10,000
	Formal sector	about K£ 667
Employment:	Informal sector	about 55 workers
	Formal sector	about 5 workers

Thus the informal sector has a potential to contribute to increasing production and employment opportunities with the smaller amount of investment capital, and should be more emphasized when the available investment capital is limited as is the case with Kenya.

#### 2.4 Dualistic structure within the informal sector

The "Nairobi's Informal Sector" survey cited before pointed out that the informal sector can be dichotomized into two main parts: a dynamic subsector where the business heads make a firm commitment to their enterprises, and a relatively stagnant group in menial employment with subsistence returns to their efforts. There are considerable differences in the education attainment and the business activities between the two groups. The survey names the former group as "Intermediate Subsector" in the sense of its dynamic activity and its transitive characteristic to develop into formal modern sector, and the latter as "Community of the Poor" in the sense of its stagnancy and its level of net earnings lower than the minimum statutory wage. The differences between the two groups are illustrated by the following tables.

Table A.4 Comparison between Two Groups of Informal Sector

##### (1) Percentage distribution of Education Attainment

Education attainment	Intermediate Subsector	Community of the Poor
Form 4	8	1
Incomplete secondary	12	6
CPE	32	27
Incomplete primary	38	49
No school	10	17
	100	100

##### (2) Average Levels of Various Economic Indicators

Economic indicator	Intermediate Subsector	Community of the Poor
Initial capital (K£)	72	51
Current capital (K£)	704	329
Capital-output ratio	0.2	1.4
Capital-labour ratio	218	140
Usual weekly sales (K£)	78	16
Addition to investment (K )	438	180

(3) Proportion of Respondents Reporting Changes  
in Sales and Employment since Commencing Operation

Change in employment	Intermediate Subsector	Community of the Poor
Large increase	20	9
Small increase	17	7
No change	59	78
Small decrease	3	2
Large decrease	1	4
	100	100

Change in volume sales	Intermediate Subsector	Community of the Poor
Large increase	36	15
Small increase	43	46
No change	15	24
Small decrease	6	11
Large decrease	0	4
	100	100

Note: In the "Nairobi's Informal Sector" survey, the author sets "Residual Subsector" between the "Intermediate Subsector" and "Community of the Poor". This subsector is omitted due to no significant difference in the activities and characteristics between the subsector and "Community of the Poor" subsector,

Source: Nairobi's Informal Sector, 1977

The "Intermediate Subsector" is considered the most potentially desirable subsector to be developed in future. This subsector will play such an important role as stimulating both of the "Community of the Poor" subsector in the informal sector and the formal modern small scale industry by its progressive activities and upgrading to the formal modern small scale industry group. Therefore, the industrial policies for development of the informal sector, would better be directed to the "Intermediate" subsector in order to maximize the efficiency of the limited public resources.

## 2.5 Net earnings of business heads and wage of employees

Table A.5 illustrates the net weekly incomes, after accounting for all expenses, accruing to the heads of informal sector business. Assuming the reference week was not untypical, the average incomes seem quite reasonable compared with the legal minimum wage of Kshs.350 per month, current as of mid 1977. The subsectors which appear especially rewarding are metal goods, restaurants (food kiosks) and vehicle repairs. On the other

hand, the service subsectors offer the lowest rewards. Factors which induce the differences in the net earnings between the sub-sectors are:

- 1) Low capital and skill intensity which result in easy access for newcomers and fierce competition as generally seen in the service subsector.
- 2) Large market/demand and easy business which result in a high labour productivity as seen in the restaurants.
- 3) High capital and skill intensity, and comparative difficulty in acquisition of raw materials which result also in a high labour productivity as seen in the metal goods and vehicle repairs.

However, the distribution of net income within the subsectors is such that 45% of manufactures, 23% of traders and 53% of those engaged in providing services fall below the approximate minimum wage of Kshs.80 per week. Moreover, the very low incomes are concentrated amongst tailors and shoemakers in manufacturing sub-sector and amongst all the service subsectors except vehicle repair workshops.

Table A.5 Average Income of Heads of Enterprises for  
Week Preceding Interview

	(Unit: Kshs/week)
Tailors	172
Footwear manufacturer	135
Furniture	272
Metal goods	550
All manufacturing	295
Retails	320
Restaurants	531
Charcoal	196
All trade	401
Footwear repair	58
Vehicle repair	602
Clothes repair	79
Barbers	113
Shoeshine	99
Miscellaneous repair	194
All services	236
Transport	174

Source: Nairobi's Informal Sector.

## 2.6 Regional distribution of informal sector

On the employment base, 71% of formal manufacturing enterprises and 64% of informal manufacturing enterprises concentrated in the two metropolitan areas (Nairobi and Mombasa) in 1978. One of the factors which brings about the high concentration of the informal manufacturing enterprises in the metropolitan areas is the existence of economies of industrial agglomeration in the areas. The second and more important factor is a big purchasing power in the areas for the products of informal manufacturing sector.

One of the difficulties faced by rural producers is that they must compete in their local markets against higher quality "imports" from Nairobi and Mombasa. They also suffer from less diverse and more expensive raw material supply, lower skill levels of workers, and less innovative and hard-driving entrepreneurs.

These advantages on the supply side should be effectively utilized to develop the informal sector in rural areas. Product and market diversification should also be pursued. Promotion of this sector along these lines as well as alleviation of the disadvantages mentioned above would require public interventions.

Based on CBS Informal Sector Survey, the informal manufacturing activities are more geographically concentrated in the two metropolitan areas than the informal sector as a whole, with 57% and 52% respectively on the employment base in 1978, while 51% and 50% respectively of the trade and catering and services concentrated in the areas. Services cannot be "exported" so that the location of service subsector is dependent on the market which needs the service activities. The development of the service subsector is generally more sensitive to the increase in income in rural areas than the manufacturing subsector.

## 2.7 Roles of informal sector in national economy

The informal sector has a longer history than the formal modern sector and has developed spontaneously responding to the people's needs. The informal sector uses locally available materials and supplies broader kinds of goods and services demanded by low income households than the formal modern sector, adopting mainly locally developed skills and technology. It also provides more employment opportunities to the unskilled people both in rural and urban areas, and plays an important role in rectifying the income distribution.

Two important roles of informal sector are noted in relation to the formal modern sector. First, it performs a buffer or absorption function of employment in the metropolitan areas. Population of Nairobi is estimated to grow annually at around 7% and its labour force at 9%. The employment in the formal sector has recently grown at an annual rate of around 3% which is below the growth rate of the output of the sector mainly due to the adoption of more capital intensive production technology. The informal sector is put in a position to absorb the surplus labour force beyond the employment in the formal and public sectors. The annual growth rate of more than 10% of employment in the informal sector discussed before illustrates the point of issue. The employment in the public sector is not expected to expand due to the national employment policy described in the Sessional Paper No. 1 of 1986. As a consequence, the buffer or absorption function will have to be strengthened in

future. Second, the informal sector plays a role of supplying basis for developing African entrepreneurs and trained workers for supply to the formal modern sector. The heads in the intermediate subsector in the informal sector as discussed before are potential entrepreneurs of the formal sector, and many workers trained in the informal sector pass the national examination and are employed in the formal sector.

The concentration of the informal and formal sector enterprises in the two metropolitan areas not only causes an over-population problem in the areas but also becomes one of the factors which enlarge the income differentials among regions. Public investment for alleviating the problems caused by the overpopulation tends to further the trend. The rural-urban balance policy stated in the Sessional Paper No. 1 of 1986 is a commendable one with this respect as it aims at not only mitigating the overpopulation in the urban areas but also equalizing the standards of living between rural and urban areas and among regions.

### 3. Problems Faced by Informal Sector

Problems faced at present by the informal sector, pointed out in the surveys and found through interviews in June, 1986 with the heads of the informal sector in Nyanza Province, are summarized as follows.

The heads of the informal sector revealed the strong needs for the following, as also pointed out in the "Nairobi's Informal Sector":

- 1) Obtaining space or premises with electricity and water supply facilities,
- 2) Establishing market, and
- 3) Making access to loan capital

The "Nairobi's Informal Sector" survey pointed out that 72% of the respondents had never received a loan from any sources, including relatives and friends. Those in the "Intermediate Subsector" had expanded their business by reinvesting their profits. They have a strong intention to expand their business in spite of their severe business circumstances, and they would have been able to expand their business, provided that they could have easy access to public loans.

As expressed in the Sessional Paper No. 1 of 1986, the Government recognizes the informal sector as an indispensable sector for the national and regional economic development and is going to formulate policies on improving the informal sector business environment. Thus, in the near future, the problems encountered by the informal sector is expected to be alleviated.

The following circumstances are expected to evolve, surrounding the informal sector, as a result of the national policies on the sector. First, the kinds and quality of goods and services demanded by rural and urban people will change in accordance with the increase in income, especially, in rural areas. If the informal sector cannot respond to the foreseen change, the formal sector may acquire the incremental and high-quality demand, and the market for the informal sector may become relatively small except its exclusive markets. Second, the national policy aims to increase the heads of the informal sector enterprises

mainly through an enhancement of secondary technical education. This will make the competition among the informal sector enterprises severer.

#### **4. Possibility of Development and Policies for Informal Sector**

##### **4.1 Basic strategy for development of informal sector**

Sessional Paper No. 1 of 1986 emphasizes the necessity of developing the informal sector from the following viewpoints:

- 1) To create employment opportunities with a fairly small capital requirement compared with the formal modern sector;
- 2) To satisfy the basic needs because the sector supplies goods and services for low income households;
- 3) To stimulate activities of the private production sector through fostering African entrepreneurs in the informal sector and furnishing the entrepreneurs to the modern sectors; and
- 4) To contribute to regional development through its usage of indigenous raw materials.

The paper recognizes clearly that in order to develop the informal sector industry, the increase in farmers' income mainly through growth in agriculture is most essential, and the related policies stated in the paper are set in line with this recognition. The importance of the informal sector enterprises (including formal small scale enterprises) has been recognized since the second Development Plan (1970-74), but the policies directed to it have so far benefitted only the formal modern large scale enterprises. Moreover, an attention has not been paid to the importance on the demand side.

##### **4.2 Policies for the development**

The previous reports on the informal sector, including the ILO Commission Report, Nairobi's Informal Sector Survey, World Bank Report and Sessional Paper of No. 1 of 1986 enumerated policies to promote this sector, covering all the conceivable measures. Taking all the measures proposed, the sector would be in a position of over-protection and dynamism which is now in the informal sector may disappear.

The policies enumerated are broadly classified into the following three categories:

- 1) policies relating to the supply side i.e. informal sector enterprise side,
- 2) policies relating to the demand side, and
- 3) policies relating to the regional dispersion of the sector.

