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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

INDUSTRIAL DEVELOPMENT REVIEW SERIES

KENYA

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PREFACE

This Industrial Development Review of Kenya is part of a series aimed at strengthening the "country focus" of UNIDO activities. Within the framework of the work programme of the ???Industrial Development Reviews Branch of UNIDO, which monitors the international industrialization process, the reviews provide a survey and analysis of each county's industrial development achievements. The Reviews are intended to provide a service to those within UNIDO and other international agencies concerned with industrial policy, planning, project development and implementation, and to be a ready source of information for governments, investors, industrialists, entrepreneurs, policy makers, international organizations, aid agencies, academics and research institutes.

The Reviews have two separate but interrelated objectives: they are designed to facilitate and promote activities of UNIDO, as well as to serve as an informative and analytical document for the international industrial community. The analyses contained in the Reviews are intended to support the technical assistance programming for industry by providing specific analysis which may serve as an input to programming activities and as a basis for informed discussions. The Reviews are also designed to accommodate the needs of a wide readership in the international community associated with industry, finance, trade, business, research and government, laying the groundwork for undertaking in-depth analyses of specific aspects of industrial development trends, policies and strategies.

This Review comprises three Chapters. Chapter I presents and overview of the economy of Kenya and analyses the economic policy environment. The structure and performance of the manufacturing sector are analyses in Chapter II with particular reference to growth and structural change, employment, productivity, ownership, location, environmental impact and trade. Chapter III examines the performance and prospects of key industrial branches. Data on macroeconomic and industrial trends are presented in Annex A, and a list of major organizations and associations supporting industrial development in Kenya are provided in Annex B.

This Review is based on information available as of November 1995.

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Dates divided by a slash (1991/92) indicate a fiscal year or a crop year. Dates separated by a hyphen (1991-92) indicate the full period, including the beginning and end years.

In Tables:
Totals may not add precisely because of rounding.
Two dots (..) indicate that data are not available or not separately reported.
A dash (-) indicates that the value is nil or negligible.

The following abbreviations are used in this publication:

AEF	Africa Enterprise Fund
APDF	African Project Development Facility
ASALs	arid and semi-arid lands
AVA	Associated Vehicle Assemblers
BAT	British American Tobacco Company Kenya
BP	British Petroleum
BPCC	Bamburi Portland Cement Company Limited
CAN	calcium ammonium nitrate
CBK	Central Bank of Kenya
CBU	completely built up
CKD	completely knocked down
CMA	Capital Markets Authority
COMESA	Common Market for Eastern and Southern Africa
DAP	diammonium phosphate
DDF	District Development Fund
DEG	German Development Bank
DFCK	Development Finance Company of Kenya
DFS	District Focus Strategy
DGIPE	Department of Government Investments and Public Enterprises
EACC	East African Cooperational Council
EADB	East African Development Bank
EAPCC	East African Portland Cement Company
EDESA	Economic Development for Equatorial and Southern Africa
EPC	Export Promotion Council
EPZs	Export Processing Zones
EPZA	EPZ Authority
ESTU	Executive Secretariat and Technical Unit
EU	European Union
FIPA	Foreign Investment Protection Act
FKE	Federation of Kenya Employers
FMO	Netherlands Overseas Finance Company
GDP	gross domestic product
GM	General Motors Ltd
GNP	gross national product
HCDA	Horticultural Crops Development Authority
ICDC	Industrial and Commercial Development Corporation
ICSID	International Centre for the Settlement of Investment Disputes
IDB	Industrial Development Bank
IFC	International Finance Corporation
IMF	International Monetary Fund
IPC	Investment Promotion Centre
IPO	public offering
IPS	Industrial Promotion Services Ltd.
ISD	international and subscriber dialling

JCI	Japan Consulting Institute
KAM	Kenya Association of Manufacturers
KCB	Kenya Commercial Bank
KCC	Kenya Cooperative Creameries
KEAS	Kenya Exporters Assistance Scheme
KEDS	Kenya Exporter Development Support
KIE	Kenya Industrial Estates
KIRDI	Kenya Industrial Research and Development Institute
KMC	Kenya Micro Computer
KNCCI	Kenya National Chamber of Commerce and Industry
KPC	Kenya Pipeline Company
KPR	Kenya Petroleum Refineries
KPTC	Kenyan Post and Telecommunications Corporation
KRAA	Kenya Revenue Authority Act
Ksh	Kenyan shilling
KSTS	Kenya Small Traders Society
KTDA	Kenya Tea Development Authority
KVM	Kenya Vehicle Manufactures Ltd
KWFT	Kenya Women's Finance Trust
LPG	liquefied petroleum gas
MIGA	Multilateral Investment Guarantee Agency
MUB	Manufacturing Under Bond
MVA	manufacturing value-added
NBFI	non-bank financial institutions
NGOs	non-government organizations
NIC	newly industrialized countries
NPK	nitrogenous phosphate and potassic fertilizers
NSE	Nairobi Stock Exchange
ODA	official development assistance
PABX	private automatic branch exchanges
PAPM	Pan African Paper Mills
PRPC	Parastatal Reform Programme Committee
PTA	Preferential Trading Area
REF	Rural Enterprise Fund
RMPCA	Restrictive Trade Practices, Monopolies and Price Control Act
RTPC	Rural Trade and Production Centres
SADC	Southern African Development Community
SEFCO	Small Enterprise Finance Company
SMEs	small and medium enterprises
TA	technical assistance
TC	technical cooperation
TSP	triplesuper phosphate
UNEP	United Nations Environmental Programme
VAT	value-added-tax
WTO	World Trade Organization

BASIC INDICATORS

BASIC INDICATORS I: THE ECONOMY

Population (1994)	:	25.4 million[a/]
Annual growth rate of population (1980-1990)	:	3.5 per cent
Labour force[b/] (1990)	:	8.18 million
GDP (1994)	:	Ksh 9,493 million
GDP per capita (1994)	:	$204

Growth of GDP (percentage) :

1988	1989	1990	1991	1992	1993	1994
5.2	5.0	4.3	2.1	0.5	0.2	3.0

Structure of GDP (percentage) :

	1980	1994
Agriculture	30.3	25.0
Manufacturing	13.0	13.6
Trade, tourism	10.8	11.3
Business services	6.3	9.6
Building and construction	4.7	2.5
Other	34.9	38.0

Exports (1993)	:	Ksh 3,678.3 million
Principal exports	:	Tea (Ksh 993.7 million), Coffee (Ksh 551.5 million), cement (Ksh 65.0 million)
Imports (1993)	:	Ksh 5,056.4 million
Principal imports	:	Mineral fuels (Ksh 1,275.8 million), chemicals (Ksh 994.1 million), manufacturing goods (Ksh 736.0 million), machinery and transport equipment (Ksh 1,167.4 million)
Current account surplus (1994)	:	$104
International reserves (1994)	:	$1.057 billion
External debt (1994)	:	$6.9 billion
Debt service ratio (1994) (Percentage)	:	34.1[c/]

Consumer price change (Percentage) :

1990	1991	1992	1993	1994
15.8	19.6	27.3	46.0	28.8

Exchange rate (Ksh equivalents to US$1) :

1990	1991	1992	1993	1994
23.1	27.3	32.3	58.0	56.1

a/ Provisional.
b/ Estimated number of persons employed in the modern and informal sector is only 3 million.
c/ Central Bank of Kenya estimates.

BASIC INDICATORS II: THE MANUFACTURING SECTOR

MVA (1994) : Ksh 1,696.5 million

MVA per capita (1994) : Ksh 66.79

Manufacturing employment (1993) : 193,400

Real growth of MVA (percentage) :

1990	1991	1992	1993	1994
5.3	3.9	1.3	1.8	1.9

Structure of MVA (percentage) :

	1980	1991
Food processing	23.90	30.16
Beverages	10.36	11.51
Machinery and transport	17.08	9.86
Chemicals	8.24	9.32
Textiles and clothing	9.21	7.08
Metal products	5.92	6.22

Share of manufacturing exports in total exports (1994) (percentage): 48.4

Structure of industrial exports (1994) (percentage)[a/] : Consumer goods (28.1), processed food and beverages (25.6), processed industrial supplies (42.2), transport (2.3), machinery and equipment (1.9)

Share of manufacturing imports in total imports (1994) (percentage): 74.5

Structure of industrial imports (1994) (percentage)[a/] : Processed industrial supplies (43.9), capital equipment (20.6), transport equipment (16.5), processed food and beverages (10.1), consumer goods (9.0)

a/ Adds to more than 100 due to rounding.

BASIC INDICATORS III: INTER-COUNTRY COMPARISON OF SELECTED INDICATORS[a/]

Indicator	Unit	Kenya	Ethiopia	Nigeria	Uganda	United Republic of Tanzania
Population (1993)	Million	25.3	51.9	105.3	18.8	28.0
Area	Thousand square km	580	1,097	924	236	945
GNP per capita (1993)	$	270	100	300	180	90
Average annual rate of inflation (1980-1993)	Percentage	9.9	..	20.6	..	24.3
Private consumption (1993)	Percentage of GDP	66	86	63	89	82
Gross domestic investment (1993)	Percentage of GDP	16	12	15	15	51
Gross domestic savings (1993)	Percentage of GDP	21	3	19	-2	10
Exports of goods and services (1993)	Percentage of GDP	42	..	36	5	31
Energy consumption per capita (1993)	Kg of oil equivalent	99	23	141	21	35
Food industry (1992)	Percentage of MVA	39	62	..	..	..
Textiles and clothing (1992)	Percentage of MVA	9	21	..	..	..
Machinery and transport equipment (1992)	Percentage of MVA	10	1	..	..	..
Chemicals (1992)	Percentage of MVA	9	2	..	..	..
Other industries (1992)	Percentage of MVA	33	14	..	..	..
Manufactured exports to OECD countries (1993)	$ million	133	2	199	3	51
Current account balance (1992)	$ million	153	-183	2,268	-107	-408
Gross international reserves (1993)	$ million	437	500	1,640	146	203
External debt (1993)	$ million	6,994	4,729	32,531	3,056	7,522
Debt service ratio (1993)	Percentage	28.0	9.0	..	143.6	20.6

Source: World Bank, *World Development Report 1995* (Washington D.C., 1995).

a/ Data for Kenya may not correspond to those cited elsewhere in this report because of different sources.

SUMMARY

Since gaining independence in 1963, Kenya's economic performance has been mixed. From 1963 through the mid 1980s, the country followed a policy of market economy with strong government intervention and public-sector led growth and development. Policy in the early years also focused on import substitution. From 1986, however, policy switched to one of decreased direct government presence in the economy, with government's main role being that of creating an "enabling environment" in which the private sector can flourish. In recent years this has included a move to reform the entire economic system. These reforms, it is hoped, will re-establish economic stability, and then accelerate and sustain development. In the immediate term, it hoped that they will result in renewed business confidence, both by domestic investors and potential international investors.

Since 1986, and especially in the last few years, a great deal of progress has been made in this direction. The trade regime has been liberalized, foreign exchange regulations have been abolished and the shilling floated, reform of the financial sector has begun, the budget deficit as a per cent of GDP has been slashed, and the rationalization of the civil service and privatization and/or restructuring of the many state-owned enterprises has been started. Moves have also been made to ease the regulations and limits on foreign investment, and in fact to encourage such investment.

Ultimately Kenya would like to adopt the "Asian Tiger" model of such countries as South Korea, Hong Kong and Singapore. It was with this model in mind that *Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year 2010*, stated the government's intent to follow a strict macroeconomic management with tight control of budget deficits, the money supply and inflation; establish an outward orientation which does not overvalue the shilling but allows ready access to foreign exchange; establish trade policies which foster an export bias and stimulate private foreign investment; develop the country's human resources through education and training; liberalize the labour market to increase labour mobility; and especially to rely on the "private sector to determine industrial expansion".

As well as policies directed specifically at economic factors, a large of part of Kenya's recent efforts focus on the need to restore political stability and confidence at home, and international credibility. After 30 years of political stability, in the past four years the country has been plagued with ethnic strife, often of a very violent nature. In Sessional Paper No. 1 of 1994, the government acknowledged the need to address the political problems facing Kenya and pledged to create a "tolerant society in which all Kenyans, regardless of their ethnic background, colour and creed are free to practice and profess their customs, cultures and religious beliefs". To achieve this, the Government pledged to put an appropriate institutional framework into place.

While growth in later half of the 1980s was a vast improvement over that of the first half of the decade, manufacturing did not take off as was the goal. After 1989, real growth slowed for a combination of factors including: a period of severe drought which decreased agricultural production as well as led to power rationing; ethnic strife which disrupted agricultural production; uncertainty surrounding the 1992 multi-party elections which reduced investment and the number of tourists to the country; and a large inflow of refugees which put a strain on the country's limited resources. Recession in many of Kenya's export markets also exacerbated the situation by decreasing export earnings and thus the country's ability to import capital goods and other inputs. The price of coffee, Kenya's second largest export and foreign exchange earner, was also down during the period and the country's import capacity was severely limited by the freezing of quick-disbursing aid (balance of payments support) in November 1991 (reversed two years later). The election year 1992, also saw serious lapses in fiscal and monetary restraint and inflation soared reaching a high of an annualized rate of 100 per cent in June 1993.

By 1994, it was clear that the policies and initiatives in the 1986 Sessional Paper needed to be reframed and taken a step further. By the end of that year, the Minister of Finance Mr. Wycliffe Musalia Mudavadi had pushed through a wide range of reforms including the restructuring of the financial system, de-regulation of the oil sector which abolished the last price controls that were

still in place in the country, and renewed efforts to speed the reduction of the government's direct influence in the economy, especially in the form of efforts to increase the pace of privatization.

The new and renewed initiatives appear to be having the desired effect. The average annual rate of inflation was down to 8.7 per cent by May 1995 and the three month annualized rate down to 4.2 per cent . Between June and October 1994, the schilling appreciated in value form KSh56:$1 to KSh42:$1, and remained strong for eight months until it dropped to a more realistic value of KSh51:$1 in May 1995. Foreign exchange reserves rose to equal five months import cover by May 1995 and Kenya got back on schedule repaying its foreign debt, including the clearing of a portion of accumulated debt service arrears.

GDP rose 3.0 per cent in 1994, and the production of agricultural goods rebounded with the end of the drought. Manufactured and horticultural exports rose for a second year, while the price of coffee recovered. The current account showed a marginal improvement in 1994, gross fixed capital formation was up, the number of employed persons outside of the rural small scale and pastoral sector grew by close to 12 per cent, reaching 3.36 million. All of this employment growth took place in the private sector as public sector employment was stagnant.

In response to the varied industrial policies and approaches of the government of Kenya, the country's manufacturing sector has also had a mixed performance over the period since independence. In the early years following independence, the manufacturing sector grew rapidly. Government policy encouraged production for import substitution and incentives favoured production for the domestic market. Production in these years was skewed toward consumer goods such as food processing, beverages, electrical appliances and machinery, paper products, printing, sugar and confectionary, and petroleum products.

Manufacturing stagnated wit the rest of the economy in the early 1980s and with the Session Paper No. I of 1986, as noted, policy was switched to one which encouraged manufacturing for export as a means to lessen the country's dependence on commodity exports and ease the foreign exchange constraints. Those subsectors with large foreign exchange requirements such as metal products have been boosted by the liberalization of trade. Those focusing largely on the domestic market are finding themselves facing extremely tough competition from imports, many of which are cheaper and of a better quality. Despite this change in policy, however, there has been relatively little change in the structure of manufacturing in Kenya. In terms of their contribution to overall manufacturing output, food processing and beverages still dominate, and non-industrial chemicals, non-machinery metallic products and non-metallic minerals are the only subsectors with a significant contribution. The has been significant growth in the export of horticulture goods, processed and not, as a result of the recent policies changes, however.

The new policy initiatives have also not yet had a significant effect on either the size or ownership structure of Kenyan manufacturing as yet. The vast majority of manufacturing establishments are small, while the relatively few large establishments dominate output. Privatization has made little headway as yet. Employment in manufacturing in Kenya has increased in recent years, from just over 1 million persons in 1981, to an estimated 3.3 million in 1994, including employment in the informal sector.

Over the past 20 years, manufacturing value-added as a per cent of gross output has fallen steadily, clearly indicating serious structural problems in the sector. But while the cost structure of Kenyan industry has increased, so to has labour productivity. While still not high, it is encouraging that even in the difficult years of 1991 to 1993, the productivity of labour continued to rise. As a percentage of gross output, wage cost has declined in recent years.

The profitability of Kenyan manufacturing concerns is not easy to determine. Most firms are privately held and are not required to publish detailed financial data sufficient to indicate their individual profitability. But measured in terms of gross profit as a percentage of total manufacturing value-added, profitability has been on the rise over the past 20 years. Individual subsectors have performed differently. For example, the profitability of the china and pottery subsector has dropped by half since 1980, while that of leather footwear has risen sharply.

As would be expected, a large portion of the investment in the country, 45 per cent, was traditionally undertaken by the public sector. Little of this, however, was ever targeted at manufacturing. Gross fixed capital formation in the manufacturing sector has varied widely from year to year, ranging from 13 per cent in 1985, to -14 per cent in 1991. In 1994, it was 16 per cent of total investment. Foreign direct investment, including reinvestment of profits is estimated at $3 billion. Little of this, however, is new investment.

Industry in Kenya is primarily located in the Nairobi and Mombasa areas. The promotion of industry in other parts of the country is a top priority of the current government and several regional initiatives have been put in place.

As noted, trade liberalization in the second half of the 1980s had mixed effects on Kenyan manufacturing. From 1986 to 1990, the import of manufactured goods jumped sharply, as did the import of all goods. Processed industrial goods imports nearly doubled, as did consumer goods imports. The country's trade gap widened significantly as a result. Manufactured goods have been accounted for approximately 76 per cent of all imports for some time. Processed industrial goods traditionally have been the largest portion of this, 40 per cent or more.

On the export side, efforts to promote the export of manufactured goods began to take effect in 1990 when they rose in both real value and as a percentage or total exports. Ranging from 22 to 24 per cent of total exports over the 1980s, in 1990 manufactured exports began to rise, first to 26.4 per cent in 1990 and then to 48.4 per cent by 1994. Processed industrial supplies, followed by consumer goods and then processed food and beverages are the most important Kenyan manufactured exports.

Given Kenya's dominate agricultural base, food processing and other agro-related industries have played and continue to play an important role in the country's economy and its economic and industrial development. Together they account for more 68 per cent of total manufacturing output. Over 60 per cent of the country's manufacturing establishments are agro-based enterprises. The most important of the agro-based subsectors are food processing, beverages and tobacco.

Food processing activities in Kenya include: maize milling; wheat-based baked goods; beans and pulses; some root crops; fruits and vegetables; oil-seeds; sugar and beverage crops (tea and coffee). Meat processing and dairy are also an important activities based on the herding of cattle, sheep, goats and pigs. All of these activities have undergone a period of disruption due to the liberalization of trade. For example, the reduction of import duties on farm inputs and the freeing of prices of maize led to an initial increase in maize flour production, oil-seed processing, however, has dropped in the face of stiff competition from cheap imports.

Coffee and tea, are and will remain the country's primary export products and foreign exchange earners for some time. They will both also remain subject to wide price fluctuations and there is little Kenya can due to protect itself against this other than keep the costs of production as low as possible and expand markets to avoid over reliance on too few markets.

With abundant fresh and salt water resources, fish processing is one of Kenya's brightest un-tapped resources. It has been estimated that current fish landings are only one-third of potential. While high transport costs and a lack of cold storage facilities and other constraints do face the subsector, given the country's need to provide food security and generate foreign exchange, the prospects for growth are very high.

Kenya's textile industry is based on both locally sourced and imported raw materials. Domestic fibres include wool, cotton and sisal. Nylon, polyester, acrylic, jute, linen and cotton are imported. Textiles are the second most important manufacturing subsector after food processing and beverages. Production centres around fabric for clothing, blankets and knitted goods. Both yarn fabrics and ready-made garments are exported.

The textile industry has been fraught with problems lately, including old and obsolete equipment, a fall in the production of local cotton, competition from imports, general mismanagement and the imposition of new quota on imported shirts by the United States. Government policies for the future development of the sector include support to existing enterprises in the form of making available technical training, duty enforcement, promotion of small and medium garment making factories, encouragement of EPZs and MUB and continued privatization of state-owned textile enterprises.

Despite the lack of domestic oil resources, petroleum refining has been an important industrial activity in Kenya. The country's one crude refining facility was built in 1963. Since then Kenya has been a supplier of refined products to the Eastern African region. Most of the oil processed in the country is of the light low-sulphur variety (80 per cent). In fact, the processing of heavy crude is not really economical in Kenya. This one of the sector's greatest constraints since light crude is very expensive. Decreased demand for Kenyan oil and oil products has had an adverse effect on the subsector in recent years, as had the aging of equipment.

In recent years the oil industry also has undergone a liberalization and de-regulation. This has freed prices and effectively removed Kenya Petroleum Refineries' (KPR) priviledged position in refining and supplying domestically. The future of this sector, however, will be dependent on new investment to upgrade existing facilities as well expand refining capacity.

The production of non-industrial chemicals in Kenya includes chemical fertilizers and pesticides, salt, rubber, pharmaceuticals, soaps, detergents, disinfectants, perfumes and cosmetics. Chemical fertilizers and pesticides are important inputs to Kenyan agriculture and demand for them rising sharply in the home market and in surrounding countries. Currently there are two major producers of fertilizers in the country, one manufactures single super phosphate and one imports and blends NPK fertilizers. The biggest constraint facing the increased production of fertilizers in Kenya is the lack of locally available resources and the capital intensity of the subsector, and thus size of investment required. Pesticide production in the country is primarily limited to the formulating and repackaging of imported materials. Demand is high, however, and the subsector is likely to expand, boosted by the need to increase agricultural yields, import liberalization and the exploitation of locally available pyrethrin.

Both rubber and pharmaceutical production are based on imports and the future development of both is likely to based on the increased exploitation of locally available resources. In the case of rubber, this has already taken the form of proposals to introduce the cultivation of rubber plants. In the pharmaceutical subsector, investment potential has been identified in development of quinine extraction facilities using Cinchona trees and their increased cultivation, and the extraction of hecogenin from sisal waste and the synthesis of betsmethsasone from the hecogenin. Both the local and regional demand for pharmaceuticals is strong and rising.

Most of the raw materials needed for the production of soaps are available locally. Other raw materials for the production of perfumes and cosmetics, as well as disinfectants are imported. Despite this reliance on imported goods, the subsector has diversified in recent years and has become one of the largest foreign exchanger earners for the country. There are 43 firms (not including informal sector production) engaged in the production of soaps, detergents, disinfectants, perfumes and cosmetics. This is also an important subsector in terms of the current participation of small and micro enterprises and the future potential for the development of such production. Technology, especially for soaps, detergents and disinfectants, is simple and affordable and the raw materials are readily available, if not locally available.

Cement is currently the most important building material produced in Kenya. Most of the raw materials are available locally and demand is rising rapidly. The current level of technology and state of plant and equipment makes production relatively expensive, however. Limitations on the country's transport infrastructure also add to the cost of bringing Kenyan cement to market. Given the level of demand and encouragement from the government for establishing new facilities, this subsector is set for expansion.

The raw material for ceramics are also readily available locally and are cheap. Production currently centres on tiles and crockery, as well as sanitary ware. Output has been erratic recently and the subsector is currently producing well under capacity although local production does not meet demand. Inadequate technology has kept quality low and prices high and the subsector is now facing stiff competition from cheaper, higher quality imports.

Motor vehicle assembly and automotive components have traditionally been important industries in Kenya. The assembly enterprises are dominated by three large enterprises. Two are franchises. General Motors assembles its own vehicles. There are over 80 small and medium enterprises manufacturing and reconditioning motor vehicle spare parts. The recent liberalisation of trade has had an adverse effect on the spare parts and components producers since the vehicle assembly franchise holders are now permitted to import 100 per cent completely knocked down.

I. THE MACROECONOMIC AND INDUSTRIAL POLICY ENVIRONMENT

A. RECENT ECONOMIC TRENDS

Economic trends pre-1990

Since gaining independence in 1963, Kenya's economic performance has been mixed. From 1963 through 1985 the country followed a policy of market economy with strong government intervention and public-sector led growth and development. Policy in the early years also focused on import substitution. From 1986, however, policy switched to one of decreased direct government presence in the economy, with government's main role being that of creating an "enabling environment" in which the private sector can flourish.

The first decade after independence (1963-1973) was characterized by rapid growth, the development of industries aimed at import substitution, favourable weather and rising agricultural income. In the period from 1973 to 1980, growth began to slow as the result of two oil crisis, deterioration in the terms of trade and generally adverse weather conditions. By the close of the 1970s it was also becoming apparent that the country faced structural problems in both its agriculture and industrial sectors. Nevertheless, for the 1963-1980 period as a whole, GDP grew at an annual average of 6.8 per cent in real terms and growth of the industrial sector averaged 9.7 per cent per year in the 1970s.

In the 1980s, the structural problems began to take their toll. The country's balance of payments deficit swelled as the terms of trade worsened further, and there was a sharp decline in international reserves. The government budget deficit reached 9.5 per cent of GDP in the 1980/1981 fiscal year.

The external current account deficit reached close to 15 per cent of GDP by 1980 and inflation hit 20 per cent in 1981. Heavy borrowing on the international market left a debt service ratio of more than 27 per cent by 1984 and 35.7 per cent in 1986. By 1982, the situation had deteriorated to the point that in that year a stabilization programme was initiated under the insistence and with the support of the IMF: fiscal policy was tightened, the shilling was devalued, interest rates were raised to positive real levels, real wages were allowed to fall and import restrictions were temporarily intensified.

The initial response to these measures was a modest improvement in economic performance, also supported by the inflow of aid from various multilateral and bilateral donors. But, by 1986, it had to be acknowledged that Kenya's economic problems were definitely structural in nature and action had to be taken to address them directly. A full reversal of policy was developed and initiated with the *Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth*. Exports, particularly value added exports, were to be promoted in order to remove the constraint to development of a chronic lack of foreign exchange, and controls on the private sector were to be lifted in order to allow the sector to become competitive, especially in international markets, and lead the country's growth and development. Key to the success of this new approach was to

be fiscal and monetary constraint on the part of the government in order to create a stable environment in which the private sector would be able to develop.

Because of the critical need to create jobs, especially in the towns, and the desire to decrease the country's dependency on cash crop exports and increase the relative value of exports through diversification, development of the manufacturing sector was a key element of the new strategy. *Sessional Paper No. 1* identified five strategic goals for industry:

- To help expand and diversify the manufactured export base;
- To create jobs at a rate greater than 4 per cent per annum;
- To develop the basis of high and rising productivity which would support higher average earnings for a large and growing number of workers;
- To encourage indigenous Kenyan entrepreneurs and managers; and
- To support and promote the development of agriculture and rural areas by promoting the efficient processing of agricultural goods.

Manufacturing was to be the main engine of economic growth and target output for the sector during the 1984-1988 period was set at 6.5 per cent per year rising to 7.4 per cent per annum from 1988-2000. Manufactured exports were expected to rise a real 6 per cent per year over the period, while total exports were to rise 5 per cent per year. The economy as a whole was targeted to grow at a rate of 4.8 per cent per year.

With the new role of government to be to create the environment in which this rapid growth in manufactured goods and especially manufactured exports could occur, the domestic and international trade regimes were liberalized significantly, the shilling was devalued further, import quotas were dropped in favour of tariffs, duties and tariffs were rationalized, and several schemes were put in place to encourage exports including new exemptions from duties on imported goods, Export Processing Zones (EPZs) and Manufacturing Under Bond (MUB) schemes. A full description of these measure is given in Section C of this chapter.

The economy responded well to these measures with growth in 1986/87 showing improvement. By 1988/89, however, the economy was faltering, not taking off, and *Sessional Paper No. 1 of 1986* targets were not met (see Table I.1).

Table I.1. Growth of GDP versus target rates, 1981/82-1989/90
(Percentage)

	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90
Annual GDP growth (1982 prices)	2.4	3.1	0.9	5.1	5.6	4.9	5.2	5.0	4.3
Target GDP growth rate	..	..	..	4.8	4.8	4.8	4.8	5.9	5.9
Annual per capita growth rate	-1.6	0.8	-2.8	1.4	1.9	1.2	1.6	1.4	0.8
Per capita growth target	..	..	..	1.0	1.0	1.0	1.0	2.1	2.1

Sources: Deloite Haskins & Sells Management Consultants, Kenyan Association of Manufacturers Study, *The Present and Future Financing Needs of the Industrial Sector in Kenya*, Nairobi, May 1992, Central Bank of Kenya, and Central Bureau of Statistics.

Manufacturing growth actually turned down in 1988, a year when it was forecast to increase significantly, and in the last years of the decade, manufacturing employment declined. And, while

the value-added of non-petroleum based and coal products manufactured exports rose in the 1986-1988 period, in real terms, their value fluctuated widely and they ended the period barley above their level in 1980.

Import liberalization in the second half of the decade resulted in a sharp increase in imports, especially of manufactured goods. From 1986 to 1990, the import of machinery and capital equipment more than doubled, processed industrial goods and consumer goods imports nearly doubled, and processed food and transport equipment imports were up significantly. As a result, the trade balance in manufactured goods widened significantly in both current and real terms.

Economic trends post-1990

While growth in later half of the 1980s was a vast improvement over that of the first half, an average rate of 5.9 per cent per annum, manufacturing did not take off as hoped and begin to drive growth and development. After 1989, real growth slowed. It dropped to 4.3 per cent in 1990, 2.1 per cent in 1991, 0.5 per cent in 1992 and 0.2 per cent in 1993 (see Table I.2). A combination of factors are blamed for the decline, both internal and external.

First, the period was one of severe drought which decreased agricultural production as well as led to power rationing (Kenya relies heavily on hydro-electricity for power). The later affected both agricultural production and manufacturing output. Second, agriculture was also disrupted by ethnic strife, especially in 1992. A third factor affecting output was the uncertainty surrounding the 1992 multi-party elections. Heightened tensions reduced investment and the number of tourists who were also put off by the ethnic conflicts. The fourth internal factor cited is the inflow of refugees which put a strain on the country's limited resources.[1]

External factors exacerbating the situation were a recession in many of Kenya's export markets which decreased export earnings and thus its ability to import capital goods and other inputs, and a fall in the price of coffee, Kenya's second largest export and foreign exchange earner. Investment was off 14 per cent in 1992 and inventory accumulation was down 74 per cent. The country's import capacity was also severely limited by the freezing of quick-disbursing aid (balance of payments support) in November 1991 (reversed two years later). The election year 1992, also saw serious lapses in fiscal and monetary restraint and inflation soared reaching a high of an annualized rate of 100 per cent in June 1993. Interest rates also soared, peaking at 80 per cent that same month.

By 1994, the government saw the critical need to reaffirm many of the initiatives and the general policy established in the *1986 Sessional Paper*. The impetus for the new commitment was the appointment of Mr. Wycliffe Musalia Mudavadi as Minister of Finance. By the end of 1994, Mr. Mudavadi had pushed through a wide range of reforms including the restructuring of the financial system and deregulation of the oil sector which abolished the last price controls that were still in place.

The reduction of government direct influence in the economy was speeded, foreign exchange controls lifted, and tariffs and the international trade regime further rationalized. In response to scandals in the banking sector and the insolvency of many banks, the Central Bank of Kenya (CBK) under went a shake up and many "political banks" were closed. And in an effort to increase the amount of capital available for financing development, one of the greatest constraints to the country's development, the entire financial system is under going a restructuring and liberalization (see Banking and finance below). Fiscal and monetary policies were also severely tightened.

The new and renewed initiatives have had the desired effect. The average annual rate of inflation was down to 8.7 per cent in May 1995 and the three month annualized rate was down to 4.2 per cent. Interest rates on Treasury bills had fallen to close to 14.58 per cent over the same period.

Between June and October 1994, the shilling appreciated in value from KSh56.1:$1 to Ksh42.38:$1 and remained near that level until May 1995 when it dropped in value to KSh51:$1 (the currency

had been made convertible in October 1993 at a rate of KSh67:$1). Foreign exchange reserves rose to equal five months import cover by May 1995. At the same time, Kenya was back on schedule repaying its foreign debt, including the clearing of a portion of accumulated debt service arrears. In 1993, Kenya's debt arrears had been rescheduled in agreement with the Paris Club of creditors.

GDP rose 3.0 per cent in 1994, and the production of agricultural goods (maize in particular) rebounded with the end of the drought. The real value added in manufacturing, however, rose only 1.9 per cent compared to 1993's rise of 1.8 per cent. The sluggish performance in this sector is attributed to the stiff competition Kenyan manufacturers are facing from imported finished goods.

The fastest growing sector of the economy was financial and business services and real estate. Growth in this sector's output registered over 6 per cent for the 1994 year, and its contribution to GDP increased to 9.6 per cent, up from 7.9 per cent in 1990. Both Barclays Bank Kenya and the Kenya Commercial Bank reported a second banner year with pre-tax earnings of KSh3.3 billion and KSh2.8 billion respectively.

Manufactured and horticultural exports rose for a second year, while the price of coffee recovered (1993 was a poor year for coffee production) and remained high. But overall 1994's export growth was well short of 1993's 111.1 per cent rise, increasing by 16.4 per cent. Domestic exports increased 15 per cent while re-exports more than doubled. Total imports rose 13.4 per cent, also well below the 71 per cent rise seen in 1993. The stronger shilling is partially responsible for the lower export rate. Commercial imports rose by 15 per cent reflecting an increase in the import of raw materials and capital goods. Overall, the balance of trade posted a 7 per cent increase in the deficit for the 1994 year.

The current account showed a marginal improvement in 1994, with the surplus increasing from $99 million to $104 million. On the other hand, the capital account weakened from a surplus of $344 million in 1993 to a deficit of $10 million in response to the lifting of exchange controls as was expected.

Gross fixed capital formation was up 14.2 per cent in 1994. Fifty-three per cent of the investment was from the private sector. Of this, 94 per cent was financed domestically, up from 79 per cent in 1992.

During the 1994/95 financial year, the number of employed persons outside of the rural small-scale and pastoral sector grew by close to 12 per cent, reaching 3.36 million. Within this sector the largest rate of growth, 22 per cent, took place in the number of persons employed in the informal sector which now totals 1.79 million. Employment growth in the modern sector was a modest 2 per cent over the period and now totals 1.5 million persons. All of this employment growth took place in the private sector as public sector employment was stagnant.

The period since 1993 also had its negative events. The price of tea, Kenya's major export good, fell sharply in 1994 dampening foreign exchange earnings. In 1993, several banks and other financial institutions were liquidated due to insolvency (see Banking and finance below). In 1994, customs officials seized 13,000 tonnes of Brazilian sugar that was being illegally imported into the country. Such fraudulent imports created a glut in the market and were depressing the price to the point of threatening a collapse of the industry. The government's reaction was the raising of import duties. There also have been allegations of dumping by several other countries following the lifting of import restrictions. Kenya Breweries Ltd. in particular, is complaining that South Africa is dumping its Castle beer on the market.