Private sector enterprises including the informal sector enterprises make their locational decisions to maximize their profits given the market situations. Therefore, there is no direct measures available to the Government to prohibit the private enterprises to locate in a certain area (e.g. two metropolitan areas) or to disperse the enterprises from urban to rural areas. The Government can take only indirect measures. Incentive measures for encouraging industries to establish in rural areas are typical examples of the indirect measures. For the enterprises which have no ability to export their products to another region, the latter measures will work more effectively than the former. In this case, the policies relating to the regional dispersion of the informal sector just come to the policies relating to the demand side.

The specific policy measures, relating to the supply side may be summarized as follows.

Table A.6 Policies Relating to the Supply Side

<u>Sub-Category</u>	<u>Measures</u>
Location	<ul style="list-style-type: none"> <li>- Encouragement of location in district capital, secondary town and trade centers, number of location depending on the district population</li> <li>- Provision of mini KIE facilities</li> </ul>
Establishment/ Operation	<ul style="list-style-type: none"> <li>- Licensing to all informal sector enterprises</li> <li>- Extension of loans</li> <li>- Extension service</li> <li>- Cooperative purchase of raw materials</li> <li>- Provision of marketing information</li> </ul>
Education	<ul style="list-style-type: none"> <li>- Enhancement of secondary technical school</li> </ul>

The informal sector enterprises would be able to be more easily developed than otherwise, when they are clustered into a few places in a district because they can enjoy the economy of agglomeration. District capital, secondary towns and trade centers may be selected as suitable places because this selection is in line with the rural urban balance policies stated in the Sessional Paper No. 1 of 1986. Market facilities should be provided in a place for the trade and service subsectors of the informal sector.

It is also proposed to build a mini KIE facility in each district in order to respond to the request not only from the heads of the informal sector enterprises now operating but also from many local authorities who express their desire in their "District Development Plans". However, to ask KIE to establish such facilities would pose a problem because more than ten facilities in the Region will be listed up, imposing too much financial and human resources' burden on the KIE. Therefore, it is proposed that the facilities be built mainly through the Harambee effort with the Government assistance. This proposal would bring



about the following two kinds of benefit. First, it would raise a degree of participation of the residents/entrepreneurs concerned to their business, sharing even small parts of the construction cost. Second, through increased participation, the machine and equipment to be installed in the facilities would be so selected as to match the needs in terms of skill to be developed and consumer's propensity. This would lead to construction of efficient facilities with a minimum cost. As discussed before, giving a licence to all the informal sector enterprises is the first step for the legal recognition and protection by the Government.

The access to public loans should be improved for the informal sector enterprises. To utilize the limited fund effectively, only the "Intermediate" subsector group should be made eligible as borrowers at the first stage, and when the fund becomes large, the coverage of the loan should be extended also to the lower subsector, i.e. the "Community of the Poor" subsector.

More painstaking extension services will be required by the enterprises than those undertaken by enterprises in the KIB. The enhancement of the extension service especially in the fields of the management techniques and marketing will become one of the key factors for the development of the informal sector. It is very important to charge the enterprises with even a small part of the cost. The entrepreneurs are expected to consider the ways of the business more carefully than otherwise through the charge.

In the case that the informal sector enterprises purchase their raw or intermediate materials from the formal or large scale enterprises, a system of cooperative purchase of the materials would be useful to protect the informal sector enterprises from some disadvantageous transactions.

One of the most important factors for the informal sector enterprises is to keep a sure market and to exploit another. They must always endeavour for it by themselves. However, there may be a limit imposed by their poor financial and human resources. Therefore, the provision of the marketing information by related public agency will become an essential service for the development. It should not be neglected to charge the users with even a small part of the cost.

The Sessional Paper No. 1 of 1986 puts a great emphasis on the enhancement of the secondary technical education to furnish a new type of entrepreneurs with higher level of technology. Needs for management and technologies which the informal sector enterprises have now or expect to have and the problems encountered should be reflected in such courses.

As discussed before, the most fundamental strategy for expanding the market for the informal sector is an increase of income both in rural and urban areas. Public purchasing and subcontracting are proposed as complementary measures to the strategy. The authority for raising the materials for the public use in a district has already been delegated to the district. The proposed "public purchasing" means therefore an increase in the portion for purchasing the goods and services produced by the informal sector enterprises in the total public purchase. The kind and volume of the goods and services purchased may be dependent on a balance between an efficient use of fund and the benefit to the informal sector in sustaining and developing the market. When the district authority purchases the

goods and services from the informal sector, it is very important for both of the buyer and seller that the buyer points out the improvements to be made in the goods and services. This is not only a meaningful public education to the sector but also a way of using the fund efficiently.

Some informal manufacturing sector enterprises raise their raw or intermediate materials from the formal/large scale enterprises and in turn sell their finished goods to the formal sector enterprises as an intermediate materials to the latter. The informal service subsector enterprises purchase the finished goods of the latter. The informal sector enterprises are in a subcontracting relationship with the formal/large scale enterprises. According to the "Nairobi's Informal Sector" survey, 23% of the respondents had obtained the subcontracts, and of those obtaining contracts, 75% of all respondents and 79% of manufacturers supplied their goods and services to the formal sector. Subcontracts were received for metal goods (60%), furniture (38%) and auto repairs (19%).

Those who obtained subcontracts in the informal sector earned on average Kshs. 15,000 more per year than enterprises without access to subcontracts. The subcontracting should be encouraged, as also recommended by Presidential Committee on Unemployment, to stabilize and expand the market for the informal sector. However, there is a criticism that the informal sector is incapable of expanding in an evolutionary manner, with rising labour productivity and incomes, because it is exploited by the formal sector buying from it at very low prices and selling to it at high prices. Therefore, monitoring of subcontracting should be conducted, as this recommendation is adopted.

#### 4.3 Forecast of informal sector in the Region

In this subsection, the number of persons engaged, gross earnings and output obtained in the informal sector in the Region are estimated for 1985 and 2005. The data utilized for the estimate and forecast are as follows:

(a)	GDP, consumer price	.. Economic Survey, Statistical Abstract
(b)	Labour productivity	.. Nairobi's Informal Sector Survey
(c)	Informal sector employment, gross earning	.. Survey on Informal Sector, Report of the Presidential Committee on Unemployment 1982/83

The survey on informal sector conducted annually by CBS covers the informal sector enterprises in all towns having a population of 2,000 or more and a number of trading centers, but does not include the enterprises in rural areas. The activities of the enterprises in rural areas may be relatively small since about 70% of the activities of the informal sector on the employment base are in the trade and restaurants subsector, which is difficult to stand in the rural areas.

The following premises are adopted due to the lack of the data for the consistent and detailed estimate and forecast:

(1) The gross value added ratio of the informal sector as a whole is estimated to be 68% in 1977, based on the data of (b) and (c) above. The ratio is assumed to be constant over time and the same for all the three subsectors of the informal sector (manufacturing, trade and catering, service including transportation) and also between regions.

(2) The following annual rates of increase in labour productivity in the subsectors are also assumed.

For manufacturing subsector 1% per year

For trade and catering, and service subsectors 0.5% per year

These rates are lower than those assumed in the Sessional Paper No. 1 of 1986 (1.3% per year), mainly because the informal sector is the most labour-intensive industry and it needs more efforts to raise the labour productivity than that in the capital - intensive industry.

(3) An annual growth rate is common to the three subsectors. As a result, the shares of the subsectors in the informal sector remain unchanged over time.

(4) The informal sector in the Region has not an export capability of their commodities and the market is limited within the Region. Based on the characteristic that the commodities and services produced by the informal sector are mostly for the low income households and the policy to create Rural Trade and Production Centers, the market is regarded to be limited within a district in the Region.

The market can be divided into two kinds: the market for the existing goods and service provided by the informal sector whose expansion in future is dependent on the increase of income in the Region, and a newly created market for goods and services different in quality from the existing ones. The new market will be created by the policies discussed in previous subsection such as increased public purchase and subcontracting, through a change in the demand structure in compliance with the increase in income and through a severe competition in the supply side which will be brought about by the newcomers with higher technology.

The development of the two kinds of markets can be expressed in terms of elasticity of the demand for the goods and services to the increase in income within the Region. The elasticity must be larger than 1.0, the part above 1.0 corresponding to the development of the newly created market. The elasticity can be estimated for the past and will be assumed in future, based on the data and analyses described in the previous subsections as follows.

### Income elasticity of demand for the informal sector

1977-1981	3.56	(estimated)
1981-1985	2.00	(adopted)
1985-2005	1.20	(adopted)

The estimated elasticity of 3.56 for the period of 1979-1981 based on the data is surprisingly and abnormally high. It can be judged that the slow growth in the formal modern sector for the period caused mainly by the second oil crisis forced the informal sector to expand. The elasticity is decreasing over time from 3.56 for 1979-1981 to 1.20 for 1985-2005. This reflects first that the high and abnormal elasticity observed for the period of 1979-1981 will not be held in future and secondly that the market will be gradually invaded by the formal sector as the market becomes larger in proportion to the increase of income.

The first step of forecasting is to estimate the persons engaged, gross earnings and output by subsectors (manufacturing, trade and catering, services) at the levels both of the nation and the Region in 1985. This work is required because in spite of different kinds of data sources described before, no data are available for 1985. The second step is to make forecast for the year 2005 based on the values estimated for 1985 and the premises discussed above. The estimate and forecast for 1985 and 2005 are summarized in Table A.7.

The number of persons engaged in the informal sector in the Region are estimated to be 35,060 in 1985, about 1% of the total labour force in the Region, and forecasted to become 148,670, a little more than 2% of the labour force in 2005.

**Table A.7**      **Gross Earnings, Output and Persons Engaged by Subsector in the Informal Sector in 1985 and in 2005**

(a)      **Gross Earnings (million K£, at 1985 constant price)**

Year	Subsector	Kenya		The LBDA Region		Annual growth rate (%)
		Value (A)	Share %	Value (B)	(B)/(A) (%)	
1985	Manufac- turing	27.5	9.5	3.7	13.3	7.6
	Trade & catering	236.6	81.8	40.7	17.2	84.2
	Service	25.2	8.7	4.0	15.7	8.2
	Total	289.2	100.0	48.3	16.7	100.0
2005	Manufac- turing			17.3		8.1
	Trade & catering			193.2		8.1
	Service			18.8		8.1
	Total			229.3		8.1

(b) Output (million K£, at 1985 constant price)

Year	Subsector	Kenya		The LBDA Region			Annual Growth Rate (%)
		Value (A)	Share %	Value (B)	(B)/(A) (%)		
1985	Manufacturing	40.4	9.5	5.4	13.3	7.6	
	Trade & catering Service	347.9	81.8	59.8	17.2	84.2	
		37.0	8.7	5.8	15.7	8.2	
	Total	425.3	100.0	71.0	16.7	100.0	
2005	Manufacturing			25.5		7.6	8.1
	Trading & catering Service			284.1		84.2	8.1
				27.6		8.2	8.1
	Total			337.2		100.0	8.1

(c) Persons Engaged

Year	Subsector	Kenya		The LBDA Region			Annual Growth Rate (%)
		Person Engaged (A)	Share (%)	Person Engaged (B)	(B)/(A) (%)		
1985	Manufacturing	35,130	16.4	4,670	13.3	13.3	
	Trade & catering Service	151,440	70.7	26,050	17.2	74.3	
		27,630	12.9	4,340	15.7	12.4	
	Total	214,200	100.0	35,060	16.4	100.0	
2005	Manufacturing			18,140		12.2	7.0
	Trade & catering Service			111,890		75.3	7.6
				18,640		12.5	7.6
	Total			148,670		100.0	7.5

5. Recommendation

There are three separate opinions on the development possibility of the informal sector in future: first, a rather optimistic opinion as represented by the "Nairobi's Informal Sector" survey, second, a pessimistic one asserting that the informal sector is incapable of expanding in an evolutionary manner because it is exploited by the formal sector which buys from it at very low prices and sells to it at high prices, and third, an opinion from the standpoint of the national policy, as expressed in the "Sessional Paper No. 1 of 1986",

expressing that the informal sector should be developed though there are many problems to be solved. This in turn implies that it is not easy to develop the informal sector.

It is recommended that the suitable public agency prepare and maintain a ledger (inventory) of all the informal sector enterprises in the Region, and collect and analyze the information on the market and disseminate the information to the informal sector enterprises. The former is indispensable for the general policy making on the sector and is very useful for enhancing the subcontracting; and the latter is essential for the informal sector enterprises which need the information on directions of changes in the market under the expected situation of severe competition to be caused by the newcomers and the pressure from the formal and modern sector.

## **Chapter 5 MINERAL RESOURCES**

**This chapter presents the results of the sector study on mineral resources, conducted as a part of the Integrated Regional Development Master Plan study for the Lake Basin region. Objectives of the study have been:**

**to examine present development conditions of the mining sector,  
to evaluate development potentials of mineral resources, and  
to prepare a programme for mining development.**

**The study has been carried out, based in principle on existing available reports and data, supplemented by field reconnaissance to past, existing and prospective development sites.**

**The present development conditions are described in Section 5.1 covering mining policies, activities, existing plans, past and on-going studies and constraints to development. Development potentials for mineral resources of the Region are described in Section 5.2, considering not only the mineral occurrence but also their uses in consideration of demand and prices, quality, treatment and other conditions. Finally in Section 5.3, necessary actions for mining development are recommended.**





## Chapter 5 MINERAL RESOURCES

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## 5.1 Present Development Conditions

### (1) Policies

#### National policies

The search for and exploitation of minerals in Kenya is governed mainly by the Mining Act (CAP 306, Laws of Kenya). This Act invests in the Commissioner of Mines and Geology all the powers relating to the search for and exploitation of mineral resources in the country.

The overall goal in mineral resources development as stated in the Development Plan 1984-88 is to maximise the benefit accruing from exploitation through systematic exploration and exploitation. The Government's policy is to streamline the laws and provide with the necessary incentives for attracting investment in the mineral resources sector.

Specifically, the Government will conduct revision of geological mapping to 1:50,000 scale to cover those areas previously mapped at reconnaissance level. Evaluation of both metallic and non-metallic minerals will be done with particular emphasis on copper, lead, gold, nickel and iron. Mineral inventory reports will also be compiled.

#### Regional policies

The Lake Basin Development Authority has outlined its policies in this sector for the plan period 1983-1988 as follows:

- (i) to accelerate the geological activities to identify economically advantageous deposits;
- (ii) to improve and co-ordinate prospecting activities aimed at exploring possibilities of rehabilitating old (abandoned) mines and to develop new mining enterprises in the area; and
- (iii) to co-ordinate exploration activities of mineral resources.

### (2) Mineral occurrence in the Region

Many minerals have been recorded to occur within the Region. These include both metallics and non-metallics, namely: apatite, graphite, ilmenite, carbonatite, copper, gold, radioactives, rare earths, iron, limestone, silver, and soapstone. Many of the occurrence have never been investigated in detail. However, gold has been extensively mined but mostly on a small scale. The general mineral occurrence is indicated in Figure 5.1.

Dimension stone, sand and rocks for ballast occur in various parts of the Region. Quartz sand is abundant in streams traversing granitic terrains in Kakamega, South Nyanza, Uasin Gishu and Bungoma districts. Tuffs and agglomerates associated with Tertiary volcanics and thermally metamorphosed sediments near carbonatite centre suitable for dressed stone occur around the slopes of Mt. Elgon, at Kedowa in the Nyanza rift and the south of Kendu Bay. Basalt and phonolite suitable for ballast occur near Turbo, Kisumu, Awasi and Nyakach plateau.

### **(3) Mineral production in the past and at present**

Mineral production in Kenya in recent years is summarized in Table 5.1. At present, two mineral products from the Rift Valley Province, viz. soda ash and fluoride, are important export products. In the past, many other minerals such as gold, silver, copper, diatomite were produced as shown in Table 5.2. Gold, silver and copper were produced mainly from the Authority's area.

Mining companies started gold exploitation in the Region in the early 1930's. In the peak year of 1938, the Region produced 3,000 kg of gold, and there were more than fifty mills treating the gold ores.

Gold mining declined during the second world war. Adverse factors of rusted machines, low prices of products, lack of manpower after the war eroded the industry and almost all mines ceased their operations by 1950. The biggest gold producing mine, Rosterman Mine, located to the south - west of Kakamega district terminated its operation in 1951. Gold continued to be produced in the Region as a by-product of the Macalder Copper Mine.

Copper mining started at the Macalder Mine in South Nyanza in 1951. The mine had originally been worked for gold. The mine continued operation after the war, but underground workings ceased their operation in 1966 and the mine was finally closed in 1969. This mine was the sole producer of copper in Kenya. Silver was also recovered at Macalder. The Macalder Mine area is presently under a 21-year mining lease to Uniafro Ores Limited.

At present, only two mining companies are in operation in the Region. They are the Homa Lime Co., Ltd. and the San Martin Mining Research and Investment Co., Ltd. as explained below.

#### **Homa Lime Co., Ltd.**

The Homa Lime Co., Ltd. started its operation in 1939 at Homa Bay based on the limestone deposits there, but moved to the present location at Koru in 1951. Limestone cobbles and boulders in the weathered zone of a Tertiary limestone bed are mined by bulldozers and manpower without blasting at quarries. The mined ores are hauled by 7-ton lorries to a plant and treated by the following process:

Calcination in kilns → Crushing → Hydration → Drying → Separation.

One or two out of three kilns are operated at present, producing slaked lime at a rate of 30 tons/day per kiln. The produced slaked lime is used for sugar plants, road construction, building works, tanning and others, and partly exported to Uganda.

#### **San Martin Mining Research and Investment Co., Ltd.**

The San Martin Mining Research and Investment Co., Ltd. started its operation in 1983. Ore deposit of gold bearing quartz vein type is mined by open pit shaft sinking at Ramba,

Siaya. The mined ores are treated at a mill located on the shore of the Lake at Asembo Bay. The treatment process is by the gravity method as follows:

Crusher → Ball mill → Cyclone → Jigger → Shaking table → (Concentration)

The original plan to combine this with a cyanidation process has been suspended due to the hazardous effects associated with the use of cyanide. The capacity of the mill is more than 100 tons/day, but at present about 20 tons/day are treated by some 20 labourers.

In addition, gold operation on an artisanal villager level is widespread in Kakamega, Siaya and South Nyanza districts. Resources to this kind of operation are wasted materials of old mining operations, near surface parts of gold bearing quartz veins and placer gold deposits in rivers. The exact magnitude of the activity is difficult to estimate as no record is kept due to its illegal character, but it seems to be an important cash earning occupation for the people involved. It is estimated that between five to ten thousand people are engaged in the artisanal gold operations.

Uniafro Ores Ltd. which owns the Macalder Mine is not carrying out any visible mining activity at present.

#### (4) Past and on-going studies and plans

The Mines and Geological Department has been carrying out since 1932 general reconnaissance, geological surveys, airborne and ground geophysical surveys and detailed geochemical and drilling programmes in the Region. The results of these surveys have been published in the forms of reports, bulletins, memoirs and internal reports. They are of varying quality and cover most of the Lake Basin region. Some of the reports related to the Region are listed in Table 5.3.

The Mines and Geological Department with assistance of the United Nations Development Programme carried out a programme aimed at evaluating the gold potential of the whole of Western Kenya in the period of 1964-1971. An airborne geophysical survey of selected target areas 1-5 was conducted by the Mines and Geological Department with Canadian - technical assistance during 1977-79 (Figure 5.2).

Ground follow-up of the area 1 was conducted in 1980 - 83 with the United Nations Revolving Fund for Natural Resources Exploration and in 1978 - 83 with the Canadian Technical Assistance. The United Nations Revolving Fund also carried out diamond drilling in the Oyugis area (1985-1986). All of these studies aimed at locating gold, base metals and diamond. The data, although held confidentially, are available at the Mines and Geological Department, Nairobi. An industrial minerals programme was conducted by the Mines and Geological Department with Finnida (Finnish Aid) assistance during 1981-85. The results are held by the Mines and Geological Department.

The Lake Basin Development Authority has commissioned several studies in the Region. A feasibility study was carried out by Intermediate Technology Consultants on brick and tile development in the Region. A mineral potential inventory of the Lake Basin area was carried out with technical aid from the Netherlands. The Kenya Industrial Research

Development Institute was commissioned and carried out a feasibility study on the utilization of Kisii Stone (soapstone). The Japan Consulting Institute has also done another feasibility study of bricks and tiles industry. Moreover, the Lake Basin Development Authority commissioned a feasibility study on bricks and tiles manufacture in the Region funded by the Italian Government. The contract was carried out by Viginter of Milan, Italy.

#### (5) Constraints to mineral resources development

Most metallic mineral deposits expected in the Region may be exploited by underground mining, which requires large pre-production investment and skilled manpower. Although gold is exploitable on a small scale by near-surface mining, underground mining on a large scale and by modern technology would be required for full utilization of the resource.

Due to risks involved at exploration stage, strong entrepreneurship is indispensable for promoting mining industries, and adequate exploration technology is required to minimize risks. Ore reserves calculation based on adequate exploration is necessary before setting out an operation plan.

The inactivity of metal mining in the Region is mainly due to:

- lack of strong entrepreneurship,
- immature exploration technology,
- lack of incentives to attract investment in mining,
- insufficient investment capital, and
- shortage of skilled underground miners.