In his June 1995 budget speech, Mr. Mudavadi stressed that Kenya's recent growth is neither guaranteed, nor enough to meet all the challenges that the country faces. The rate of domestic savings must be raised significantly in order to support an increase in the rate of investment needed for development and job creation, calling for much more effort on the part of government to create the necessary enabling environment. In the meantime, the government hopes to decrease

Kenya's reliance on foreign aid funds and loans in favour of direct foreign investment and foreign portfolio investment. Many reforms and incentives aimed at stimulating the flow of foreign investment funds have already been put in place (see Section D).

Table 1.2. Selected economic indicators, 1990-1995

	1990	1991	1992	1993	1994 (Estimate)	1995 (Projected)
National income and prices (million US dollars)						
GDP at current prices	7,257	6,994	6,809	4,690	5,744	5,989
GDP at constant prices	3,657	3,159	2,691	1,498	1,595	1,795
Per capita income	327	305	287	191	204	224
Real GDP growth (percentage)	4.3	2.1	0.5	0.2	3.0	4.8
Consumer prices (percentage)						
Annual average inflation	15.8	19.6	27.3	46.0	28.8	7.2
Month-on-month (end of period)	18.2	10.5	33.7	54.7	6.6	2.1
Gross national savings (percentage of GDP)	15.4	15.7	13.8	17.2	19.4	19.7
Gross domestic investment (percentage of GDP)	24.3	21.3	17.4	18.4	20.6	20.8
Government budget (million Kenyan shillings)						
Revenue and grants	47,232	53,639	63,217	73,603	107,275	131,011
Total expenditure	55,142	65,846	70,764	93,400	135,828	145,032
Budget deficit						
Total	-7,910	-12,207	-7,547	-19,797	-28,553	-14,021
As percentage of GDP	4.3	5.6	3.1	7.0	7.1	2.9
Money and credit						
Total money supply (M2)	61,494	74,326	99,292	124,829	162,726	187,501
Reserve money	15,736	18,005	25,733	42,132	55,316	53,423
Total domestic credit	72,365	86,603	99,858	100,228	146,323	161,719
Of which: government	29,422	32,547	32,311	30,625	55,256	46,483
others	42,943	54,056	67,547	69,603	91,067	115,236
External sector (million US dollars)						
Current account	-516	-212	-98	99	104	331
Of which: exports	1,078	1,138	1,082	1,136	1,527	1,796
imports	2,205	1,940	1,835	1,493	2,051	2,452
services	611	590	655	406	420	987
Capital account	369	107	-171	344	-10	55
Balance of payments	-147	-105	-269	443	94	386
Foreign reserves	343	262	336	857	1,057	1,276
Of which:official	275	192	177	508	632	794
Months of import cover	1.5	1.2	1.2	4.1	3.7	3.9
Commercial banks and public	68	70	159	349	425	482
Foreign debt/GDP ratio	34.9	40.2	47.8	84.5	77.2	64.8
Debt service ratio (percentage of exports)	33.8	30.5	32.9	28.6	34.1	20.7
Exchange rate (Kshs:$)	23.1	27.3	32.2	58.0	56.1	..

Source: Central Bank of Kenya

One continued constraint to growth has been the slow pace of privatization and restructuring of those enterprises reserved for continued government control (see Section D). While the process of reform of the parastatals began in 1991 with the closing of several of most serious loss-making enterprises, only a few enterprises have yet to be sold and it is unlikely that the government will be able to meet its target of end 1997 for completion of the process. This will slow the generation of revenue to state coffers, as well as continue to drain state resources.

B. ECONOMIC STRUCTURE

The physical environment

Straddling the equator in eastern Africa, Kenya covers 580,367 square kilometres (224,081 square miles) of area, including 11,230 square kilometres of water. The country extends from approximately 4 degrees north, to 4 degrees south of the equator. To the north Kenya shares borders with Sudan, Ethiopia and Somalia. To the west it borders with Uganda, and the United Republic of Tanzania lies to the south.

Kenya is made up of erosional plains that rise gently from sea level to 1,500 metres, and highlands that reach altitudes of 2,500 to 3,000 metres. There are two major mountains: Mount Kenya in the mid-portion of the country which extends to 5,199 metres; and Mount Elgon in the west which reaches 4,321 metres. Kenya also borders Lake Victoria to the west, and includes Lake Turkana in the northwest. The Great Rift Valley bisects the country from north to south, running through the highlands and is dotted with small lakes and inactive volcanoes.

Because of the variation in altitude, the range of climatic conditions is dramatic. The highlands above 1,500 metres have a temperate climate, but temperatures drop so low as to limit cultivation above 2,750 metres. Average temperatures at sea level are 26 degrees Celsius, and decline an average of 1.7 degrees for each 300 metre rise above sea level.[2/]

The most critical climatic factor effecting the country is rainfall, or the lack thereof. Only some 15 per cent of Kenya receives adequate rainfall for cultivation, estimated at 750 millimetres in four of five years. Rainfall is greatest on the coast, in the western portion of the country near Lake Victoria and in the highlands. The vast plains below 1,200 metres are arid or semi-arid lands. The rains come to the western portion of the country in one long rainy season, while in the east there are two periods of rain, the long rains in March-May and the short rains in September-October.

Because of the wide variation in climatic conditions, land use patterns in Kenya are distinct. Forests are restricted to the upper levels of the highlands which receive the most rainfall and plantations of conifers and wattle are limited to that area. Crop cultivation is carried out in the highlands and livestock raising is primarily located in the dry plains.

Demographic base

As of 1990, Kenya's population was 22.7 million. The vast majority of these people are African, with only small minorities of Arabs and Asians. Over the decade of the 1970s, large numbers of Asians emigrated from the country. Few Europeans still remain in Kenya. Kiswahili is the official language, although English is generally understood. Kikuyu and Luo, the languages of the two main tribal groups are also widely spoken.

Most Kenyans continue to follow traditional African religious beliefs but there is a large Christian community centred around the Anglican and Roman Catholic faiths. Islam is also practised by a sizable minority, mostly of Arab ancestry, and has a dominant influence in the coastal areas where most Muslims live.

While the population density is 36.7 per square kilometre, close to 75 per cent of the population lives on only 10 per cent of the land. In 1990, 15 per cent of the population lived in urban areas (primarily the largest cities of Nairobi, Mombasa and Kisumu). The non-African population is concentrated in the urban centres.

Kenya's population centres are concentrated in the southern portion of the country and along the coast. According to the 1989 Census, the major cities are:

Nairobi	1,346,000	Meru	78,100
Mombasa	465,000	Thika	57,100
Kisumu	185,100	Kitale	53,000
Nakuru	162,800	Kisii	44,000
Eldoret	104,900	Kericho	40,000
Nyeri	88,600	Malindi	35,200

While the rate of increase of Kenya's population is dropping due to a decrease in fertility rates,[3/] Kenya continues to have one the highest rates of population growth in the world, at an average of 3.5 per cent per year during the 1980s. Projections for this decade are for growth to fall to an annual average of 2.7 per cent and to an annual average of 2.2 per cent in the first decade of the next century. By 2010, Kenya's population will be more than twice the level in 1980 (see Table I.3).

Table I.3. Projection of population to the year 2010
(Thousand)

	1980	1990	2000	2010
Total population	16,670	22,753	29,706	36,898
Growth rate (percentage), end of period	3.5	2.7	2.2	
Female	8,390	11,399	14,855	18,461
Male	8,280	11,354	14,851	18,437
Rural	14,170	18,727	22,755	25,581
Percentage share, end of period	85	82.3	76.6	69.6
Urban	2,500	4,026	6,951	11,2217
Percentage share, end of period	15	17.7	23.4	30.4

Source: Republic of Kenya, *Sessional Paper No. 1 of 1994*

As a result of the rapid rate of growth, close to 60 per cent of Kenya's population is 20 under years of age. This poses a special problem for the country in combating unemployment. Youth traditionally have a higher unemployment rate than other portions of the labour force, and with such a large percentage of young and inexperienced people entering the job market, it is expected that most will have to create their own employment in the informal and agricultural sectors.

Not only does the rate of growth create a great challenge for the economy in the creation of jobs, the situation is exacerbated by the rapid urbanization of the population. Table I.4 presents the distribution of urban population in 1989. During the 1980s the urban population grew by an annual rate of 5 per cent, versus the country average of 3.5 per cent. Growth in the urban areas is expected to remain well above the national average and it is estimated that by the year 2010, over 30 per cent of the population will be in urban areas. In the 1980s, 25 per cent of the growth in the population was urban dwellers, and by 2010 that rate is expected to have reached 50 per cent.[4/]

Within the urban areas the fastest growing segment was the Town Councils (average size 12,000). But the large cities (average population 48,000) are also growing rapidly. The need for upgrading and extending infrastructure and services in the urban areas is pressing, at the same time the country faces the need to provide such services to the remote areas.

Table 1.4. Distribution of urban population in 1989

Region	Total (Thousand)	Percentage share of total	Average size	1979-1989 Growth rate (Percentage)	Total increase (Thousand)	Percentage share of increase
Municipalities:						
Nairobi	1,346	36.0	1,346	5.0	518	36.4
Mombasa	465	12.4	465	3.1	124	8.7
Other	1,240	33.2	48	4.3	424	29.8
Subtotal	3,051	81.7	109	4.4	1,066	74.9
Other urban areas:						
Town Councils	263	7.0	12	9.1	153	10.7
Others	422	11.3	6	6.8	204	14.3
Subtotal	685	18.3	7	7.6	357	25.1
Total urban	3,736	100.0	31	4.9	1,423	100.0

Source: Republic of Kenya, *Sessional Paper No. 1 of 1994.*

Agriculture, forestry and fishing

Agriculture

While Kenya has an industrial and tourism base much more developed than that of many sub-Saharan countries, agriculture continues to dominate the economy accounting for 25 per cent of GDP in 1994. Agricultural goods, coffee, tea and horticulture, are also the country's primary foreign exchange earners, together accounting for about 60 per cent of exports. Agriculture also employs approximately 70 per cent of the labour force and agricultural land is home to approximately 85 per cent of the population. As a result, the promotion and growth of the sector are critical to the future of Kenya and its development.

Of a total land area of 56,914,000 hectares, over 52 million hectares are classified as agricultural land. Over 42 million hectares of this, however, is classified as having low agricultural potential.[5/] This area is primarily arid and semi-arid lands (ASALs). Close to 7,000 hectares are classified as high potential for agricultural production and just over 3,000 are in the medium classification. Only 52,000 hectares are currently irrigated, although the potential for irrigation is believed to be some 540,000 ha.

Because of the low level of irrigation, much of Kenya's agriculture is extremely susceptible to drought. For example, in recent years output was depressed by bad weather and drought in 1983, 1984, 1987, 1989, 1990, and especially in the 1991-1993 period when there was a severe drought. The value of Kenya's agricultural output is also effected by external booms and busts. Coffee and tea in particular, are the victims and beneficiaries of world production and price movements.

As well as coffee and tea, Kenya's main cash crops include sugar cane, maize, wheat, sisal, pyrethrum and cotton. The country is the third largest producer of tea and second largest producer of sisal, after Brazil. The production of this crop has fallen steadily since its peak production of 86,526 tonnes in 1974. In 1992, sisal production was only 34,148 tonnes. Sisal is

produced mainly on large estates, the number of which has fallen dramatically from 60 in 1954, to just 19 presently.

Another crop that has suffered recently is cotton. While the production of cotton increased steadily during the 1970s, it began to founder in the 1980s. Cotton requires large amounts of water and is thus particularly susceptible to drought, and tends to be produced on larger plots. Production has also been hampered by a poor marketing and payments system, and low prices.

In 1971, the Kenya Sugar Authority was established to promote sugar production and processing. By 1980, the country was running a surplus in sugar of 150,000 tonnes (domestic demand was 275,000 tonnes). By the late 1980s, however, the domestic demand for sugar had risen sharply and the country was importing significant quantities. In the 1989-1991 period, cane harvests reached record levels, peaking at 522,000 tonnes, but by 1992 production was down to 372,253 tonnes.

Sugar production in Kenya has been fraught with problems. First, despite the record harvest, in the early 1990s, Kenyan sugar was being smuggled into Uganda at such a rate that shortages were arising in the home market. Then by 1995, illegal imports of sugar into Kenya created a glut in the market that was so severe it threatened to precipitate a collapse and the loss of 13,000 jobs.[6]

Kenya currently supplies 65-70 per cent of the world market in pyrethrum and has some 30,000 hectares under cultivation. Pyrethrum is produced mainly by cooperatives. Future production is threatened, however, by declining world demand.

Horticulture has become the new growth area for Kenyan agriculture and is also a significant and growing source of foreign exchange. Fresh flowers, fruits and vegetables are air-freighted to Europe and the Middle East. Except for pineapples, vegetables and fruits are grown by small-farmers. Cut flowers are produced by two large firms. The sector has high potential but has been hampered by a shortage of airfreight space and poor handling and storage facilities at the airports.

Maize is the country's primary food crop. Once again, production is susceptible to weather conditions, especially drought. In years of severe drought, the country has to import to meet its food requirements. As the critical crop in the country's food security programme, maize is now stockpiled for emergencies. In 1984 and again in 1992, Kenya faced serious shortages of food. During periods of drought the consumption of maize increases as the availability of other food stuffs decreases. Kenya has never been self-sufficient in wheat and continues to import some 30 per cent of its consumption

Livestock and dairy production are important both for local consumption and for export. Livestock activities are mainly concentrated on the arid and semi-arid lands and centres around the herding of cattle, sheep, goats and pigs. Cattle and dairy products are the most important components of livestock production in terms of monetary value.

From 1980 to 1990 the number of slaughtered cattle and calves rose from 310,000 head to 828,000 head. The number of slaughtered sheep and goats rose from 108,000 head to 1.2 million head and the number of pigs climbed from 53,000 head to 84,000 head. From 1982 until 1990, milk production increased from 260,000 litres to 392,300 litres.

As part of its overall reform policy, the government has liberalized the agricultural sector in recent years ending the monopolies previously held by most of the commodity boards. Dollar sales at the Mombasa coffee and tea auctions have also been established. The National Cereals and Produce Board monopoly on maize imports has been abolished, as have restrictions on the movement of maize across district boundaries. However, when it appeared that the variable duty system on agricultural goods was being circumvented in early 1995, authorities placed a nine-month ban on the importation of maize, wheat, milk and sugar.

Forestry

Kenya has relatively few forest resources with only 1,690 thousand hectares of natural forests (1990), including 204,000 hectares of grasslands, 943,000 hectares of closed forest, 339,000 hectares of woodland, 150,000 hectares of bamboo and 47,000 hectares of mangroves. Most of these natural forests are located in the mountain areas and are classified as protected areas.

Generally, forests have been the source of fuel, building materials, tools, medicine and forage for domestic animals. Only in recent years have they been used as the base for wood-based industries. In 1992, the total area under forestry plantation was 159,000 hectares and was composed mainly of exotic softwoods (80 per cent). Exotic hardwoods cover about 14,000 hectares, while indigenous hardwoods and industrial softwoods cover another 8[illegible]0 hectares.

Fishing

In 1992, it is estimated that the total fish production of 198,000 tonnes was only one-third of its potential. With significant fresh and salt water resources, the potential exists to develop fishing as both a source of cheap protein for local diets and as an export commodity. Lake Victoria alone accounted for over 94 per cent of the fish catch in 1994, indicating the vast underutilization of marine resources in particular. The country's fish farming potential is also estimated to be great at 50,000 tonnes per year

Mining and energy

Mining

Kenya has little in the way of exploitable mineral resources although exploration continues to take place. Soda ash is currently the country's primary mineral product (see Table 1.5) and is the leading mineral export. The ash is mined at Lake Magadi in the Rift Valley.

Table 1.5. Mineral production, 1990-1994

	1990	1991	1992	1993	1994[a/]
Mineral (tonnes)					
Soda ash	231,900	219,500	181,330	216,890	224,200
Fluorspar	80,529	77,402	80,360	78,725	89,155
Salt	70,318	72,402	72,494	74,669	75,757
Limestone products[b/]	35,733	32,017	30,656	30,349	30,469
Other	39,388	39,963	40,150	40,553	40,934
Total	457,868	441,331	404,990	441,186	460,515
Value - K pounds					
Soda ash[c/]	34,900	42,453	48,425	69,514	88,299
Fluorspar[c/]	8,018	7,849	8,117	14,000	13,422
Salt	3,938	4,057	4,426	5,400	5,644
Limestone products	1,556	1,394	1,449	1,536	1,483
Other	1,951	1,979	2,029	2,090	2,129
Total	50,363	57,732	64,446	92,540	110,977

Source: Republic of Kenya, Central Bureau of Statistics

a/ Provisional
b/ Excluding input to cement production
c/ Excluding export value

Other mining activity centres around the extraction of small amounts of gold, salt and limestone. One fluorspar deposit in the Rift Valley has been exploited since 1975 and produced 89,155 tonnes in 1994. Smaller-scale extraction activities include the mining of vermiculite and gem stones (rubies).

Deposits of garnet crystals have been discovered at Tsavo and have received high valuations. The region promises to bear several other minerals as well. Already identified are deposits of apatite, graphite, kaolin, kyanite, rubies, topazes, green tourmaline and tsavolite. Exploration for copper, nickel and chromite in the Kerio Valley is also being undertaken.

Oil exploration began in Kenya in the 1950s and has continued to take place intermittently both on land and offshore. There has been little success to date, however. In 1984, Kenya passed the Oil Exploration Act, under which foreign companies can participate in Kenyan oil and gas development on a production-sharing basis. Concessions have been taken by such international giants as Amoco (United States), Campaigne Francais des Petroles/CFP-Total (France), Marathon Oil Co. (United States), Mobil Oil (United States), Fina (Belgium), Texaco (United States), Shell Exploration (Netherlands) and Petro-Canada (Canada). In recent years only one well (out of more than 20) has shown traces of oil and gas. It is the remote northwest region of Turkana.

Energy

With no currently exploitable deposits of oil, gas or coal, petroleum is imported and refined by the Mombasa-based Kenya Petroleum Refineries (KPR) which operates the country's only refinery. While an estimated 70-80 per cent of domestic energy requirements are met by wood fuel sources, the critical industrial and transport sectors rely on oil. In fact, oil-based fuels account for 80 per cent of commercial energy use. Refined oil products accounting for 30 per cent of crude oil imports,[7] however, are a traditional export of Kenya to neighbouring landlocked countries, representing the country's fourth largest foreign exchange earner. (See External trade and payments below.)

Between 1972 and 1992, Kenya's annual consumption of petroleum fuels rose from 1,193 thousand tonnes to 1,839 thousand tonnes, while the consumption of liquefied petroleum gas rose from 10,000 tonnes to 27,000 tonnes. The process of urbanization and a drop in the use of charcoal has also led to significant increase in the amount of kerosene consumed. In 1972, 52 thousand tonnes were used while by 1992, that figure had risen to 175 thousand tonnes.

The demand for oil-based fuels is expected to rise 1.1 per cent per annum over the 1995-1996 period and continue to rise as the economy returns to a path of growth and development. To meet the continued rise in demand, the government intends to encourage further exploration of domestic sources by international companies and consortiums, as well as promote the development of alternative sources for commercial use such as solar, bio-gas and wind.

Since 1990, two major changes in oil prices have taken place. The first was the result of the introduction of the Road Maintenance Levy (see Transport and communication below) under which a special tax was added to the retail prices of various petroleum products in an effort to raise funds for the rehabilitation and extension of the country's road network. The second change in prices was the result of the liberalization of prices in October 1994 that took place as part of the deregulation of the oil sector under the government's broad policy of removing itself from direct participation in the industrial sectors. As a result of this move, the retail prices of premium and regular motor gas increased slightly (2.5 per cent and 0.6 per cent respectively), while the retail price of gas oil, declined 7.9 per cent.

Along with the liberalization of prices, restrictions on the supply of imported petroleum fuel were lifted when the energy sector was de-controlled. Since October 1994, oil firms have been able to import and set prices freely and the privileged position of Kenyan Petroleum Refineries and the National Oil Company of Kenya to import 30 per cent of the country's crude requirements ended. At the same time the Kenya Pipeline Company lost its monopoly rights to the transport of all oil

products from Mombasa to Nairobi and on to Kisumu (to which its pipeline was recently extended).

Not all government influence has been removed, however. Because there were no facilities for the handling of imported LPG, local refineries have been required to process a minimum amount of oil into LPG. This requirement is to be lifted when storage and handling facilities are in place.

The primary source of electricity is the hydroelectric plants (five major stations) in the Tana River basin and the geothermal station at Olkaria. Uganda supplies the country with 30 MW per year from its Owen Falls plant under a 50-year agreement signed in 1958. As is the case with petroleum and gas based fuels, the consumption of electricity has also risen sharply in last twenty years, yet only 10 per cent of Kenyan households were electricity consumers in 1993. Over the 1972-1992 period, the generation of hydro-electricity increased fivefold. Geothermal generation declined, however, due to the high cost of maintaining and running such plants.

Manufacturing

While growing rapidly in the early years after independence, manufacturing has stagnated since the 1980s and its contribution to GDP has actually dropped slightly from roughly 12 per cent in the early 1980s to 10.5 per cent in 1993 and 1994 (in real terms the share of manufacturing rose over the period from 13 to 13.6 per cent). As noted above, this is despite the fact that manufacturing was supposed to be the principal driving force of economic growth and development in the 1980s and 1990s.

Within the manufacturing sector the most important subsectors in value terms are food processing, petroleum and chemical products, metals and machinery. In terms of employment, the food processing industry also leads, followed by metals, machinery and transport equipment, and textiles (primarily cotton-based). Kenya has fairly well-developed auto parts industry and has three auto-assembly plants that assemble both commercial and passenger vehicles. Major foreign investment has been made in several manufacturing sectors including: motor vehicle assembly, chemicals, tobacco, shoes, pharmaceuticals, beverages and food processing.

The majority of Kenya's manufacturing concerns tend to be small in size with less than 50 employees. In 1980, of the 2,002 manufacturing establishments (locations versus companies) in the country, only 612 were of a size greater than 50 employees. Three hundred and sixty establishments had between one and four employees, 231 has between five and nine employees, 312 had ten to 19 employees, and 326 employed between 20 and 49 persons. The majority of employment, on the other hand, does take place in the larger establishments. In 1980, of the total 187,203 persons employed in the manufacturing sector, 166,276 worked for establishments employing more than 50 employees.

Disappointed with the past performance of the sector, the Development Plan for 1994/96 re-affirmed the need to liberalize the sector and pledged to continue on the path of economic reform and restructuring which was begun, with varying amounts of commitment, in the mid-1980s. Prices have been decontrolled further, restrictive foreign exchange regulations have been abolished, import licensing has been eased and reform of the financial sector has begun with the hopes that by easing the credit constraint, investment in manufacturing will increase. Several incentives aimed specifically at promoting investment in manufacturing have been put in place as well, such as manufacturing under bond schemes and the exemption from import duties for capital equipment and investment goods. Full details of the development of the manufacturing sector and the government promotion schemes are given in Chapter II and in Section D of this Chapter.

Transport and communication

Transport

Kenya's transport sector is centred on road, rail and air systems. In 1992, the national road system consisted of 8,621 kilometres of paved roads, 26,092 kilometres of gravel roads and 28,406 kilometres of dirt roads. The rail system consists of 2,709 kilometres of rail lines. The country has two international airports, Nairobi's Jomo Kenyatta and Mombasa's Moi International Airport, as well as several smaller facilities in various parts of the country (plans to build a third international airport appear to have been at least temporarily scrapped). Kenya also has a pipeline running from the coast west to Uganda and to Kisumu on Lake Victoria.

Anyone who has driven through Kenya can only agree with government's assessment that the road system has not been maintained and that it is grossly inadequate to support the level of development and increased activity they are hoping for in the future. A strategy for upgrading, repairing and extending the road system is now in place. Its primary financing component is the Road Maintenance Levy on motor fuels which replaces the old system of tolls.

New enforcement measures have also been initiated to control the axel-load on the road system. The recent completion of a section of the oil pipeline in the Eldoret region has provided some relief already by easing road tanker traffic and it is hoped that increased efficiency and capacity of the Kenya Railways (expected as the result of its restructuring that is currently under way) will further ease the burden on the country's road system.

Kenya Airways and its freight handling subsidiary, Kenya Airfreight Handing Ltd. are the country's major airlines. Both are currently state-owned but on the slate to be privatized. The role of air transport has grown consi lerably with the number of passengers going through the two main airports reaching 2.6 million in 1992. Passenger traffic within the country is also important as more and more tourists participate in "flying safaris" and multiple destination holidays.

The expansion of the air system has also included the shipment of high-value perishable items, particularly horticultural goods. Demand for these services continues to outstrip supply, however, and there are many problems associated with inadequate refrigeration facilities at the airports and the poor handling of goods in general. It is hoped that privatization will improve, as well as expand these services.

The Kenyan rail system, consists of one main line running west from the coast through Nairobi with connecting lines to points in Uganda and the United Republic of Tanzania. As of 1992 there were 586 locomotives. Kenyan Railways has been plagued with problems and has generally not been competitive with other modes of transportation, especially commercial road transport. A restructuring of the company is currently being undertaken with the hopes of increasing efficiency and, as noted, drawing heavy freight traffic from the over-burdened road system.

Communications

While few Kenyans within, and almost none outside of the major urban areas, have access to telecommunications, international links are generally good. Since 1977, telecommunications and postal services have been provided by the Kenyan Post and Telecommunications Corporation (KPTC). Those two services are now to be separated and all but the core services which relate to national security are to be privatized.

Between 1987 and 1991, growth in telecommunications provision was strong with the number of exchanges increasing an average of 9 per cent per year. The increase in international and subscriber dialling (ISD) was 11 per cent per year. Projections in the 1994-1996 Development Plan are for a return to strong growth (see Table 1.6) and investment will continue to increase until the restructuring and privatization of KPTC is completed.

Table I.6. Projected domestic telecommunications network, 1990-1996

	1990	1991	1992	1993	1994	1995	1996
Telephone exchanges							
Automatic and manual	415	459	468	478	532	617	15
ISD	104	119	165	171	138	160	185
Digital	57	90	167	116	104	121	140
Telephone capacity							
Automatic and manual	227,870	286,740	334,360	387,858	332,000	385,000	447,000
ISD	175,000	231,500	281,560	335,058	268,540	311,506	361,347
Digital	48,000	127,200	150,300	203,798	147,000	71,000	198,000
Connections							
Automatic and manual	183,340	200,220	207,442	349,072	232,000	269,000	312,000
ISD	182,040	199,020	235,529	301,552	230,863	267,801	301,649
Digital	26,283	56,308	71,415	183,418	65,000	75,000	87,000
Telephone stations							
Automatic and manual	383,116	407,697	420,567	423,332	473,000	49,000	637,000
Public call offices	5,135	5,521	5,907	5,916	6,450	,400	8,600

Source: Republic of Kenya, *Development Plan 1994-1996*.

Banking and finance

The development of the financial sector in Kenya has gone through two distinct phases. In the post-independence years of the 1960s, there was a rapid monetization of the economy, measured by the ratio of the money supply to GDP. At the same time there was also a rise in financial intermediation, measured by a decrease in the proportion of the money supply accounted for by currency emissions. In the 1970s and 1980s, a significant diversification of the financial system occurred. Not only did the number of commercial banks grow, the number of non-bank financial institutions (NBFI) rose and both banks and NBFIs developed extensive branch networks. The ratio of broad money to GDP stood at 37.8 per cent in 1989, compared with 50.7 per cent and 60.6 per cent in Zimbabwe and Mauritius respectively.

Table I.7. Relative financial depth, 1989
(Ratio of broad money to GDP)

Kenya	37.8
Ghana	13.9
Côte d'Ivoire	30.5
Zimbabwe	50.7
Mauritius	60.6
Germany (FRG)	64.3
United States	66.2

Source: Deloitte Haskins & Sells Management Consultants Ltd, *The Present and Future Financing Needs of the Industrial Sector in Kenya*, May 1992.

As of mid-1995, Kenya's financial sector consisted of the Central Bank of Kenya, responsible for the supervision of the commercial banking and financial sector, as well as the country's monetary policy, 37 commercial banks (including several partly or wholly foreign-owned), five building

societies, the Post Savings bank, 43 non-bank financial institutions (including three re-insurance companies) and an active stock exchange.

Kenya has recently entered a new phase of financial sector development precipitated by the natural growth process, as well as a series of past abuses. Financial intermediation through banks and non-bank financial institutions is the way an economy efficiently channels its savings to investment. A major study conducted by the management consulting firm Deloitte Haskins & Sells and African Development and Economic Consultants Ltd. for the Kenya Association of Manufacturers in 1992,[8] concluded that the greatest constraint facing the future expansion and development of Kenyan industry was a lack of capital. Several suggestions for reform of the sector were put forth as a way to ease some of that constraint.

At the same time that this study was being conducted and presented, the stability of the financial system and the ability of the Central Bank to regulate it was called into question. In 1989, the Banking Act was passed which consolidated all existing banking and financial legislation and tightened the CBK's regulatory authority over the sector. In 1991, however, a revision was made to the act that allowed the minister of finance to exempt certain banks from those controls. By 1992, this revision was already resulting in serious problems. Two local banks (the Trade Bank and the Pan African Bank) were forced into insolvency and ultimately to close due to non-performing loans. Examination of the banks' portfolios revealed an extremely high level of "political" lending. The crisis deepened in 1993, when two further banks (the Exchange Bank and the Postbank Credit) collapsed also due to irregular and highly political lending practices.

A full audit of the banking sector was ordered (at the insistence of the IMF) and before it was over 12 financial institutions were liquidated and placed under the control of the Deposit Protection Fund. The regulatory practices of the Central Bank were strengthened, the Bank's governor was replaced and the 1991 revision to the Banking Act was repealed.

Also as part of the reform measures aimed at limiting abuses, the commercial bank cash ratio was raised from 18 per cent to 20 per cent and a reserve ratio is being placed (progressively) on non-bank financial institutions. NBFIs also are being strongly encouraged to either convert into banks or merge with one. In fact, ten applied for licenses to convert but only four had done so at mid-1995. Two other institutions have chosen to convert to mortgage finance companies.

Reform efforts aimed at increasing the efficiency of the financial system and increase the capital available on a longer term basis[9] also have been undertaken in recent years. Interest rates have been completely liberalized, foreign exchange regulations have been abolished, foreigners have been permitted to borrow locally and the amount of investment permitted by foreign institutions of the Nairobi Stock Exchange has been increased. As of January 1995, foreign residents were permitted to purchase up to 20 per cent of the shares of a new or existing issue, with any single investor allowed to purchase 2.5 per cent. In June these limits were raised further to 40 per cent and 5 per cent respectively.

The Nairobi Stock Exchange (NSE) was established in 1954 as a limited liability company licensed by the Capital Markets Authority (CMA), which is charged with its oversight. It is one of the oldest exchanges in Africa. The NSE has a capitalization over $1.5 billion and trades the shares of over 70 corporations as well as government securities. In 1994, seven new shares were registered on the Exchange and one insurance company de-registered.

The CMA is currently looking into the creation of a second tier market with easier registration requirements. It is hoped that this market would serve as a source of venture capital to start up businesses that do not have an established track record. The CMA, together with the Central Bank of Kenya, is also working on the promotion of a secondary market in debt securities which would allow for the efficient workings of open market operations by the CBK and greatly expand its influence on domestic liquidity.

Although treasury notes and bills have been issued for several years now, the lack of a working secondary market in government securities has limited the effectiveness of open market operations.

As a result, the CBK still relies heavily on changes in the statutory cash ratio and the manipulation of the re-discount rate and credit available through overnight lending facilities to pursue its monetary policy.

Despite the troubles experienced by several banks and other financial institutions in the 1992-1993 period, the financial sector has seen strong growth and healthy profits. In 1994, Barclays Bank Kenya posted pre-tax earnings KSh3.3 billion, up 51 per cent over 1993. The Kenya Commercial Bank, the country's largest bank, increased its profits 48 per cent over 1993's level, reaching a pre-tax figure of KSh2.8 billion.

Trade and tourism

Kenyan tourism, centred around its vast wildlife and beautiful coastal resources, is also its largest producer of foreign exchange with gross receipts at $421 million in 1993, accounts for about 14 per cent of GDP and is a large employer. In recent years, however, the number of tourists to Kenya appears to have peaked in the 500,000-600,000 range. In 1964, the number of tourists to Kenya was 65,400.

To encourage increased development and growth of the sector, new initiatives are being made to develop the high level eco-tourist market and multi-destination packages. One part of this includes discussion with neighbouring "game-viewing" countries to ease the regulations regarding border crossing, as well as undertake regional efforts in wildlife management and protection.

At the same time, the luxury tourist market is being developed and methods to accommodate and promote mass tourism are to be explored. Kenya is also hoping to develop its domestic tourism through such efforts as promotion of budget hotel facilities.

In recent years, the tourism sector has faced the problem of recession in the developed markets from where it draws its tourists, as well the discouragement of travel to Kenya due to ethnic strife in one of the prime game viewing regions. In the future, Kenya will also meet stiff competition for wildlife and beach holiday tourist from South Africa, which can also offer a developed infrastructure to international visitors. The problem of competing demands for limited land between the country's increased population and food requirements and its foreign exchange generating wildlife will also be an issue that needs to be faced.

The demand structure of GDP

A close look at the structure of Kenya's real GDP in 1982 prices shows relatively little change over the past 15 years in its components. Since 1980, the share of agriculture in GDP has fallen modestly from 30.3 per cent to an estimated 25 per cent in 1994. Building and construction has also dropped from 4.7 per cent in 1980 to 2.5 per cent in 1994. Over the same period of time manufacturing rose only a disappointing 0.6 percentage points from 13 per cent in 1980 to 13.6 per cent in 1994 and tourism-related services, mining activity, electricity generation and fishing activities have all remained constant.

The growth sectors (albeit modest growth) have been in financial and business and other services. Financial services (including real estate, insurance and other business services) has jumped from just 6.3 per cent of GDP in 1980 to 9.6 per cent in 1994. Other services rose from 2.1 per cent in 1980 to 3.4 per cent in 1994. The ownership of dwellings also rose modestly over the period from 4.6 per cent in 1980 to 5.4 per cent in 1994.

On the expenditure side, consumption has remained 82-85 per cent since the early 1980s. The private sector component of consumption grew steadily in the 1980s, rising from just over 60 per cent of total consumption in 1983, to a peak near 68 per cent in 1989. Private consumption dropped as total consumption fell, to just over 62 per cent in 1993. Private sector gross capital formation rose sharply that year.

Gross investment has also remained a fairly steady 18-21 per cent of GDP over the 1980s, but dropped dramatically in the 1990s to a level of just over 13 per cent in 1993 (in current terms this share dropped from close to 12 per cent in the early 1980s to just 10.5 per cent in 1994). The private sector share in gross fixed capital formation changed little during the 1980s, but dropped to 50.8 per cent in 1990, from its 1989 level of 57.15 per cent. Since then, however, it has climbed back to a level of 60.38 per cent in 1993.

Domestic savings collapsed in the late 1980s, dropping from over 18 per cent in 1983, to just under 15 per cent in 1987 and 13.5 per cent in 1989. In the 1990s, the rate recovered somewhat, but has been volatile. Investment has continued to outstrip domestic savings and Kenya has relied heavily on outside aid and loan funds for financing.