For industrial minerals, the inactivity is, in addition to the above, due to:

- lack of local demand,
- lack of efforts to explore uses of minerals, and
- lack of marketing research.

## 5.2 Development Potentials

Based on the uses and the estimated prices, minerals may be divided into those for foreign export and others for domestic industries where they are processed into import substituting products. Taking present industrial level of Kenya into consideration, those minerals which are not for the time being expected to be used domestically in considerable amounts are regarded as potential export products. Those minerals which require a large scale facility or high technology for refining into usable state may be exported as crude materials, even if they are eventually imported as refined materials to be used in Kenya. Minerals used in Kenya, especially those for which exporting as raw materials seems infeasible due to fairly high inland and ocean freight, are classified into raw materials for domestic industries.

Thus all metallic minerals, Kyanite and graphite are considered as potential foreign export materials. Industrial minerals excluding Kyanite and graphite are considered as materials for domestic industries in this study.

## **(1) Minerals for foreign export**

### **Gold**

Gold may be exported in the state of gold bullion. It is relatively simple to refine gold into bullion in small scale plants.

Practically all of the Kenya's gold production in the past, over 30,000 kg in total, came from the Lake Basin region, and it reached an annual production of about 3,000 kg in the peak year of 1938. Data about gold occurrence are abundant in the publications of the Mines and Geological Department and they are well-compiled in the "Mineral Potential Inventory Study of the Lake Basin Development Area (1983)".

Gold bearing quartz veins are the major sources of gold production. They are distributed in the rocks of the Nyanzian and the Kavirondian Systems, especially in those of the Migori Gold Belt and the Kakamega Gold Belt (see Figure 5.1).

Economic quartz veins are usually several hundred meters long along the strike and range in width from a few centimeters to 10 meters thick. Usually they are steeply dipping and occur not alone but in parallel or in more intricate patterns. The gold content of these veins is generally 10 to 20 g/ton but is also often erratically high in bonanza.

Data available do not permit detailed evaluation of gold potential due to lack of information on downward extension of veins. In connection with downward extension, it is noteworthy that the Rosterman mine which had its peak annual production in 1940 with 740 kg made a total production of some 8,000 kg over its life, and underground development was down to 600 meters. It is emphasized that the steady development to depth often leads the mining to a big success even if surface indications are seemingly poor.

Although the Rosterman mine was the largest gold mine in the Region, its operation rate of about 100 tons/day is of minimum scale for modern gold mining. It may be difficult to maintain underground mining structure and cyanidation mill plant properly by the operation rate smaller than 100 tons/day. The shallow mining with amalgamation of old deposits is not recommendable, as it would leave large idle resources.

Generally it is necessary that the ore reserves sufficiently large for ten years operation should be confirmed before entering upon development of the underground gold mine. Therefore, downward exploration by means of diamond drilling to delineate ore reserves is indispensable.

Assuming the past peak production of about 3,000 kg of gold per year, mill head ores of about 700 tons/day are required as the following calculation indicates:

$$\begin{aligned} 700 \text{ tons-ore/day} \times 15 \text{ g-gold/ton of ore} \times 0.85 \text{ (recovery ratio)} \\ \times 350 \text{ (days of year)} = 3,100 \text{ kg-gold/year.} \end{aligned}$$

In case of a medium scale gold mine with operation rate of 700 tons/day, deposits with ore reserves of 2 to 3 million tons are needed; the exploration cost of more than one million US

dollars may be required to delineate the ore reserves. Further, more than ten million US dollars are required to develop a medium scale underground gold mine with a cyanidation mill plant.

In general, exploration for each individual mine has to be carried out by private licence holders, but general reconnaissance should be undertaken by the Government. This is applicable to gold exploration in the Region. The Government agencies concerned (LBDA and/or The Mines and Geological Department) should also take both technical and legal measures which would give an incentive for bringing in private investors to gold exploration in the Region.

### Copper

Copper may be sold to an overseas custom smelter in the state of concentrates. It is not expected that copper concentrates will be collected in a volume sufficient to warrant the establishment of a copper smelter in Kenya.

All of the copper production in the past was from the Macalder Mine in South Nyanza. The mine produced a total of just over 20,000 tons of copper between 1951 and 1969. They ceased operation on exhaustion of economic ore, so it is not recommended to revive the mine on remaining reserves. The deposits of Macalder Mine belong to the type of volcanogenic massive sulfide deposits which are distributed in the green-stone belts in the various parts of the world and known as important copper sources.

There are several minor occurrences of copper other than the Macalder Mine in the Lake Basin region, which are well described in Memoir No. 4 "Copper in Kenya (1964)". None of the known occurrences, however, has yet proved to be of economic value.

In conclusion, so far as available data are concerned, there is only expectation of hidden deposits similar to the deposit of Macalder Mine but not actual showing of economic interest. Therefore exploration works have to be started from a preliminary stage. Judging from geological circumstances, the volcanogenic massive sulfide deposit is the best target for copper exploration in the Region.

Exploration should be carried out along the banded iron formation in the Nyanza system as a key horizon, which is also one of the target horizons for gold exploration. It may be more practical, therefore, to proceed with exploration with interest in both gold and copper.

### Rare earth elements and niobium

Both rare earth minerals and niobium are known to occur in carbonatite of five localities: viz. Rangwe, North Ruri Hill and South Ruri Hill, Wasaki (Sokolo) and Homa Mountain in South Nyanza, and Buru Hill in Kericho (Figure 5.1).

Assay results of carbonatite in the Homa Bay area are quoted in Table 5.4 and summarized below.



Sample	Location	Assay results(%)	
Alvikite*	South rim of Homa Bay Mountain	Rare earth	0.35
		Nb <sub>2</sub> O <sub>5</sub>	0.70
Alvikite	Northwest rim of Homa Mountain	Nb <sub>2</sub> O <sub>5</sub>	0.11
Alvikite	Rangwe	Rare Earth	0.16
		Nb <sub>2</sub> O <sub>5</sub>	0.28
Ferrocarnatite** of North Ruri	Southeast summit	Rare earth	0.50
Ferrocarnatite	West of Homa Mountain	Rare earth	0.75
		CeO <sub>3</sub>	0.55
Ferrocarnatite	North of Homa Mountain.	Nb <sub>2</sub> O <sub>5</sub>	0.12

\* Medium- to fine-grained and light-coloured carbonatite

\*\* Dark-coloured carbonatite containing essential iron bearing carbonate minerals.

The deposit in Buru Hill may be composed of a small carbonatite plug. Chemical analysis of sample ore yielded the following (R.B. Taylor, 1954).

CaO	13.75%
P <sub>2</sub> O <sub>5</sub>	1.45
Rare earth	2.90
ThO <sub>2</sub>	0.10
Nb <sub>2</sub> O <sub>5</sub>	0.50

Reserves of rare earth and niobium and their production in the world are dominated by a few big producing countries as shown in Tables 5.5 and 5.6. Their supplies are handled by a few non-ferrous metal traders having connection with these producers. The markets for these minerals are thus immature, and even the most attractive pyrochlore bearing carbonatite deposit at Mrima in Coast Province has not drawn attention of foreign mining companies. Therefore, an early development of the deposits in the Region, though promising, cannot be recommended, and only a preliminary exploration should be undertaken in the near future.

#### Kyanite and graphite

Both kyanite and graphite have been observed to occur as constituents of kyanite-graphite schist or kyanite-graphite gneiss in the Mozambiquian system. In the LBDA region, graphite was examined in two localities in the Southern Cherangai Hill, Elgeyo Marakwet. They are graphite schists outcropping to the east of Garamoso summit and graphite gneiss on the Sembeywa ridge. Kyanite schist was also located on the southern shoulder of Garamoso. These showings are contained in pelitic to semi-pelitic strata of the Mozambiquian system extending northerly.

The same kind of rocks are exposed on the Loita Hill, Narok where emplacement of kyanite-graphite schists are expected. Before developing these deposits in the Region,

however, it seems reasonable to revive old mines in Kitui and Taita, which were once operated successfully for exports.

## (2) Raw materials for domestic industries

### Materials for ceramics

Materials for ceramic body are composed of clay, quartz, feldspar and carbonate, each of which has a wide variation in properties. Important properties of clay are plasticity, green and dry strength, dry and fired shrinkage, vitrification range and fired colour. These properties depend on constituents of clay and their grain size.

Quartz is used to adjust the plasticity of materials and to prevent cracking caused by drying shrinkage. At high temperature firing, it acts to increase the strength of the finished products. Feldspar acts as a flux and promotes fusion of clay and quartz, and imparts strength and durability to the finished products. It also acts to lower viscosity of materials. Carbonate acts to lower the vitrification temperature but reduces the vitrification range.

Ceramics can be subdivided into earthen ware, soft and hard pottery, stone ware and porcelain. Characteristics and uses of these different kinds of ceramics are summarized in Table 5.7.

Availability of materials for each kind of ceramic is discussed below. Of the materials for earthen ware, gray alluvium and brown soil are suitable for brick making. These materials exist in enormous quantities all over the Region except where is covered by black cotton soil. Five brick yards are already in operation at Kisumu, Solongo (Kakamega), Kapsabet, Sironga (Kisii) and Koderia Forest.

For making soft pottery, gray alluvium is recommended. This material is available in large quantities along streams in the Region. For hard pottery, clay and subordinate quartz, feldspar and carbonate are compounded in various proportion, depending on usage.

Materials for stone ware are mainly clay and quartz. Porcelain is usually made by blending white clay with feldspar and quartz. The clay must have adequate plasticity associated with finer particle clays. When white and finer fraction of Kisii stone and nepheline concentrates are successfully obtained respectively by hydraulic elutriation and floatation of urtite, porcelain products can be made by locally available materials. However, shrinkage and distortion must be kept to a minimum, and electrical properties such as dielectric content are important so that various tests on different mixings will be needed.

Kisii stone is the most sizable clay material available in the Region. It is estimated that 5.8 million tons of ore are available on the largest deposits at Got Chaki and additional ores are expected on three other deposits (Industrial Research and Development Institute, 1985). Assay results show the following ranges for contents of main constituents.

	Range (%)	Average (%)
SiO <sub>2</sub>	46.0-54.1	47.6
Al <sub>2</sub> O <sub>3</sub>	33.0-37.7	36.2
Fe <sub>2</sub> O <sub>3</sub>	0.12-0.67	0.35
MgO	0.05-0.31	0.17
CaO	0.04-0.49	0.18
TiO <sub>2</sub>	1.31-2.50	1.94

These contents meet the quality requirements of clay for ceramics, except the TiO<sub>2</sub> content. However, fired color is not bright enough probably due to TiO<sub>2</sub> content, and plasticity is poor as an inherent nature of kaoline. This titanium content may be removed by means of hydraulic elutriation, which may also be effective for obtaining finer particle size fractions.

Silica stone in the form of giant white quartz veins is expected to be the most unmixed quartz available in the Region. If quartzite in the Kisii series which is embedded on the Kisii stone bed is usable, it is more economical than using the giant white quartz vein.

There is a possibility of emplacement of feldspar deposits of economic nature in the form of pegmatite in the Mozambiquian system, but no occurrence is confirmed in the Region. Rock bodies consisting mainly of nepheline exist at Usaki in Homa Bay area as an important substitute for feldspar. Ore reserves of this kind of nepheline rocks have not been calculated, but seem large enough to be exploited. The nepheline rocks are petrographically named urtite, and are composed of nepheline, wollastonite (another ceramic material) and other minor minerals (Table 5.8). It is expected that nepheline wollastonite can be separated into constituent minerals by means of floatation.

There exists a large limestone deposit at Koru, which will be explained in the next subsection on cement. Another limestone emplacement exists to the southwest of Homa Mountain. Assay results indicate that it may be better in quality than that at Koru, although smaller in quantity.

#### Materials for cement

Cement raw materials are divided into those supplying the lime component (calcareous) the silica component (silicious), the alumina component (argillaceous) and the iron component (ferriferous). These materials are put into a clinker, mixed with gypsum in order to control reaction rate, and then pulverized into finished product. The following raw materials are used to make one ton of standard portland cement.

Calcareous	- limestone	1.25 tons
Silicious	) - clay or pelitic rock	0.25
Argillaceous		
Ferriferous	- ferric oxide	0.03
Gypsum		0.04

Availability of each component is discussed below.

Deposits at Koru are well known limestone source available in the Region. Past estimates of ore reserve vary widely between 4 and 11 million tons. A recent study gives another estimate, including not only high grade ores but also low grade ores according to the following classification of rocks.

Limestone	over 65% $\text{CaCO}_3$ (or 36% $\text{CaO}$ )
Marl	35-65% $\text{CaCO}_3$ (or 20-36% $\text{CaO}$ )
Calcareous	below 35% $\text{CaCO}_3$ (or 20% $\text{CaO}$ )

Estimated ore reserves include low grade limestone and most of marl as well. The results are given as follows.

<u>Koru area</u>	
Walker deposit	36.9 million tons
Villiers-Stuart deposit	16.4
Ruke deposit	12.0
Burton deposit	1.2
Total	66.5 million tons
<u>Songhor area</u>	
Western deposit	7.8 million tons
Southeastern deposit	0.1
Northern deposit	0.1
Total	8.0 million tons

Reserves of Koru limestone are large enough for a small scale cement plant of international standard, catering for Western Kenya; the maximum scale of the plant could be 500,000 tons/year. Songhor limestone, another Tertiary limestone exposed near Songhor road at the foot of Nyando escarpment is difficult to exploit economically due to its limited extent and low calcium contents.

Another important factor affecting the suitability of limestone for manufacturing portland cement is magnesium oxide contents. The maximum content permissible in the limestone is three percent  $\text{MgO}$  so that its content is less than five percent in finished products. The Koru limestone meets this requirement with the  $\text{MgO}$  contents ranging in 0.3-1.0% (Table 5.9).

As another source of limestone, carbonatites in the Homa Bay area are available. Of these types of carbonatites, ferro-carbonatite contains high  $\text{Fe}_2\text{O}_3$  and low  $\text{CaO}$  and thus is unsuitable for making cement (Table 5.4). Alvikite and sovite have 50.8% and 50.1%  $\text{CaO}$  on average, respectively. If high phosphorous parts are avoided in mining, they may be usable for cement materials. However, investigation into valuable minor constituents should be proceeded first, as the best usage of carbonatites is to extract those valuable constituents first and then to use the tailings as limestone source. The carbonatites in the Homa Bay area crop out in four localities, and have sufficiently large reserves to be exploited by open cast, although they are somewhat more difficult to pulverize than sedimentary limestone.

In case that alumina and silica are not present in the limestone in sufficient quantities, it is necessary to add clays or pelitic rocks so that the desired silicates are formed in the cement. For the Koru limestone, it will be most economical to use muddy to silty rocks in the Tertiary sediments as argillaceous and siliceous, or otherwise use weathered pelitic rocks in Mozambiquian or Kavirondian system. Silica deficiency, if exists, may be corrected by mixing sand or sandstone nearby.

For iron materials, "murrum" can be easily obtained and used. Gypsum will have to be brought in from other areas, as there is no showing of its deposit in the areas of limestone.

#### Materials for fertilizer

Of three kinds of fertilizers, nitrogen fertilizer is compounded mainly from ammonia gas which is industrially processed from natural gas or naphtha fraction of oil, and potassic fertilizer occurs in nature as potassic salt such as silvite (KCl). Since there is no indication of existence of natural gas, oil and potassic salt in the Region, only possibility is phosphatic fertilizer which is produced from phosphate rock.

A major source of phosphate is apatite, which is known to be present in carbonatites in the Homa Bay area. However, no primary concentration of apatite in economical grade has been reported. According to the assay results, the maximum content is 5.81%  $P_2O_5$  with the average of 1.34% (Table 5.4). Higher grades over 10% are desirable for making phosphatic fertilizer.

#### Materials for construction

Rocks for ballast and dimension stone occur in various parts of the Region. The best stones for ballast are the Tertiary lavas of phonolites and nephelinites.

At present phonolites are quarried for ballast near Kisumu, Awasi, Turbo near Eldoret and on the Nyakach plateau. The potential for future development of these resources is vast as the deposits are large.

Rocks that are cut into dimension stones for building construction are limited to thermally altered sediments near the Homa carbonatite and to agglomerates and tuffs associated with volcanic centres in the Nyanza rift and around Mt. Elgon. These deposits can be developed further in future.

Rocks occurring in the Region that can be polished into ornamental stones are mainly granites. The granites are generally light to dark brown in colour. Due to the bulky nature of these resources, the best recommended location for an industry processing polished slabs of granite is at Kisian or at KIE Kisumu. The industry will use the rocks occurring on Kisian hill above the railway station. Other localities are in general far from the needed infrastructure except for the occurrence near Bungoma.

### 5.3 Mining Development Plan

#### (1) Objective and basic strategy

The mining sector is not a significant contributor to the Region's economy and will not likely be so in the near future. However, in view of successful operation of gold and copper mining in the past as well as potential resources endowed, this sector cannot be taken lightly in planning a long-term development of the Region. The objective for mining development in the Region may be spelled out as follows:

To promote the mining development in the Region in order to diversify the income- and employment-generating activities and to consolidate the economic structure of the Region.

Under this general objective, distinguishing what can be done in a shorter run and what should be expected in a longer run, the following basic strategy should be taken.

- 1) To establish in a shorter run such mining and related industries that would depend on local/domestic market and readily available raw materials for immediate benefits, including ceramic industry and a cement plant;
- 2) To strengthen the exploration activities for minerals having export potential, such as gold, copper, rare earth and niobium, in order to prepare for the time of their development in a longer run; and
- 3) To take measures to facilitate coordination of exploration activities by related agencies and to encourage private sector participation.

Along the basic strategy, the exploration program for mining development and other related measures have been prepared as presented in the following paragraphs. Phasing of these measures is indicated in Table 5.10.

#### (2) Exploration program

Considering the development status of the Region in general and exploration activities in mining sector in particular, as well as general riskiness involved in mining industry, the development efforts should be concentrated on the most promising minerals in the Region. These are found to be gold and copper, rare earth and niobium minerals, and materials for ceramics and cement.

Sub-surface exploration of gold by means of diamond drilling should be conducted to delineate the downward extension of gold bearing quartz veins, distributed in the rocks of the Nyanzian and the Kavirondian systems (Figure 5.1). Priority should be given to those veins of the Migori Gold Belt and the Kakamega Gold Belt.

Exploration works for copper will have to be started from a preliminary stage, as no known deposit of economic value exists. Judging from geological circumstances, the volcanogenic massive sulfide deposits would be the best targets for exploration. In this case, the

exploration should be carried out along the banded iron formation in the Nyanzian System. As this is one of the targets for gold exploration as described above, it would be more practical to proceed along with more advanced gold exploration.

Rare earth and niobium minerals worth exploration occur in carbonatite of five localities - viz. Rangwe, North and South Ruri Hill, Wasaki (Sokolo) and Homa Mountain in South Nyanza, and Buri Hill in Kericho (Figure 5.1). However, in view of international market situations for these minerals dominated by a few big traders connected with a few giant producing countries, it is advisable to proceed only with preliminary exploration in a short run in order to assess exploitable quantity and quality for future development.

For exploration of minerals for ceramics, the following set of actions should be taken at an early time.

- 1) Comprehensive study for systematic expansion of ceramic industry with a range of products;
- 2) Research for technologies necessary to produce high quality ceramics such as hydraulic elutriation of Kisii stone, refining of nepheline rock by floatation and separation of wollastonite-nepheline rock by floatation; and
- 3) Development of Kisii stone for small-scale pottery production.

These actions will be followed by further exploitation of Kisii stone and development of other related materials for expansion of ceramic manufacturing.

Koru limestone deposits should be exploited for cement production. The carbonatite deposits in Homa Bay area are another raw materials for cement, but they should be developed first for rare earth and niobium minerals as suggested above. The tailings can be used for cement production, if additional raw materials become necessary in the future for the Koru cement plant.

### (3) Other measures

Primarily for promoting gold exploration, the following measures should be taken to give incentives for private investors to enter into the development.

- 1) Establishment of a data bank by compiling detailed data kept in the Mines and Geological Department; and
- 2) Establishment of a technology center with a laboratory for assaying, where technical advices and other services will also be available.

A stronger role of LBDA is also expected for coordinating the activities of private sector and government organizations.