External trade and payments

As noted earlier, Kenya's primary exports are agricultural goods and agro-industry based goods. In 1993, food and live animal exports accounted for 8.5 per cent of total exports, while beverages (including coffee and tea) made up 43.2 per cent (see Table I.8). Coffee alone accounted for 14.9 per cent of exports, and tea made up 25.4 per cent of the total. Horticultural goods accounted for a further 10.6 per cent.

Table I.8. Value of merchandise exports, 1983-1993, selected years
(Million KSh)

	1983	1989	1993
Domestic exports			
Food and live animals	85.2	136.0	315.7
Maize, unmilled	12.2	15.6	0.3
Pineapples, canned	20.9	37.1	96.8
Beverages and tobacco	286.5	482.9	1,588.9
Coffee, unroasted	160.1	203.8	551.5
Tea	123.4	271.9	993.7
Crude materials, inedible (excluding fuels)	48.2	90.7	329.3
Sisal fibre and tow	12.1	16.3	35.9
Mineral fuels	134.5	118.6	369.0
Animal and vegetable oils and fats	0.9	2.3	17.9
Chemicals	27.5	58.3	162.5
Manufactured goods[a/]	47.7	101.8	533.6
Cement	21.8	11.0	65.0
Machinery and transport equipment	2.5	9.3	27.0
Other exports	0.2	0.1	281.4
Total domestic exports	633.1	999.9	3,625.2
Non-oil exports	498.6	881.2	3,256.2
Horticulture	17.5	112.1	390.2
Re-exports	19.1	19.9	53.0
Food (excluding manufactured)	4.8	0.6	1.3
Machinery and transport equipment	8.3	12.7	29.6
Total exports	652.2	1,019.8	3,678.3

Source: Republic of Kenya, Central Bureau of Statistics.

a/ Excluding chemicals, processed food, machinery and transport equipment.

Mineral fuels accounted for 10 per cent of exports and manufactured goods (excluding fuel, food processing, and machinery and transport equipment) were 9 per cent of total exports.

Imports are dominated by mineral fuels at 25 per cent in 1993, and machinery and transport equipment at 23 per cent (see Table I.9). Chemicals accounted for 19.7 per cent of imports, and manufactured goods (excluding processed food and chemicals) was 14.6 per cent. A full 23 per cent of all imports in 1993 were capital goods.

Table I.9. Value of merchandise imports, 1983-1993, selected years
(Million KSh)

	1983	1989	1993
Food and live animals	38.2	74.0	286.6
Beverages and tobacco	2.1	5.4	28.1
Crude materials, inedible (excluding fuels)	26.3	59.3	147.8
Mineral fuels	333.5	355.4	1,275.8
Animal and vegetable oils and fats	45.9	71.2	190.8
Chemicals	126.6	353.5	994.1
Manufactured goods[a/]	103.8	351.6	736.0
Machinery and transport equipment	204.4	879.9	1,167.4
Miscellaneous manufactured articles	24.7	83.5	215.4
Other miscellaneous imports	-	5.3	14.5
Total imports, cif	905.6	2,239.0	5,056.4
Non-oil imports	572.1	1,883.6	3,780.6

Source: Republic of Kenya, Central Bureau of Statistics.

a/ Excluding chemicals, processed food, machinery and transport equipment.

Regional trade is extremely important to Kenya, with Africa accounting for 44.58 per cent of all its exports in 1993 (see Table I.10). Uganda is its single biggest export market, taking 12.7 per cent of total 1933 exports. The United Republic of Tanzania follows as the second largest of the African-based markets absorbing 10.6 per cent of exports.

The European Union (EU) is the second largest market for Kenyan exports at 31.88 per cent of total exports in 1993. Within the EU, the United Kingdom is the most important single market absorbing 11.59 per cent of total exports in 1993 and is, in fact, Kenya's second largest export market in the world. The United Kingdom is followed by Germany which accounted for 7.77 per cent of 1993 exports.

The Far East and Australia together make up 11.31 per cent of Kenya's total export market. The United States accounted for only 3.4 per cent of total 1993 exports.

In terms of imports, the European Union is the largest market providing 33.6 per cent of all 1993 imports. The United Kingdom was the single largest source for imports at 13.17 per cent, while Germany provided 6.2 per cent. Total African-sourced imports were only 13.7 per cent in 1993, with the United Republic of Tanzania as the primary African market at 0.9 per cent.

Imports from the Middle East, largely crude oil, accounted for 15 per cent of the total, while imports from the Far East and Australia were 24.4 per cent. Japan is the largest Far Eastern import source, providing 8.6 per cent of total 1993 imports.

Although the range of Kenyan exports is relatively wide, the heavy dependence on tea and coffee creates a variable and often uncontrollable trade balance situation. Deficits, however, while

varying in magnitude, are the norm. Since 1972, the price of Kenya's primary export products, coffee, tea, petroleum products and horticultural goods, have risen dramatically. At the same time, however, the price of its imports have also gone up even more substantially. The terms of trade have declined from a figure of 153 in 1972 to a low of 71.0 in 1990 (1982 = 100) fluctuating widely in between. In 1994, the terms of trade were in Kenya's favour for the first time since 1986 at 101 (see Table I.11).

Table I.10. Direction of trade, 1993 and 1994
(Million KSh)

	Imports			Exports	
Country	1993	1994	Country	1993	1994
European Union	1,746.5	1,936.4	European Union	1,320.2	1,365.5
of which:			of which:		
United Kingdom	602.4	757.6	United Kingdom	590.2	496.6
Germany	361.5	357.6	Germany	267.8	332.7
Middle East	1,152.0	885.8	Netherlands	145.7	182.0
of which:			Africa	1,274.5	1,909.1
United Arab Emirates	759.1	643.6	of which:		
Far East and Australia	949.0	1,393.5	United Rep. Tanzania	270.5	454.8
of which:			Uganda	326.0	544.3
Japan	383.0	496.8	Zambia	8.5	8.9
India	136.5	217.1	Far East and Australia	446.9	407.2
Australia	12.8	17.3	of which:		
Africa	121.6	790.9	Japan	33.4	33.3
Of which:			India	29.6	25.7
United Rep. Tanzania	24.4	54.5	Australia	12.8	16.2
Uganda	16.0	9.3	Middle East	105.0	74.3
Zambia	17.6	7.1			
United States	293.4	381.6	United States	137.2	146.8

Source: Republic of Kenya, Central Bureau of Statistics.

Table I.11. Kenya terms of trade, 1972-1994, selected years

	1972	1982	1985	1986	1988	1989	1990	1991	1992	1993	1994
All items	153.0	100.0	91.6	103.4	88.4	78.8	71.0	81.5	9.5	88.3	101.0
Non-oil items	100.0	87.3	93.0	78.9	69.5	62.0	71.4	70.8	79.1	91.0	..

Source: Republic of Kenya, Central Bureau of Statistics.

On the other hand, the country has run a surplus on services every year since 1989 due to its large tourism sector. Net transfers also show a regular surplus due to the extension of aid by donor countries. And in 1993 and 1994, the current account was in modest surplus (see Section A above).

On the capital account, the inflow of direct investment has been extremely disappointing and the country has had to rely heavily on aid flows and loans to cover its traditional trade imbalances and foreign exchange requirements. New initiatives to promote foreign investment, both strategic and

portfolio, have been put in place and it is hoped that by next year these flows will be on the rise (see Section D below).

The above situation has resulted in the expected large amount of foreign debt, $6.9 billion in 1993 according to the World Bank,[10/] or 135 per cent of GNP, and a debt service ratio of 28 per cent. The amount of external debt has stayed relatively constant since 1990 as the portion of concessionary loans has increased. Kenya has never undertaken a rescheduling of its debt, although it did receive a series of debt forgiveness between 1986 and 1992 totalling of $623 million, interest forgiveness of $16 million in 1989 and 1990, and recently negotiated a rescheduling of its interest in arrears.

Graphic illustrations (4 pages)

C. POLICY ENVIRONMENT

Macroeconomic reform policies

As was noted in Section A, the main thrust of Kenyan economic policy in the past few years has been the reform of the entire economic system and especially the reduction in the direct role of government in the economy in favour of the private sector. These reforms, it is hoped, will re-establish economic stability, and then accelerate and sustain development. In the immediate term, it is hoped that they will result in renewed business confidence, both by domestic investors and potential international investors.

Ultimately, Kenya would like to adopt the "Asian Tiger" model of the Republic of Korea, Taiwan Province of China, Hong Kong and Singapore. It was with this model in mind that *Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year 2010* stated the government's endeavour[11/] to follow a strict macroeconomic management with tight control of budget deficits, the money supply and inflation; establish an outward orientation which does not overvalue the shilling but allows ready access to foreign exchange; establish trade policies which foster an export bias and stimulate private foreign investment; develop the country's human resources through education and training; liberalize the labour market to increase labour mobility; and especially to rely on the "private sector to determine industrial expansion".

Beginning as early as 1986, with the publication of *Sessional Paper No. 1* of that year, it has been the goal of government to create an "enabling environment" in which development would flourish, with a significantly reduced role of government in the economy. Since 1986, and especially in the last few years, a great deal of progress has been made in this direction. The trade regime has been liberalized, foreign exchange regulations have been abolished and the shilling floated, reform of the financial sector has begun, the budget deficit as a per cent of GDP has been slashed, and the rationalization of the civil service and privatization and/or restructuring of the many state-owned enterprises has been started. Moves have also been made to ease the regulations and limits on foreign investment, and in fact to encourage such investment.

As well as policies directed specifically at economic factors, a large part of Kenya's recent efforts focus on the need to restore political stability and confidence at home, and international credibility. After 30 years of political stability, in the past four years the country has been plagued with ethnic strife, often of a very violent nature. In *Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year 2010*, the government acknowledged the need to address the political problems facing Kenya and pledged to create a "tolerant society in which all Kenyans, regardless of their ethnic background, colour and creed are free to practice and profess their customs, cultures and religious beliefs". To achieve this, the government pledged to put the following institutional framework into place:[12/]

- encouraging, through constitutional reform, the development of a political system based on democratic principles of openness, tolerance, freedom of expression, association and choice, and the enjoyment of freedoms enshrined in the Constitution;

- ensuring the benefits of development are equitably distributed among individuals and across the country. Citizens will be offered equal opportunities in the economic sphere and in access to basic welfare provisions; and

- maintaining good neighbourliness, friendly international relations and regional cooperation by honouring and respecting international treaties and laws.

Fiscal policy

The key goal of Kenyan fiscal policy remains the reduction of the budget deficit. Despite efforts to improve revenue generation and control expenditures in recent years, the deficit continued to be high as a percentage of GDP in fiscal 1992/93 and 1993/94 at 7 and 7.1 per cent respectively.

Projections for 1994/95, however, are for 2.9 per cent of GDP, as reform efforts began to take effect.

The main thrust of policy has been to improve the generation of state revenue through increased taxation and more efficient collection and to decrease expenditures through the prioritization of expenditures and through civil service reform. From the 1992/93 financial year to 1994/95, current revenue rose by 82.8 per cent. Unfortunately, current expenditure was also up by 70.3 per cent.

The healthy gain in revenues may be attributed to several factors including:[13/]

- improved collection of income tax, and customs and excise duties;
- collection of tax arrears from parastatals;
- higher external grants;
- imposition of a 10 per cent withholding tax on Treasury bills;
- introduction of road maintenance levy funds;
- introduction of transit toll levies;
- expansion of value-added-tax (VAT) to cover the service sector;
- increase of VAT and duties of petroleum and petroleum products;
- temporary imposition of a 25 per cent duty on all imports (repealed in September 1994); and
- high tax collection from financial institutions as a result of strong profit performance.

Inflation over the period contributed to both increased revenues and expenditures. Other factors increasing expenditures were:

- increased allocation of food relief and water supplies to drought-affected areas;
- increased security expenditures in the north and north-eastern parts of the country and areas affected by ethnic clashes;
- increased expenditure on development projects;
- salary increases for civil servants, teachers, doctors and members of Parliament; and
- repayment of domestic interest charges on high-yielding Treasury bills.

Increased tax compliance and collection remain the aim of the government, and Parliament recently passed the Kenya Revenue Authority Act (KRAA) bringing the collection of the major taxes under one administration. The Act also provided for the employment of a high-powered staff in order to reduce tax evasion.

On the expenditure side, progress is continuing in reducing expenditure on recurring items and policy remains to concentrate 75 per cent of total development expenditure toward "core" projects and ensure their funding, while at the same time holding expenditure constant as a per cent of GDP. A full 60 per cent of recurring costs in the Kenyan 1994/95 budget were civil service salaries. A plan to reduce the size of the civil service and increase its efficiency has been in place for one year now. In fact, in 1994 there was no increase in government employment.

This rationalization of the civil service is to be completed in three stages by the end of the decade. The first stage (currently in its second year and expected to last until mid-1997) focuses on cost containment through the reduction in the number of staff. The reduction of staff by 48,000 is to take place through attrition and early retirement incentives, including retraining. The second stage of the rationalization will place emphasis on performance improvement and the development of greater policy analytical capability. The third stage will focus on the introduction of widespread and effective financial and management delegation.

The reform, in the way of restructuring and privatization, of the parastatals is also being undertaken to not only increase the efficiency of these enterprises and boost the private sector, but to decrease the drain they have on the resources of the government. A full description of these policies is given in Section D below.

Medium- and long-term fiscal policy goals have been stated as follows:[14/]

- the balancing of the budget (including grants), with net repayments of public domestic debt;
- the stabilization of current revenue at the 24 per cent of GDP level. The base of taxation is to be broadened and the collection improved to allow for a progressive reduction in rates, while maintaining overall revenue targets;
- government expenditure is to be restricted to between 24 and 26 per cent of GDP;
- budget rationalization measures will aim at maximizing the productivity of government expenditures;
- objective technical and economic criteria will be applied to project selection, and priority will be given to projects in the areas of health, education, infrastructure and the environment; and
- the present system of monitoring the budget and controlling expenditures will be strengthened in order to ensure the full compliance by government officials of fiscal objectives and targets.

Monetary policy

In the most recent years (since 1992), the goals of monetary policy in Kenya have been to restore monetary discipline to the system, just as those of fiscal policy have been to restore fiscal disciple. As noted in Section A, pregress has been made on this front. After a serious lapse in restraint in the election year 1992, the Central Bank has returned to a tight stance and the growth of the money supply has slowed significantly. In the 1994/95 year, the average monthly rate of growth in the money supply slowed to just over 20 per cent, down from 1993/94's rate of over 30 per cent.

Inflation, which peaked at an annualized rate of 100 per cent in June 1993, was down to an average annual rate of 8.7 per cent in May 1995, and a three-month annualized rate of just 4.2 per cent. Treasury bill rates dropped from a high of 80 per cent in June 1993 to 14.58 per cent in May 1995.

The volatility of the shilling over the past two years (see Foreign exchange policy below) has had a somewhat destabilizing effect on monetary policy. Despite intervention by the Central Bank to correct what it considered an overvaluation of the unit in October 1994 (the shilling had appreciated substantially in the prior four months to a rate of KSh42.3:$1 from a rate of Ksh56.2:$1 in June of that year), speculation continued with the market believing that the unit was still overvalued and further Central Bank action would be forthcoming. The result was substantial net redemption of Treasury bills and large jump in the money supply. Despite the set back, policy remained steady in subsequent months and money growth was curtailed. In the future, the CBK aims to contain the growth of liquidity to a rate consistent with target rates of GDP growth, while maintaining positive real interest rates.

In its efforts to maintain monetary discipline, the Central Bank is striving to increase the range of tools available for these efforts and thus its overall effectiveness. Budget deficits in Kenya were traditionally financed directly through overdrafts at the CBK. In recent years, however, several new methods have been developed. Treasury bills and notes with varying maturities have been introduced and secondary markets in these instruments encouraged. In addition, interest rates have been fully liberalized giving the CBK a far more sophisticated means to conduct policy. Through its open market operations, the CBK may now finance the budget deficit without necessarily raising the money supply.

Such open market operations in Kenya, however, are limited in their effectiveness. To date, the secondary market in Treasury instruments is not large and thus transactions changing the rates of interest on Treasury securities do not immediately, or efficiently, translate into changes in the savings and lending rates of commercial banks. In order to expand the market and thus make it more effective, the CBK is now running a campaign aimed at individual investors to encourage their participation in Treasury securities, is lowering the denomination of the securities on offer and has appointed the commercial banks as agents for the sale of Treasury securities. There is also a push on to expand the trading of Treasury instruments on the Nairobi Stock Exchange.

With open market operations still limited, the CBK continues to rely on changes in the statutory cash ratio and manipulation of the re-discount rate available through overnight lending facilities to carry out its policies.

Price policy

Over the past several years price liberalization has been under way and with the deregulation of the oil industry in the fall in 1994, the last price controls in Kenya were removed. After decades of elaborate price supports and controls run by the various ministries, the market is now the determiner of Kenyan prices. Competition, both domestic and international as a result of import liberalization, was to check price increases. In some cases, however, the decontrol has resulted in sharp jumps in the prices of basic commodities anyway.

Concern over this situation has led to a move to strengthen the Restrictive Trade Practices, Monopolies and Price Control Act (RMPCA) which was passed in 1988 as a safeguard against abuse resulting from decontrol. The Act established a Monopolies and Price Commissioner to investigate alleged abuses and a department at the Treasury under the control of the Minister of Finance. It also provides for an independent and appellate Restrictive Trade Practice Tribunal. The commissioner investigates alleged abuses and then reports to the minister of finance who has the authority to issue an order requiring the responsible parties to desist and compensate the injured parties (competitors and customers). The accused party has the right of appeal. If the order is ignored, the commissioner can ask for prosecution. By the end of 1994, only 44 cases had come before the tribunal, and of that only one ministerial order was issued and only one case ever went before the High Court.[15]

Trade policy

In recent years it has become evident to Kenyan economic authorities that the most important determinant in the country's ability to meet its growth and development targets is the extent to which it can export to world markets.[16] The promotion of trade, and exports in particular, has been central to Kenyan liberalization and reform policy for many years.

Beginning as early as 1986, with the publication of *Sessional Paper No. 1 of 1986*, it became policy to create an export bias in the economy. As noted in Section A above, this was a change from earlier policy which aimed at the development of import substitution industries. In order to develop export industries, it was important to ease restrictions on the importation of critical machinery and capital equipment as well as other inputs. Thus, tariff rationalization was under taken and by 1993, import liberalization was virtually complete with the abolition of almost all import restrictions.[17]

As a first move, quantitative restrictions (quotas) were replaced with a tariff system. Second, that system was rationalized and the rates reduced dramatically. For example, in 1987, 124 import items were subject to tariffs of 100 per cent or more and a further 109 items carried duties of 80-99 per cent. Excessively high rates have been removed, and the average tariff rate is now below 30 per cent. With the June 1994 budget, the number of tariff rates was reduced from eight to seven and tariff rates were again reduced. The 50 per cent and 40 per cent bands were combined at 45 per cent, and the 25 per cent band was eliminated with all items falling under the 20 per cent rate, and a new 5 per cent band was established for certain primary commodities. At that time the temporary 25 per cent surcharge which had been designed as a revenue generating means was revoked.

While the effect of import liberalization has been generally favourable, in 1994 Kenya did experience some of the drawbacks in the form of increased dumping. In his 1995 Budget Speech, Mr. Mudavadi claims that Kenya has been the victim of unfair trade practices by both its European and African trading partners such as the use of hidden subsidies to producers. In several cases, Kenya has put countervailing duties in place. Such moves include duties on maize and sugar, iron and steel, and paper bags.

Another problem the country has faced is the fraudulent claim of duty exemption under the country's export promotion scheme, whereby importers are exempt from duties on items that are to be re-exported, or used in the production of export products. Imports for use in aid-supported projects are also exempt and fraud has been attempted in this area as well. The fraud is reported by the Minister of Finance to be extensive and particularly damaging to the textile industry.

Kenya's hope for the future lies in its ability to export and to generate foreign exchange to pay for the needed know-how and technology for development. But as well as promote exports in general, the goal of Kenya's policy is promote value-added goods and reduce the country's reliance on its highly volatile traditional commodity exports. Thus within the agricultural arena, horticulture is a high priority. The promotion of manufactured exports is especially important.

Several measures have been taken over recent years such as the abolition of export duties, improvement of capital allowances and moves to increase the availability of export finance. Liberalization of foreign exchange and insurance regulations were also initiated that eased the burden on exporters, and local suppliers to companies manufacturing under bond (see below) were zero-rated for VAT. With the June 1995 budget, further steps were taken to reduce the financial burden on exporters. Tariffs were again reduced on a wide range of raw materials and capital goods, and the Treasury was directed to begin discussions with private investors over the establishment of an export credit guarantee scheme.

Kenya's major export promotion efforts, however, come under three major incentive schemes: duty/VAT exemption; Export Processing Zones; and Manufacturing Under Bond. And while these schemes initially targeted only manufacturing production, they have been expanded to include services and primary production as well. Details of these schemes are discussed under Section D below.

Several institutions are also in place to support export industries and promote exports. The most important are: the Export Promotion Council (EPC); Kenya Exporters Assistance Scheme (KEAS); Kenya Exporter Development Support (KEDS); and the Horticultural Crops Development Authority (HCDA). EPC, KEAS and KEDS provide technical and limited financial support to primarily small and medium enterprises (SMEs).

The Export Promotion Council is a policy board established in 1992 as a presidential council to promote and provide advisory services to the export sector. It establishes targets for Kenyan exports, identifies new export markets, disseminates export-related information, reviews export performance, and advises the government on new policy initiatives for increasing exports and attracting investment in export industries.

Trade relations

Key among Kenyan efforts to promote trade is the establishment of good trading relations with its neighbours and the international community. Kenya is a participant in the Lomé IV Convention and member of the World Trade Organization (WTO), as well as several trading blocs closer to home such as the East African Cooperational Council (EACC) together with the United Republic of Tanzania and Uganda, and the Common Market for Eastern and Southern Africa (COMESA) which is the successor to the Preferential Trading Area (PTA).

As a member of the Lomé IV Convention, Kenyan industrial exports may enter European Union markets free of duty and quantitative restrictions provided certain rules of content are followed. Most agricultural products also receive Most-Favoured-Nation treatment. As a member of WTO, Kenya is obliged to follow a programmed reduction of protectionist barriers. It has invoked its right to a five-year grace period in order to give its Customs Department and other affected agencies time to prepare for the change in valuation of imports that will be required, but states it expects to be in full compliance well before that period is up. It is already in compliance in terms of direct inward investment controls and is close on portfolio investment.

Kenya, the United Republic of Tanzania and Uganda formed the special regional trade association, the East African Cooperation Council, through which to work to harmonize trade tariffs, as well as discuss other issues that pertain to the three countries. The United Republic of Tanzania and Uganda account for 33 per cent of total Kenyan exports and over half of all African exports.

The broader intra-African market is also united through COMESA which is made up of the former PTA members and the members of the Southern African Development Community (SADC). The COMESA Treaty was ratified in November 1994 and already several measures have been adopted including the harmonization of road transit charges, the adoption of the Road Customs Transit Declaration Document and the Single Goods Declaration Document, as well as the adoption of the Customs Bond Guarantee scheme. Under discussion are double taxation treaties among the members and cross listing on regional stock exchanges. COMESA aims to have a full-fledged common market in place by the year 2000 and common currency agreement by 2020.

Foreign exchange policy

A major portion of Kenya's overall reform and marketization efforts was the liberalization of the foreign exchange regime. By freeing the shilling and abolishing foreign exchange transaction limitations, it was hoped that the amount of foreign exchange available would significantly increase. As noted earlier, it is widely believed[18] that one of the constraints to Kenyan development, especially industrial development, has been the chronic lack of foreign exchange.

Since October 1993, the shilling has floated freely and exchange controls have been reduced through a series of legal notices granting exemptions from the Exchange Control Act. On 1 November 1995 Parliament voted unanimously to repeal the Act in its entirety.

The shilling value is now determined by the interbank market. Residents and non-residents alike are permitted to buy and sell foreign currency at authorized dealers for most transactions. Purchases of foreign exchange in an amount greater than the equivalent of $5,000 must be supported by documentary evidence of a commercial transaction. No justification is necessary for amounts below that level.

There are no longer any retention quotas in place and exporters may keep 100 per cent of their foreign exchange in local foreign currency accounts if they wish. All restrictions on trade-related payments also have been removed. Residents are now permitted to borrow from abroad without restriction, and foreigners (legal persons/companies) may borrow locally. Blocked funds provisions have been removed.

Since its liberalization in October 1993, the shilling has been relatively volatile. Just prior to floating the unit had already lost substantial ground in the interbank market, falling from KSh58:$1 in March 1993, to KSh80:$1 in June of that year. With the tightening of monetary policy and the easing of exchange controls over the summer, however, the unit appreciated significantly and the rate in the interbank foreign exchange market was close to the official rate of KSh69:$1. In response to the narrowing of these two markets, the Central Bank decided the time was right to remove all controls on the currency.

Over the course of the next year, the shilling appreciated steadily, peaking at KSh42.38:$1 the following October (1994). Following the de-control of the oil industry that fall, however, the shilling dropped substantially, hitting KSh51:$1 by 1994. It then remained at level until April 1995 when it dropped again to the KSh55:$1 range in response to the increased voicing of dissatisfaction with the country's progress on the political and privatization fronts by major donor organizations.

The early strengthening of the unit upset exporters who were adversely effected by the move, while importers were pleased. The recent weakening of the shilling has, of course, had the opposite effect with exporters pleased and importers finding themselves under pressure. This has sparked an internal debate as to whether the CBK should intervene in the market. The Bank, however,

is continuing to argue the virtues of free market and the freeing of the Bank from holding large amounts of foreign exchange with which to support the currency. For now, policy will remain that of implementing sound fiscal and monetary policies and letting that keep the shilling stable.

Employment policies and human resource development

With a population growing at an average annual rate of 3.3 per cent and a small modern sector, job creation and employment growth are critical to the future of Kenya. While reliable data on current rates of unemployment are not available, the government estimates indirectly that in 1993, unemployment ranged between 17.8 per cent and 23.6 per cent. Despite efforts to reduce this figure, they expect that in 1996 the range will remain between 16.8 per cent and 23.8 per cent.[19/] To reach full employment by the year 2010, the government estimates that jobs will have to be created at a rate of 4.3 per cent per year for a total of 6.4 million new jobs. Agriculture will have to create one half of them, the urban informal sector a further 23 per cent.

The creation of jobs in the modern sector, which will have to expand by 1.6 million to meet the goals of full employment, will depend on the expansion of the private sector. While in the past, government was the generator of jobs, creating 63.5 per cent of modern sector jobs in the 1986-1990 period, the change in Kenyan policy and civil service reform means this will no longer be the case. Under the new reform policy, the responsibility of job creation falls to the private sector, and the role of government becomes that of providing the environment in which the private sector can expand and create employment opportunities.

In the 1994/95 financial year, the private sector responded well to the challenge, and according to the government, the number of employed outside of the rural small-scale and pastoral sector grew by close to 12 per cent. Most of this, however, was in the informal sector which increased 22 per cent. Modern sector employment was up 2 per cent. The later was all in the private sector since with the civil service reform programme under way, government employment was held constant.

While the key element and concern of Kenyan employment policy is the creation of new jobs, human resource development and the upgrading of skills and productivity are also prime objectives. There is an abundance of labour at the unskilled and semi-skilled level, but a shortage at the technical and managerial levels. Increasing labour mobility, both geographic and functional is also a main goal. The later is a particular emphasis of the Civil Service Reform Programme. Early retirees are encouraged and given training opportunities to enable them to move to the private sector.

Industrial training and retraining programmes are also important components and the government has put in place a National Training Levy to raise the funds to finance these programmes. A trade testing and certification system is also being put in place. Virtually all employers operating in Kenya pay into the levy fund either at a rate of KSh100-500 per employee or a turnover-based rate, depending on the sector.

While most training takes place on-the-job and is conducted by and/or paid by the employer, the National Industrial Training Council, created under the Industrial Training Act, manages a craft apprentice scheme to support the on-the-job training of apprentices. Other vocational and technical training in Kenya takes place in several different institutions. There are currently three National Polytechnics which offer degrees to secondary school leavers and employer sponsored students; technical training institutes which replaced the former technical secondary schools; Youth Polytechnics which provide training at the artisan level to primary school leavers; Harambee Institutes of Technology which are community-based organizations but receive government support; and industrial training centres.

Some management training is also sponsored by the government. Training courses for both junior and senior managers are held at the Management Training and Advisory Centre.

As noted earlier, youth unemployment is a particular problem in Kenya, and one that is increasing. Over 59 per cent of the population is under the age of 20. In an effort to address this directly, the government has increased its financial support to the country's system of Harambee Institutes of Technology, Youth Polytechnics and other institutes of higher education. The National Youth Service has also been increased to accommodate 3,000 trainees, up from 2,000.

Because it is one of the largest generators of employment growth, government support of *jua kali* enterprises takes many forms, ranging from special credit programmes to the support for the development of regional market centres (a full accounting of government support to this sector is given in Section D below). One of most important government supports, however, is the provision of management training schemes now being provided by District Trade Officers. *Jua kali* enterprises are the largest source of non-farm job creation in the country. They make extensive use of local inputs and recycled materials and have many forward and backward linkages. But they also suffer greatly from poor productivity and erratic quality. Increased training in quality management and other technical aspects, as well as management training are necessary to decrease the mortality rate of these enterprises.

Environmental policies

While Kenya's relatively low level of industrialization has spared it from many of the environmental disasters associated with development such as high levels of lead in the air and water, the country's high rate of population growth, among other factors, has left it facing critical decisions to be made on land use and deforestation. The natural environment also gives many problems with regards to water use and availability. Kenya often faces severe droughts. Rapid urbanization also poses critical problems of waste management in the urban centres.

With a growth rate over 3 per cent per annum, the demand for land for housing purposes is increasing rapidly. The demand for agricultural land to feed this increasing population is also high. But land is not unlimited in Kenya. As noted above, a great deal of Kenyan land is arid or semi-arid and not suitable for most agricultural pursuits. Kenya also has a fragile wildlife population that requires vast amounts of land for its survival. And since this wildlife, through tourism receipts, accounts for over $200 million in foreign currency and together with beach resources, 14 per cent of GDP, there is an urgent need to balance these demands.

Kenya has stated that it is in agreement with the Rio Declaration and Agenda 21 and intends to lead the way in making development economically, socially and ecologically sustainable. The Seventh Development Plan (1994-1996) attempts to incorporate these goals into Kenyan policy, including a change in basic food security policy that calls for the availability of foreign currency for food purchases rather than the cultivation of lands that are inappropriate for agricultural production. Research into drought resistant crops, reforestation programmes, protection of wetland areas, protection of wildlife, the promotion of energy efficient technologies and the promotion of the efficient use of water resources have all been included in the plan.

According to the Seventh Development Plan, increased emphasis is also to be placed on the environmental impact of development projects through the requirement of environmental impact assessments for all public and private projects. All energy-related projects already require such an assessment.

As well as finding the funding to provide the necessary infrastructure for such things as water and waste management, one of the major problems facing Kenya in its efforts to ensure environmentally sustainable development is the drafting of comprehensive environmental law. Currently there is no such comprehensive environmental legislation in Kenya. The relevant legislation is mostly contained in local authority bylaws on building and town planning and in workplace health and safety laws. For example, the following are several of the relevant pieces of legislation that deal with environmental protection and health and safety:[20] the Occupiers Liability Act (Chapter 34); the Public Health Act (Chapter 242); the Radiation Protection Act (Chapter 243); the Land Control Act (Chapter 302); the Land Planning Act (Chapter 303); the Plant Protection Act (Chapter 324); the Plant Varieties Act (Chapter 326); the Pest Control

Products Act (Chapter 346); the Water Act (Chapter 372); the Wildlife (Conservation and Management) Act (Chapter 376); the Forests Act (Chapter 385); the Traffic Act (Chapter 403); and the Factories Act (Chapter 514). As would be expected this makes enforcement difficult.

The National Environment Action Plan, published by the Ministry of Environment and Natural Resources in June 1994 set out the government's new environmental policy objectives and strategies for their implementation. Its main recommendation is the creation of a single institution with the legal authority to coordinate the management of environmental resources and the harmonization of the existing legislation. The first step in this harmonization is to be the development of "umbrella" legislation, followed by the assessment of existing legislation to ensure that it conforms.

The drafting of such comprehensive legislation and then the coordination of all other legislation is a long and complex process that many developing countries and the countries in transition are facing. It is also a relatively expensive process, and the cost of upgrading existing facilities to meet new standards can be staggering. Kenya is receiving assistance from the United Nations Environmental Programme (UNEP) for the review of the laws. The cost of upgrading and the timing of such upgrading (when existing facilities will be required to comply with any new and more stringent laws) is a problem still to be faced.

Because environmental issues, especially those relating to air and water, transcend national boundaries, it is the intent of Kenya to work closely with its neighbours (the United Republic of Tanzania and Uganda) in developing regional environmental protection legislation.

D. INDUSTRIAL POLICY

As noted above, Kenya's main economic and political goal is to promote sustainable economic development. The key to this, the government believes, is to develop Kenya's industrial base, especially export industries, following the model of development and the policies of the newly industrialized countries (NIC) of Asia. Kenya, in fact, hopes to attain NIC status by the year 2010. To this end, a comprehensive economic reform policy aimed at restructuring the economy and promoting industrial development has been put into place. With an accent on reducing the direct role of government in the economy through the relaxation of regulations and restrictions on trade (internal and external) and prices, and the marketization of the economy, Kenya has put several initiatives and incentives in place to promote the development of new industries and enhance the efficiency of existing facilities. The most important of these initiatives are the promotion of export industries and the creation of an export thrust in the economy, the restructuring and privatization of parastatal enterprises, the promotion of small industries, especially in rural areas to create employment and balanced development, and the promotion of direct foreign investment, both strategic and portfolio. The latter is seen as a critical means of narrowing the gap between the financial requirements of development and domestic resources while freeing the country from its heavy dependency on aid funds.

Export promotion

As discussed above, an important element of Kenyan industrial policy since 1986 is the desire to create an export thrust in the economy, especially through the promotion of manufactured exports. Three main schemes are now in place to encourage investment in manufactured exports: duty/VAT exemption; Export Processing Zones (EPZ); and Manufacturing Under Bond (MUB). As noted above, while these schemes were primarily designed for manufactured exports, they have now been extended to cover primary production and services.

Manufacturing Under Bond was established in 1986. The main incentives to participate in this scheme are duty and VAT exemption on imported plant, machinery, equipment, raw materials and intermediate inputs, and investment allowances of 100 per cent on immovable fixed-assets. While such production is to be exported, in certain cases and with the approval of the commissioner of

Customs and Excises goods may be sold in the domestic market subject to the payment of normal duties and taxes plus a 2.5 per cent surcharge.

There are currently seven locations available for registration as an MUB enterprise: Nairobi; Mombasa, Kisumu, Eldoret, Nakuru, Nyeri and Thika. The areas immediately surrounding these towns are also included in the scheme. To be eligible for MUB status, a manufacturer must demonstrate a minimum of KSh10 million worth of exports per year or provide employment for 50 or more persons. The manufacturer must also be able to prove a foreign market for its production.

Hoping to attract increased foreign investment, in 1990, Kenya passed the Export Processing Zone Act aimed at manufacturers for export only. The Act provides for the development of export zones under a special EPZ Authority (EPZA). A number of such zones have been established already, the first of which was the Sameer Industrial Park in Nairobi. The Park has been extremely successful and was fully occupied soon after completion. The first government-owned EPZ was built at Athi River (outside of Nairobi).

In all, Kenya has nine designated EPZs. Four are in the Nairobi area: Sameer Industrial Park and Thomas de la Rue EPZ Ltd which are operational, and Real Industrial Park and Embakasi which are under development. Three zones are in the Mombasa area: Birch Investments EPZ Ltd and East Africa Molasses Ltd which are operational, and Changamwe and Kwa Jomvu Zones which are under development. Athi River EPZ is operational and Anicit Kenya EPZ Ltd in Nakuru is under development.

Participation in the EPZs includes companies from several industrial sectors such as: clothing and textiles, textile yarn, engineering and vehicle assembly, pharmaceuticals, moulded rubber products, food processing, non-food agro-processing printing, electronic goods, and refined petroleum products.

Companies operating in EPZs qualify to receive the following benefits:[21]

- ten-year tax holiday and flat 25 per cent tax for ten years;
- exemption from all withholding taxes on dividends and other payments to non-residents during the first ten years;
- exemption from import duties on machinery, raw materials and intermediate inputs;
- no restrictions on management or technical arrangements;
- no restrictions on foreign capital repatriation; and
- exemption from VAT.

In an effort to expand exporting beyond MUB status firms and export-only firms located in an EPZ, a third scheme was put in place aimed at promoting increased production for export and local production of the inputs to export-oriented industries. Through this scheme, the exemption from duty and/or VAT is available to all companies for materials imported for use in the manufacture of goods for export or duty-free sale domestically. This includes the importation of materials that will be used for the production of raw materials that are in turn used for the production of export goods or locally-sold duty free items. The exemption is available for goods directly exported and those sold to another concern which will then export them. The exemption is available through the Export Promotion Programmes Office which was established in 1992 under the Ministry of Finance.

Promotion of small industry and balanced development

The promotion of small scale industry, or *jua kali* enterprises, became central to Kenya's development strategy with *Sessional Paper No. 1 of 1986* and the Sixth National Development Plan, 1989-1993. Over the plan period of 1989-1993, the sector was targeted to create 587,000 new jobs out of a total of 1.9 million for the economy as a whole. In 1989, the government also conducted a study on the constraints facing the *jua kali* sector and developed a strategy[22] for over coming

them. In March 1992, the framework of that strategy was published in *Sessional Paper No. 2 of 1992 on Small Enterprises and Jua Kali Development in Kenya*.

Early efforts on the part of the government to support *jua kali* enterprise development included investment allowances, exemption from duties and taxes on imported capital equipment (up to a certain amount), and the establishment of two funds; the District Development Fund (DDF) in 1987 aimed at providing enabling infrastructure via the development of Rural Trade and Production Centres (RTPC); and the Rural Enterprise Fund (REF) in 1989 to finance *jua kali* entrepreneurs. Concerned that few *jua kali* enterprises ever graduated into the formal sector, however, in 1992 the government called for an abundance of new measures. Included in these was an assessment and prioritization of the infrastructure needs of *jua kali* enterprises. Other measures were the encouragement of the formation of groups of small artisans so that they might benefit from the government-financed rural electrification programme, and increasing the availability of industrial and commercial land. The Ministry of Research, Science and Technology through its parastatals and University-Industry Link Committee also was asked to draw up guidelines for the development and transfer of technology, as well as the identification of appropriate technologies. And, information was to be more widely disseminated on both local and international markets. Other efforts were to reduce the regulatory constraints and encourage the more effective use of programme benefits by the sector.

By 1994, it was evident that many obstacles to the development of small enterprises remained, not the least important of these were the lack of coordination among the many support agencies and weak links between policy initiatives and programmes and projects. In a new action plan drawn in 1994,[23] several further measures were identified as necessary. Most important, however, the new strategy called for the creation of a partnership between government, the private sector, non-government organizations (NGOs) and the donor community. Efforts are to focus on increasing the impact of the existing institutions, not on creating new ones.

Specific measures called for under the 1994 Action Plan are:

- improving mechanisms for policy and strategy implementation, coordination and monitoring of SME and *jua kali* activities, and assessing the impact of such policies and programmes on target beneficiaries;
- improving the legal and regulatory environment;
- the development of institutional and physical infrastructure;
- market development for SME and *jua kali* products;
- improving access to credit and finance;
- technology and technical skills development;
- improving the design and delivery of other vital support programmes for SMEs and *jua kali* enterprises;
- promoting the involvement of women in SMEs and *jua kali* development; and
- facilitating information gathering and dissemination.

A further constraint to the development of SMEs and *jua kali* enterprises has been industrial technology. To ease this situation, the Kenya Industrial Research and Development Institute (KIRDI) has been directed to focus efforts on the re-design and adaptation of technologies for use by SMEs.

Given that the per cent share of the population living in urban areas is rising rapidly and placing a great strain on government's limited resources, the promotion of balanced development and limiting, to the extent possible, the number of people migrating to the cities, is also a key policy concern. The promotion of the *jua kali* sector and the development of SMEs is a major part of the effort to balance Kenya's development and encourage rural development. Beginning in 1987 with the creation of the District Development Fund and creation of Rural Trade and Development Centres, Kenya has been encouraging the creation of employment, self-employment and SMEs in the rural areas.

Other measures to encourage the development of industry outside of the urban areas include investment incentives for new investments made in hotels or manufacturing outside of Nairobi and Mombasa.

Industrial technology

A critical component of Kenyan industrial policy is the promotion of industrial technology. Kenyan industry will only be able to compete on world markets if it has the same advantages of modern and new technologies as other countries. To assist in the transfer of technology from the developed economies to Kenya, the government has established a National Council for Science and Technology. This council is in the process of formulating an industrial technology policy. While not yet complete, they aim to create a policy that will:[247]

- build local technological capacity and culture with a strong national inclination;
- provide guidelines on technological development, choice and transfer, and the adaptation of technology;
- streamline and strengthen institutional arrangements and linkages and build capacity; and
- promote private sector participation in the development of industrial technology.

The primary technological institution in Kenya is the Kenya Industrial Research and Development Institute (KIRDI). It was established in 1979 by the Science and Technology Act and comes under the Ministry of Research, Science and Technology. KIRDI is a multi-disciplinary institution conducting research in industrial and allied technology in the areas of civil and chemical engineering, electronics, mechanical engineering, textiles, fibres, plastics, ceramics, clays, foods and chemicals. It also conducts research in the field of mining and power resource development.

The Institute is mandated to: create facilities to enhance indigenous scientific and technological capabilities for fully exploiting the national resource potential; facilitate the transfer of technology through the redesign of local equipment and/or the adaptation of the technology to local endowments where necessary; select identified technologies and establish pilot projects for demonstration; and provide information on appropriate technologies to industrialist and entrepreneurs. Recent directives have placed emphasis on the adaptation of technologies for small industries in particular.

Investment policy

Under Kenya's new reform policy to reduce government involvement in the economy, government investment in areas outside of infrastructure and those projects necessary for the delivery of social services (schools, hospitals, etc.) is also to be reduced. Investment in parastatals is declining, there is a moratorium on new investment in those parastatals slated for privatization. Already in 1995, 55 per cent of total investment was accounted for by the private sector.

In its efforts to increase the share of private sector investment, the government has put in place a three-prong approach: to encourage inward and domestic investment by removing fiscal and other regulatory constraints which increase investment risk; to give priority in approvals in all sectors of the economy to job creating, domestic resource utilizing, infrastructural and export-oriented investments; and to facilitate the privatization of the state enterprises and other services. To a large extent, excessive regulations regarding licensing and price controls which discourage investment have been removed.

While Kenya has no generalized investment incentive scheme in place other than the incentives available to exporters described above, there are several ad hoc incentives that are normally negotiated on a case-by-case basis. In *Sessional Paper No. 1 of 1994*, however, the government stated its intent to initiate legislation for an investment code which would pertain to both domestic and foreign investors and under which the Investment Promotion Centre (IPC) would operate. When passed, the Code is to lend transparency and accountability to the investment process.

Some investment allowances are in place, but as of 1995, the previous rates of investment allowance: 85 per cent on plant, machinery, buildings and equipment for investments in hotels and manufacturing concerns located outside of Nairobi and Mombasa and 35 per cent for investments in those cities; had been collapsed into one flat deduction of 60 per cent. Companies with Manufacturer Under Bond status continue to receive allowances of 100 per cent.

Investments in several sectors also receive favourable asset depreciation treatment. Hotels are depreciable at a rate of 4 per cent per year, industrial buildings at 2.5 per cent per year, plant and machinery at 12.5 per cent per year, and vehicles, trucks and tractors at 25-37.5 per cent per year. The rules on loss carry forward are also liberal: tax losses may be carried forward indefinitely.

Box I.A. Investment incentives

Ownership	100 per cent foreign ownership permitted
Tax holiday	10 years for enterprises operating in EPZs
Import duty	Capital goods, machinery and plant equipment with a value greater than KSh10 million: exempt from import duties
Export duty	Raw materials for export goods: duty free Inputs for MUBs and EPZs: duty free
Income tax	1-37.5 per cent depending on tax bracket
Corporate tax	35 per cent resident companies 42.5 per cent branches of non-resident companies
Withholding tax	7.5 per cent, with a 10-year exemption period for EPZs
Losses carried forward	Losses may be carried forward indefinitely
Capital allowances	Hotel and manufacturing sectors: 60 per cent allowance MUBs and EPZs: 100 per cent allowance
Exchange controls	Free operation of foreign currency accounts
Remittance	No restriction on remittances
Staff recruitment	May employ expatriates where local talent not available
Location incentives	Numerous incentives apply to the EPZs: VAT exemptions, import duty exemptions, tax holidays, no withholding taxes and low depreciation rates
Investment guarantees	Protection clause, bilateral treaties and member of MIGA
Dispute resolution	ICSID contracting State

Source: UNIDO Investment Services

In some cases, the duty on imported goods can be reduced. For example, duties on machinery and equipment can be reduced to 10 per cent if the investment is expected to result in a net foreign exchange earning or savings for Kenya. Custom duties on imported plant and equipment for use in industries located outside of major towns can also be charged at 10 per cent. A reduction in duties and tax of 50 per cent is granted to industries located within Nairobi and Mombasa and other urban areas.

Foreign investment

As noted throughout this study, one of the most critical factors hampering Kenyan growth and development has been a lack of investment funds. Over the years, the amount of foreign direct investment (strategic and portfolio) has been limited. It is estimated[25/] that there are a total of 180 transnationals with some form of investment in Kenya, while total foreign investment in the country is thought to be around $3 billion (including profit reinvestment). British companies are the largest investors, followed by companies from the United States and Continental Europe.

In 1994, the Investment Promotion Centre received only 82 investment project proposals, down from 112 in 1993, of which 25 were for manufacturing under bond. In fact in recent years, the only significant new foreign investment that has taken place has been in the oil sector. Existing investors, however, have continued to expand their operations.

In an effort to increase the amount of foreign investment flowing to the country, an important element of the country's new economic reform policy, many of the regulations on foreign-controlled firms that were making operating in Kenya difficult have been and are in the process of being removed. The limit on local borrowing by foreign firms, for example, has now been lifted.

Foreign investment is now being actively pursued by Kenya. Government officials now stress the need to free the country from dependence of foreign aid, by increasing the amount of foreign investment as well as generating domestic capital. All sectors of the economy have been opened to foreign investment so long as the investment is seen to increase employment, accommodates local investment, has no adverse effect on the environment and has no adverse national security implications. While export-oriented investments are particularly favoured, those targeted at the local market are also encouraged. Foreign investment is also permitted in the privatization process (see below).

Under Kenyan law, foreign investors are guaranteed protection from expropriation for reasons other than national security and then fair and prompt compensation will be made. Capital and profit repatriation is also guaranteed under the Foreign Investment Protection Act (FIPA). Under the provisions of this Act, the following may be repatriated: after tax profits, including retained profits not capitalized; the book value of the initial investment plus retained earnings that have not been capitalized; and principal and interest associated with any loan specified in the Certificate of Approved Enterprise. This Certificate, obtained from the Ministry of Finance, is required for receipt of FIPA guarantees. While delays in repatriation were notorious in the past, Kenya's healthy foreign exchange reserves have removed this problem. Capital profits are not currently repatriable, but are expected to be so soon.

Kenya is also a member of the World Bank affiliated Multilateral Investment Guarantee Agency (MIGA) which issues guarantees against non-commercial risk. And, the country is a member of the International Centre for the Settlement of Investment Disputes (ICSID).

There are generally no restrictions on the foreign ownership of firms engaged in commerce and industry in Kenya. There are restrictions on insurance companies, which require Kenyan participation.[26/] The acquisition of domestic firms by foreigners on the Nairobi Stock Exchange is restricted. Foreigners are only allowed to own 40 per cent (raised from 20 per cent in August 1995) of the shares of a local company and any single investor may own 5 per cent. Under the Restrictive Trade Practices, Monopolies and Price Control Act of 1989, there are restrictions on

the purchase of a firm by a firm in the same industry and the merger of two or more firms in the same industry.

There are no restrictions on the foreign purchase of real estate except for agricultural land and sea-front plots.

Locally registered foreign-controlled companies are not discriminated against in terms of taxation. All locally registered companies are taxed at a rate of 35 per cent. When withholding tax is taken into consideration, the effective rate is 41.5 per cent for foreign firms. Branches of foreign firms are taxed at 42.5 per cent. Income is defined as total worldwide income, less expenses incurred in the generation of that income. No credit is given for taxes paid on that income unless the country in which the tax was paid has a double-taxation treaty with Kenya.

Currently there are taxation treaties in place with eight countries: Canada, Denmark, Germany, Norway, Sweden, the United Kingdom and Zambia. None of the treaties reduces the withholding on dividend or interest remittances paid to non-residents. Only three provide for a reduction in the 20 per cent withholding on royalties and management fees. Treaty rates are lower for Canada at 15 per cent for both royalties and fees; the United Kingdom at 15 per cent for royalties and 12.5 per cent for fees; and India at 17.5 per cent for fees.

Public enterprise reform and privatization

As noted above, one of the principal objectives of Kenya's investment policy is the privatization of 207 of the 240 parastatal enterprises. By the 1980s, it was clear that the parastatal enterprises were not achieving their primary objectives and were far less efficient and productive than enterprises in the private sector. All parastatals received direct and indirect subsidies from the government and number of them were large loss makers. In June 1982, a working party was formed to study government expenditure. The result of that, as indicated by subsequent studies, was that the poor performance of the parastatals accounted for a large portion of the domestic budget deficit. Divestiture of many and full privatization of other parastatals was recommended.

The following summarizes an analysis of the parastatal sector in the years 1986-1991 conducted by the World Bank.[27]

Efficiency indicators (1986-1991)

Total value added (annual percentage)	0.5
Value added in manufacturing (annual percentage)	-0.1
Change in total factor productivity (annual percentage)	-0.7
Growth rate of labour use/growth rate of labour use in the private sector	0.6
Growth rate of capital inputs/growth rate of capital in the private sector	2.1

Relationship to budget and external accounts (1986-1991)

Net lending and equity to parastatals/overall net lending by government (percentage)	35.4
Profits, interest and dividend payments/tax revenue	3.7
Parastatal external debt/total public and public guaranteed debt (1990) (percentage)	17.0
Parastatal external debt servicing/total (1990) (percentage)	25.5
Net exports of parastatals/total net exports (percentage)	-27.7

Relationship to Banks and Non-Bank Financial Institutions (1986-1991)

Parastatal deposits/total commercial bank deposits	6.7
Parastatal deposits/total NBFI deposits	10.0
Parastatal credit/commercial bank credit	6.0
Parastatal credit/NBFI credit	1.3

In 1991, the process of privatization was established in Kenya under the administration of the Parastatal Reform Programme Committee (PRPC) which is under the chairmanship of the minister of finance. The Executive Secretariat and Technical Unit (ESTU) of the PRPC coordinates and manages the programme.

The goals of privatization in Kenya are to:

- enhance the role of private sector in the economy;
- reduce the demand of public enterprises on the Treasury;
- rationalize the operations of public enterprises;
- improve the regulatory environment; and
- broaden the base of ownership and enhance the capital markets.

Under Kenyan law, several methods may be used to privatize a state-owned enterprise:

- public offering (IPO) of shares on the Nairobi Stock Exchange;
- the sale of shares through a private placement;
- negotiated trade sales in so far as preemption rights exist and have been exercised;
- sale of enterprise assets (including liquidation);
- new private investment in enterprises;
- employee/management buy-out; and
- leasing or award of management contract.

By October 1994, 69 enterprises had been disposed of the following way:

Liquidation (dormant and insolvent enterprises)	26
Preemptive rights	20
Receivership	7
Voluntary liquidation	6
IPO	5
Competitive bidding	5

According to the Policy Paper on Public Enterprise Reform, of October 1994,[28/] a further 58 enterprises were slated for privatization through preemptive rights, 26 through competitive bidding, and 19 via IPOs. The privatization method for eight enterprises had not yet been chosen.

As has been the case in all country's undertaking such a policy, it has not been without its critics. On the domestic side, complaints have ranged, as one would expect, from accusations that the country's "crown jewels" are being sold too cheaply, to the country is "selling out" to white foreigners. On the international side the complaints are mainly that the process is moving too slowly, especially in the eyes of the multi- and bilateral donors.

Largely in response to the complaints of a lack of transparency and speed, the government published the October 1994 policy paper on privatization. This paper spelled out in detail its intent to follow a strict set of rules regarding the procedures for privatization, including the publication of the criteria to be used to asses bids. These procedures and principles are given in Box I.A.

Box I.B. Procedures governing Kenyan privatization

1. Enterprises will be divested into competitive markets; intact or unregulated monopolies will not be sold.

2. Buyers will not receive special protection or access to credit on concessionary term.

3. In cases where the government retains a minority share, it will not exercise any special or extraordinary voting rights, except in limited, predetermined and well defined policy areas.

4. Excluding financial and operational (but not physical) restructuring that are necessary to prepare state enterprises for sale, there will be a moratorium on new government investments in enterprises that are to be privatized.

5. All privatization sales will be on a cash-only basis, with the possible exception of shares sold to employees of the firm.

6. No specific class of potential purchasers will be excluded from the process.

7. All transactions will be conducted in an open and transparent manner, consistent with normal standards of commercial discretion. Unless justified by the existence of legal rights, no predetermined direct sale or negotiations by private treaty will be entertained except after publicly solicited bids have been obtained. Upon completion of the sale, all aspects of the transaction will be in the public domain where appropriate, this means:

   - a prospectus or offering memorandum will be prepared and published for each firm to be sold;
   - full financial, management and other information will be available to the investing public;
   - fair and equitable bidding procedures will be established;
   - criteria for ranking bids will be established and published;
   - bids will be opened in public;
   - upon the completion of the sale, the names of the purchasers, the price paid and conditions of the sale will be made public; and
   - the valuation of the assets and details of the offer received will be in the public domain.

8. To promote and ensure competitiveness of the markets in which privatized companies operate, the government will continue to build upon existing anti-monopoly legislation and the institutional capacity to implement it in a transparent manner, including publicizing it.

9. The sale of a public enterprise or portion thereof to another public enterprise or public institution will not be considered as privatization.

10. No new parastatal will be established in the productive sector except for investments made purely for venture capital assistance through the restructured development finance institutions.

Again in his 1995 budget speech, Mr. Mudavadi pledged to speed the process of privatization. By June of 1995, a total of 61 enterprises had been sold generating KSh20 million for the Treasury and KSh100 million for the Industrial Development Bank (IDB), Industrial and Commercial Development Corporation (ICDC), Kenya Tourism Development Corporation and other holding companies. By the end of 1997, the government hopes to have sold its holdings in all but 33 strategic enterprises. For the purposes of the retention of state ownership, strategic enterprises are defined as those which provide essential services or play a key role in terms of national security, health and environmental protection.

Enterprises slated for privatization[29] include the country's six sugar companies, and enterprises in the textile, cement, hotel, banking, retail food markets, wines and spirits imports, insurance and real estate sectors. The government's stake in the 39 tea processing facilities are also to be privatized through the sale to small holders.

Those enterprises to remain in state hands include utilities, railways and the postal authority. The telecommunications portion of the Kenya Post and Telecommunications (KP&T) is to be spilt off and sold. In fact, the delay in privatizing this portion of KP&T has been the cause of some tension between the government and several of the donor organizations and countries.

Because much of what is needed in these enterprises, as is generally the case in state-owned enterprises worldwide, is the inflow of new technology, management know-how and investment, and with the lack of funds available in Kenya, the obvious place to turn is to foreign strategic investors. Foreign participation and interest in the process has been limited thus far, however. Of the 69 enterprises sold or liquidated by October 1994, foreign participation was almost exclusively limited to the buy-out of the government's share of an existing joint venture.

Under the procedure and plan established in the October 1994 policy paper, five parastatals that have a major impact on the economy have been chosen for immediate restructuring. The responsibility for restructuring these enterprises falls to the Department of Government Investments and Public Enterprises (DGIPE) within the Ministry of Finance. DGIPE will represent the government's ownership rights in public enterprises with minority state shares and take the oversight and leadership role in those where the state has majority holdings. DGIPE will devise and execute the restructuring of these enterprises, and in the long term, be responsible for monitoring their performance, carrying out effective debt management, as well as providing a controlling and accountability function for all budgetary allocations to the parastatals.

Selected institutions supporting industrial development

Investment Promotion Centre (IPC): Created by an Act of Parliament, the IPC serves as a primary point of contact for both domestic and foreign investors exploring the investment opportunities in the country. Among other things, the IPC provides basic information on: the investment climate; investment regulations; major investment opportunities; advice on obtaining finance; and assistance in arranging site visits. The IPC can also provide approval for projects so that investment may begin while the required licenses are being applied for.

African Project Development Facility (APDF): APDF was established jointly by the IFC, UNDP, USAID and the ADB to support medium-sized African-owned projects. Assistance is offered in project preparation, locating joint venture partners and negotiating project finance.

Federation of Kenya Employers (FKE): The FKE was established in 1959 under the Trade Unions Act as an association to represent the collective interests of the country's employers. Its major objective is to defend the interest of employers while at the same time raising their consciousness of the importance of promoting increased labour productivity, sound management practice, better industrial relations, fair labour practices, effective work organization and staff motivation in the realization of their firms' full potential. FKE has also sponsored several programmes aimed at the support and development of industry in Kenya. The **Small Enterprise Development Programme** is one such programme FKE developed to promote the improvement

in the performance of small enterprises. It provides productivity and quality improvement programmes, provides a data base and networking of business information. It also offers management consultancy, legal aid and technology services. It will assist in the preparation of feasibility studies, improvement in marketing techniques, and provide subcontracting and credit advisory services. It also helps to facilitate the transfer of technology from large to small enterprises and between small-scale enterprises, and offers training and follow up advise on business management. FKE has several other initiatives aimed at supporting industrial development including the **Total Quality Management Programme** and various other technical and management training programmes.

Kenya Association of Manufacturers (KAM): KAM was established in 1959 as a corporate body bringing together industrialists in an organization aimed at encouraging investment and the development of Kenya's industrial potential. KAM has sponsored several studies of the constraints facing Kenya industry and lobbied government with its findings.

Kenya National Chamber of Commerce and Industry (KNCCI): The Kenya Chamber of Commerce and Industry was established in 1965 and functions in the same manner as Chambers across the world. It provides information and other support services to its industrial, commercial and service sector members. KNCCI has branches throughout the country.

Kenya Small Traders Society (KSTS): With 4,000 members drawn from small enterprises, KSTS functions as a lobbying association for small business interests.

Kenya Industrial Research and Development Institute (KIRDI): Established in 1949, KIRDI was reorganized in 1975. As well as conducting research, KIRDI provides advice to industry on existing technologies and appropriate technology choice. It also works to modify and adapt foreign technologies to domestic uses and identify local technology needs.

Export Promotion Council (EPC): This Presidential Council was established in 1992 with purpose of promoting exports and the development of export industries. As an independent council, it supports exporters to overcome the obstacles and bottlenecks facing them to increase their export performance though advice and the identification of new markets for Kenyan production. It also drafts legislation for consideration by Parliament and makes suggestions on the development of incentives and regulation changes that will encourage exports further.

Kenya Exporters Assistance Scheme (KEAS): KEAS is a World Bank-financed project which provides financial, technical, and marketing assistance to small and medium enterprises manufacturing non-traditional exports. Its primary goal is to help raise the quality of these exports.

Kenya Exporter Development Support (KEDS): KEDS is funded by USAID and supports the development and growth of non-traditional exports. Technical and financial assistance is provided to both public and private sector institutions. Focus is primarily on small and medium manufacturing enterprises, agri-business and trading sectors.

The Horticultural Crops Development Authority (HCDA): HCDA aims to facilitate the promotion of horticulture through the dissemination of market information, organizing groups of small growers, advising growers, processors and exporters, and providing technical training on the proper use of inputs and post-harvest handling techniques. HDCA also monitors movements in horticultural prices.

Selected institutions providing financial support to industrial development

Industrial Development Bank (IDB): IDB is a government funded financial institution established to promote the expansion and modernization of medium and large industrial enterprises. IDB provides medium- and long-term loans, direct equity investments and loan guarantees for projects in mining, agro industries, engineering, tourism, transport, shipping and other sectors. IDB

provides working capital and corporate advisory services. IDB does not normally finance more than 50 per cent of a project, or loan or invest more than KSh75 million. Loans are made on the basis of sound financial practice and at market rates. The Bank is limited to holding no more than 20 per cent of its portfolio in any one sector.

Industrial and Commercial Development Corporation(ICDC): Founded in 1954, ICDC has acted as the government's primary means of investing in joint ventures with both local and foreign partners. In its early years, ICDC established many programmes that provided funding for small-scale projects. In recent years, however, it has undergone a restructuring and it is now focused on larger projects. ICDC is mandated to provide venture capital in a minority position, secured long-term loans and export financing, and management advisory services. ICDC will normally lend up to 2/3 of the secured value of loans between KSh5 million and KSh10 million in size for industrial projects and KSh200,000 and KSh10 million for commercial loans. Loans are for terms of 5 to 10 years and at market rates. The ICDC will not undertake equity stakes greater than 40 per cent. Amounts also will range between KSh5 million and KSh10 million. ICDC targets disposal of the investment in three to six years, but not longer than 10 years. Although considered venture capital financing, most of ICDC's equity investment is provided to existing companies, with only a limited portion going to start-up ventures.

Development Finance Company of Kenya (DFCK): DFCK is a joint venture between Kenya (through the ICDC) and the Netherlands Overseas Finance Company (FMO), the German Development Bank (DEG), and the International Finance Corporation (IFC). DFCK provides medium-term shilling and foreign currency financing for industrial, agro-processing and tourism sector projects.

East African Development Bank (EADB): Owned primarily by the governments of Kenya, the United Republic of Tanzania and Uganda, the EADB provides medium- and long-term foreign currency denominated loans to projects in the region.

Kenya Industrial Estates (KIE): KIE is the main government-owned financing facility aimed at providing term loans to the country's smaller enterprises. Established in 1967 as part of the ICDC, it was officially split off from the parent institution in 1975. Since 1988, KIE has had a programme in place to lend to the informal sector. KIE has traditionally provided loans on soft terms, but is now undergoing a restructuring that will eliminate much of this subsidized element in its activities.

Small Enterprise Finance Company (SEFCO): SEFCO was established in 1983 by a group of development finance institutions and is largely dependent upon its foreign partners for capital. Current SEFCO programmes include the Craftsmen Credit Guarantee Scheme and the Individual Credit Guarantee Scheme.

International Finance Corporation (IFC): The IFC provides finance to private sector projects in the agricultural, manufacturing and tourism sectors. Both loans and equity investments are available. Most IFC participation is for greater than $20 million and will not cover more than 25 per cent of the cost of a project. Loans are generally made in foreign currency. The IFC also manages the **Africa Enterprise Fund (AEF)** which is designed to support projects with smaller financial requirements.

Industrial Promotion Services Ltd. (IPS): IPS is a venture capital company owned jointly by the Aga Khan, the IFC, Kenya Commercial Bank and a United Kingdom merchant bank. IPS offers equity investments up to 49 per cent of the share capital of a company, loans and management assistance. IPS will also assist in project development and the location of technical know-how.

Economic Development for Equatorial and Southern Africa (EDESA): EDESA provides medium- and long-term financing in both local and foreign currencies. It will put together individual packages of funding for start-up, rehabilitation and expansion activities, including loans, convertible loans, guarantees and equity.

Other Financial Support Schemes:

Barclays Bank: One of the few commercial banks active in lending to the *jua kali* sector, Barclays established a small business unit in 1988 to on-lend funds from the USAID (especially Rural Private Enterprise Fund/RPE monies) and ODA. It also works with the Kenya Women's Finance Trust (KWFT) in administering a programme of lending to women entrepreneurs.

Kenya Commercial Bank (KCB): With the largest network of branches in the country, and predominantly government owned, KCB has participated in the USAID funded RPE and guarantee schemes. The bank also runs the Jua Kali Credit Scheme.

NOTES TO CHAPTER I

1/ By January 1993, Kenya was sheltering an estimated half-million refugees, 400,000 of whom were from Somalia. Approximately 80,000 were from Ethiopia and a further 20,000 from Sudan. Europa Publications Ltd., *Africa South of the Sahara 1995*, London, October 1994, p. 491.

2/ Europa Publications Ltd, *Africa South of the Sahara 1995*, London, October 1994, p. 485.

3/ Fertility rates dropped from 7.9 per cent in 1981 to 5.4 per cent in 1991 and are forecast by Kenyan authorities to drop further to 4.1 per cent in 2000 and 3.3 per cent in 2010. A slower population growth rate is also expected to result from the increase in the number of early deaths due to the HIV/AIDS epidemic. The incidence of HIV is still spreading rapidly and by the year 2000, Kenyan authorities expect the number of AIDS related premature deaths to reach 900,000. By the year 2010, they are expecting a staggering 2.8 million premature deaths. These forecasts incorporate an assumption that the spread of the disease will not slow until the year 1997, when they expect a change in sexual behavior to begin as a result of increased awareness of the disease. Republic of Kenya, *Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year 2010*, p. 24.

4/ Republic of Kenya, *Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year 2010*, p. 25.

5/ Low potential lands are those with less than 612.5 mm of rainfall annually. Medium potential lands are those with 735 mm to 857.5 mm of annual rainfall (up to 980 mm in the Coast Province and only 612.5 mm to 857.5 mm in the Eastern Province). High potential lands are those with greater than 857.5 mm of annual rainfall, or more than 980 mm in the Coast Province.

6/ Kenyan customs authorities seized 13,000 tonnes of Brazilian sugar which the importer claimed was for delivery to the International Committee of the Red Cross, an organization which had not imported sugar for over ten years. In response to this and claims by the largest sugar producer in the country that it was unable to sell 70 tonnes of its daily 800 tonne output, Kenyan authorities raised the sugar development levy on imported sugar from 5 to 20 per cent. Those importers who did not wish to pay the levy were given permission to re-export the sugar.

7/ Republic of Kenya, *Development Plan 1994-1996*, p. 22.

8/ Deloitte Haskins & Sells Management Consultants Ltd. and African Development and Economic Consultants Ltd., *The Present and Future Financing Needs of the Industrial Sector in Kenya*, May 1992.

9/ One of the greatest constraints the Deloitte Haskins & Sells study identified is the lack of medium- or long-term lending by the domestic financial sector. Commercial banks tend to limit their lending to term loans of up to one year and overdrafts. Continuity is then provided by the rolling over these facilities. Non-bank financial institutions tend to lend for longer but still inadequate terms. Rarely do their loans extend for more than five years. This has left Kenya businesses dependent on development financial institutions, mostly foreign, for long-term funds. Few businesses have been able to go to the Nairobi Stock Exchange for equity financing.

10/ World Bank, *World Debt Tables 1994-95, Volume 2 Country Tables*, Washington D.C., p. 242.

11/ Republic of Kenya, *Sessional Paper No.1 of 1994 on Recovery and Sustainable Development to the Year 2010*, Nairobi, 1994, p. 3.

12/ Republic of Kenya, *Sessional Paper No.1 of 1994 on Recovery and Sustainable Development to the Year 2010*, Nairobi, 1994, pp. 8-9.

13/ Republic of Kenya, Central Bureau of Statistics, *Economic Survey 1995*, p. 78.

14/ Republic of Kenya, *Sessional Paper No.1 of 1994 on Recovery and Sustainable Development to the Year 2010*, Nairobi, 1994, p. 28.

15/ The Economist Intelligence Unit, *Investing Licensing & Trading Conditions Abroad, Kenya 1995*, New York, March, 1995, p. 24.

16/ This theme has been reiterated in several government economic policy documents including *Sessional Paper No. 1 of 1994, the Development Plan 1994-1996* and the *Budget Speech* by the Minister of Finance in June 1995.

17/ Restrictions remain on certain goods including the prohibition of bones, horns, teeth and ivory of animals on the endangered species list, coral and sea shells, and nuclear and other toxic waste. Approval is required for weapons, ammunition and fireworks. Technical, sanitary, health and environmental standards must be met for the importation of live animals, fish, plants and some chemicals.

18/ This was a major finding of the Deloitte Haskins & Sells and African Development and Economic Consultants study and they strongly recommended the further liberalization of exchange controls.

19/ Republic of Kenya, *Development Plan 1994-1996*, p. 204.

20/ The Economist Intelligence Unit, *Investing Licensing & Trading Conditions Abroad, Kenya 1995*, New York, March, 1995, p. 14.

21/ Republic of Kenya, National Investment Committee, *Kenya: A Guide for Investors*.

22/ The document was entitled *Strategy for Small Scale and Jua Kali Enterprise Development in Kenya: Towards the Year 2000*.

23/ Republic of Kenya, Ministry of Planning and National Development, *Policy and Strategy for Small Scale and Jua Kali Enterprise Development in Kenya: Action Plan 1994-1996*, Nairobi, October 1994.

24/ UNIDO national consultant.

25/ The Economist Intelligence Unit, *Investing Licensing & Trading Conditions Abroad, Kenya 1995*, New York; March, 1995, p. 9.

26/ For example, insurance firms with a capitalization of Ksh 5-10 million require Kenyan ownership of 51 per cent of the first Ksh 5 million and 15.67 per cent of the excess. One-third Kenyan ownership is required for insurance firms with a capital greater than Ksh 10 million. The Economist Intelligence Unit, *Investing Licensing & Trading Conditions Abroad, Kenya 1995*, New York, March, 1995, p. 14.

27/ World Bank, *Kenya Poverty Assessment*, Washington D.C., 15 March 1995, pp. 5-6.

28/ Republic of Kenya, Department of Government Investments and Public Enterprises, *Policy Paper of Public Enterprise Reform and Privatization*, October 1994.

29/ Republic of Kenya, Ministry of Finance, *Budget Speech for the Fiscal Year 1995/96*, June 1995.

II. THE MANUFACTURING SECTOR

A. GROWTH AND STRUCTURAL CHANGE

Growth

In the early years following independence (the 1960s) Kenya's manufacturing sector grew rapidly. Up until 1985, government policy was aimed at promoting manufacturing for import substitution and incentives favoured the domestic market. Production was skewed towards consumer goods such as food processing, beverages, electrical appliances and machinery, paper products, printing, sugar and confectionary, and petroleum products.