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Table 5.1 Recent Mineral Production of Kenya

Mineral	1981	1982	1983	1984	1985*
<b>Quantities (Tons)</b>					
Soda Ash	157,870	161,310	193,690	226,000	227,760
Fluorspar	90,099	88,726	59,084	50,883	58,174
Salt	27,796	26,823	83,427	49,449	34,348
Limestone Products**	33,063	26,646	34,150	20,855	39,040+
Other	20,052	4,475	41,475	35,818	37,202+
<b>TOTAL</b>	<b>328,880</b>	<b>307,980</b>	<b>411,826</b>	<b>383,005</b>	<b>396,524</b>
<b>Value (1000 K£)</b>					
Soda Ash***	5,884	8,150	7,273	11,836	13,180
Fluorspar***	4,443	5,530	3,099	2,951	3,897
Salt	223	630	2,963	1,481	1,029
Limestone Products	522	353	480	662	1,239+
Other	1,338	1,230	1,738	1,500	1,558+
<b>TOTAL</b>	<b>12,410</b>	<b>15,893</b>	<b>15,553</b>	<b>18,430</b>	<b>20,903</b>

Notes: \* Provisional  
 \*\* Excluding limestone used as input into cement product  
 \*\*\* Export value only  
 + Rough estimates only

Source: Economic Survey 1986

Table 5.2 Records of Mineral Production of Kenya in the Past

		1926-30	1931-35	1936-40	1941-45	1946-50	1951-55
Gold	(kgs)	145	2,277	11,997	7,862	3,679	1,733
Graphite	(long tons)					-	744
Kyanite	(long tons)				-	2,311	27,559
		1956-60	1961-65	1966-70	1971-75	1976-80	1981-84
Asbestos	(long tons)*	249	697	115	-	-	-
Copper	(long tons)	8,255	10,909	983	145	-	-
Diatomite	(long tons)*	10,467	14,494	9,491	7,904	9,742	6,786
Feldspar	(long tons)	-	-	3,514	9,289	4,335	2,142
Fluorspar	(long tons)	-	-	5,925	136,851	399,822	288,792
Gold	(Kgs)	1,455	1,751	2,959	14	18	20
Graphite	(long tons)	3,715	-	-	-	-	-
Kaoline	(long tons)*	3,364	11,397	6,840	1,665	1,984	2,923
Kyanite	(long tons)	3,264	-	-	-	-	-
Limestone**	(long tons)*	57,431	81,476	99,846	144,635	196,921	114,714
Magnesite	(long tons)*	3,330	2,213	1,648	2,380	3,586	244
Salt	(long tons)	-	61,892	206,333	262,614	222,702	187,495
Silver	(kgs)*	3,930	6,774	824	-	-	-
Soda ash	(long tons)*	386,953	528,680	593,232	778,700	798,342	738,870

Notes: \* Data before 1958 are not available and thus not included.

\*\* Excluding material used for cement

Source: Records of the Mines and Geological Department

Table 5.3 Selected Publications of the Mines and Geological Department

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Report

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Memoirs:

- \*4. Sanders, L.D., Copper in Kenya, 1964.
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Note: \* Particularly useful.

Table 5.4 Assay Results of Carbonatites in the Homa Bay Area (1/2)

## ALVINKITES

	N179	N340	MC14	MC12	MC15	MCSK/2	HC629	HF68A	HF500	HF668	NDS5	41/1323	MEAN	SIGMA
SiO <sub>2</sub>	1.71	2.61	0.65	0.34	1.48	0.92	0.16	1.32	0.31	0.19	0.39	0.45	0.88	0.76
TiO <sub>2</sub>	0.27	0.10	0.18	0.09	0.27	0.24	0.07	0.09	0.16	0.16	0.28	0.28	0.18	0.08
Al <sub>2</sub> O <sub>3</sub>	0.55	0.69	0.00	0.32	5.37	1.78	0.17	0.11	0.07	0.08	2.87	4.84	1.40	1.93
Fe <sub>2</sub> O <sub>3</sub>	10.59	3.18	3.78	2.27	3.47	4.53	4.04	2.70	0.98	2.27	1.99	5.89	3.81	2.50
FeO	3.36	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.36	0.98
MnO	0.48	0.47	0.31	0.08	0.37	1.36	0.41	0.39	2.57	0.72	0.00	0.66	0.65	0.70
MgO	0.22	0.89	0.29	0.40	0.62	0.91	0.67	0.03	0.47	0.00	0.00	0.11	0.38	0.33
CaO	46.43	50.58	51.59	53.89	48.79	46.66	51.20	52.00	53.40	52.80	52.59	50.08	50.83	2.46
Na <sub>2</sub> O	0.48	0.72	0.30	0.38	0.27	0.00	0.25	1.73	0.61	0.52	0.19	0.31	0.48	0.44
K <sub>2</sub> O	0.08	0.20	0.00	0.00	0.00	0.00	0.01	0.11	0.08	0.05	0.00	0.00	0.04	0.06
P <sub>2</sub> O <sub>5</sub>	1.73	0.94	1.70	0.90	1.65	3.65	1.52	0.00	0.00	0.00	0.00	0.17	1.02	1.11
CO <sub>2</sub>	32.64	37.92	40.16	41.41	37.74	33.81	39.50	38.10	38.70	37.48	40.31	33.12	37.57	2.90
H <sub>2</sub> O+	0.95	0.84	0.00	0.00	0.00	2.22	0.00	2.88	2.26	4.49	0.00	1.18	1.24	1.45
H <sub>2</sub> O-	0.45	0.76	0.21	0.26	0.32	0.00	0.20	0.00	0.00	0.00	0.29	0.31	0.23	0.23
TOTAL	99.94	99.96	99.17	100.34	100.35	96.08	98.2	99.46	99.61	98.76	98.91	98.24	99.07	

N179	Magnetite-rich Alvikite with Pyrochlore and Apatite. S. End Plateau North Ruri. (520412)
N340	Limonitic Alvikite. Cus Vent Agglomerate, Near Summit North Ruri. (523415)
MC14	Alvikite with Apatite. W. of Summit, North Ruri. Mccall, 1958, P.65. (also BAO 1.05, FE as FE203)
MC12	Alvikite. N. E. Spur, North Ruri. Mccall, 1958, P.65. (FE as FE203)
MC15	Alvikite with Apatite. E. Spur, Summit or South Ruri. Mccall, 1958, P.65. (FE as FE203)
MCSK/2	Alvikite with Apatite. Cave S.W. of Sokolo, Wasaki. Mccall, 1958, P.66. (also BAO 0.54 F 0.39 S03 0.83, FE as FE203)
HC629	Rhomb-Alvikite with Magnetite. S. Rim of Homa Mountain. (662569) (also BAO-SRO 0.48, REE 0.35, NB205 0.70)
HF68A	Non-Porphyritic Alvikite. N.W. Rim of Homa Mountain. (655582) (also SRO 0.38, BAO 0.04, NB205 0.11, FE as FE203)
HF500	Porphyritic Alvikite. N. Rim of Homa Mountain. (665581) (also SRO 0.38, BAO 0.23, FE as FE203)
HF668	Rhomb Alvikite. Nyasanja, N. of Homa Mountain. (676588) (FE as FE203)
NDS5	Alvikite. Nduru, S. of Homa Mountain. Saggerson, 1952, P.81. (FE as FE203)
41/1323	Magnetite-Alvikite. Rangwa, Kisingiri. Mccall, 1958, P.43. (also BAO 0.63, REE 0.16, NB205 0.28, S03 0.32, F 0.07)
MEAN	Derived from Alvikite Analyses Listed

Source: Carbonatite - Nephelinite Volcanis (1977)

Table 5.4 Assay Results of Carbonates in the Homa Bay Area (2/2)

## SOVITES

## FERROCARBONATITES

	N 428	HF509	MCSK/1	N 423	N339	MC18	MCSK/3	MCSK/4	HF15	HF91	HF661	NDS6	SUT35	MEAN	SIGMA
SiO2	3.33	4.86	1.83	2.28	0.34	0.66	0.74	0.89	0.83	5.83	0.43	1.30	1.63	1.49	1.63
TiO2	0.22	0.17	0.20	0.22	0.22	0.36	0.14	0.34	0.07	0.28	0.23	0.23	0.15	0.22	0.09
Al2O3	0.54	0.30	1.33	0.77	0.03	3.21	2.30	1.74	0.65	1.64	0.13	0.05	0.62	1.11	1.07
Fe2O3	4.01	1.71	3.20	7.72	1.19	3.95	7.54	10.04	11.00	8.47	6.68	3.91	9.15	6.97	3.08
FeO	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
MnO	0.20	0.27	0.35	1.12	2.02	0.31	2.71	1.54	5.53	1.23	0.56	0.24	0.53	1.58	1.60
MgO	0.90	0.31	0.71	1.35	0.00	0.59	1.26	1.61	0.36	10.05	0.28	0.16	0.55	1.62	3.01
CaO	49.70	50.45	50.15	47.33	51.53	48.89	44.99	42.58	43.60	35.13	50.00	51.39	47.42	46.29	4.98
Na2O	0.67	1.09	0.00	0.73	0.45	0.41	0.00	0.00	0.05	0.35	0.07	0.97	0.38	0.34	0.33
K2O	0.34	0.17	0.00	0.41	0.13	0.00	0.00	0.00	0.06	1.35	0.06	0.00	0.20	0.22	0.42
P2O5	1.72	1.00	2.31	1.21	0.29	1.70	0.46	5.81	0.42	0.00	0.18	2.90	3.33	1.63	1.87
CO2	34.60	34.84	37.49	33.48	37.13	38.49	34.73	27.72	30.42	24.10	39.74	38.68	35.21	33.97	5.14
H2O+	2.44	1.27	1.26	2.01	0.00	0.00	2.22	2.43	1.56	6.11	0.31	0.00	0.00	1.46	1.92
H2O-	0.27	0.00	0.00	1.23	0.87	0.22	0.00	0.00	0.50	0.00	0.16	0.21	0.00	0.32	0.42
TOTAL	99.97	96.44	98.83	99.86	94.20	98.79	97.09	94.70	95.05	94.54	98.83	100.04	99.18	97.22	

N428 Sovite with Pyrochlore, Apatite and Magnetite. S.W. Spur, North Ruri. (515411)

HF509 Platy Sovite with Aegirine. Near Summit of Homa Mountain. (663576)

MCSK/1 Sovite. W. Foot of Sokolo Hill Wasaki Peninsula. McCall, 1958, P.66. (also BAO 0.28, F 0.20, S03 0.34)

N423 Ferrocarbonate. Rabur Kaboge, W. of North Ruri. (507408) (FE as FE203)

N339 Ferrocarbonate with Yellow Segregations. S.E. Summit of North Ruri. (525414) (also SRO 0.50, BAO 5.00, REE 0.50)

MC18 Ferrocarbonate. Summit of Okuge, N. of North Ruri. McCall, 1958, P.65. (also BAO 1.32, FE as FF203)

MCSK Ferrocarbonate. S.W. Side of Sokolo, Wasaki. McCall, 1958, P.66. (also BAO 1.89, F 0.10, S03 1.31, FE as FE203)

MCSK Ferrocarbonate. NR. Summit E. Hill, Sokolo, Wasaki. McCall, 1958, P.66. (also BAO 2.05 F 0.90 S03 0.99 FE as FE203)

HF15 Ferrocarbonate. NR. Got Bonde W. of Homa Mt. (650585) (SRO 0.09 BAO 1.87 REE 1.75 CE203 0.55 F 0.60 FE as FE203)

HF91 Dolomitic Ferrocarbonate. Nyasanja N. of Homa Mountain. (670595) (also SRO 0.40, BAO 2.00, FE as FE203)

HF661 Ferrocarbonate. Odiaho, N. of Homa Mountain. (679589) also BAO 0.67, NB205 0.12, FE as FE203)

NDS6 Ferrocarbonate. Ndiru, S. of Homa Mountain. (669549) (also BAO 0.62, FE as FE203)

SUT35 Ferrocarbonate. N. Ridge, Toror. Sutherland, 1966, P.138.