Manufacturing growth began to stagnate in the 1980s, and by 1986 it was clear to government officials that they were facing major structural problems in the economy. With *Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth*, policy was switched to that of promoting export development as a means of easing the foreign currency constraint industry was facing and lessening the dependence of the country on a few commodity exports. Thus, in 1986, the liberalization of trade was begun.

The key element of the new policy was that manufacturing would become the driver of the economy. Extremely ambitious targets rates of growth were established for both the economy as a whole and for manufacturing in particular. From 1988 to the year 2000, manufacturing was expected to rise at an annual rate of 7.5 per cent. GDP at factor cost was targeted for 5.9 per cent per annum growth. As can be seen in Table II.1, that despite the initial good response to the new initiatives, it was immediately clear that these targets would not be met.

Table II.1. Trends in manufacturing, 1975-1994, selected years

	1975	1980	1985	1990	1991	1992	1993	1994
MVA (million KSh)	127.0	295.0	518.4	987.4	1,167.4	1,230.7	1,419.7	1,696.5
MVA (million KSh 1980 prices)	168.9	295.0	356.4	470.7	489.2	495.3	504.2	513.8
Real growth of MVA (percentage)	..	5.1	4.5	5.3	3.9	1.3	1.8	1.9
Share of manufacturing in total output (percentage)	11.8	12.6	11.7	11.8	12.2	11.2	10.4	10.5

Sources: UNIDO, Industrial Development Reviews Information Database; Republic of Kenya, Central Bureau of Statistics, and World Bank, *Kenya Poverty Assessment*, March 1995.

Increased growth returned to the manufacturing by the end of 1986, 5.9 per cent versus 1985's 4.5 per cent, and continued to be strong at 5.6 per cent in 1987 and 6.1 per cent in 1988. But by

1989, the trend had again reversed and the rate of growth was slowing. By 1991, it was clear that the sector was still facing major problems and growth has dropped to 3.9 per cent. Export industries had not taken up the slack resulting from the adverse effect import liberalization was having on domestic industries such as textiles.

The situation was exacerbated in 1991-1993 with poor weather conditions which effected agricultural output and had a negative effect on the agro-based industries. Drought conditions also effected the generation of hydro-power, and power shortages led to a decreased output across almost all industrial sectors.

Industries with large foreign exchange requirements, such as metal products, saw output boosted by the moves to liberalize trade and an increased availability of foreign exchange. Strong export demand and growth in the demand from the domestic *jua kali* sector also helped support the sector's performance in 1994.

The transport equipment sector has suffered in recent years due the increased cost of imports and a decrease in world demand. The sector's rise in 1994 followed three years of sharp contractions. The performance of the paper sector has been effected by the increase in demand for plastic packaging as a substitute to paper packaging.

Table II.2. Manufacturing production by sector, 1987-1994
(1976 = 100)

Industry	1987	1988	1989	1990	1991	1992	1993	1994
Meat and dairy	115.3	127.9	130.9	139.9	125.1	94.0	95.8	87.0
Canned foods, oils and fats	268.1	267.7	291.1	320.9	363.4	338.9	384.4	275.0
Milled grain products	198.3	224.7	175.5	177.9	178.1	170.5	154.8	204.8
Baked goods	151.5	155.4	155.1	158.1	166.1	172.9	178.5	274.5
Sugar and confectionery	189.5	201.5	210.0	203.1	210.6	195.7	198.3	156.8
Miscellaneous foods	189.7	224.7	225.6	226.8	227.4	236.7	220.0	225.9
Total food processing	157.8	167.5	171.0	173.2	174.7	168.3	168.2	167.7
Beverages	196.9	207.9	210.3	218.0	210.8	245.0	243.4	225.2
Tobacco	170.8	178.1	178.6	178.2	173.5	192.8	194.8	196.2
Total beverages and tobacco	194.3	201.9	204.1	210.7	203.9	235.7	234.6	219.3
Textiles	192.5	197.2	202.3	227.8	218.5	218.5	252.0	186.9
Clothing	359.8	368.3	378.6	347.2	323.6	320.6	292.4	183.9
Leather and footwear	83.5	88.1	94.7	99.2	101.5	97.1	87.9	96.8
Wood and cork products	68.1	66.4	68.1	70.2	73.1	74.0	73.7	76.0
Furniture and fixtures	73.5	72.7	72.9	73.7	70.8	46.8	49.6	50.6
Paper and paper products	170.0	189.3	194.7	203.9	214.6	257.7	180.5	155.6
Printing and publishing	372.2	389.1	392.9	401.8	405.8	411.2	411.2	424.8
Basic chemicals	170.0	182.1	198.1	211.3	233.8	234.0	244.6	213.0
Petroleum and other chemicals	303.5	342.9	396.0	457.8	510.7	481.8	69.2	453.6
Rubber products	277.0	286.3	308.7	325.9	322.4	630.3	622.4	613.7
Plastics	212.3	202.8	219.1	227.4	274.3	323.7	357.2	362.6
Clay and glass	291.7	306.5	338.1	367.2	259.3	575.2	1,199.0	1,770.6
Non-metallic minerals	142.7	140.7	147.0	167.1	174.4	205.7	201.5	211.7
Metals	116.2	133.1	154.6	177.0	203.1	183.8	184.2	205.0
Non-electric machinery	127.9	138.7	132.8	103.8	101.0	95.3	94.6	100.3
Electrical equipment	168.4	189.3	193.8	190.3	259.7	251.5	224.5	226.2
Transport equipment	547.4	612.4	638.0	673.5	662.0	603.7	541.2	571.4
Miscellaneous manufactures	336.0	350.3	375.0	406.1	441.0	442.9	442.9	442.9
Total manufacturing	**199.4**	**211.3**	**223.8**	**235.6**	**242.3**	**245.4**	**249.9**	**254.7**

Source: Republic of Kenya, Central Bureau of Statistics.

Structural change

Despite the change in government policy to promote export industries over import industries beginning in the late 1980s, there has been relatively little change in the structure of the manufacturing sector in terms of subsector contributions to total manufacturing output. The importance of food processing has increased, in 1975 food products accounted for 23.42 per cent of manufacturing, in 1994 their share was 30.16 per cent. The share of beverages rose only modestly, from 10.41 per cent in 1975, to 11.51 per cent in 1994.

The only other sectors to change in relative importance to any extent are transport equipment and electrical machinery. Transport equipment's share of total manufacturing value added dropped from 7.51 per cent in 1975, to just 3.97 per cent in 1994. Electrical machinery rose over the period from accounting for just 3.75 per cent of total manufacturing value-added, to accounting for 5.36 per cent.

There has also been relatively little change in the size structure of Kenyan manufacturing. The vast majority of manufacturing establishments remain small in size, less than 50 employees. The number of large scale enterprises, greater than 50 employees has risen slowly, but steadily in recent years, however. According to one classification, in 1986 there were 609 establishments (places of work rather than firms), employing 142,253 persons. By 1990, the number of establishments had risen to 647, and employment was 166,276. A second classification excluding public sector establishments, placed the number of establishments in the modern sector with greater than 50 employees at 612 in 1990, out of a total of 2,002 establishments.[1/]

Table II.3. Branch share in total manufacturing value added, 1975-1993, selected years
(Percentage)

	1975	1980	1985	1990	1991	1992	1993
Food products	23.42	23.90	27.84	27.66	28.75	30.15	30.16
Beverages	10.41	10.36	12.91	11.20	11.58	11.45	11.51
Textiles	5.64	7.10	6.27	6.03	5.83	5.50	5.49
Clothing (non-footwear)	2.57	2.11	2.77	1.72	1.70	1.60	1.59
Leather and leather substitutes	0.47	0.80	0.37	0.48	0.49	0.61	0.46
Leather footwear	1.04	1.49	0.92	1.44	0.89	1.30	1.32
Wood and cork products	2.31	2.53	2.03	1.82	1.78	1.68	1.72
Furniture and wood fixtures	1.70	1.25	1.48	1.24	1.22	1.30	1.26
Paper and paper products	3.11	4.47	3.50	4.59	4.37	4.20	4.23
Printing and publishing	4.43	3.08	2.95	2.97	3.00	2.82	2.78
Industrial chemicals	3.58	2.94	2.40	1.91	1.86	1.83	1.85
Non-industrial chemicals	6.06	5.30	7.56	7.37	7.13	7.25	7.47
Petroleum refineries	4.04	1.16	0.92	0.77	0.81	0.76	0.79
Rubber products	3.25	3.15	4.06	3.64	3.56	3.28	3.31
Plastic products	1.33	1.70	2.03	2.68	2.83	3.21	3.17
Pottery, china and earthenware	0.07	0.07	0.18	0.10	0.08	0.08	0.07
Glass and glass products	0.50	0.42	0.55	0.57	0.49	0.53	0.46
Non-metallic minerals	5.35	2.87	4.61	4.59	4.54	4.27	4.30
Basic iron and steel	1.20	1.21	0.18	0.29	0.24	0.30	0.38
Metal products (non-machinery)	5.84	5.92	4.42	6.99	6.88	6.57	6.22
Non-electrical machinery	0.99	0.76	0.55	0.57	0.57	0.53	0.53
Electrical machinery	3.75	6.79	5.35	4.79	5.18	5.34	5.36
Transport equipment	7.51	9.53	4.61	4.31	4.21	3.97	3.97
Professional and scientific equipment	..	..	0.07	0.06	0.08	0.10	0.13
Miscellaneous manufacturing	1.43	1.07	1.48	2.20	1.94	1.76	1.98

Source: UNIDO, Industrial Development Reviews Information Database.

B. INDUSTRIAL EMPLOYMENT

Quantitative trends

Employment in the manufacturing sector in Kenya has increased in recent years, but at a very disappointing rate. While growth in manufacturing employment was strong in the late 1 70s, by the early 1980s it had slowed significantly. Between 1981 and 1985, the growth of manufacturing wage employment was just 2.2 per cent. Over the period the share of total wage employment that manufacturing accounted for dropped from 14.3 per cent to 13.4 per cent.

Table II.4. Persons engaged, recorded totals, 1981-1994, selected years
(Thousand)

	1981	1990	1994
Modern establishments: urban and rural areas - wage employees	1,024.3	1,409.3	1,504.4
Self-employed and unpaid family workers	62.1	48.2	58.3
Informal sector	157.3	436.6	1,792.4
Total	**1,243.7**	**1,894.2**	**3,355.1**

Source: Republic of Kenya, Central Bureau of Statistics.

Table II.5. Wage employment by industry, 1981-1994, selected years
(Thousand)

	1981		1990		1994	
	Private	Public	Private	Public	Private	Public
Agriculture and forestry	173.6	61.9	202.4	67.3	212.8	67.9
Mining and quarrying	1.5	0.7	3.4	0.7	3.9	0.7
Manufacturing	116.7	29.6	146.1	41.6	158.3	39.3
Electricity and water	0.2	10.0	0.5	21.9	1.2	20.8
Building and construction	32.6	28.7	36.8	34.6	44.0	29.3
Wholesale and retail trade, restaurants and hotels	67.7	4.9	104.6	9.3	119.7	6.9
Transport and communication	18.9	36.5	25.5	49.0	37.2	40.7
Finance, insurance, real estate and business services	31.1	8.4	47.1	18.2	57.1	17.9
Community, social and personal services	97.9	303.4	142.5	457.8	102.6	464.1
Total	**540.2**	**484.1**	**708.9**	**700.4**	**810.8**	**687.6**
Total employment	1,024.3		1,409.3		1,504.4	

Source: Republic of Kenya, Central Bureau of Statistics.

In the second half of the 1980s, the rate of employment creation in manufacturing increased to an average of 2.9 per cent per year, but this was not enough to keep up with the increase in the labour force and the share of manufacturing in total wage employment fell further to 13.2 per cent.

Within the manufacturing sector, food processing is the largest employer with 28.64 per cent of the total manufacturing labour force in 1993. This is up significantly from 1985 when the subsector employed only 19.74 per cent of the manufacturing labour force (see Table II.6). The next most important source of manufacturing jobs is the textile industry accounting for 12.99 per cent of total manufacturing employment in 1993. Transport equipment remains an important Kenyan employer at 7.93 per cent of the manufacturing labour force, but this share is down by half from 15.93 per cent in 1975.

Table II.6. Manufacturing employment by branch, 1975-1993, selected years
(Percentage)

	1975	1980	1985	1990	1991	1992	1993
Food products	19.74	24.21	26.15	27.45	28.36	28.25	28.64
Beverages	4.52	3.59	4.78	4.08	4.18	4.20	4.25
Textiles	12.63	13.93	14.37	13.38	12.94	12.93	12.99
Clothing (non-footwear)	4.25	3.77	4.84	3.66	3.6[illegible]	3.54	3.52
Leather and leather substitutes	1.12	1.05	0.76	0.77	0.77	0.79	0.81
Leather footwear	1.66	1.50	1.25	1.27	1.21	1.19	1.19
Wood and cork products	7.65	6.50	4.95	4.61	4.57	4.49	4.48
Furniture and wood fixtures	2.51	2.15	2.83	2.08	1.98	1.98	1.98
Paper and paper products	3.15	2.45	3.02	3.81	3.81	3.80	3.81
Printing and publishing	4.32	3.15	3.27	3.19	3.11	3.13	3.13
Industrial chemicals	1.90	1.97	2.08	1.90	1.85	1.88	1.87
Non-industrial chemicals	3.15	3.64	4.47	4.62	4.62	4.71	4.83
Petroleum refineries	0.29	0.24	0.20	0.14	0.14	0.14	0.14
Rubber products	1.33	1.38	1.22	1.17	1.22	1.21	1.21
Plastic products	1.15	1.45	1.31	1.82	1.90	2.05	2.09
Pottery, china and earthenware	0.07	0.10	0.14	0.11	0.12	0.13	0.11
Glass and glass products	0.66	0.66	0.80	0.77	0.76	0.76	0.77
Non-metallic minerals	3.58	3.54	3.08	2.88	2.89	2.96	2.95
Basic iron and steel	0.93	1.28	1.38	2.84	2.92	2.94	2.90
Metal products (non-machinery)	5.95	7.60	5.76	6.31	6.29	6.29	6.30
Non-electrical machinery	1.27	1.13	0.85	0.79	0.78	0.78	0.77
Electrical machinery	1.03	1.11	1.41	1.26	1.37	1.46	1.45
Transport equipment	15.93	12.83	9.75	9.10	8.66	8.48	7.93
Professional and scientific equipment	..	..	0.11	0.10	0.11	0.12	0.13
Miscellaneous manufacturing	1.21	0.79	1.23	1.91	1.76	1.80	1.76

Source: UNIDO, Industrial Development Reviews Information Database

Educational background and skill levels

Information relating to the educational and skill level of the industrial labour force does not exist. Extrapolation must be made from data on the entire population.

In 1994, Kenya boasted over 37,000 non-university educational institutions with a total of over 6 million students. Pre-primary schools numbered 19,083 while primary and secondary schools numbered 15,900 and 2,834 respectively. There were also 25 training colleges for primary educators and three for secondary educators.

While over 5 million students were enroled in primary education, only 619,839 attended secondary schools in 1994. Kenya also has three polytechnical institutes which had 10,836 students enroled in 1994. These institutions offer technical training for middle and high level skilled manpower to secondary school leavers and employer-sponsored trainees.

Vocational and technical training is an important component of Kenya's educational system. These institutes aim to provide increased training to school leavers. This training takes place in several different kinds of training institutes such as:

- Youth Polytechnics which offer training to primary school leavers at the artisan level;
- Technical Training Institutes which replaced former technical secondary schools;
- Harambee Institutes of Technology which are community based government assisted institutions; and
- Industrial Training Centres.

The country has five public universities: the University of Nairobi with 12,545 undergraduates and 1,249 postgraduates in the 1993/94 academic year; Moi University with 5,456 undergraduates and 211 postgraduate students; Maseno University College (part of Moi University) with 1,391 undergraduates and four postgraduate students; Kenyatta University with 8,475 undergraduates, 102 in its Masters programme and 11 Doctoral candidates; Jomo Kenyatta University of Agriculture and Technology with 1,553 undergraduates and 30 graduates; and Egerton University with 7,956 enroled students.

There are also 12 private universities in the country that offer degree courses but only three of them are accredited by the government. Most of these have religious affiliation and sponsorship. In the 1994/95 school year they enroled 3,545 students.

While the number of females enroled in primary school is roughly even with that of their male counterparts (49 per cent in 1994), by secondary school age, females have dropped out of the system in significant numbers. Only 46 per cent of secondary students are female. However, a surprisingly large number of women attend university. In 1994, 25.2 per cent of all students in the country's five public universities were women. The number of women enroled at Jomo Kenyatta University of Agriculture and Technology was only 11.3 per cent, the lowest at all the universities.

In an effort to increase the rate of literacy which is currently 69 per cent for the total population (age 15 and above) and 58 per cent for females, Kenya has initiated adult literacy courses. Enrolment totalled 114,278 in 1994, 76.7 per cent of whom were women.

Youth unemployment and the creation of jobs for the labour market's young and inexperienced members is a particular concern due to the rapid rate of increase in the population and the vast numbers of new entrants to the labour pool. In an effort to help these young people get the experience they need to find jobs and support themselves through self-employment, as well as provide the skills needed for development, the government established a National Youth Service. Some 2,000 trainees have been enroled in this programme per year and the 1995/96 budget has allocated increased funds to up the number of participants to 3,000 per year.

The role of women

According to World Bank data, female participation in the labour force has dropped slightly over the past 20 years from 42.2 per cent in 1973 to 39.3 per cent in 1993.[2/] The role of women in the industrial sector is far lower, however. In 1993 and 1994, women accounted for just 12 per cent of total manufacturing employment.

Women also tend to have lower paying jobs. In 1990, women accounted for 24 per cent of those employed individuals earning under KSh215 per annum and only 18 per cent of those earning over KSh3,000 per annum. And women are concentrated in service jobs such as education. Over 57 per cent of female wage employment in 1994 was in the service sector, and 27 per cent in educational services. In 1983, the figures were 58.4 per cent in services and 24 per cent in educational services. In fact, very little change has taken place over the past ten year in the structure of female employment in Kenya.

Table II.7. Industrial wage employment by gender, 1983-1991, selected years
(Thousand)

	1983		1990		1994	
	Male	Female	Male	Female	Male	Female
Agriculture and forestry	195.7	35.4	205.3	64.4	215.4	64.3
Mining and quarrying	3.4	0.1	3.3	0.9	3.4	1.2
Manufacturing	134.8	13.9	166.5	21.2	173.5	24.1
Electricity and water	16.1	1.2	19.3	3.1	19.0	3.0
Building and construction	57.5	2.7	67.4	4.0	69.6	3.7
Wholesale and retail trade, restaurants and hotels	68.9	11.4	95.5	18.5	104.3	22.3
Transport and communication	47.8	7.2	63.8	10.7	66.7	11.2
Finance, insurance, real estate and business services	36.4	9.2	50.8	14.4	57.6	17.4
Community, social and personal services:						
Public administration	116.1	23.9	142.8	41.4	154.1	39.6
Educational services	125.1	46.8	162.5	74.1	163.7	94.4
Domestic services	41.7	15.0	0.6	0.3	40.3	21.8
Other services	54.7	28.3	122.7	55.9	89.2	43.6
Total employment	**898.2**	**195.1**	**1,100.5**	**308.9**	**1,156.8**	**347.6**
Regular	730.8	168.0	962.6	265.8	1,020.9	311.9
Casual	167.4	27.1	137.9	42.7	135.9	35.7

Source: Republic of Kenya, Central Bureau of Statistics.

After services, agriculture is the next largest employer of women with almost 19 per cent of total female wage employment in 1994. In 1983, the figure was 18.14 per cent. Manufacturing employed 7.69 per cent of the female wage earning population in 1983 and 6.93 per cent in 1994. Fifteen per cent of wage earning males are employed in the manufacturing sector.

The issue of the role of women in the development and future of the country has begun to be raised. Efforts are being made to address the constraints to female participation in the modern sector. The government recognizes that previous development projects have tended to marginalize women and their role and the 1994-1996 Seventh Development Plan calls for the establishment and strengthening of "women's desks in key sectors such as Health, Agriculture, Environment, population, Planning, Education, Office of the President, DPM, etc." Noticeably lacking, however, is the mention of a women's desk at the Ministry of Trade and Industry.

C. PRODUCTIVITY AND OUTPUT

Output

Over the past 20 years, manufacturing value added as a per cent of gross output in the manufacturing sector has declined dramatically. In 1975, the share was 21.88 per cent, by 1993 it was just 9.7 per cent. The decline has been steady, pointing up the critical structural problems facing Kenyan manufacturing. Across all sectors, there is a relatively high physical input cost structure. Those with the highest input cost structure are transport equipment, iron and steel, food products and clothing, which have seen serious deterioration over the period. Those sectors that have traditionally had a lower cost structure are beverages, textiles, leather footwear, printing and publishing, electrical and non-electrical machinery.

Few manufacturing sectors have seen improvement in there cost structure over the years. The share of manufacturing value added in gross profit has risen in the textile sector, from 28.28 per

cent in 1975 to 37.55 per cent in 1993. Furniture and wood fixtures has also seen improvement, as has glass and glass products.

Table II.8. Share of manufacturing value added in gross output, by branch, 1975-1993, selected years
(Percentage)

	1975	1980	1985	1990	1991	1992	1993
Food products	18.40	15.69	11.52	8.01	7.92	8.05	6.87
Beverages	37.77	40.51	32.41	28.61	30.04	27.37	24.34
Textiles	28.28	27.86	23.45	51.64	43.38	47.69	37.55
Clothing (non-footwear)	20.16	22.02	21.74	10.98	6.73	9.09	.17
Leather and leather substitutes	19.29	34.86	12.48	24.97	12.49	4.83	11.65
Leather footwear	25.38	41.47	20.85	28.84	19.65	23.93	22.48
Wood and cork products	31.21	29.80	25.58	20.43	20.38	18.04	6.06
Furniture and wood fixtures	24.46	23.99	28.58	34.22	44.13	51.49	5.23
Paper and paper products	20.74	31.39	20.22	26.66	21.69	23.50	8.39
Printing and publishing	28.14	27.05	29.09	36.05	37.37	33.04	8.96
Industrial chemicals	20.01	20.73	14.13	11.37	12.50	10.21	0.89
Non-industrial chemicals	21.22	22.98	20.30	6.78	8.13	8.09	0.43
Petroleum refineries	6.06	2.16	1.20	0.86	0.82	0.69	0.62
Rubber products	46.80	27.66	34.38	24.36	24.17	20.09	17.30
Plastic products	31.08	31.02	25.58	28.28	23.03	23.59	13.75
Pottery, china and earthenware	30.00	32.57	100.00	12.46	50.34	3.33	24.64
Glass and glass products	28.27	25.47	42.84	46.17	46.14	46.72	8.81
Non-metallic minerals	34.86	24.55	26.04	22.85	18.99	18.60	9.34
Basic iron and steel	14.04	11.90	2.05	2.52	1.78	2.09	2.61
Metal products (non-machinery)	26.57	23.75	12.83	19.47	16.86	6.54	15.61
Non-electrical machinery	32.17	28.58	15.00	50.05	50.00	43.81	2.02
Electrical machinery	33.74	41.79	24.17	17.30	16.84	16.71	4.62
Transport equipment	39.85	28.89	12.02	11.06	11.74	10.70	0.55
Professional and scientific equipment	..	..	20.16	6.64	8.50	8.83	10.00
Miscellaneous manufacturing	11.22	24.62	28.58	21.90	16.44	13.86	16.48
Total manufacturing	**21.88**	**21.23**	**15.34**	**11.85**	**11.41**	**11.06**	**9.70**

Source: UNIDO, Industrial Development Reviews Information Database.

Productivity

Labour productivity in Kenya, while not high, has grown steadily. Even in the difficult years of 1991 to 1993, labour productivity continued to increase, if only by marginal amounts. As a percentage of gross output, wage cost has declined steadily (except for 1991) since the early 1980s. Wage cost as a per cent of value-added has also been on a downward trend over the period.

As would be expected, in general the highest level of labour productivity in Kenyan manufacturing occurs in those sectors that are the most modern and have the highest level of capital investment and inputs, and the lowest level of labour inputs. Petroleum refining, electrical equipment, rubber production and the beverages sectors have the highest level of labour productivity. Measured relative to the average labour productivity of manufacturing in total, the index for petroleum refining was 582. This is down, however, from 1,388 in 1975. This decline has been the result not only of a real decline in the labour productivity in this sector, but increases across other sectors.

Table II.9. Growth of labour productivity in manufacturing, 1982-1994, selected years
(Percentage)

	1982	1987	1989	1990	1991	1992	1993	1994
Change in the quantum index of manufacturing	2.2	5.7	5.9	5.3	4.1	1.2	1.8	1.9
Change in the number of manufacturing employees	0.3	2.3	2.8	2.7	0.6	0.4	1.7	2.1
Implicit change in labour productivity	1.9	3.4	3.1	2.6	3.5	0.8	0.1	0.6
Wage cost as a percentage of gross output	6.6	4.6	4.3	3.9	4.1	3.5	3.1	3.0
Wage costs as a percentage of value-added	34.8	33.8	34.5	33.1	35.7	2.1	32.2	32.3

Source: Republic of Kenya, Central Bureau of Statistics.

Table II.10. Index of labour productivity, 1975-1993, selected years
(Total manufacturing = 100)

	1975	1980	1985	1990	1991	1992	1993
Food products	119	99	106	101	101	107	105
Beverages	230	288	270	275	277	273	271
Textiles	45	51	44	45	45	43	42
Clothing (non-footwear)	60	56	57	47	46	45	45
Leather and leather substitutes	42	76	49	62	63	77	57
Leather footwear	63	100	74	113	73	109	112
Wood and cork products	30	39	41	39	39	37	38
Furniture and wood fixtures	68	58	52	60	61	66	63
Paper and paper products	99	183	116	121	115	110	111
Printing and publishing	102	98	90	93	96	90	89
Industrial chemicals	189	179	115	101	101	97	99
Non-industrial chemicals	193	146	169	160	154	154	155
Petroleum refineries	1,388	483	456	544	579	551	582
Rubber products	244	229	333	310	292	272	274
Plastic products	116	117	154	147	149	157	152
Pottery, china and earthenware	99	74	134	86	67	60	57
Glass and glass products	77	64	69	75	64	70	60
Non-metallic minerals	149	81	150	160	157	144	146
Basic iron and steel	129	94	13	10	8	10	13
Metal products (non-machinery)	98	78	77	111	109	104	99
Non-electrical machinery	78	67	65	72	72	69	69
Electrical machinery	363	614	380	379	378	367	370
Transport equipment	47	74	47	47	49	47	50
Professional and scientific equipment	..	..	67	66	67	82	105
Miscellaneous manufacturing	118	137	120	115	110	98	113
Total manufacturing	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: UNIDO, Industrial Development Reviews Information Database.

The beverage industry has seen a modest increase in its relative labour productivity, up from 230 in 1975 to 271 in 1993 in index terms, while electrical machinery has remained constant in the 360-370 range.

Those industries with the lowest level of labour productivity are iron and steel, textiles, clothing, wood and cork products, and transport equipment. The relative productivity of labour in the iron and steel industry has been on a downward trend since 1975, and collapsed in the mid-1980s.

Labour productivity in the textile industry has remained constant in relative terms over the past 20 years. The clothing sector, however, has seen a decline. Wood and cork products, on the other hand, rose in relative terms, peaking in the mid 1980s and then contracting somewhat through 1993. The productivity of labour in the paper sector rose sharply in 1976, following the coming on line of a new plant in 1975 that raised annual production by 30 per cent. As the plant and equipment aged, however, and as demand shifted away from paper packaging to plastics, relative labour productivity has declined.

Profitability

The level of profitability in Kenya is not easily measurable. Most firms are privately held and are not required to publish financial data sufficient to indicate their individual profitability. Only those few firms listed on the Nairobi Stock Exchange are required disclose full financial data. Measured in terms of gross profit as a per cent of manufacturing value-added some rough indications of relative profitability can be ascertained.

Over the past 20 years, the share of gross profit in total manufacturing value-added has increased slightly. In 1975, 63 per cent of manufacturing value-added was gross profit. In 1993, the share was 68 per cent. This increase has been fairly steady.

Based on this measure (see Table II.11), the most "profitable" sectors within manufacturing are: electrical machinery; beverages; rubber products; food processing; petroleum refining; and, professional and scientific equipment. These are also the sectors with the highest relative level of labour productivity. And, as would be expected, those sectors with lowest relative share of labour productivity are also those with the lowest share of gross profit in manufacturing value-added: textiles; transport equipment; and, wood and cork products.

Since 1975, several sectors have seen significant changes in their level of gross profit as a share of manufacturing value-added. For example, pottery, china and earthenware has dropped by almost one-half from 80 per cent in 1975, to 49.41 per cent in 1993. Leather footwear, on the other hand, has seen a significant increase in its share, from 44.68 per cent in 1975, to over 70 per cent in 1995. Other leather and leather substitutes has also increased over the years. And as expected, petroleum refineries has decreased significantly from 89.33 per cent in 1975, to 75.92 per cent in 1993.

Table II.11. Share of gross profit in manufacturing value added, 1975-1993, selected years
(Percentage)

	1975	1980	1985	1990	1991	1992	1993
Food products	74.12	74.75	77.10	77.25	78.74	77.67	76.38
Beverages	72.07	73.54	74.81	77.21	78.66	80.01	80.28
Textiles	49.88	52.83	46.70	46.91	51.82	47.53	45.70
Clothing (non-footwear)	60.52	51.79	56.87	57.66	60.43	56.25	7.02
Leather and leather substitutes	34.25	57.59	43.91	52.75	57.82	63.52	1.49
Leather footwear	44.68	63.49	60.03	70.93	59.93	72.82	70.16
Wood and cork products	48.88	53.30	56.55	53.88	56.19	53.19	51.87
Furniture and wood fixtures	57.10	51.37	49.76	52.63	59.55	60.69	0.89

continued

Table II.11. (continued)

	1975	1980	1985	1990	1991	1992	1993
Paper and paper products	43.88	74.65	66.32	69.21	71.20	68.38	9.36
Printing and publishing	48.20	39.55	49.93	49.97	54.16	50.13	1.44
Industrial chemicals	65.52	60.70	60.38	61.16	63.78	60.92	62.16
Non-industrial chemicals	66.23	61.77	61.61	61.71	64.06	63.01	4.27
Petroleum refineries	99.33	60.73	73.61	73.74	76.09	72.91	75.92
Rubber products	80.68	76.49	79.46	80.33	81.37	79.79	79.73
Plastic products	64.31	72.86	79.91	80.04	81.38	80.14	79.23
Pottery, china and earthenware	80.00	57.37	77.05	61.84	56.16	50.00	9.41
Glass and glass products	56.54	49.57	90.00	57.19	53.46	55.33	0.79
Non-metallic minerals	69.30	21.32	58.12	66.35	69.07	66.14	67.33
Basic iron and steel	67.09	53.40	..	..	..	..	..
Metal products (non-machinery)	59.57	47.31	46.37	64.94	67.07	64.08	3.20
Non-electrical machinery	50.41	38.18	46.66	58.53	61.57	57.20	8.15
Electrical machinery	83.82	88.37	82.21	85.30	86.14	85.20	85.67
Transport equipment	19.46	48.65	16.04	16.88	24.64	20.81	25.77
Professional and scientific equipment	..	..	55.31	62.76	64.12	67.95	75.07
Miscellaneous manufacturing	69.91	81.63	79.13	73.56	75.30	69.09	72.29
Total manufacturing	63.33	63.81	65.29	66.97	69.49	68.20	68.14

Source: UNIDO, Industrial Development Reviews Information Database.

D. OWNERSHIP AND INVESTMENT PATTERNS

Investment

The rate of growth of capital formation in Kenya has been erratic.[3/] In the period from 1985 to 1994, it ranged from a high of 13.06 in the modern economy, to a low of -14.8 in 1991. Capital formation in the manufacturing sector, rose over that period (in 1982 prices) from KSh65.18 to KSh130.9. In 1994, total investment in manufacturing was KSh612.16 million (current shillings), 16 per cent of all investment in the monetary economy. This was down from 19 per cent in 1990, but slightly up from 1992's level of just under 15 per cent.

In 1994, an estimated 53 per cent of gross fixed capital formation came from the private sector. The public sector, including the parastatal enterprises, has traditionally accounted for about 45 per cent of investment in Kenya, but only for small amounts of investment in the manufacturing sector. Public investment in the manufacturing sector in 1990, was only KSh5.36 million, down from KSh9.58 million in 1989. This is less than 4 per cent of total investment in manufacturing in 1989, and less than 2 per cent in 1990.

Table II.12. Gross fixed capital formation in manufacturing, 1985-1994
(Million KSh)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Current prices	101.8	161.34	171.8	218.3	253.9	363.3	341.6	307.3	414.9	612.2
Constant 1982 prices	65.18	83.87	89.64	112.35	110.52	130.9	111.47	96.36	103.6	116.0

Source: Republic of Kenya, Central Bureau of Statistics.

One of the major constraints to the development of industry in Kenya has been the lack of available capital. In an effort to provide this capital, several government and quasi-government industrial development finance institutions have been established. Their track records have not been particularly good, however. In recent years the numbers of projects financed has dropped, as has the total schilling value of loans.

Table II.13. Financing of gross fixed capital formation, 1981-1994, selected years
(Million KSh)

	1981	1990	1994
Gross fixed capital formation			
Gross fixed capital formation	725.41	2,028.00	2,825.26
Changes in stocks	133.40	345.32	112.23
Total	858.81	2,373.32	2,937.49
Financing			
Grants from abroad	20.70	296.10	484.62
Net borrowing from abroad	326.90	572.53	-287.82
Domestic savings	551.21	1,508.01	2,740.69
Total	898.81	2,376.64	2,937.49

Source: Republic of Kenya, Central Bureau of Statistics

Table II.14. Industrial projects approved by selected government and quasi-government institutions, 1990-1994

Institution	Number of projects					Approved expenditure (million KSh)				
	1990	1991	1992	1993	1994	1990	1991	1992	1993	1994
Industrial Development Bank	8	7	4	7	5	3.4	9.6	7.1	15.0	10.7
Development Finance Co. of Kenya	9	9	21	11	9	5.3	8.9	22.5	11.5	17.8
Kenya Industrial Estates	219	169	105	94	204	4.0	3.7	2.9	2.0	3.9
Industrial and Commercial Development Corporation	12	20	10	9	1	4.0	20.6	8.7	11.9	0.8
Total	**248**	**205**	**140**	**121**	**219**	**16.7**	**42.8**	**41.2**	**40.4**	**33.2**

Source: Republic of Kenya, Central Bureau of Statistics.

Ownership

Despite the significant change in policy in 1986 to move to reduce the influence of government in the economy and encourage the role of the private sector, the state has continued to account for a significant ownership portion of Kenyan industry. Through 1990, the parastatal sector accounted for 11 per cent of GDP. According to the Policy Paper on Enterprise Reform and Privatization published by the Ministry of Finance in October 1994, the government continued to have direct or indirect ownership in 250 enterprises. Of this, they had a majority share in 38 and a minority holding in 66 industrial enterprises. While the total number of companies may not seem large, they are primarily large enterprises and are concentrated in the textile, cement and sugar sectors.

Parastatal enterprises were, and are, characterized by a negative growth of factor productivity, high rates of capital intensity and low levels of employment growth. In fact, the level of inefficiency is such that the World Bank[4] (see Chapter I, Section D) estimates that if they had functioned at the same level of efficiency as the private sector, the rate of GDP growth would have been two percentage points higher. Not only are they inefficient, they are a significant drain on government resources. The level of subsidies (direct and indirect) to the sector over the period amounted to 5.5 per cent of GDP.

While Kenya has embarked on a programme of privatization and reform (see Chapter I, Section D) aimed at reducing government ownership of the economy, thirty-three "strategic" enterprises are slated to remain in state hands. They are primarily utilities, transport (Kenya Railways) and general services such as the post, but also include the National Oil Corporation of Kenya, Kenya Pipeline Co. and Kenya Petroleum Oil Refineries, as well as several industrial development finance institutions.

Within the private sector, the vast majority of companies are small in size.[5] For example, in 1990, of the 2,002 existing establishments, 1,390 had less than 50 employees and 1,064 had less than 20 employees. Of the limited number of medium and large enterprises, most are owned by foreigners (multinational corporations) and Asian-Kenyans.

Foreign investment in the manufacturing sector has been relatively strong. In fact, one estimate[6] puts foreign ownership of the manufacturing sector at 50 per cent (based on capital investment). Foreign ownership in the manufacturing sector ranges across several subsectors including, textiles, shoes, food processing, petroleum products, chemicals and pharmaceuticals. Foreign companies are also involved in the manufacture and assembly of motor vehicles and parts. The largest foreign investor in the country is the United Kingdom, followed by the United States.

In 1990, foreign-owned companies in all sectors employed 117,000 out of the total private modern sector labour force of 713,500. Parastatal enterprises in all sectors accounted for the employment of a further 117,100.

E. INDUSTRIAL LOCATION

Industry in Kenya is centred around the country's main cities, especially Nairobi and Mombasa, where there is the necessary infrastructure in place to support industrial activities. According to the 1977 Census of Industrial Production, the last one available, manufacturing activity centred around Nairobi (53.68 per cent of establishments), Mombasa (13.45 per cent) and Nakuru (4.8 per cent). By province, manufacturing concerns lead in Nairobi, followed by the Rift Valley (Nakuru) and then the Coast.

Mining and quarrying activity is also concentrated in Nairobi with 30 per cent of establishments. Mombasa is the location for a further 9.5 per cent, followed by Kisumu near Lake Victoria. Based on province, however, the Coast (Mombasa) lags behind the others as home to mining and quarrying concerns. The leading province is Nairobi, followed by Nyanza and the Western provinces combined, the Central province, the Rift Valley. Only the Eastern and North Eastern provinces have less activity in this sector, and, in fact, have very little other modern sector activity either.

Construction activities were overwhelmingly located in the Nairobi area which accounted for over 70 per cent of all concerns. Mombasa was home to just over 10 per cent of the country's building and construction establishments.

While there are no figures currently available, it is unlikely that any change to this location pattern has taken place over the past 18 years. The recent creation of export processing zones (EPZs) seems to support this. They have located near the main cities of Nairobi and Mombasa which continue to offer the best infrastructure.

Table II.15. Location of industry in 1997 by main towns

	Establishments (Number)	Employees (Thousand)	GDP (Million KSh)
Mining and quarrying			
Nairobi	54	1,082	487
Mombasa	17	455	303
Kisumu	12	662	429
Nakuru	9	507	193
Thika	7	456	167
Other Areas/Towns	80	1,301	985
Total	**179**	**4,463**	**2,564**
Manufacturing			
Nairobi	1,811	61,905	106,514
Mombasa	454	19,322	31,126
Kisumu	81	3,412	2,345
Nakuru	163	4,563	4,252
Thika	64	11,790	14,242
Eldoret	60	4,868	4,379
Other Areas/Towns	741	38,465	54,128
Total	**3,374**	**144,325**	**216,986**
Building and construction			
Nairobi	816	38,610	21,242
Mombasa	126	3,011	1,207
Kisumu	30	454	76
Nakuru	36	1,381	372
Thika	18	183	104
Eldoret	4	52	41
Other Areas/Towns	121	2,518	718
Total	**1,151**	**46,209**	**23,760**

Source: Republic of Kenya, Central Bureau of Statistics.

Table II.16. Location of industry by province, 1977

	Establishments (Number)	Employees (Thousand)	GDP (Million KSh)
Mining and quarrying			
Nairobi	54	1,082	487
Coast	18	637	348
Rift Valley	24	476	449
Central	29	759	452
Nyanza	34	883	484
Eastern and North Eastern	20	626	344
Total	**179**	**4,463**	**2,564**
Manufacturing			
Nairobi	1,811	61,905	106,514
Coast	471	20,628	32,303
Rift Valley	535	21,158	29,536
Central	261	23,920	22,497
Nyanza	73	2,275	2,817
Eastern and North Eastern	56	4,798	14,449
Western	167	9,641	8,870
Total	**3,374**	**144,325**	**216,986**
Building and construction			
Nairobi	816	38,610	21,242
Coast	137	3,436	1,227
Rift Valley	72	2,223	497
Central	54	955	458
Nyanza	42	548	107
Western	30	437	229
Total	**1,151**	**46,209**	**23,760**

Source: Republic of Kenya, Central Bureau of Statistics.

As pointed out in Chapter I and is clearly evident here, Kenya faces a major problem and challenge in the promotion of rural development, especially the promotion of manufacturing. Kenyan policy is to aim for a balanced pattern of rural/urban development. To this end many initiatives have been undertaken already beginning with the development of a District Focus Strategy (DFS). Most of the individual efforts come within the framework of small-scale enterprise development such as the Rural Trade and Development Centers and the District Development Fund which supports RTDC development, the Kenya Rural Enterprise Programme which provides funding to small rural enterprises. In the 1990-1994, 35 per cent of the employment in the informal or *jua kali* sector was in rural areas.

Other initiatives designed specifically to promote investment and development outside of the major urban centres have been undertake. For example, to promote investment in manufacturing and hotels outside of Nairobi and Mombasa, the government has offered generous investment allowances. A more detailed accounting of these initiatives is given in Chapter I, Section D.

F. ENVIRONMENTAL ISSUES

As noted in Chapter One, Kenya is currently in the process of overhauling its environmental legislation by drafting an "umbrella law" and then harmonizing all existing legislation under that guideline. It is doing this with the help of the United Nations Environmental Programme (UNEP). Once this process is completed, it will not only make enforcement easier, it will make compliance easier. Currently environmental legislation is part of several other pieces of legislation ranging of occupancy laws to acts on traffic.

The biggest question facing Kenyan manufacturers on this issue is when they will be required to meet any new and stricter standards that result from this process. With the existing resource constraints facing most manufacturing concerns and the lack of adequate public waste management infrastructure and facilities, it is unlikely that immediate compliance will be expected.

New plant and facilities, however, are likely to be required to meet new standards and could then be at a cost disadvantage to their competitors. Such problems can usually be worked out with tax allowances, however, and do not have to pose a hindrance to new investment. What may well result in a constraint to new investment is the lack of adequate public water and waste infrastructure. The provision of on-sight water and waste treatment in certain investments may add significantly to their cost.

The other environmental question that is generally a concern to acquirers of existing companies and thus becomes an issue in the privatization process, is past environmental standards and practices. This is especially a concern in highly polluting industries such as iron and steel and other ore processing, and in industries dealing with hazardous materials such as chemical fertilizers. One of the issues that Kenyan privatization authorities will need to deal with is who be responsible for any future liability that results from pre-existing problems.

When the purchaser is a strategic investor (another company) the issue can be resolved fairly in straight forward manner. A careful environmental audit is performed and the cost of cleaning up any past damage is then either reduced from the purchase price and buyer takes the responsibility of cleaning up and bringing the site up to standards, or the cost is borne by the seller and the clean up is done prior to the finalization of the purchase. The issue is not so straight forward when the privatization is performed through the public issuance of shares, especially when the potential purchaser of the shares are individuals not necessarily informed of the ramifications that any future legislative changes might have and their potential liabilities.

G. TRADE IN MANUFACTURES

Imports

Import liberalization in the second half of the 1980s led to a sharp jump in imports, especially that of manufactured goods. From 1986 to 1990, the import of processed industrial goods nearly doubled, as did consumer goods imports. Machinery and capital equipment imports more than doubled, and processed food and transport equipment imports were up significantly. As a result, the trade balance in manufactured goods widened from KSh872 million in 1986, to KSh1,625 in 1990. In real terms the increase in the gap was more than 33 per cent.

As a share of total imports, manufactured goods has remained fairly stable in the 76 per cent range. They increased sharply in 1987 as the result of the significant increase in the value of processed industrial goods and transport equipment. Within manufactured imports, processed industrial goods (including chemicals, basic metals and non-metallic mineral products) has been the largest component for some time. In the 1980s, they accounted for close to 40 per cent of all manufactured imports. But by 1991, the share had increased to over 46 per cent. It has remained at that level since.

Capital goods and machinery is the second largest import item within manufactured goods, accounting for 20 per cent of the total in 1994. This share has dropped in recent years from a high of 32.5 per cent in 1990. Transport equipment is the next largest category of manufactured imports at 16 per cent. This is down some from the 20 per cent of total manufactured imports it accounted for in 1980, but recovered from the low levels in 1991-1993 when decreased demand for assembled cars (re-exports) and shortages of foreign currency limited imports.

Table II.17. Manufactured imports, by broad economic category, 1980-1994, selected years (Million KSh)[a/]

	1980	1986	1987	1988	1989	1990	1991	1992	1993	1994
Processed foods and beverages	429.42 (4.98)	79.20 (7.57)	62.76 (5.73)	72.14 (4.92)	111.0 (6.08)	110.8 (5.68)	65.39 (3.2)	175.6 (8.4)	145.8 (4.1)	430.9 (10.1)
Processed industrial supplies	227.6 (38.5)	393.3 (37.6)	425.5 (38.8)	619.7 (42.2)	728.3 (39.9)	778.8 (39.9)	951.1 (46.4)	936.3 (44.6)	1,822 (51.7)	1,883 (43.9)
Machinery and capital equipment	154.6 (26.2)	254.5 (24.3)	319.7 (29.2)	414.3 (28.2)	476.5 (26.1)	634.1 (32.5)	608.7 (29.7)	600.0 (28.6)	739.4 (21.0)	883.4 (20.6)
Transport equipment	121.2 (20.5)	259.6 (24.8)	190.7 (17.4)	267.2 (18.2)	393.9 (21.6)	315.5 (16.2)	293.0 (14.3)	238.0 (11.3)	461.8 (13.1)	706.0 (16.5)
Consumer goods	57.7 (9.8)	59.79 (5.71)	70.6 (6.4)	93.9 (6.4)	116.9 (6.4)	110.5 (5.7)	132.6 (6.5)	149.1 (7.1)	357.9 (10.2)	385.1 (9.0)
Total manufactured imports	590.5	1,046	1,096	1,467	1,826	1,950	2,051	2,099	3,527	4,288
Real value of manufactured imports	714.0	715.7	716.9	886.2	1,008	955.4	26.48	29.5	1,127	1,285
Percentage of total imports	..	78.2	76.6	83.1	81.6	76.5	77.5	71.0	69.8	74.5

Sources: Deloitte Haskins & Sells Management Consultants and African Development and Economic Consultants Ltd, Kenyan Association of Manufacturers Study, *The Present and Future Financing Needs of the Industrial Sector in Kenya*, Nairobi, May 1992, and Republic of Kenya, Central Bureau of Statistics.

a/ Figures in parentheses indicate percentage share in total manufactured imports

Imported processed foods and beverages varies in response to food production at home. In periods of food shortages, the amount of imported processed food stuffs will increase. The sector also jumped in response to import liberalization, especially in terms of sugar imports (see chapter I, Section A).

Measured by manufacturing branch rather than broad industrial category, chemicals become the most important manufactured import accounting for 46.16 per cent of total manufactured imports in 1993. Next in importance is machinery and transport equipment (combined by this classification method).

Table II.18. Manufactured imports by industrial branch, 1975-1993, selected years
(Percentage of total manufactured imports)

Year	Processed foods	Textiles and clothing	Wood products, furniture	Paper, printing, publishing	Chemical industry	Non-metallic products	Basic metals, iron and steel	Machinery and equipment	Misc. goods
1975	5.73	8.01	0.18	5.61	21.33	1.52	7.22	49.59	0.81
1980	7.12	3.87	0.26	3.13	25.22	1.75	9.65	48.31	0.69
1985	11.43	3.55	0.23	3.16	28.36	1.41	9.80	41.45	0.61
1986	10.49	2.66	0.15	2.98	24.38	1.25	7.25	50.35	0.48
1987	8.27	3.81	0.18	2.86	26.79	1.33	9.03	47.21	0.51
1988	8.58	2.14	0.29	2.99	25.10	1.49	9.73	49.05	0.64
1989	6.25	2.72	0.22	2.64	19.25	1.34	8.05	58.67	0.84
1990	9.90	1.97	0.32	2.80	18.08	1.51	8.97	55.97	0.48
1991	11.93	2.17	0.53	3.43	22.19	1.83	9.60	47.78	0.53
1992	16.00	2.96	0.44	4.19	25.36	1.58	8.82	40.12	0.54
1993	8.21	7.21	0.65	3.19	25.01	1.30	7.01	46.16	1.28

Source: UNIDO, Industrial Development Reviews Information Database.

Exports

As can be seen in Table II.19 below, efforts to encourage the export of manufactured goods began to take effect by 1990 when they rose in real value and as a percentage of total exports. A change in the structure of manufactured exports has also taken place over the years. In the 1980s, the share of consumer goods in the total manufactured goods exports rose from 1980's share of just over 19 per cent, to over 28 per cent in 1986. In 1988 and 1989, there was a sharp drop in the share of exports to 24.6 per cent and 22.7 per cent respectively. A modest recovery was made to the 25 per cent range where consumer goods exports remained until they took a large jump in 1995, to 28.1 per cent of total manufactured exports.

This rise in the relative share of manufactured consumer goods exports is mirrored by a decline in the relative share of processed food exports over the 1980-1994 period. In 1980s, the share of processed food and beverages in manufactured exports was over 32 per cent. By 1994, that share had fallen 25.6 per cent, with most of the drop occurring since 1990. At the same time the share of industrial processed exports has fluctuated with the world price of commodity raw materials, ranging from a high of 46.7 per cent in 1986, to a low of 37.9 per cent in 1987.

Table II.19. Manufactured exports, by broad economic category, 1980-1994, selected years (Million KSh)[a/]

	1980	1986	1987	1988	1989	1990	1991	1992	1993	1994
Processed food and beverages	31.09 (32.8)	48.16 (27.6)	49.04 (29.9)	53.78 (28.0)	73.02 (29.3)	106.3 (32.7)	139.7 (29.9)	171.0 (29.7)	378.0 (26.3)	515.6 (25.6)
Processed industrial supplies	41.28 (43.5)	68.70 (46.7)	62.16 (37.9)	80.66 (41.8)	109.0 (43.0)	127.0 (39.1)	199.1 (42.6)	243.5 (42.3)	653.1 (45.4)	850.6 (42.2)
Machinery and capital equipment	2.48 (2.6)	4.17 (2.4)	4.06 (2.5)	5.61 (2.9)	6.53 (2.6)	6.90 (2.1)	10.52 (2.3)	13.76 (2.4)	23.43 (1.6)	37.30 (1.9)
Transport equipment	1.66 (1.8)	3.23 (1.9)	4.14 (2.5)	5.34 (2.8)	4.52 (1.8)	2.62 (0.8)	4.35 (0.9)	8.06 (1.4)	30.59 (2.1)	47.00 (2.3)
Consumer goods	18.38 (19.4)	49.95 (28.7)	44.72 (27.3)	47.52 (24.6)	56.54 (22.7)	82.23 (25.3)	113.5 (24.5)	139.1 (24.1)	353.6 (24.6)	566.6 (28.1)
Total manufactured exports	94.89	174.2	164.1	192.9	247.6	325.1	467.1	575.5	1,438	2,017
Real value of manufactured exports	114.7	119.2	107.3	116.5	137.8	163.9	211.0	227.4	459.3	604.5
Percentage of total exports	22.9	19.9	24.8	24.4	24.5	26.4	30.5	33.7	39.7	48.4

Sources: Deloitte Haskins & Sells Management Consultants and African Development and Economic Consultants Ltd. Kenyan Association of Manufacturers Study, *The Present and Future Financing Needs of the Industrial Sector in Kenya*, Nairobi, May 1992; Republic of Kenya, Central Bureau of Statistics.

a/ Figure in parentheses indicate percentage share in total manufactured imports.

H. INTERNATIONAL COOPERATION FOR INDUSTRIAL DEVELOPMENT

Kenya has been a major recipient of official development assistance (ODA) since its independence. Billions of dollars have been granted and loaned over the past 30 years. In the late 1980s, the annual amount of ODA to Kenya ballooned from the net level of $400-450 per annum (1980-1987), to a net flow of $1,187 billion in 1990. Dissatisfaction with the speed of political and economic reform, however, led to a sharp decline in the amount of multilateral ODA in 1991 and 1992. In November 1991, quick-disbursing balance-of-payments aid was frozen, and remained so for two years. The continued dissatisfaction by multilateral and bilateral donors, together with the general belt tightening in the West with regard to ODA to all recipients, has created a desire in the country to reduce its level of dependence on ODA flows as noted above.

In recent years, the amount of ODA funds used for technical cooperation (TC) has risen dramatically from 14 per cent in 1990, to 30 per cent in 1992. As well as an examination of the appropriate uses of ODA, disappointment with many of the development projects undertaken in the past, has also led to an examination by Kenyan authorities of the use of much of these ODA funds used for technical cooperation. This is especially the case with technical assistance (TA) to small and medium enterprises as described in Chapter I, Section D.

UNIDO has been particularly active in Kenya, with over 80 TC projects completed since 1969. Currently, thirteen projects are under way. UNIDO projects, past and present, cover a broad area of the TC needs of the country. Past projects have included: industrial training in such areas as food processing; technology transfer and appropriate technology choice; advisory services to the

Ministry of Industry; support to NGOs; support to women in industry; and an investment promotion seminar. Many industrial sectors have been covered: the food processing; leather; energy; pulp and paper; cement; boat-building and synthetic fibres industries to name just a few.

Kenya's technical assistance needs remain great and UNIDO activity in the country is, and will be, on-going. Future areas of cooperation will continue to include support to NGOs, support to small-scale industries, industrial training, technology choice and the many other areas where UNIDO can provide support. As a result of the withdrawal of the Kenyan government from a direct role in the economy, it is expected that UNIDO support directly to the private sector will rise.

NOTES TO CHAPTER II

1/ Republic of Kenya, Central Bureau of Statistics, *Statistical Abstract 1991.*

2/ World Bank, *World Tables 1995,* Washington D.C.

3/ Republic of Kenya, Central Bureau of Statistics, *Statistical Abstract 1991,* pp. 43-49 and *Economic Survey 1995,* pp. 28-30.

4/ World Bank, *Kenya Poverty Assessment,* Washington D.C., March 1995.

5/ Republic of Kenya, Central Bureau of Statistics, *Statistical Abstract 1991,* p. 86.

6/ Europa Publications Ltd., *Africa South of the Sahara 1995,* London, October 1994, p. 494.

III. INDUSTRIAL BRANCH PROFILES

A. FOOD PROCESSING AND RELATED AGRO-INDUSTRIES

As noted throughout this study, the food processing and other agro-related industries are an important element of Kenya's economy and have played a leading role in the country's economic and industrial development. Their combined share in the country's total manufacturing sector exceeds 68 per cent, measured in terms of the contribution to GDP. Sixty per cent of the more than 4,000 industrial establishments in Kenya are agro-based enterprises.

The agro-industry sector has developed on the basis of traditional domestic resources and activities include food processing, beverages and tobacco. This trend of development is likely to continue into the future, as the utilization of domestic resources still remains a primary objective in Kenya's development strategy.

STARCHY STAPLE FOODS

The resource base

The main food crops produced and consumed in Kenya are maize, wheat, rice, sorghum and millet. Others are root crops, beans and pulses. Maize is Kenya's most widely consumed food item and accounts for nearly half of the calories and useable protein available to the population. Recently, the country has managed to achieve self-sufficiency from local production except during years of bad weather.

Wheat is the second most important cereal crop consumed in the country after maize. It has been grown in Kenya since the colonial times and production had principally been by large-scale farms. The country produces slightly less than 50 per cent of its wheat requirements, however, and thus imports the rest. While domestic wheat output has exhibited very slow growth, consumption has increased rather rapidly mainly due to population growth and urbanization.

Rice production in Kenya occurs primarily on small-scale farms. Both irrigation and rain-fed cropping methods are used. Irrigation takes place at Mwea, Ahero, Bunyala and West Kano. Rain-fed production is mainly concentrated in the Western, Nyanza and Coast Provinces. Two varieties of rice are produced in Kenya, Basmati and Sindano. Rice production from irrigated schemes accounts for about 35,000 tonnes per year, while rain-fed production accounts for about 6,000 tonnes per year.

Although sorghum and millet are traditional crops, their consumption is declining. They have, however, been identified as potential cash crops in semi-arid areas and their production is being encouraged.

Table III.1. Production and consumption of major staples, 1988/89-1993/94[a/]

Period	Maize (million bags)		Wheat (million bags)		Rice (tonnes)	
	Production	Consumption	Production	Consumption	Production	Consumption
1988/89	31.4	27.6	2.78	5.00	34,170	61,700
1989/90	30.3	28.5	2.62	4.80	36,000	63,954
1990/91	35.0	29.5	2.95	5.10	35,500	66,195
1991/92	26.0	30.4	2.42	5.40	36,000	67,600
1992/93	25.0	30.9	2.20	5.50	40,000	70,725
1993/94	19.5	33.3	2.60	5.70	41,070	78,000

Source: Republic of Kenya, Ministry of Agriculture and Livestock Development, Planning Division.

a/ Estimate.

MAIZE MILLING

Past trends

Historically, maize flour has been a major food item in Kenya's household consumption pattern. Consequently, maize milling has remained the largest industrial activity under the grains and grain products subsector. The product of maize milling is sifted maize flour and the by-products are maize bran (used in animal feed), maize germ (used in oil extraction), and semolina used in breakfast foods and the brewery industry.

Table III.2. Production of grain milling products, 1990-1994
(Tonnes)

Product	1990	1991	1992	1993	1994
Maize meal	241,411	227,350	119,614	168,123	233,185
Wheat flour	171,870	185,545	222,457	143,068	191,435
Wheat offal	31,408	45,156	51,900	38,124	49,990
Maize germ	38,335	35,047	15,110	19,643	25,535
Maize offal and bran	22,537	-	11,501	15,603	16,716
Rice	20,004	15,207	18,206	13,609	10,999

Source: Republic of Kenya, Central Bureau of Statistics.

Almost all rural markets in Kenya have milling facilities commonly referred to as "Posho Mills", which literally means flour mills. Most of them are operated by local entrepreneurs and self-help groups or cooperative societies. There are, however, major maize millers such as Jambo Flour Millers, Nairobi Flour Mills, Unga Maize Millers, Bakery Millers, the National Milling Corporation, Mombasa Maize Millers and Kirinyaga Flour Mills. These enterprises are located in the urban centres of the country.

Between 1963 and 1980, maize production increased at a growth rate of 2.5 per cent per annum. From 1980 to 1990, the rate picked up to reach 5.9 per cent per annum. However, the above trend was reversed in the 1990s during which production has recorded a negative growth rate of

nearly 9.0 per cent per annum. This reduction in output is attributed to unfavourable weather, a decline in the use of fertilizer due to high prices and to some extent, the low quality of seeds.

Capacity utilization of the mills rose in 1994 when the maize market was liberalized and the production of maize flour increased to 232.2 thousand tonnes from 120.0 thousand tonnes in 1992.

Constraints and prospects

In the past, price controls on maize hindered the free market forces necessary for its increased production. The decontrol of agricultural prices in 1994 (see Chapter I) has not yet had the desired effect of increasing production, however. In fact, the concurrent liberalization of trade has meant that the country has faced stiff competition from cheap maize imports. As a result, the government was forced to intervene to protect local industry by imposing taxes on imported foodstuffs. The reduction of import duties on agricultural farm inputs, and the freeing of maize prices should, however, lead to increased production in near future.

WHEAT-BASED PRODUCTS

Past trends

Wheat has been grown in the Kenya since independence in 1963, but despite the effort government has made in such areas as providing credit support for increased production, the country remains a net importer. Demand from the bakery industry alone is six million bags of wheat flour and only two million bags are produced locally. The rest of the wheat requirement is met from imports which include all the durum wheat required for the manufacture of pasta products such as macaroni and spaghetti. Durum wheat is imported from Canada and the United States.

Despite a more than 40 per cent rise in the production of wheat in 1994 (from 76.9 thousand tonnes to 107.8 thousand tonnes), imports rose over 12.3 per cent to a record 353.1 thousand tonnes. Measured in terms of bags (Table III.1 above) this is a shortfall of 3.1 billion bags.

Demand for wheat flour is distributed as follows: home-baking 64 per cent; bread making 32 per cent; biscuits three per cent; and pasta products and baby foods one per cent. Between 1991 and 1993, the level of capacity utilization of bakery enterprises was an average of 63 per cent. In 1994, bakery enterprises have increased production as indicated by the figures in the Table III.3 below. The main product of wheat milling is sifted wheat flour. By-products include bran and germ used in animal feed.

Table III.3. Production of bakery products, 1990-1994
(Tonnes)

Product	Unit	1990	1991	1992	1993	1994
Bread	Million tonnes	99,230	95,944	95,944	98,773	156,273
Scones	Million tonnes	152	228	228	272	231
Cakes	Kilogramme	167,950	60,849	60,849	62,552	91,450
Biscuits	Kilogramme	2,449,075	3,773,305	2,124,940	2,289,668	3,600,153

Source: Republic of Kenya, Central Bureau of Statistics, *Economic Survey*, various issues.

Constraints and prospects

The major constraint to the further development and expansion of the wheat-based product food processing and baked goods industries, is the simple fact that Kenya is not self-sufficient in wheat production and has to import a substantial amount of wheat while faced with serious foreign exchange availability constraints. Wheat imports range from 33 per cent of the country's wheat consumption to 66 per cent, depending on the harvest of any given year.

It also is unlikely that there will be a significant increase in the local production of wheat. First, the cost of inputs used in domestic wheat production, such as fertilizers, imported machinery and their spare parts has risen and will continue to do so. And, land reforms following independence which favoured the subdivision of land into smaller plots has been counter productive to the production of wheat, the farming of which is highly mechanized and benefits from the economies of scale offered by large-scale farming. Small-scale wheat farming, while on the increase, suffers from a lack of appropriate technology.

The liberalization of pricing and marketing of wheat products, and the removal of duty on fertilizer should improve domestic production, but Kenya will remain a net importer of most of its wheat requirements. On the other hand, the growth of the population alone means that the demand for wheat-based products will continue to rise strongly for many years to come.

BEANS AND PULSES

Past trends

Beans and pulses form an important food item and source of cheap protein for a large portion of the population in both urban and rural areas. Current production of beans is about 443,000 tonnes while that of other pulses (pigeon peas, cowpeas and green grams) make up another 200,000 tonnes. The total national requirement for beans and pulses is estimated at 684,500 tonnes which implies that Kenya requires about 41,000 more tonnes to cover the supply gap. Kenya has been producing an average of two million bags per year in the 1990-1994 period (see Table III.4).

Table III.4. Estimated production of selected crops, crop forecast survey, 1990/91-1994/95[a]
(Million bags)

Crop	1990/91	1991/92	1992/93	1993/94	1994/95
Beans	2.34	2.10	2.39	1.25	2.82
Potatoes	2.13	1.95	2.26	1.99	2.51
Sorghum	0.88	0.82	0.95	0.86	1.05
Millet	0.40	0.35	0.45	0.39	0.47

Source Republic of Kenya, Central Bureau of Statistics

a Provisional

Constraints and prospects

It is expected that the incentives given to farmers through the reduction of farm input prices and the better pricing of output will result in an increase in production to meet demand. Weather, and the availability of crops to process, will also greatly effect the ability of the sector to expand. Since there is no large-scale processing of beans, much of the outlook for this sector will also depend on the effectiveness of the support schemes for small business and *jua kali* sector.

ROOT CROPS

Past trends

The main root crops grown in Kenya are Irish potatoes, sweet potatoes, cassava and yams. The combined total production of these crops is estimated at 1.73 million tonnes. Root crops form an important reserve for a majority of rural people and have a cushion effect during periods of drought and food shortages since they are more resistant to prolonged drought. Production of potatoes increased from 2.0 million bags in 1992 to 2.5 million bags in 1994 as indicated by Crop Forecast Survey conducted by Central Bureau of Statistics (Table III.4 above). Irish potatoes are used primarily in the hotel industry and for making French fries (crisps).

Constraints and prospects

A change in the eating habits of Kenyans has resulted in a drastic drop in the production of sweet potatoes, cassava and yams. The government is encouraging farmers to increase the production of these more drought resistant crops as part of the country's overall food security programme, however. The outlook for this subsector will thus depend to a large degree on how successful this promotion is.

FRUITS AND VEGETABLES

The resource base

Kenya produces about five million tonnes of fruits and vegetables per year. The major products are pineapples, French beans, cut flowers, avocadoes and mangoes. Horticulture is the fourth largest foreign exchange earner in Kenya after tourism, tea and coffee. In 1994, horticulture exports earned Kenya KSh414.9 million. Exports are carried out either directly by investors or through the Horticultural Crop Development Authority (HCDA) whose share of exports in 1994 was KSh246.8 million. Cut flowers are the biggest horticultural exports followed by French beans.

Past trends

While a large portion of the production of fruits and vegetables are consumed and exported fresh, it is estimated that about 350,000 tonnes of fruits and vegetables are processed annually. There are approximately 30 processing plants in Kenya, of which the largest is Del Monte. The Del Monte plant has a captive plantation producing close to 250,000 tonnes per year of the fresh fruits and vegetables, mainly pineapples. Processing of fruits and vegetables in Kenya include the canning, dehydration, freezing, extraction of juice, and manufacture of jams and marmalades.

The main enterprises involved in fruit and vegetable processing are:

(i) Del Monte(K) Ltd. Located in Thika, Del Monte is the largest food processing factory in the country processing mostly pineapples for canning and juice.

(ii) Kenya Fruit Processors. Also located in Thika, this enterprise extracts fruit juice from passion fruit and also makes passion juice concentrate mainly for export.

(iii) Njoro Canning Factory. Located in Njoro, this enterprise cans French beans.

(iv) Trufoods Ltd. Located in Nairobi, Trufoods processes fruit juices and jams.

(v) Kenya Orchards Ltd. Located in Machakos, this enterprise cans fruits and vegetables, and manufactures jams.

(vi) Kabazi Canners. Located in Nakuru, Kabazi cans a variety of vegetables.

Table III.5. Production of canned fruits and vegetables, 1990-1994

Product	Unit	1990	1991	1992	1993	1994
Jams and marmalades	Kilogramme	1,124,754	1,125,376	1,098,403	1,233,385	1,309,166
Fruit and vegetable juices	Kilogramme	5,167,892	5,227,249	5,287,367	5,287,367	5,257,367
Squashes	Litre	2,736,085	3,354,017	1,448,809	1,347,116	1,252,560
Canned fruits	Million tonnes	209,084	175,016	180,514	236,510	204,327
Canned vegetables	Kilogramme	441,965	479,902	474,145	291,906	423,707

Source: Republic of Kenya, Central Bureau of Statistics.

Constraints and prospects

The major constraint affecting this subsector is the lack of cooling facilities both at production areas and airports. The later is more a problem for the exporters of un-processed fruits and vegetables, however. Another major problem the sector is facing is the pricing structure for fruit and vegetable produce. The prices offered to farmers by processing facilities for their produce is lower than that in the fresh market, thus enterprises which rely on independent growers for produce, do not receive adequate supply. This is the primary cause of the low capacity utilization in the sector. This pricing structure also results in the quality of the produce made available to processors being quite low - low enough that it can not be easily sold in the fresh market.

As noted in Chapters I and II, in 1994, the government announced production incentives which include providing the enabling environment to increase the quality of produce, namely the encouragement of the establishment of cold storage facilities, the duty free importation of fertilizers and greenhouse sheeting, and the intensification of research to improve the quality of produce.

OIL-SEEDS

The resource base

Kenya has a suitable climate to grow a wide range of oil crops such as sunflowers, coconuts, groundnuts, simsim, cotton and soybeans. However, the area under oil-seeds production has been declining since 1987 due to increased competition from cheap imported oils and low domestic prices. With the fall in production of oil-seeds, the production of vegetable oils in Kenya has deteriorated over the past few years and currently dependence on imports is nearly total. The country imports over 95 per cent of its edible oil requirement of about 200,000 tonnes and oil-seed derivatives such as oil meal and cake valued at KSh5-6 billion annually.

Table III.6. Production of oil-seeds, 1990-1994
(Tonnes)

Crop	1990	1991	1992	1993	1994
Cotton	37,000	28,400	31,800	20,749	28,690
Coconuts	46,947	50,162	52,900	53,270	51,960
Sunflower	12,893	18,700	10,750	5,570	9,902
Groundnuts	16,133	10,233	9,105	7,460	8,564
Simsim	855	997	967	1,146	424
Soybeans	308	409	238	185	3

Source: Republic of Kenya, Ministry of Agriculture and Livestock Development, Planning Division.

Past trends

There are over 30 processing facilities in Kenya engaged in processing a variety of oil-seeds, oil bearing materials and vegetable oils (oil milling, solvent extraction, refinery and hydrogenation). The current installed oil extraction capacity is about 265,500 tonnes per annum. The low international prices of edible oils have rendered most of the domestic processing of oils uneconomical and most plants are operating well under capacity.

An additional 342,000 tonnes per annum refining capacity is available mainly to process imported crude palm oil. The major refineries based on imported palm oil are East Africa Industries Ltd, Kapa Oil Refineries and Bidco Industries. While oil extraction units were established mostly during the period of expansion of oil crops in Kenya, the refining capacity was created especially to process palm oil and contrary to the situation in the oil milling/extraction subsector, the refining of imported crude palm oil attracted large investments and the establishment of several modern refineries equipped with the latest technology and skilled manpower. As a result, the capacity utilization of the refineries is higher than that of the oil-seed processors.

Table III.7. Installed capacity and utilization of processing facilities

Types of facilities	Installed annual capacity (Tonnes per annum)	Capacity utilization (Percentage)
Oil milling (expeller)	217,500	15
Solvent extraction	48,000	25
Refineries	342,000	58

Source: United Nations Food and Agriculture Organization, *Yearbook 1993*.

Constraints and prospects

The decline in oil crop production in Kenya as a result of competition from cheap imported oils, coupled with low domestic producer prices is the major constraint in the development of the sector. The current import duty structure, however, encourages the import of crude oils over refined products. The duty on both oil seeds and crude oils is 20 per cent, while the duty on refined edible oils is more than double that level at 45 per cent.