MEAN Derived from Ferrocarbonate Analyses Listed.

Table 5.5 Estimated Reserves of Rare Earths and Niobium in the World

(1) Rare earth oxide

Country	Estimated reserve
China	38.0 x 10 <sup>6</sup> tons
USA	5.2
India	2.5
Others	2.0
Total	47.7 x 10 <sup>6</sup> tons

Source: Mineral Commodity Summaries, 1985

(2) Niobium

Country	Estimated reserve
Brazil	3,170 x 10 <sup>3</sup> tons
USSR	670
Canada	120
Others	100
Total	4,060 x 10 <sup>3</sup> tons

Source: Mineral Facts and Problem, 1985

Table 5.6 World Production of Rare Earths and Niobium

(1) Rare earth oxide

Country	Production in 1984
USA	15,400 tons
Austraria	7,100
China	5,400
Others	4,730
Total	32,630 tons

Source: Mineral Commodity Summaries, 1985

(2) Niobium

Country	Production in 1983
Brazil	6,820 tons
Canada	1,280
Thailand	90
Others *	150
Total *	8,340 tons

Note: \* Excluding the communist bloc

Source: Mineral Yearbook Vol. I, 1983

Table 5.7 Classification of Ceramics with Properties and Uses

Class	Basic ingredients	Firing temperature	Products	Properties
1 Earthen ware	Clayey earth	800°C	Brick, Water jar, Flower pot	Coloured, Porous
2 Soft pottery	Clay (coloured)	1000-1200 °C	Roofing tile, Table ware	Coloured High absorption
3 Hard pottery	Clay (usually white), Quartz, Feldspar, Carbonate	1000-1200°C	Sanitation fixture Table ware, Wall tile	White Opaque Absorption below 10%
4 Stone ware	Clay (coloured), Quartz	1200-1300°C	Potter pipe, Floor tile, Facing tile, Acid-proof bottle	Coloured Opaque Absorption 0-3%
5 Porcelain	White clay, Quartz Feldspar		Table ware, Insulator, Facing tile, Chemical apparatus	White Translucent Non-absorption

Table 5.8 Assay Results and Modes of Urtite in Usaki

Assay Results	U1111 %	U 211 %	U1054 %	U 224 %	U 78 %
SiO <sub>2</sub>	43.64	42.80	43.11	45.24	47.23
TiO <sub>2</sub>	0.00	0.52	0.13	0.14	0.19
Al <sub>2</sub> O <sub>3</sub>	23.15	19.47	21.72	17.26	12.52
Fe <sub>2</sub> O <sub>3</sub>	1.40	3.24	1.54	1.73	2.35
FeO	0.70	2.18	0.73	0.40	0.20
MnO	0.16	0.15	0.18	0.14	0.19
MgO	0.96	2.61	0.19	1.52	0.63
CaO	9.42	13.30	15.74	15.90	20.28
Na <sub>2</sub> O	12.00	9.35	9.95	11.05	9.22
K <sub>2</sub> O	5.30	4.01	4.73	4.33	4.45
P <sub>2</sub> O <sub>5</sub>	0.08	0.36	0.41	0.12	0.16
CO <sub>2</sub>	0.57	1.00	0.59	0.81	0.58
H <sub>2</sub> O+	1.45	0.77	0.75	1.06	1.80
H <sub>2</sub> O-	0.12	0.13	0.18	0.07	0.08
<b>Total</b>	<b>98.95</b>	<b>99.89</b>	<b>99.95</b>	<b>99.77</b>	<b>99.88</b>
<b>Mode</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>	<b>%</b>
Nepheline	78	66	65	54	68
Aegirine-augite	3	14	3	2	1
Melanite	-	2	1	trace	-
Wollastonite	7	14	26	33	16
Pectolite	9	3	4	11	9
Apatite	2	tr	1	-	2
Calcite	1	1	-	trace	4

Notes: U1111 Urtite. Chilled margin. Otaragoge, Usaki  
 U 211 Wollastonite-urtite with few pyroxene bands. Nyakoya, Usaki  
 U1054 Wollastonite-urtite. Waiga school hill, Usaki  
 U 224 Wollastonite-urtite. Otaragoge, Usaki  
 U 78 Pegmatitic wollastonite-urtite. Otaragoge, Usaki.

Source: Carbonatite-Nephelinite Volcanism, (1977)



Table 5.9 Assay Results of Kōru Limestone

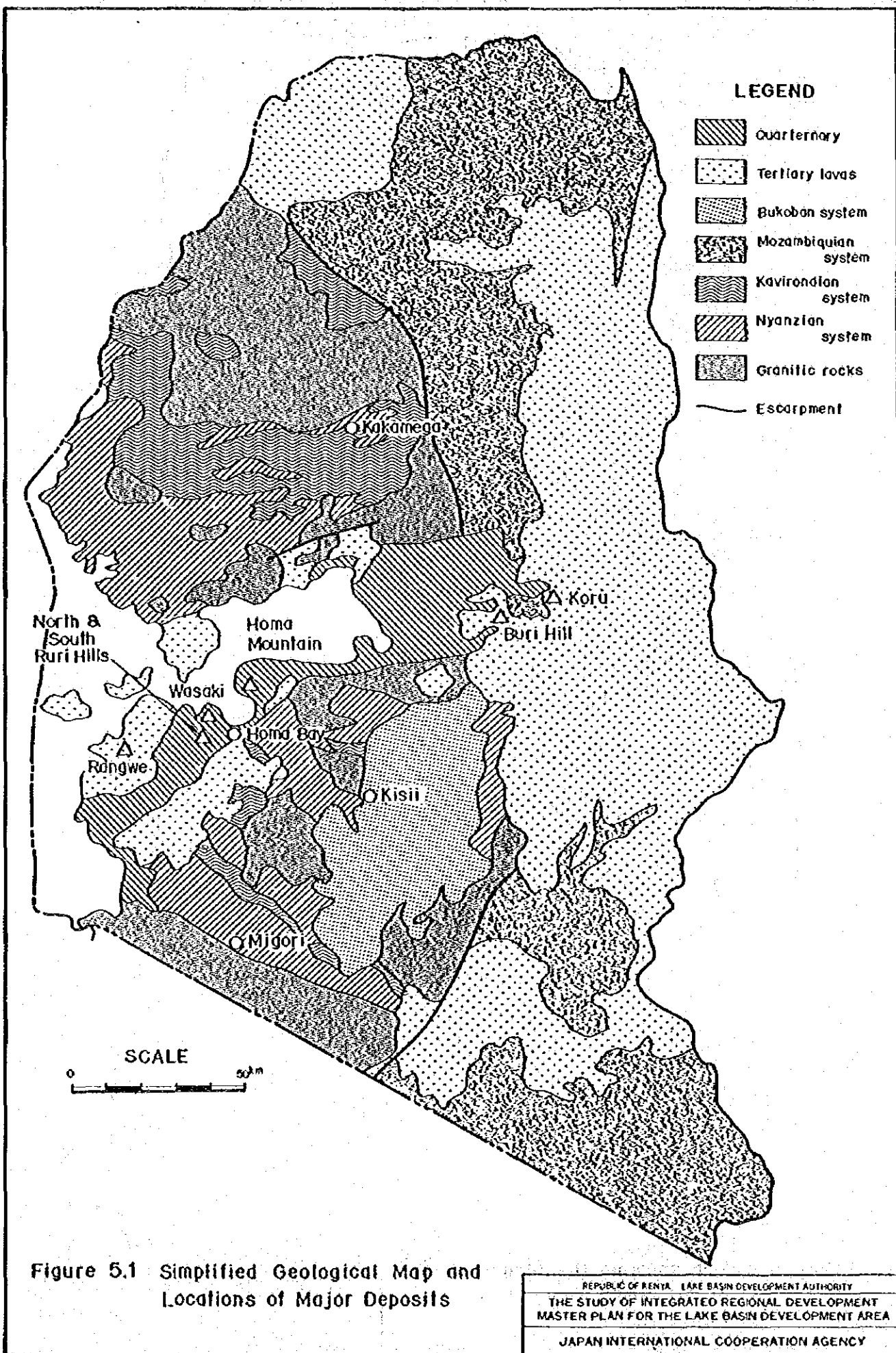
	1	2-A	2-B	3	4-A	4-B	4-C
	%	%	%	%	%	%	%
SiO <sub>2</sub>	1.74	1.41	2.23	2.16	7.0	2.3	1.0
Al <sub>2</sub> O <sub>3</sub>	3.50	3.42	3.66	2.04	2.2	0.7	0.3
Fe <sub>2</sub> O <sub>3</sub>	2.50	1.78	3.58	2.79	3.7	4.3	1.8
CaO	50.55	51.31	49.39	49.88	45.6	49.9	52.4
MgO	0.34	0.31	0.37	0.46	0.8	0.4	0.3
Loss Ign	39.89	40.32	39.24	38.65			
Balance	1.48	1.45	1.53	4.02			
Total	100.0	100.0	100.0	100.0			
CaCO <sub>3</sub>	90.27	91.62	88.20	89.07	81.4	89.1	93.6

Notes: 1 East African Portland Cement Co. (1940) Average of 15 samples  
 2-A Hitchen (1940) Average, Villiers-Stuart  
 2-B " Average, Walker  
 3 Pooley (1946) Average of 2 assay results  
 4-A Barnstone (1971) Average of 5 samples, Villiers-Stuart  
 4-B " Average of 5 samples, Walker  
 4-C " 1 sample, Ruke

Source: A Preliminary Report on a Proposal for Cement Manufacture at Kōru, Western Kenya. (1978).