The edible oil sector is also constrained by its structure. The oil extraction industry in Kenya is highly fragmented and lacks integration. Most operations are stand alone oil mills or solvent plants, and refineries, leading to low oil recoveries, high costs, poor product quality and low capacity utilization.

The growth of an efficient edible oil processing industry in Kenya requires increasing the availability of oil-seeds. This can be accomplished by both increasing production and, in the immediate term, imports. Encouraging imported oil seeds via such a mechanism as a preferential tariff, would enable oil-seed processing enterprises to increase their capacity utilization, which in turn would help stimulate the revival of the market for domestic oil-seeds and increase the availability of protein meal for animal feed.

Because the use of intermediate technology is possible in this sector, the government's programme to improve the enabling environment and promote the development of small and medium enterprises should indirectly encourage oil-seed processing and could easily be adapted to include specific policies to promote the development of such entities.

SUGAR

Past trends

The importance of the sugar subsector in the Kenya economy can not be overemphasized. The industry provides employment to about 40,000 regular employees and about 80,000 small-scale farmers are engaged in cane production as a cash crop. Sugar cane farming started in Kenya in 1920s. There are currently two main producing zones: the Nyando belt and the Western Kenya belt. The Nyando belt has three operating facilities, Miwani, Chemelil and Muhoroni, with cane crushing capacities of 60,000 tonnes, 75,000 tonnes and 55,000 tonnes per annum respectively.

The Western belt has four operating facilities, Mumias, Nzoia, South Nyanza (Sony) and Western Kenya Sugar company, with cane crushing capacities of 218,000 tonnes, 75,000 tonnes, 65,000 tonnes and 60,000 tonnes per annum respectively. There are also 13 small facilities producing brown sugar known as jaggery factories. Their total estimated production capacity is 159.25 tonnes of jaggery per year.

Despite the long history of cane production in Kenya, the country has never managed to achieve long-term and sustained self-sufficiency in sugar production. Local demand must often be met with imports. In 1971, the Kenya Sugar Authority was established to promote the development of the production and processing of sugar. By the 1980s, the country was running a large surplus. By the end of that decade, however, domestic demand had risen sharply and imports were significant. Then, despite record harvests in the 1990s, sugar was being smuggled to Uganda in such quantities that shortages were occurring at home. By 1995, however, the shortage in the market had become a glut due to the illegal import of sugar and the entire industry was near collapse. Because the situation had become so severe and it was felt that 13,000 jobs were at stake, the government was forced to ban the importation of sugar for six months.

Sugar production and consumption figures are given in Table III.8.

Table III.8. Production and consumption of sugar, 1988-1994

Year	Production (tonnes)	Consumption (tonnes)
1988	411,296	462,207
1989	441,261	489,544
1990	431,836	537,999
1991	433,713	493,945
1992	371,225	552,200
1993	384,800	580,847
1994	349,805	610,470

Source: Republic of Kenya, Ministry of Agriculture and Livestock Development, Planning Division.

Constraints and prospects

The sharp decline in the production of sugar has been caused primarily by inadequate investment in cane development. The future of the sector lies in opening up new areas to sugar production and increasing yields, as well as the rehabilitation and capacity expansion of existing processing factories and the establishment of new sugar processing facilities. There are two factories which have been proposed for construction, Siaya and Busia. The Busia Sugar Project is already under way with cane being developed and is now awaiting factory construction.

Other government efforts to stimulate the sugar industry and raise productivity, include implementing policies aimed at increasing production including the liberalization of consumer prices, removal of import licensing requirements, imposition of a variable duty on cheap and subsidized imports, freedom to sell directly to consumers up to 20 per cent of each factories' output, and government guarantees for the securing of local and offshore loans. It is hoped that all these measures will yield good results in the long run.

BEVERAGE CROPS

The resource base

Kenya is one of the leading countries in the world in the production of both coffee and tea. The two crops are the major agricultural commodities and foreign exchange earners for the country. Coffee was among the earliest cash crop planted in Kenya and it is now produced by cooperative societies involving thousands of small-holder farmers and large estate farms. Most coffee grown in Kenya is of the Arabica variety.

Tea in Kenya is produced by small-scale farmers under the umbrella of Kenya Tea Development Authority (KTDA) which is a parastatal body and owns over 30 tea factories scattered all over the tea growing zones. Other producers are large private farms such as Brooke Bond and Finlay which have their own tea processing facilities.

Past trends

Since 1990, the production of coffee has been declining. Output has dropped from 103,900 tonnes in 1990 to 79,900 tonnes in 1994. The decline in production has been largely the result of the substantial drop in the coffee agreement export quota system in 1989. Despite the decline in world coffee prices Kenya's coffee still enjoys a premium over world prices because of its high quality. Over 95 per cent of coffee produced is exported. The leading market for Kenyan coffee is the EU, with Germany as the leading country.

The coffee subsector plays an important role in the development of the country through its foreign exchange earnings and employment generation. The subsector earned the country over KSh4.4 billion in 1990 and over KSh13.0 billion in 1994.

The production of tea rose from 197,000 tonnes in 1990 to over 209,00 tonnes in 1994. The decline in 1992, evident in Table III.9 was due to drought. The general good performance of the subsector has been the result of liberalization of the tea industry, introduction of foreign exchange retention accounts, strong prices offered in the auction markets and maintenance of rural access roads enabling growers to get their produce to market. Tea exports earned Kenya KSh6.3 billion in 1990 and KSh16.9 billion in 1994. The major markets for Kenyan tea are Pakistan and the United Kingdom.

Table III.9. Production of tea and coffee, 1990-1994

	Tea			Coffee		
Year	Area (Thousand hectares)	Production (Thousand tonnes)	Exports (Billion KSh)	Area (Thousand hectares)	Production (Thousand tonnes)	Exports (Billion KSh)
1990	97.00	197.0	6.3	153.1	103.9	4.4
1991	99.80	203.6	7.5	155.4	86.4	4.4
1992	103.50	188.1	9.5	153.8	85.3	4.1
1993	104.86	211.2	18.7	158.2	75.1	11.0
1994	105.91	209.4	16.9	158.7	79.9	13.1

Sources: Republic of Kenya, Central Bureau of Statistics and *Export Promotion Council Report*

Constraints and prospects

The coffee subsector has been performing poorly over the last four years mainly because of the decline in world prices which has made it uneconomical to produce. This has been exacerbated by delayed payments to farmers which resulted in many abandoning the crop. The suboptimal application of fertilizers and other chemicals due to the high price of these inputs has also adversely affected the output of both tea and coffee. With an improved system of payments to farmers and the expected privatization of the country's tea factories, production of the crops should improve. Kenya is also looking into expansion of its export markets with a view of avoiding over reliance on too few markets.

Both tea and coffee will always be subject to the swings in the world price of these commodities, however, and there is little that can be done to combat the adverse effects of drops in the price except to strive for the lowest cost production possible.

ALCOHOLIC BEVERAGES

The resource base

The primary ingredients in the production of beer are barley and hops. Kenya is basically self-sufficient in production of barley, although occasional shortfalls that necessitate importation due occur. Hops are still imported, although experimentation on their local production has been successful. The main input in the production of spirits is molasses which is locally available as a by-product of sugar processing. The growing of grapes for wine-making is not significant.

Past trends

Alcoholic beverages produced in Kenya include beer, limited amounts of wine and spirits. Beer production is dominated by Kenya Breweries Ltd which has five breweries: three in Nairobi, one in Mombasa and one in Kisumu. Wines and spirits are produced by the Kenya Wine Agencies (wines), International Distillers Kenya Ltd (spirits) and Mohan Meakin Ltd (spirits). The bulk of the production of beer, wines and spirits is consumed locally, however, small amounts are exported mainly in the COMESA region. Production of beer decreased in 1994 as a result of stiff competition in the local market from imported beer from South Africa and Germany.

Table III.10. Production of spirits and beer, 1990-1994

Product	Units	1990	1991	1992	1993	1994
Beer and stout	Thousand litres	331,114	314,005	368,648	358,866	325,005
Spirits	Litre	1,195,917	1,688,302	1,480,323	2,259,130	1,674,000

Source: Republic of Kenya, Central Bureau of Statistics.

Constraints and prospects

Kenya has in the past approved the establishment of brewery projects but none has taken off mostly due to the monopoly Kenya Breweries has in the production of barley. Wine production has been hampered by the inadequate production of grapes. It is recognized that the utilization of local fruits offers potential for increased wine production and efforts to produce other fruit-based wines such as pupaya wine already are being intensified.

While Kenya Breweries has a dominant share of the local beer market, it is likely that with privatization and new investment, the amount of exports can be increased to both the COMESA market and to the EU as the demand for "exotic" beers continues to be strong there.

TOBACCO

The resource base

Kenya is self sufficient in tobacco leaf production. The major company involved in this sector is British American Tobacco Company Kenya (BAT). Tobacco is grown and sold to BAT Kenya by small-scale farmers who number about 11,000 and who cultivate 6,000 hectares of land. Three main types of tobacco grown are: fire cured; flue cured; and burley. The other company involved in the tobacco industry is Mastermind Ltd. While statistics are not available to quantify its market share, it is minimal. All information and data relating to this subsector thus refers to BAT Kenya.

Table III.11. Production of tobacco, 1990-1994

Year	Production (tonnes)	Value (million KSh)
1990	6,414	119.0
1991	6,424	128.5
1992	8,406	179.3
1993	6,057	183.6
1994	5,183	260.1

Source: British American Tobacco Company, Company Report.

Past trends

As noted, BAT Kenya is the largest agro-based industry involved in the growth of leaf tobacco, the manufacture of cigarettes and other tobacco products, and distribution and export activities. The local investors have a 40 per cent share of the firm, while 60 per cent is owned by the parent BAT company. Cigarette production has shown a rising trend, particularly since liberalization efforts began in 1992.

Table III.12. Cigarette production and tobacco manufactures, 1990-1994

Year	Volume (million sticks)	Value (million KSh)
1990	523	83.2
1991	525	107.0
1992	805	207.8
1993	1,256	513.4
1994	1,409	716.4

Source: British American Tobacco Company, *Tobacco News*, August 1995.

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PROGRAMME ON ENVIRONMENTALLY SOUND AND SUSTAINABLE MANAGEMENT OF PHARMACEUTICAL INDUSTRIES*

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FOREWORD

In the spirit of The Declaration of Rio (UNCED 1992), following the call of Agenda 21 for a high quality environment and healthy economy for all peoples of the world, organizations of all kinds - from the government level to industrial enterprises- are increasingly concerned to improve and demonstrate their environmental performance.

Industries, dealing with chemicals are in the front line of interest concerning environmental protection.

The present study has been prepared to assist both authorities (governments, local municipalities, NGOs) and companies (producers, importers, distributors) in the implementation and maintaining of environmentally sound and sustainable management in the pharmaceutical industries.

The study is consisting of three parts:

Part I PROGRAMME. (LEGISLATION, CHEMICAL SAFETY)

Part II GUIDELINES FOR THE PRODUCERS OF ACTIVE SUBSTANCES

Part III GUIDELINES FOR THE PRODUCERS OF PHARMACEUTICAL PREPARATIONS

Part I of the study is dealing with the environmental issues of the pharmaceutical industry focussing to environmental legislation, chemical safety, waste management, and has been intended primarily for use by government officials and directors of enterprises and relevant institutes.

In Part II and III the practical aspects of production of active substances (medicinal chemicals) and formulation of finished products (dosage forms) are summarized. For the better understanding case studies are also attached.

During the preparation of the study a Conference on International Trade in Dangerous Chemicals has been organized by the European Commission (Brussels, 5 to 7 July 1995). The proceedings of the conference has also been used to provide up to date information.

Although the imminent publication of ISO 14000 Standard Series of Environmental Management has not been taken place yet, the spirit and philosophy of it is supposed to be reflected in the study.

CONTENTS

List of Annexes and Attachments

ABBREVIATIONS

BOD	Biological oxygen demand
CEC	Commission of the European Communities
COD	Chemical oxygen demand
EC	European Community
EEC	European Eonomic Committée
EMS	Environmental management systems
EPA	United States Environmental Protection Agency
EU	European Union
FAO	United Nations Food and Agricultural Organization
GMP	Good Manufacture Practice
ILO	Untied Nations International Labor Organization
IOMC	International Organization on Programme on Sound Management of Chemicals
IPCS	International Programme on Chemical Safety
LD_{50}	is the (single)dose of the material which causes the death of 50% of a group of test animals
LC_{50}	is the concentration of a material in air which causes the death of 50% a group of test animals when given over a set period of time, usually 1 to 4 hours
LEL	Lower Explosive Limit
ODP	Ozone depletion potential
ODS	Ozone depleting substances
OECD	Organization for Economical Cooperation and Development
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
POP	Persistant organic pollutants
SSI	Small scale industry
TSS	Total suspended solid
UEL	Upper Explosion Limit
UNCED	United Nations Conference on Environment and Development (1992)
UNEP	United Nations Environmental Programme
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compounds
VOS	Volatile organic solvents
WHO	United Nations World Health Organization
WWTP	Waste water treatment plant

DEFINITIONS

Active substance

(Bulk Pharmaceutical Chemical)

Chemical hazard
A hazard involving chemicals or processes which may realize its potential through fire, explosion, toxic or corrosive effects.

Damage
The loss of inherent quality suffered by an entity (physical or biological.

Environmental management
Those aspects of the overall management function (including planning) that determine and implement the environmental policy.

Environmental management system
The organizational structure, responsibilities, practice, procedures, processes and resources for implementing environmental management.

Environmental policy
A public statement of the intentions and principles of action of the organization regarding its environmental effects, giving rise to its objectives and targets.

Harm
Loss to a human being consequent on damage

Hazard
The situation that in particular circumstances could lead to harm.

Risk
The possibility of suffering harm from a hazard.

OBJECTIVES

BACKGROUND

In the spirit of The Declaration of Rio (UNCED 1992), following the call of Agenda 21 for a high quality environment and healthy economy for all peoples of the world, organizations of all kinds - from the government level to industrial enterprises- are increasingly concerned to improve and demonstrate their environmental performance.

The movement to protect the environment started from countries in which the industry has been the most developed, consequently the damages in environment caused by the industry appeared quickly.

The situation of the developing countries is different.
For them, industrialization seems to be one of the ways out of poverty.
Since their industrial development started later they may utilize the experiences of the industrialized countries.
Unfortunately lack of financial resources, know-how, standards and information together with inadequate environmental legislation often lead to widespread use of environmentally unsound production processes that waste raw materials and energy and unnecessarily cause pollution.

The global tendency for heavily polluting and/or highly resource/energy intensive industries to be relocated in developing countries increases the environmental risks.

ROLE OF UNIDO

In developing countries

Environmental protection is an integral part of UNIDO's fundamental mandate:
"to encourage and extend assistance to the developing countries for the development, expansion and modernization of their industries", "to provide a forum and act as an instrument to serve the developing and industrialized countries in their contacts, consultations and negotiations", "to coordinate all activities of the United Nations system regarding to industrial development".

UNIDO wants to play a leading role in the implementation of these objectives, also in the area of environment protection and continue co-operation with UNEP, WHO, and other international organizations to support them in carrying out programmes and projects derived from their mandate.

In East European transitional economies

The above quoted mandate of UNIDO has been extended to the Eastern European transitional economies. These countries with their historical, political and industrial traditions have similar and different elements in comparison with both developing and industrialized countries. Their experience may be useful for planning and/or improving industrial sectors in developing countries and have high level scientific and industrial knowledge on one hand but they need assistance in elaborating industrial policies and know-how in environmental protection on the other.

UNIDO, is one of the few international agencies specialized in government services such as assistance in the formulation and assessment of industrial policies and strategies relating to subsectoral investment promotion, formulation of subsectoral programmes, as well as technology development and transfer.

OBJECTIVES

The present programme is trying to collect and summarize all necessary information on the environmental aspects of the production and formulation of pesticides.
The aim is to yield assistance to all involved in the pharmaceutical industry in the developing countries:
governmental and local municipal authorities,
non governmental organizations,
companies producing, formulating or distributing pharmaceutical products.
Annexes, attachments and list of relevant publications will help to get more detailed information.

PART I

CHEMICAL MANAGEMENT PROBLEMS OF SMALL SCALE INDUSTRIES

Evidence from a number of countries shows that the growth of industrial activity is closely related to the progress of small industrial enterprises. Governments in most countries promote small scale industries (SSI) through fiscal and policy incentives. In India, for example, it is estimated that proliferation of SSI units is at a rate of 20% compounded annually with employment exceeding 11,000,000.
Many countries have established specific government organizations to promote and oversee the development of the SSI sector.

In the pharmaceutical industry the occurrence and role of SSI may give rise to special advantages, but also to problems. Pharmaceutical companies in most cases may be originated from small workshops, usually those of pharmacies. The majority of the big multinational companies have been developed from small family owned pharmacies. The other route has been that of the chemical manufacturers, who increasing both the volume of production and also the spectrum of their chemical products, gradually invaded into or rather created the pharmaceutical *industry*.

In developing countries both model may exist but differs significantly from the "traditional" way of development, due to peculiar character of these countries.
The small private enterprises start usually as agents of foreign companies doing marketing, sales, and distribution activities. Later they begin to import the bulk product and carry out the packaging. Formulation from imported active substance is the next step. In certain cases, following the principle of "backward integration" the production of the active substance itself is going to be implemented, usually starting with the last process step (in most cases purification of the imported "technical material" from contaminants and producing the active substance complying with the required quality requirements). Continuing the backward integration gradually more steps of the process may be introduced and finally the so called "total synthesis" of the material is implemented. The whole above mentioned procedure may be in frame of a transfer of technology from a donor, or done by the industrial venturer on its own independently from foreign companies.

The other way of creating new pharmaceutical plants is the practice of establishing a production unit of a foreign company.

It is obvious that in case of transfer of technology or establishing a daughter company, the *donor or owner resp. bears responsibility relating to environmental and occupational safety*. They have to provide all data and procedures both to the manufacturer and also to authorities in order ensure chemical

safety relating to the whole production.

SSI profile

In case of independent enterprises the situation is more complex. The small industry manufacturing establishments having less than 50 employees, comprise some 60-75% of chemicals manufacturing establishments in many rapidly industrializing countries, but provide only 15-20% of output. In many cases these enterprises were established prior to requirements for environmental impact assessments. Estimates of their inputs into the total national annual exposure burden vary widely. Based on Indian experience, for example, their contribution may be as high as 40% of total annual generation. A survey of the Asian Development Bank has indicated that the generation of hazardous wastes by SSIs is disproportionately high compared to their share in total industrial output.

SSIs suffer from a number of serious constraints in attempting compliance with new regulations. Economically they are characterized by *low capital investment, fierce competition, lack of the necessary skills and managerial resources.*
In order for a SSI enterprise to survive, it must utilize the cheapest means of production with small or no overhead costs. This type of administration normally leads to aggravated occupational safety and health problems, public health detriment in adjacent communities and environmental degradation.

Proper managerial skill and practice

Most small scale businesses, including many family enterprises, are managed by the owners themselves who may have proper education and expertise in pharmaceutical or medical sciences and practice, however lack adequate (if any) industrial managerial practice, are unfamiliar with knowledge of modern technic particularly with waste pre-treatment and disposal technologies. Examples of inappropriate management include the use of domestic *sewage systems for inadequately treated waste discharges, the use of surface drains, creeks and other water bodies for effluent discharge and both on and off-site surface disposal of sludge and toxic residues.*

Governmental support, assistance

Not all constraints on small industries are directly attributable to pure and sole economic factors.

Many of the industries are located in urban housing areas or have been illegally developed on government land over a period of many years. Little if any place is available for the treatment and

disposal of wastes.
Establishing of "industrial parks" i.e. areas dedicated towards industrial purposes located away from residential areas may provide with the advantages of necessary infrastructure, i.a.:

- proper energy supply
- central storage
- centralized collection and processing of wastes and expended waste treatment facility
- well organized, trained and equipped emergency crew

The cost sharing of certain services, first of all those relating to waste minimisation and management can assist SSI enterprises to comply with recent regulations which they could not afford alone.

Information, education especially in environmental management issues may also be useful and necessary inputs to improve the standard of management of SSI enterprises

Communal transportation, handling, storage and waste pre-treatment facilities have many advantages in addition to the cost sharing effect, some of which are as follows:

- utilization of wastes, by products
- regeneration of solvents or by-products
- technologies for large scale systems can be used
- technically specialist operators, independent from enterprises, subject to on-site supervision by the responsible authorities.

ENVIRONMENTAL MANAGEMENT SYSTEMS

The aim of an EMS is to enable its user to establish procedures to set an environmental policy and/or objectives, achieve compliance with them, and to demonstrate such compliance to others.
The user can be any organization dealing with the legislation, control, use, production or distribution of pharmaceutical products.
As the present study is dealing with the pharmaceutical *industry*, users of medicines (i.e. hospitals, other health institutions etc.) are not discussed.
Recently, pharmaceutical companies started to undertake environmental "audits" in order to prove to authorities, or commercial partners their environmental performance.
However, such audits can assess only the present status, but can not give the assurance that the company will continue to meet legislative requirements.

ENVIRONMENTAL POLICY

Environmental policy is consisting of the intentions and principles of action of the organization regarding its environmental effects.
The organization may be the government or its institution; regional or local municipality; enterprise or its production unit.
It must be public, objectives and targets must be clearly formulated avoiding ambiguity.
The policy shall contain the targets and consequent tasks of all nt levels of hierarchy within the organization.

Internationally accepted and /or used prescriptions and guidelines are worth to be complied with, or followed.
The number of publications relating to various aspects of environmental protection is abundant. Principles are laid down in form of prohibitions in most of them. Practical measurements remain to the executers.The aim of the present study is to draw the attention to laws, rules, prescriptions, guidelines shortly all available publications relevant for the legislation and operation of the pharmaceutical industry.
Practice of the industrialized countries (US, Canada, the European Union, Japan) are the best to follow, always bearing in mind the local specialties and possibilities.
A list of documents can be found among the references of the present study, but the *EPA Guides to Pollution Prevention (esp. the volume: The Pharmaceutical Industry)* and the *Technical and Economical Study on Reduction of Industrial Emissions from the Pharmaceutical and Cosmetics Industry prepared by ECE and the British Standard BS 7750 Specification for Environmental Systems*

seem to be the best guidelines for the elaboration of the environmental policy.

The policy shall also take into consideration the operational and business requirements of the organization.
Finally, but not least the financial resources should not left out of regard either.

Operational requirements,
especially the technical ones are key items. Processes of the production of *bulk pharmaceutical chemicals* (synthetic, fermentation, extraction) generate by-products: effluents and wastes. The safe handling (source reduction, material substitution, recirculation, regeneration, utilization, elimination etc.) of them is the core of the ELMS. The *formulation* of pharmaceutical products seem to be more harmless for the environment, but the character of certain products may also need due precaution in order to avoid contamination, especially certain chemotherapeutics, antineoplasmatics, allergizing substances, products having hormone-like effects etc.

Governmental level
The task of the government is to enforce the realization of its environmental policy by legislation and control.
During efforts to follow foreign prescriptions, real possibilities are always borne in mind. Impracticable orders are counterproductive by urging to prepare false or ambiguous assessments thus leading to temporarily hidden consequently uncontrollable damages in the environment.

The development of national, regional, local or site specific "cradle to grave" management plans for chemicals must take into the range, quantities and locations of the substances of concern. The plans need to impose responsibilities on all who have a role in the import, transport,production, packaging, storage, distribution of pharmaceutical chemicals and their finished forms.

Legislation is important per se, but also as an interface between chemical safety and other special regulations (e.g. employment, industrial relations, trading standards etc.)

Planning new facilities
Beside general principles it is important to pay attention to certain special characteristics of the pharmaceutical industry.

Distance from residential areas has to be taken into consideration. Especially when new facility is going to be planned, future plans of the municipality for the extension of residential quarters must have first priority. Properly chosen distance from the factory may

avoid daily harassment of the neighboring population and decrease the probability of possible accidents.It has to be stressed that the *remoteness of an industrial plant in itself does not replace the necessary working,- and environmentally safety measurements, because nature and environment must be protected even in remote areas.*
However, since the planned operation of machinery is relating to normal working conditions, in case of a breakdown the damage (first of all pollution) may be reduced by distance. Especially casualities of the population can be decreased.
Odor and noise are the most sophisticated nuisances first of all due to individual sensitiveness to them, but also because of the difficult and complex way of protection.
Distance from residence area is certainly not a drawback.

Distance from natural waters (rivers, lakes etc.)may also yield similar considerations: breakdown in the waste water treatment facilities can also not absolutely excluded.
Proper space for secondary safety equipments (e.g.valves), additional treatment (chemical or biological) together with the self cleaning possibility during the residence time of the waste water in the ducts or containers (artificial ponds) may result in decreasing or eliminating the damage.
An additional advantage may be the dilution effect of communal sewage as well.
It is obvious, that the proper distance from inhabited areas yields the safest, most cost effective i.e. optimal protection of the population and environment.

Interrelations, conflicts of interests
The policy should not only commit the organization to set up and or meet relevant regulatory and legislative requirements, but also define how it will seek to meet, exceed or develop the requirements of some, or all, of the other interested parties and secure continual improvement in environmental performance.

Format
The environmental policy should be public and available in a readily understood format to interested parties (e.g. in annual report, booklet or display)

Enterprise level
Duty of the management of a company in this respect is first of all to abide law. Since legislation on environmental issues is far from complete even in some industrialized countries and is in an initial phase in
in the majority of the developing regions, the proper way of environmental management is the responsibility of the enterprise. The present study is intended to help in finding reliable references to elaborate and implement suitable measurements.

Part II and III resp. are dealing with special issues and problems of enterprises producing and or handling pharmaceutical products.

ENVIRONMENT MANAGEMENT SYSTEM REQUIREMENTS

A brief summary of the requirements based on BS 7750 is the following:

- Organization and personnel
  - responsibility, authority of key personnel
    - inc. authorized management representative
  - interrelations within general management
  - training of personnel
- Resources
  - technical
  - financial
- Environmental effects
  - register of legislative, regulatory and other policy requirements
  - communications
    - for and from interested parties
    - internal and external
  - evaluation
  - objectives and targets
  - environmental management programme
- Documentation
  - manual
  - documentation
- Operational control
  - work instruction
  - procurement and contracted activities
  - monitoring and control of relevant processes
    - criteria for performance (in written form)
  - verification of compliance with specified requirements
  - acceptance criteria when results are unsatisfactory
  - non-compliance and corrective action
- Audits
  - audit plan
  - environment management reviews

Detailed specification or the above mentioned elements - intended to apply to all types and sizes of organizations - can be found in BS 7750 and its application for industrial and commercial enterpriseswill be discussed in Parts I and II resp.

The philosophy of the approach to set up and operate such an EMS is shown schematically in flow chart form in Figure 1.

Application of BS 7750 for industrial and commercial enterprises will be discussed in detail in Parts I and II resp.

Governments and local municipalities
may find essential support in the mentioned standard, especially if they are at the initial phase of setting up proper organizations and introduce measurements to control the protection of their environment.
As a first step, a preparatory review may be prepared in order to collect all aspects of the organization, to identify strength, weaknesses, risks and opportunities as a basis for establishing the EMS.
This review should cover the following areas:

- evaluation of significant environmental effects
- legislative and regulatory aspects
  - environmental objectives and targets beyond regulatory requirements
  - expected changes in regulations and legislation
  - views of relevant interested parties
- examination of all existing environmental management practices and procedures
- assessment of feedback from previous incidents
- use of hazardous processes
  - disposal or use of hazardous materials
- environment hazard and risk assessment of potential emergency situations
- environmental aspects of emergency planning
- environmental effects of investment policies
- nature conservation
- visual impact, noise and odors
- complaints and their recording and follow-up

The resulting report should highlight:

- the nature and extent of problems and deficiencies
- an improvement programme designed to ensure that the personnel and material resources required are identified and available.

Improvement programme
should focus first of all, but not exclusively to

- reduce waste and the consumption of resources
- reduce or eliminate the production of polluting releases to the environment
- control the environmental effects of raw material sourcing (e.g. on habitats, on species diversity and on natural beauty)
- minimize the detrimental environmental effects of new developments through strategic planning
- management of risks
- chemical accident prevention, preparedness, response
- emergency situations

Appropriate levels of municipality should, where necessary, define specialized and/or more detailed environmental targets, consistent

specialized and/or more detailed environmental targets, consistent with the government policy, in addition to the overall objectives.

It is essential that the newly set up system should lay emphasis on the *prevention* of adverse environmental effects, rather than on *detection and amelioration* after occurrence.
Real, feasible and practical prescriptions must be a first priority.
Attention is to be paid to certain limit values, concentrations of in effluents, wastes. These should be measured. Proper instruments together with validated methods and trained personnel must be available.

plants in order to avoid contamination of medicines and to protect the environment on one hand; but also limits the possibilities of the recycling of materials on the other .

Liquid effluents

The primary waste water source is the washwater of equipment and floors, which may contain medicinal chemicals, inorganic salts, sugars, and typically has low BOD, COD, and TSS, with near neutral pH.

Air emissions

in addition to the dusts may result from the use of volatile solvents.

Propellants used in aerosol flasks may be dangerous for the environment not at the site of production but at the application. Prescriptions for ODSs are to be followed.

WASTE MANAGEMENT

Waste sources

The pharmaceutical industry produces a wide range of gaseous, liquid and solid waste types.

Atmospheric emissions may be
- gaseous
- volatile (incl. VOC = volatile organic compounds and ODS = ozone depleting substances)
- particulates, in form of aerosols, i.e. suspensions of fine solid particles or liquid droplets, such as dust, smoke, fog, or mist, or
- combination of them.

From synthesis plants:
- losses during filling, emptying tanks, drums
- storage and transport of mother liquors and wet cake
- off-gases and vapor losses from reactors, dryers
- milling, sieving, packing of solid materials
- relief valve, bursting disc discharge
- building ventilation
- incineration

from fermentation plants:
- as for synthetic plants plus:
- organisms in fermenter off gases
- odors in fermenter off gases
- vapor losses from extraction plants

from extraction plants:
- as for synthetic and fermentation plants plus:
- solvent losses in extracted residues
- vapors from desolventiser exhaust

from formulation plants:
- solvent vapor losses from tablet coating
- vapor losses from solvent tanks
- milling, sieving, packing of products
- wet and dry granulation
- manipulations with dried materials
- active ingredients in ventilation exhaust

Coarser particles (larger than 10 microns) settle out of the air quickly. They are, therefore, most troublesome near their source. Smaller ones travel farther. The most problematic are those less than 1 micron (generally referred to as aerosols) because they remain suspended in the air and move easily away causing pollution far from its source.
The "fine", or "superfine" powders and their hazards will be discussed in the section dealing with formulation plants, while volatile exhausts are generated frequently by organic synthesis.

Simplified reactions in the atmosphere
The following formulas are a set of simplified reactions that generate the various atmospheric problems related to air pollution:

NO_2 + Sunlight= NO + O
$O + O_2 = O_3$
$O_3 + NO = NO_2 + O_2$
$HO + RH (+ O_2) = RO_2 + H_2O$
$RO_2 + NO = RO + NO_2$
$RO + O_2 = HO_2$ + Aldehydes, ketones and other hydrocarbons
$HO_2 + NO = HO + NO_2$
$O + SO_2 = SO_3$
$SO_3 + H_2O = H_2SO_4$

List of odor threshold values, classification of airborne carcinogenic compounds and photochemical ozone creation potentials of certain substances can be found in the annexes.

Liquid effluents

and runoff water from pharmaceutical production plants may be toxic and polluting consequently need proper management.
Even surface runoff waters in production areas are likely to contain residues, so they also requirement some sort of treatment. The segregation of clean uncontaminated rainwater via dedicated, sealed drains may significantly reduce quantities of effluent requiring treatment.
Cooling waters are normally recycled in close-loop systems and remain uncontaminated. However, a proper surveillance is needed in order to avoid leakage. Undetected leakage may result in long term, chronic pollution and the identification of the source is not always easy, especially in large industrial sites.

From synthetic plants:
- seal losses from liquid ring vacuum pumps
- wash water from various equipment
- scrubber liquor
- leaks from storage tanks
- contaminated storm water
- fire water run-off

from fermentation plants:
- as for synthetic plants plus:
- waste water from fermentation, fermenter broth
- organic solvents in waste water from extraction

from extraction plants:
- as for synthetic plants plus:
- waste water from extractors containing animal organs and parts of medicinal herbs
- wash water from extractors containing the same

from formulation plants:
active ingredients in wash waters of equipment
active ingredients in wash water of rooms
contaminated storm water
fire water run-off

Solvents most commonly used in pharmaceutical manufacturing are listed in Table 1:

Table 1.
Solvents Commonly Used in Pharmaceutical Manufacturing [1]

Acetone
Cyclohexane
Methylene Chloride
Ethyl Acetate
Butyl Acetate
Methanol
Ethanol
Isopropanol
Butanol
Pyridine
Methyl Ethyl Ketone
Methyl Isobutyl Ketone
Tetrahydrofuran

Toxic effects of common pollutants in aquatic and terrestrial environment are summarized in Annex VIII.

Solid wastes

A range of non-recoverable waste types arises from the manufacture of pharmaceutical products. These include process and effluent sludge, spent catalysts, residues of animal organs and medicinal plants, contaminated containers and package waste.
All concentrated wastes containing significant contamination should where possible be routed for disposal by high temperature incineration.

Lightly contaminated residues, such as package materials and unusable containers, can make up large volumes of low-density waste.

from synthesis plants:
residues from incinerators
sludge from WWTP
contaminated packing
still bottom residues from solvent recovery plants
reject pharmaceutical materials
from fermentation plants:
as for synthesis plants plus:
spent biomass

from extraction plants:
as for synthesis plants plus:
plant or animal residues from extraction process
from formulation plants:
active ingredients in dust collection systems
reject pharmaceutical products
contaminated packaging
contaminated clothing (gowns, gloves, etc.)

Waste minimization

Wastes from the pharmaceutical plants are in most cases be environmentally sensitive and may involve high costs for disposal. Pharmaceutical manufacture is a diverse and highly competitive industry. Because of the highly specific and often confidential nature of each company's specific operations, only very general discussions of material substitution and process modification can be given.

Methods of waste minimization are manifold corresponding to the nature of the material(s) in question and will be discussed in the respective sections of the present study.
A comprehensive summary of the possible methods is as follows:

Source reduction
of hazardous wastes can be achieved in industry through changes in

- products
- raw materials
- process technologies
- organizational practices.

Material substitution
is a change in one or more of the raw materials used in production in order to reduce the volume or toxicity of waste generated.
Replacement of solvent-based solutions by aqueous-based ones, or chlorinated solvents by non-chlorinated media are the most common examples.
In order to avoid unnecessary nuisances in the technology or in the re-registration, involvement of R&D activity is inevitable.

Process modification
or modernization may also result in reducing volume or toxicity of wastes. In most cases the product/waste ratio is determined by the product yield. Consequently improving yield means simultaneous increase in product volume and decrease in waste generating. Better controlling of reaction parameters, introducing improved process control, prevention of fouling deposit in order to improve heat and mass transfer in the reactor are the most common measures to be taken into consideration.