Table 5.10 Phasing of Mining Sector Development

	Exploration and development	Other measures
Phase 1 -1993	<ul style="list-style-type: none"> <li>Comprehensive study for systematic expansion of ceramics industry</li> <li>Development of Kisii stone for small-scale pottery production</li> <li>Preliminary exploration of rare earth and niobium minerals</li> <li>Start of sub-surface exploration of gold veins by means of diamond drilling</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of a data bank by compiling detailed data held by the Mines and Geological Department</li> </ul>
Phase 2 1993-2000	<ul style="list-style-type: none"> <li>Exploitation of Koru limestone deposits for cement production</li> <li>Further development of Kisii stone and other materials for expansion of ceramics industry</li> <li>Further exploration of gold veins and carbonatite</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of a mining technology center with a laboratory for assaying</li> <li>Research for technologies to produce high quality ceramics</li> </ul>
Phase 3 2000-	<ul style="list-style-type: none"> <li>Development of carbonatite in Homa Bay area</li> <li>Expansion of the cement plant at Koru</li> </ul>	



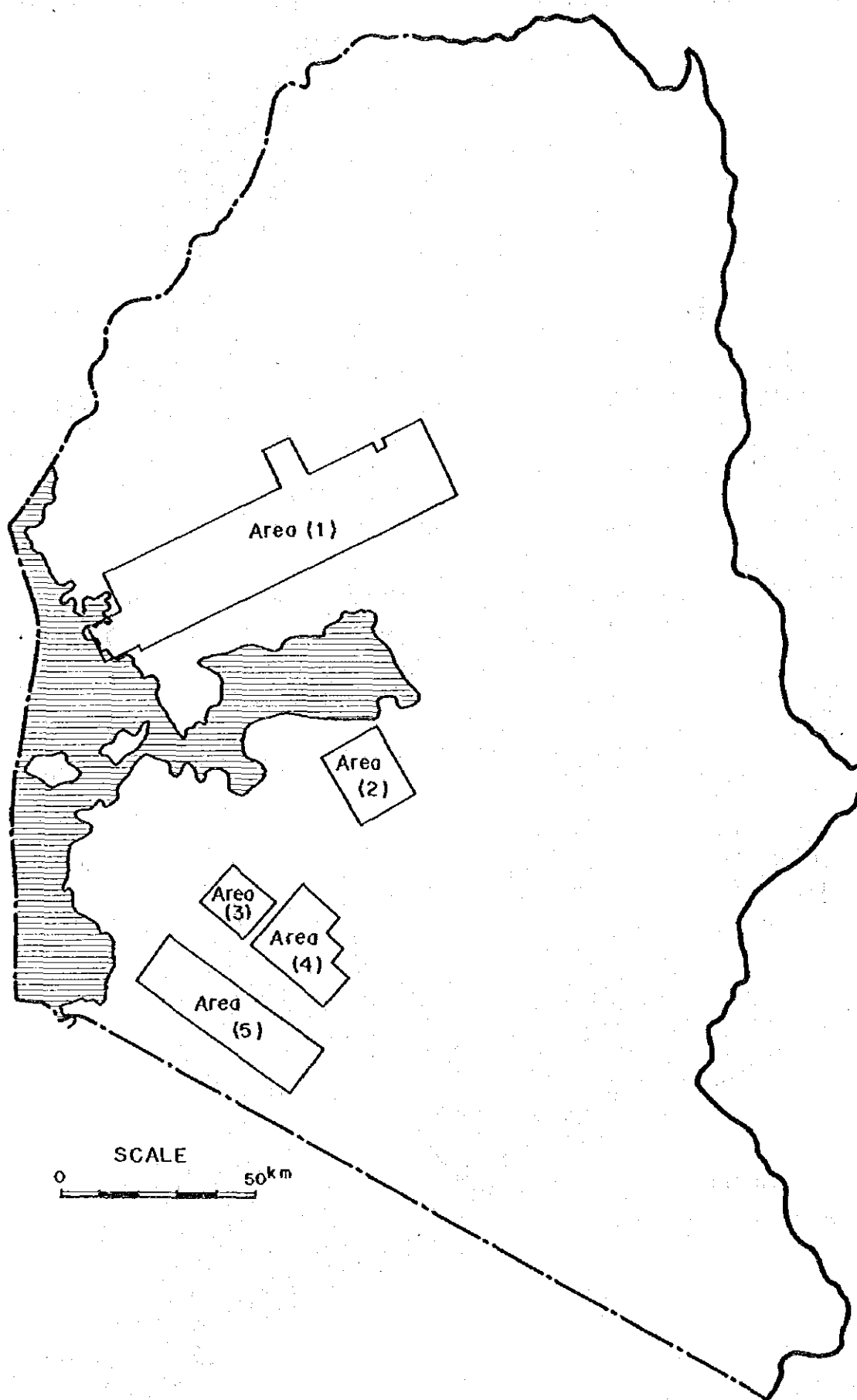


Figure 5.2 Map showing the Target Area of Air borne Geological Surveys

REPUBLIC OF KENYA LAKE BASIN DEVELOPMENT AUTHORITY
THE STUDY OF INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE LAKE BASIN DEVELOPMENT AREA
JAPAN INTERNATIONAL COOPERATION AGENCY

## **Chapter 6 TOURISM**

**As a part of the Integrated Regional Development Master Plan study for the LBDA region, a sector study of the tourism has been carried out. The results, including the tourism sector development plan, have been coordinated with the overall Master Plan and are presented in this chapter.**

**In Section 6.1, existing conditions of tourism in Kenya and in the Region are described. Development potentials are examined in Section 6.2. Targets for tourism development are also set with respect to the value-added, number of hotel beds and employment opportunities. Section 6.3 presents the tourism development plan, consisting of the objective and strategies, projects and other measures. Phasing of implementation is also clarified. Throughout this chapter, particular attention is directed to wildlife conservation and management, which are strongly related to the tourism development.**



## Chapter 6 TOURISM

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## **6.1 Existing Development Conditions**

### **(1) Policy for tourism development**

#### **National policy**

In recent years, the Government has pursued an active policy of involvement in all aspects of the tourism industry, including planning and policy formulation, the setting up of hotel standards, the provision of infrastructure, direct participation in development of hotels and other facilities, and promotion of Kenyanization of this industry. Investments in infrastructure like the new Jomo Kenyatta International Airport, Moi International Airport (Mombasa) and improvement of several airstrips and road networks have greatly improved both the comfort and speed of travel between tourist centres and the year-round accessibility of tourist attractions. Efforts will be made to double by 1988 the number of foreign tourists from 362,000 in 1982. The total bednights will be increased from 4.6 million to 6.2 million in 1988. The total bed capacity including bed-nights attributable to residents is expected to increase by about 9.9%. Kenya Tourism Development Authority (KTDA) is expected to generate about 5% of the total bed capacity, the private sector generating the rest.

#### **Regional policy**

Emphasis of tourism development on regional level will be given to the promotion of domestic tourism through the Ministry of Tourism and Wildlife and its associated parastatal organization of Kenya Tourist Development Corporation and other regional development authorities.

The current five-year development plan of the LBDA region clarifies the roles of the Authority for tourism development in the Region as follows.

- 1) To collaborate with the Ministry of Tourism and the District Development Committees in the Region;
- 2) To promote the extension of road network in conjunction with the Ministry of Transport and Communication; and
- 3) To prepare a tourism development plan for the Region.

As more specific measures to be taken for promoting tourism in the Region, the following are included in the plan:

- 1) development of cultural centres,
- 2) extension of tourism road system,
- 3) expansion of Sunset hotel and improvement of Homa Bay hotel and other hotels and lodges,
- 4) improvement of infrastructure for Ruma and Kakamega National Parks and all other parks, reserves and sanctuaries,
- 5) establishment of Lake Victoria cruise, and floating hotels, and
- 6) encouragement of sport fishing and water recreation facilities.

## **(2) Policy for wildlife conservation**

### **National policy**

The overall goal in wildlife conservation as stated in the Sessional Paper No. 3 of 1975, and the Wildlife Act Chapter 376, is to optimize the returns from this resource, taking account of returns from other forms of land use. The returns include not only the economic gains from tourism and from consumptive uses of wildlife, but also intangibles such as the aesthetic, cultural, and scientific gains from conservation of habitats and the fauna within them.

On 7.6 per cent of Kenya's area, exclusive wildlife use promises the highest returns not only through supporting the tourist industry which generates enormous foreign exchange resources, but also by maintaining examples of the main types of habitats found in this country. To ensure these returns, the Government declares such areas National Parks, Reserves and Sanctuaries, or supports the creation of Country Council National Reserves. It also allocates the resources of funds and personnel necessary to ensure that their potentials are achieved.

### **Regional policy**

At regional level, the Government undertakes appropriate measures to ensure that a wider range of representatives of the fauna and flora are included within the National Park/Reserve system. In order to encourage further expansion of tourism, more areas will be considered for inclusion in the present National Park/Reserve system.

The LBDA policy includes the following:

- 1) To encourage effective protection of the existing parks/reserves in the Region.
- 2) To develop and improve the existing parks/reserves so as to attract more tourists not only to earn the country the vital foreign exchange resources, but also to stimulate the growth of other economic activities such as agriculture, industry and infrastructural development in the Region.
- 3) To consider more areas of various natural uniqueness for inclusion in the present park/reserve system in the Region.

In order to achieve the above objectives the LBDA should strive to collaborate with the following institutions:

- i) The Ministry of Tourism and Wildlife, Wildlife Conservation and Management (Wildlife Planning Unit)
- ii) Kenya Tourist Development Corporation
- iii) African Tours and Hotels Limited
- iv) County Councils in the Region

### (3) Tourism activities

#### Tourism activities in Kenya

Tourism earnings in Kenya were K£209 million in 1985. Assuming value added ratio of tourism sector to be 50%, the value added from tourism sector calculated at K£105 million is equivalent to 2.2% of GDP. The amount of K£209 million in foreign currencies is almost equivalent to that realised by coffee export which brings the largest income of commodity export (K£231 million in 1985).

In 1985, 472,200 holiday/business visitors arrived in Kenya. Almost all the visitors arrived in and left Kenya by aircraft. The average days of stay for holiday/business visitors were 17 days in 1985. They spent an average of Kshs.8,852 per person in total or Kshs.521 per person per day in 1985. Most tourists are from Europe and the United States, those from West Germany, United Kingdom, United States and Switzerland accounting for over 50%.

Well over 80% of all bed-nights occupied in recent years are either in Nairobi or coastal hotels. Out of the total 4.0 million bed-nights occupied by foreign residents in 1985, 31% were spent in hotels in the Nairobi area, while 54% were spent in coastal hotels. The distribution of hotel occupancy by foreigners is summarized in the following table.

Area	Thousands of bed-nights occupied by foreign residents in 1985
1. Coast	2,157.8
2. Nairobi	1,235.2
3. National Parks and Reserves	454.4

(Source: Economic Survey 1986)

The number of visitors to selected museums, scenic and historic sites are as follows.

Place	Number of visitors in 1985 (1,000)
National Museum (Main gate)	194.4
National Museum (Snake Park)	177.0
Fort Jesus (Mombasa)	171.0
Kisumu Museum	48.6
Kitale Museum	20.6

(Source: Economic Survey 1986)

Five largest national parks in Kenya plus selected parks in the Region and the number of visitors to each are summarized below.