Good Operating Practices
can help to reduce hazardous or other waste generation by

- management incentives
- employee training
- closer supervision
- production scheduling
- additional documentation
- materials tracking and inventory control
- spill prevention
- material handling and storage procedures
- maintenance programmes
- waste stream segregation

Other aspects of the interrelations between environmental management systems and quality assurance activities inc. GMP are discussed in the respective chapter of the present study.

Recovery and recycle
includes direct reuse of waste material, recovering used materials for a separate use, and removing impurities from waste to obtain relatively pure substances. The strict quality control requirements of the pharmaceutical industry often restrict reuse opportunities, though some exist.
Recycling can be performed either on-site or off-site, depending on the capital investment, operating costs, and expertise needed.
Recycling of solvents either directly or recovered from wastes is widely used in the pharmaceutical industry. Processes for solvent recovery from concentrated waste streams include distillation, evaporation, liquid-liquid extraction, sedimentation, decantation, filtration.

Waste exchanges
are recently developed in industrialized countries. They can be grouped as follows:

- information exchanges are clearing houses for information on supply and demand, and typically publish newsletters catalogues
- material exchanges take temporary possession of a waste for transfer to a third party
- waste brokers charge a fee to identify buyers or sellers, but do not take possession of the waste

On-site waste treatment

Due to the extremely big number of compounds having wide variety of physical and chemical character, generally usable method for the treatment is not available. The responsibility of the producer in developing the proper process for treatment is paramount.

The main aspects of waste management are:

- survey
- inventory
- transport
- storage
- treatment
- utilization
- disposal (incl. site selection)
- risk assessment

In industrialized countries the *hazardous waste service sector* has expanded rapidly to cover (nearly) all above mentioned aspects of hazardous waste management.
Without such an industry, each waste generator must acquire the skills and equipment to deal with its own hazardous chemicals.

The following considerations deal with those *pre-treatment procedures which are necessary to be carried out on-site, "statu nascendi" of the waste. These prccesses should be regarded as inherent parts of the technology. New technologies should be introduced only in case if they contain them, ongoing ones are to be completed by them.*

Atmospheric emissions

In order to prevent discharge of hazardous materials into the air gases and vapors are to be treated depending on their physico-chemical properties:

- *condensers* may collect vapors into liquid form
- *adsorbers* can bind gaseous substances onto solid surface
- *scrubbers* can absorb gases, vapours or facilitate reaction (if necessary) by the aid of some process liquid (water in most cases)

solid state particles can be separated from the air flow by *filters and dust precipitators*. Solid particles, especially those "superfines" may be charged electrostatically, thus represent powder-explosion hazard. Precaution, including checking pyrotechnical properties of the material in question is strongly recommended.

Needless to mention, that the above mentioned treatment methods also generate new wastes by transforming gaseous substances into liquid or solid forms.

Liquid effluents

Most cases the first step of the treatment is

- *sedimentation*, and/or
- *filtration* in order to separate solid particles.

Sticky, paste like components, or viscous liquids may cause problems and need sophisticated methods.

Solved substances depending on their chemical properties may be separated from the waste liquid or transformed into less harmful materials by suitable

chemical reactions, most frequently
neutralization (by acids or bases)
precipitation and *sedimentation* or *filtration*
wet air oxidation.

Organic solvent wastes may be incinerated "in situ". In some cases it is the most economic and also environmental friendly solution of waste treatment, especially when discharge of VOSs, POPs, ODSs, can be eliminated. There are a number of various "small, but beautiful" devices on the market. Temperature and residence time of combustion are to be considered carefully. Quality, particularly construction material is worth for proper consideration, especially when halogenated compounds will be incinerated.

Solid wastes

At present, solid wastes are in most cases transported from the manufacturing plant without any pre-treatment to either incineration or disposal as landfill, or further utilization. However, in order to reduce dependence on land disposal through waste prevention, minimization and other technical possibilities represent the first choice in the hierarchy of hazardous waste management options. Chapter 20 of UNCED Agenda 21 stipulates that prevention of the generation of hazardous wastes and the rehabilitation of contaminated sites are the key elements for environmentally sound management.

Measures for control & reduction of emissions

Measures for control and reduction of emissions are inherently joined to the technologies where they originate from; consequently they will be discussed in Part II and III of the present study.

Dedicated waste treatment facilities

As mentioned previously, each waste generator must acquire the skills and equipment to deal with its own hazardous chemicals. The principle may be evident, but to comply with it is another question. The complete procedure of the waste treatment in many

cases may be more sophisticated or more expensive than to be executed as a "do it yourself" activity by the manufacturer, particularly if it is a SSI enterprise. It is unlikely that all waste generators will gain the necessary competence. *The minimum request towards producers is the proper pre-treatment which enables wastes for transport and/or further treatment.*

Establishing of local service enterprises specialized for waste treatment is essential, particularly for SSI enterprises.
Governments can foster the growth of a local service industry by providing contracts for handling hazardous chemicals.
Local engineering firms can also form joint ventures with foreign firms until they develop the proper level of expertise.
Regulations can be set up to encourage the collection and centralized treatment of hazardous chemicals, the construction of centralized incinerators and the siting of secure landfills.
Economic measures like free land for site, tax holiday, exemption from import duty for equipment etc., may enhance the development of such enterprises.

The central/communal transportation, handling, storage and waste treatment facilities have many advantages, some of which are as follows:

- central facilities resolve the problems associated with small scale operations esp. lack of capital investment and operational costs
- presently available technologies for large scale systems can be used
- the management of central facilities can be by technically specialist, independent operators subject to on-site supervision by responsible authorities.

Landfill

is the placement of wastes into or onto the ground and, in many cases because of the nature of the materials involved, equates to long-term storage. It is far the most commonly practiced waste disposal method in the majority of countries.
As a result of serious environmental and health problems experienced with historic and abandoned dump sites and the very high costs associated with cleanup measures at contaminated sites, many countries have introduced the "specially engineered landfill concept", the wastes for which are only consigned to site selected for their containment properties, these being natural, augmented by or provided directly by liners. The overall engineering being such as to ensures far as possible the isolation of wastes from the environment. Such landfills are considered a final resort option only to be used after every effort has been made to reduce, mitigate or eliminate the hazards posed by such wastes.

In a number of countries, landfill disposal is likely to be the only method available for the disposal of significant quantities of hazardous wastes.

Existing and ongoing landfills, where a significant proportion of biodegradable or bioconvertible materials is contained in the wastes deposited, will benefit from improved controls over the moisture content, pH, compaction/density. This will allow for improvement in the chemical and biochemical degradation of wastes leading to a more stabilization of the mass. Useful pre-treatment technologies are solidification and chemical fixation.

Guidelines of the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal are to be followed during planning, establishing new landfills, and also for controlling, monitoring of existing or abandoned landfill sites.

Incinerators

Incineration has been used, particularly in Europe and the USA to treat hazardous wastes for many years. Its main advantage is that it permanently destroys many of the hazardous characteristics of the waste. Organic compounds burn over a broad range of temperatures, forming carbon dioxide, water and products of incomplete combustion, some of which may be more toxic than the original waste but there would be a much smaller quantity of such compounds. (It should be noted, that in some countries, both municipal and hazardous waste incinerators have been identified as significant sources of such pollutants as dioxins and furans. However, when applying best available technology, such environmental effects could be minimized.)

Some organic compounds, including some found in certain hazardous wastes, combust less readily and must be subjected to higher temperature before they before they are fully combusted. As a consequence, to ensure maximum destruction of the organic compounds in the wastes, hazardous waste incinerators must maintain extremely high temperatures (typically ranging from 850°C to 1300°C) and have adequate residence time.
Consequently, a high level of technical competence is required in designing, operating and monitoring an incineration facility.
A condensed summary of incineration subsystems and typical process component options may be found on Fig.7.

Incinerators may used for the burning of
- municipal, or
- industrial wastes, or
- combination of them.

Since properties of municipal and industrial wastes differ

significantly a careful selection of equipment and incineration technology is needed.

Types of incinerators

- inclined moving grate type
  is used for the burning of municipal wastes, while
- cyclonic units (the simpler and cheaper), and
- rotating kilns, with after burner chamber (the more effective and expensive) represent the types of industrial incinerators.

Typical incinerator processes of a rotary kiln are illustrated on Fig.8.

Incinerators, though not as efficient in terms of heat recovery as steam-raising boilers, are often used as heat generators to produce warm water or steam for heating or generating electric energy.

CHEMICAL SAFETY

Chemicals, their residues and wastes need to be handled safely to avoid deleterious effects on public and occupational health and environmental quality. Many of them occur as pollutants and contaminants in air, soil, water and food. In some countries historical gross chemical contamination has resulted in a need for restoration which will require major capital investment and the development of new technologies.

Chemical releases, let it be large scale accidental or small but ongoing may cause loss of lives, health impairment, both acute and chronic, and environmental degradation as well as material damage and loss of natural productivity. Global importance of these effects is now becoming more widely recognized.

The issue is not just serious but also extremely complex, because chemicals, their combinations or mixtures with biological agents which, through their additive and synergistic interactions, have human and ecological toxicities near impossible to access scientifically.

Hazards associated with chemicals are still frequently perceived as a problem of developed and rapidly developing economies, however, nearly all countries of the world manufacture, formulate and import chemicals. Problems of chemical safety are exacerbated in developing countries where production technology may be inadequate, legislation and enforcement lacking, hazardous waste dumped carelessly and a population unaware of the dangers of misuse of chemicals.

Governments often have expressed a need for more effective programmes at the national level to identify in advance those hazardous technologies and systems which are likely to give rise to problems.

In the absence of an effective national registration process and of a government infrastructure for controlling the manufacture, formulation, availability, storage and disposal of chemicals, some importing countries lack the ability to assure safe in-country use.

INTERNATIONAL ORGANIZATIONS' EFFORTS ON CHEMICAL SAFETY

Although local problems need local solutions, chemicals are frequently "transboundary pollutants or contaminants" and need international cooperation to mitigate their effects through more

To a limited degree the international agencies particularly the United Nations Industrial Development Organization (UNIDO), the World Bank and the Regional Development Banks already provide guidance for chemical safety activities as part of development assistance, in particular for industrial and agricultural development and transfer of environmentally sound technologies.
The agencies (particularly ILO, UNEP, and WHO) also provide guidance on prevention of chemical accidents, and on preparedness and response to chemical emergencies and to develop mechanisms for international intervention at the request of countries in response to major chemical disasters.
The following list of organizations and publications is intended to give assistance in the legislation and management of chemical safety.

The International Programme on Chemical Safety (IPCS),
a joint activity of WHO, ILO and UNEP, administered by WHO, was established in 1980.

Agenda 21
The *United Nations Conference on Environment and Development, Chapter 19, Agenda 21 (UNCED 1992)* reiterates these concerns and markedly adverse impacts of chemical misuse on the economies of developing countries, recognized that environmentally sound management of chemicals was an important component of sustainable development set up an international strategy for action on chemical safety into the twenty-first century.
The conference called for strengthening of IPCS as the nucleus for coordination and cooperation among international safety activities and for the establishment of an intergovernmental mechanism for chemical risk assessment and management.

Commission on Sustainable Development
The United Nations General Assembly adopted the report of UNCED and established a Commission on Sustainable Development to oversee the implementation of the recommendations.

Intergovernmental Forum on Chemical Safety
To follow up the UNCED recommendation, an international conference on chemical safety was convened and hosted by the Swedish Government in Stockholm in 1994, whereby an Intergovernmental Forum on Chemical Safety was established. It is a non institutional arrangement to consider and provide advice and, where appropriate, make recommendations to governments, international organizations, intergovernmental bodies and non governmental organizations involved in chemical safety on aspects of risk assessment and management. It will provide policy guidance with emphasis on regional and subregional cooperation, develop strategies in a coordinated and integrated manner, foster understanding of issues, and promote the required policy support.

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Interorganizational Coordinating Committee
The establishment of the expanded IPCS, codified by a memorandum of understanding among FAO, ILO, UNEP, UNIDO AND WHO will provide a mechanism to build up *collaborative international programmes on chemical safety. It will also enable long-term planning and implementation of activities*. Coordination between international organizations is ensured through regular meetings of the Interorganizational Coordinating Committee.

Steering Committee on Chemical Safety
is a mechanism, within WHO, for coordination of related chemical safety activities. Policy advice to the executive heads of the international organizations is provided through meetings of the **IPCS Advisory Committee.**

Following the endorsement of the WHO global strategy for health and environment, the implementation of the IPCS currently falls into the following four broad areas corresponding to priority programme areas in chapter 19 of Agenda 21:

- chemical risk assessment
- chemical risk communication (incl. harmonization of classification and labelling of chemicals, and information exchange on toxic chemicals and chemical risks)
- action on chemical emergencies
- strengthening of national capabilities and capacities for management of chemicals

ELEMENTS OF CHEMICAL SAFETY

In order to improve chemical safety the following issues are to be taken into consideration during planning or operation of a plant dealing with the production, transport, storage, distribution of pharmaceutical products.
The following sections will summarize general information on chemical safety; focussing to duties of authorities (governments, municipalities) such as: regulatory, controlling, prevention activities related to communities and environment.
Tasks of the enterprise level will be detailed in Part II an III of the present study.

Problems of chemicals and their identification

Information on chemical substances is primarily required for three purposes:

- risk assessment (characterization, management)
- medical and public health response to acute and chronic exposures
- timely provision of appropriate health and environmental responses during incidents, accidents, and emergencies.

Information on chemicals and their formulations manufactured, imported, exported, transported, used and disposed of in the country is necessary.

The development of a centralized national information programme on chemical safety for the collection of data on all chemical products, and for the dissemination of objectively evaluated information should be considered of the highest management priority for chemicals. Access to comprehensive chemical toxicity data is a fundamental component of any national management programme.

Annex I and II provide model formats for developing National Status Profiles for chemicals Information.

A *toxicological information service* is needed to provide up-to-date information on the potential health and environmental effects of chemicals and their products.

Most of the information currently available pertaining hazardous chemicals has been established under developed country conditions.

The situation in *developing countries* is rather different.

Climate conditions in tropical regions, where most developing countries are situated, may have a sizeable impact on the dispersion of hazardous chemicals in ground water, the atmosphere, in the food chain, and on the potential for occupational exposures as well.

Information sources on chemical safety

as mentioned before, there is no globally accepted consolidated directory data bases and regulations relevant to chemical safety. There are, however, many information sources.

The *London Guidelines for the Exchange of Information on Chemicals in International Trade* are a set of guidelines widely adopted by Governments. The export to developing countries of chemicals that have been banned in producing countries or whose use has been severely restricted in some industrialized countries has been the subject of concern, as some importing countries lack the ability to ensure safe use, owing to inadequate infrastructure for controlling the importation, distribution, storage, formulation and disposal of chemicals. All countries which export chemicals subject to the *Prior Informed Consent (PC)* procedures should have the necessary mechanism in place to ensure that export does not take place contrary to importing countries' decisions.

Further sources of information are the following:

Environmental Health Criteria (IPCS)

- Health and Safety Guides (IPCS)
- International Safety Cards (IPCS)
- INFOTERRA (environmental data base) (UNEP)
- International Register on Potentially Toxic Chemicals (UNEP)
- RISKLINE a bibliographic database on toxicology and ecotoxicology (KEMI National Chemicals Inspectorate Sweden)

Risk assessment
identifies, characterizes and qualifies the potential adverse effects on human health or ecosystems, of defined exposures to a chemical substance or mixture, or to a chemically hazardous process or situation.
It consists of the following interrelated elements:

- *hazard identification* i.e. identifying the adverse effects which a special chemical or process has an inherent capacity to cause.
- *dose-response assessment*
- *exposure assessment* (dose/level/duration)
- *risk characterization* (incidence and severity of adverse effects due to actual or predicted exposure).
- *priority setting*
  identifying pollutants of greatest concern in air, water and soil
  "multiproblem chemicals" (candidates for risk reduction)
  persistent organic pollutants (POP)
  ozone depleting substances
  establishing priorities for evaluation health and environmental effects
  list of priority chemicals for testing

- *need for international cooperation*
  technical
  financial
  information (reciprocal, with neighboring regions)

Risk management
of chemicals includes the full range of activities required to prevent and assess their intrinsic hazards, and to ensure their safe production, transportation, storage, use, and ultimate disposal, so that health and the environment are protected. Environmentally sound management of chemicals and the mechanisms developed for implementing chemical safety must be through an integrated approach including both risk assessment and management.

Principles of risk management:
main objective: prevention should be preferred to clean-up
preparedness for response to chemical emergencies
- poison control programme providing toxicovigilance,

prevention and response to poisoning
- integration: it is total exposure that matters; all significant sources and pathways and the full life-cycle of a chemical "from cradle to grave" should be taken into consideration
- sound infrastructure is needed
- chemical safety information should be available to all
- intersectoral (national) coordination is essential
- responsibility of central, regional and local authorities
- legislation
  on chemicals, pollution, etc.
  registration,
  license to sell, use, store, manufacture (for enterprises)
  certificate of competence (for individuals)
- economic option (incentives, subsidies, selective taxation, economic instruments based on the "polluter pays" principle
- monitoring and surveillance
- "industry response care programmes" for prevention and emergency measurements

Risk assessment and management system introduced in the European Community is displayed in Fig.6.

Chemical emergencies

Details are discussed in Section "Prevention and Response in Chemical Accidents".

More detailed and specified information and data can be found in the IPCS Guidelines for the Strengthening of National Capabilities in Chemical Safety, and in the international reference manual: Chemical Safety by Mervyn Richardson.

PREVENTION AND RESPONSE IN CHEMICAL ACCIDENTS

Most people in industry provide assurances that industrial plants are designed and maintained in accordance with high industrial safey standards.However, proper design, maintenance and procedures in operation does not mean that accidents will not occur.
The unfortunate reality is that such risks, may be minimal, remain and the hazards posed can never totally eliminated.

Some of the chemical accidents have become historical milestones: the dioxin release in Seveso, Italy in 1976, the release of methylisocynate at Bhopal, India in 1984, the fire at a chemical warehouse in Basel, Switzerland and th e discharge of contaminated waters into the Rhine in 1986.

Chronic adverse impacts of chemicals have also been reported in a number of cases, producing, carcinogenic, mutagenic, and teratogenic effects on exposed people. Fish contaminated by organic mercury in Minamata Bay, cadmium-contaminated rice in Toyama Prefecture and rice oil polluted by poly-chlorinated biphenyls (PCB) in Japan have become classic cases of tragic chemical accidents.

Pharmaceutical industry being user, producer of hazardous chemicals is not an exception either. Prevention and response to chemical accidents must have a first priority in the design and operation of pharmaceutical plants.

Human error
Having accepted that some accidents cannot be totally prevented, the elaboration of clear guidelines and emergency plans for potental chemical accidents are necessary.
Most investigations conclude that accidents were often due to human error either during operation, in maintenance, and even in response to emergencies arising out of industrial accidents.
The man in the field must not only know his job well, but also be vigilant at all times and trained how to react in case of accident. The proper, calm reaction can be ensured only by due education and training. The knowledge of all materials involved, icluding results of possible unwanted chemical reactions should be the basis.
Responsible, mature and well trained people are needed in cherge at all levels.

Planning, design
The major problems relating to preparedness and response to chemical emergencies have been recognised as:

- inadequate planning, particularly at the early development stage for new industries

P A R T II

INDUSTRY PROFILE

The following sections of the present chapter yield a comprehensive summary of the manufacturing of active substances in the pharmaceutical industry.

The principal processes employed in the manufacturing of pharmaceutical active substances are:

chemical synthesis
fermentation and
extraction
storage, transport

Formulation into various dosage forms and packaging of finished drugs, research and development will be discussed in Part III of the present study.

Processes, raw materials and wastes of these activities are discussed from the point of view of possible environmental hazards.

CHEMICAL SYNTHESIS

Vast majority of drugs today are produced by chemical synthesis. Production in the pharmaceutical industry is differing from that of the chemical industry in many respects:
Active substances have in most cases *complicated molecular structure* produced by multi step *sophisticated chemical reactions* on a batch basis in relatively *small scale* and *high purity* under *particularly controlled procedures* to assure the standard quality of the product.

Raw materials and intermediates are usually supplied by the chemical industry where the production is carried out in dedicated plants, suitable sizes, consequently cheaper compared to the pharmaceutical plants, where the priorities are different.
General practice of the pharmaceutical companies is to buy starting materials as "near" (in chemical sense) as possible to the end product and execute only the most delicate steps in their own plant.
If the material of the end product is available on the market in a low quality, or "technical grade", the best solution is to prepare the product by - in some cases relative simple - purification.
It is obvious, that the conditions, priorities in a pharmaceutical plant differ significantly from those of the chemical industry.

The following sections of the present chapter deal with the special features of the production of active substances in the pharmaceutical industry, particularly from the point of view of

environmental hazards.

A typical synthesis plant will consist of:

- production
  - reactor and separation system
  - separation, purification
  - materials handling (finishing)- raw material storage
- auxiliary activities
  - raw material storage
    - solid materials
    - liquids
      - bulk solvent storage in tanks
      - drum, container storage
    - industrial gases
  - storage of intermediates and products
  - transfer systems, piping, transport within plant
  - waste treatment and recovery
  - maintenance, energy supply

Production

Reactor

In synthesis plants usually *batch reactor vessels* (stirred tank reactors with heat transfer jacket) with size ranging from some hundred liters to ten cubic meters are the basic items of equipment which determine the size of the production.
A typical synthesis reactor arrangement is illustrated in Fig.1.
All parts of the reactor which are, or can be in contact with the chemical materials must be resistant to corrosion, consequently they may be: glass, glass lined steel, stainless steel, or special alloys.

Process control is key element of the system, due to the many remote organs (valves, switches, measure and control instruments) and the demand for the regulation of different parameters (temperature, pressure, concentration).
Manual operation is going to be obsolete.
The computer aided control systems have the additional advantage of uniformity of the batch processes, a prerequisite of the standard quality of the product.
Within a drug manufacturing plant, reaction vessels and ancillary equipment are often arranged into separate, dedicated process units being used for the production of one single, or a family of products.
In this case an integrated process control of the whole unit is necessary.

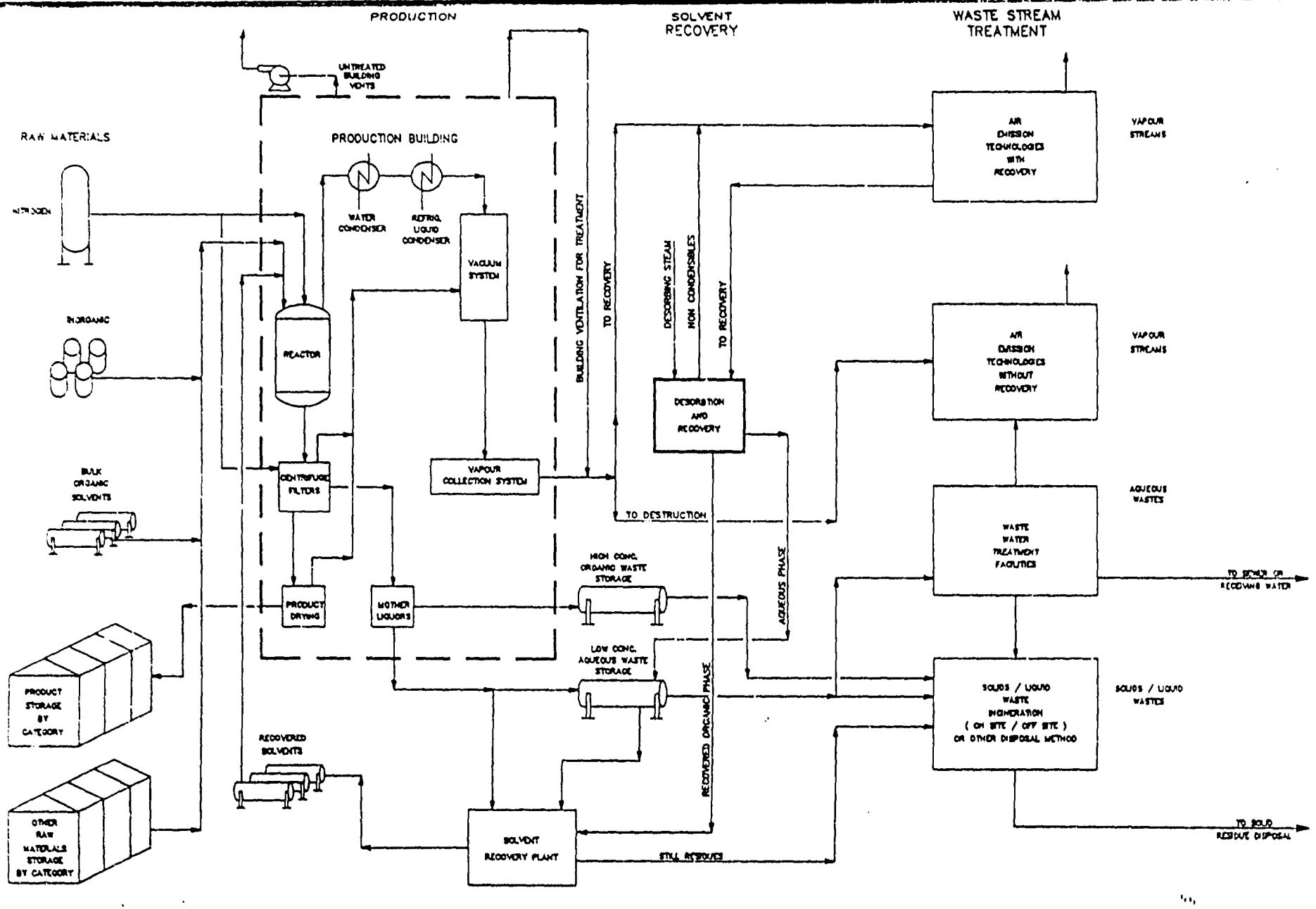
The batch type processes together with the technological flexibility of the stirred tank reactors yield the possibility of producing more than one product with the same equipment.
(Multi-product-, or multi-purpose-, or flexible plants). It has to be noted, however, that this flexibility has its own technological

and economical limitations, especially the time and labor requirements of the changing of products.
If the aim of the plant is to serve as a training basis for the personnel, or scale up/develop new process, or justify technological parameters, or validate process elements, the multi *purpose* plant will perform its duty.
A multi *product* plant may produce with good economy only a properly selected range of products.
Flexibility and change of products raise additional tasks to avoid unnecessary harms in environment. Some pharmaceutical products are manufactured in single product "campaigns", which may last a few days, weeks, or months depending upon the market. At the end of the campaign, process equipment is thoroughly cleaned - which results in huge amount of liquid wastes. Proper handling of such waste water is often neglected because of time constraint of tight campaign schedules.

Separation
Multi-step chemical reactions need certain procedures between the particular reactions in order to separate the product from remaining raw materials or by-products and to produce it in the purity required by the next reaction step.
The most typical separation procedures are: crystallization, filtration, sedimentation. If the solvent is to be removed, drying is also used.
Air ducts of centrifuges and dryers are the main sources of the volatile solvent emissions.
The rotating drum of the centrifuges work as a rotor of ventilator resulting in blowing out significant amount of air with high solvent content. The situation is much more favorable if the system is working under inert gas (usually Nitrogen).
Fluid bed dryers use air flow to lift, move the wet material and mix and contact intimately the particles with the hot air. The drying process is quick,
The dryer may be combined or closely connected to the filter (in many cases a centrifuge). Such more or less closed systems reduce the possibility of contamination of the product, but also the transportation losses and minimize the volatile solvent emission losses.

Purification
Due to the high requirements on the quality - first of all the chemical purity - of the pharmaceutical substances,the various separation procedures are the most frequently used processes in order to get rid of impurities and contaminants.
These are the suitable combinations of the following unit operations: (multiple) crystallization, filtration, adsorption, extraction, chromatography, drying).

In most cases the details of the purification are delicate know-how elements of the process and the best kept secrets of producers.
They - together with the *materials handling* procedures which result in the appropriate physical properties - ensure to meet the quality



GENERALISED MODEL – SYNTHESIS PLANTS

requirements of the product.
A simplified model of a synthesis plant may be found in Fig. 2.

Materials Handling
Milling, sieving, blending, and packaging of powder products or intermediates gives rise to *particulate emissions* which must be controlled using dust filters. The primary reason is the protection of the personnel but properly designed filter systems may also prevent dust entering the external environment.
Disposal of contaminated filters requires care and they are frequently incinerated.

Auxiliary activities

Storage, transfer of solid, liquid and gaseous raw materials, solvents, intermediates, (together with the recovery and/or treatment of wastes and facilities management may be regarded sometimes as "only" auxiliary processes, notwithstanding should merit due consideration, concerning working safety and environmental protection.
For example warehousing has been highlighted as a potential source of water pollution in the event of fire if proper precautions have not been taken to collect the run off water. Following a fire in a pesticides warehouse which caused major pollution to the river Rhine, many chemical manufacturers, especially located near major rivers, installed catch basins to collect run off water during a fire.
Concerning the hazards of warehousing, there is no difference between the pharmaceutical and chemical plants. In consequence of this, all regulations and guidelines elaborated by international organizations for the safe handling of dangerous chemicals (discussed in detail in following chapters of the present study) are also valid and be borne in mind.

Raw materials

Chemicals used in synthesis operations range widely and may include
- organic and inorganic reactants (solid, liquid, or gaseous)
- catalysts and
- liquids as solvents or reaction media.

Solid raw materials may be stored in containers or bags, outdoor or indoor. Segregation of different materials is essential. Due attention has to be paid to the chemical properties of the stored materials. Incompatible substances (those which have inclination to react)have to be stored in segregated compartments equipped with proper fire fighting and safety system.

Liquid materials are stored in tanks or drums.
Tank farms must be designed to store a complete range of fresh and recovered solvents. In order to reduce the potential of fire hazard, solvent tanks may be located underground. To avoid the risk

of ground contamination great care is needed to prevent leakage. (Double containment, leak monitors etc.)
It is common to have separate tankage for fresh solvents and mother liquor (or solvents for recovery) and recovered solvents.
In order to avoid mistakes and facilitate the transport of solvents, departments or buildings or product lines may have their own tankage.
In order to save place (especially in densely built urban areas) solvent tanks are located in the basement of production buildings. Even in case of appropriate fire precautions this solution can not be recommended.

Drums are used for the storage of quantities which are too small for tank system. Inflammable, explosive, toxic or corrosive liquids must be properly segregated even in external in storage.

All solvent storage areas (tank farms, drums; indoor or external) should be equipped with fire run-off systems in order to avoid pollution of the environment.

Transfer systems
Piping is commonly used to connect storage tanks with the receiving vessels. Pumps, valves, instruments, connections are emission sources.
Piping and air ducts are to be designed and operated with care in order to avoid cross contamination or accident caused by inadvertent contacting of non-compatible chemicals.

It is generally accepted practice that all raw materials entering a manufacturing site are accepted only when full ecotoxicological data has been provided by the supplier.

Emission sources

Waste streams from chemical synthesis operations are complex due to the variety of operations and reactions employed.

Solid wastes
Most common source of solid wastes are the various filters:
- process filters (including centrifuges)
- dust filters of the air ducts

Residues from reactors, still bottom tars are difficult to handle because of sticky behavior due to their moisture content.
Cleaning of equipment, working areas and warehouses also result in solid wastes of different nature.
In most cases these wastes will be incinerated.
Some sorts of used packaging materials can be reused or recovered, but care should be taken to avoid misuse of them.

Liquid wastes
Virtually every step of an organic synthesis generates a "mother liquor"(liquid medium in which certain operations take place e.g.: heating, cooling, mixing, crystallization, or chemical reaction)

Inoculum is prepared from the working seed (population of a microbiological strain maintained carefully in laboratory). A few cells from this culture are matured into a dense suspension through a series of test tubes and shaker flasks. All transfers are carried out in aseptic conditions aimed to grow sufficient cell mass (microorganisms or animal cells) in appropriate state to inoculate the production fermenter.
For further propagation, the cells are then transferred from the laboratory to seed-tanks which operate like full scale fermenters, but are designed not to produce the product, but for maximum cell culture growth. The final seed tank volume equals to 1 to 15 percent of that of the full scale fermenter.

Preparation of the fermentation media

The nutrients of the microorganisms must contain the necessary materials for the metabolism. Generally the main components are: carbohydrates, proteins, lipids and minerals.
The preparation steps may consist of cleaning, washing the raw material (in most cases agricultural products, or by products, in some cases wastes) mechanical treatment in order to ensure the suitable particle size distribution, and sterilization by steam at 120°C.

Production

Fermentation
starts with sterilization of the fermenter, a vessel equipped with mechanical stirrer, heater/cooler jacket, instruments, inlet/outlet pipe connections. Then the cell culture is charged from the seed tanks into the fermenter. Nutrients of the microorganisms are also fed into the fermenter. For both inputs sterilized pipes and valves are used. If the fermentation is aerobic (which it is most frequently), the content of the vessel is aerated with sterile air or oxygen. Agitation may be carried out either by the aeration system or by mechanical stirrer usually equipped with baffles. Control of the process is carried out by monitoring i.a. dissolved oxygen and CO_2 concentration, pH, temperature.
Size of the fermenters vary widely from 1-2 liters to 10.000 m^3.
Residence time may be in the range of 10 to 200 hours.
A simplified scheme of a production fermenter can be seen in Fig.3.
(Continuous fermentation in the pharmaceutical industry has recently been introduced in routine production of special, high value products such as monoclonal antibodies.)

Crude product recovery
At the end of the fermentation, the fermenter ''broth'' is usually filtered to separate solid biomass (mycelium) from the liquid phase. In most cases the product is in the filtrate. If not, it has to be gained from the filtercake.

Concentration, Purification

disintegrating, milling (which their ancillary processes such as screening, sedimentation, drying) are the most common procedures.

Extraction

may be carried out continuously, using specially designed equipment. One of them - dedicated for the extraction of alkaloids - is demonstrated in Fig. 6.

In continuous extractors the direction of flow of the two media, - the raw material and the solvent - may be parallel or counter current. Due to economy, counter current extractors are used widely.

A continuous counter current extractor takes in fresh raw material and solvent at opposite ends and transports them in opposite directions, so the nearly saturated solvent is met with the fresh raw material and the nearly fully extracted raw material meets the fresh solvent before leaving the extractor, consequently the difference of concentration of the active ingredient between the two phases is always at maximum resulting in high efficiency.

The solvent may be water, ethyl alcohol, some ketone, alkane, or a number of other solvents.

The active substance is leaving the equipment dissolved in the liquid phase.

Extraction may also carried out by batch operation, or semi continuously in multi stage (cascade of stirred) extractors.

Concentration-purification

A series of concentration and purification steps such as liquid-liquid extractions, precipitation, filtration, sedimentation, distillation etc., may be required to isolate the desired product. Once the final product has reached the desired purity, it is recovered by processes such as crystallization, filtration, and drying. For heat sensitive products thin film evaporators, ultrafiltration, freeze-drying or recently extraction by ultracritical CO_2 are used to remove the solvent.

Emission sources

Solid wastes

of natural product extraction include spent raw materials such as leaves, roots, animal tissues. The treatment of spent material is a major problem because of its bulk in relation to the quantities of product. Concerning landfill - the most usual, cheapest, however in some cases rather questionable method, as seen in other parts of the present study - some authorities set a limit of 3% by weight of the organic solvent content of wastes. Minimization of residual organic solvent content is of first priority.

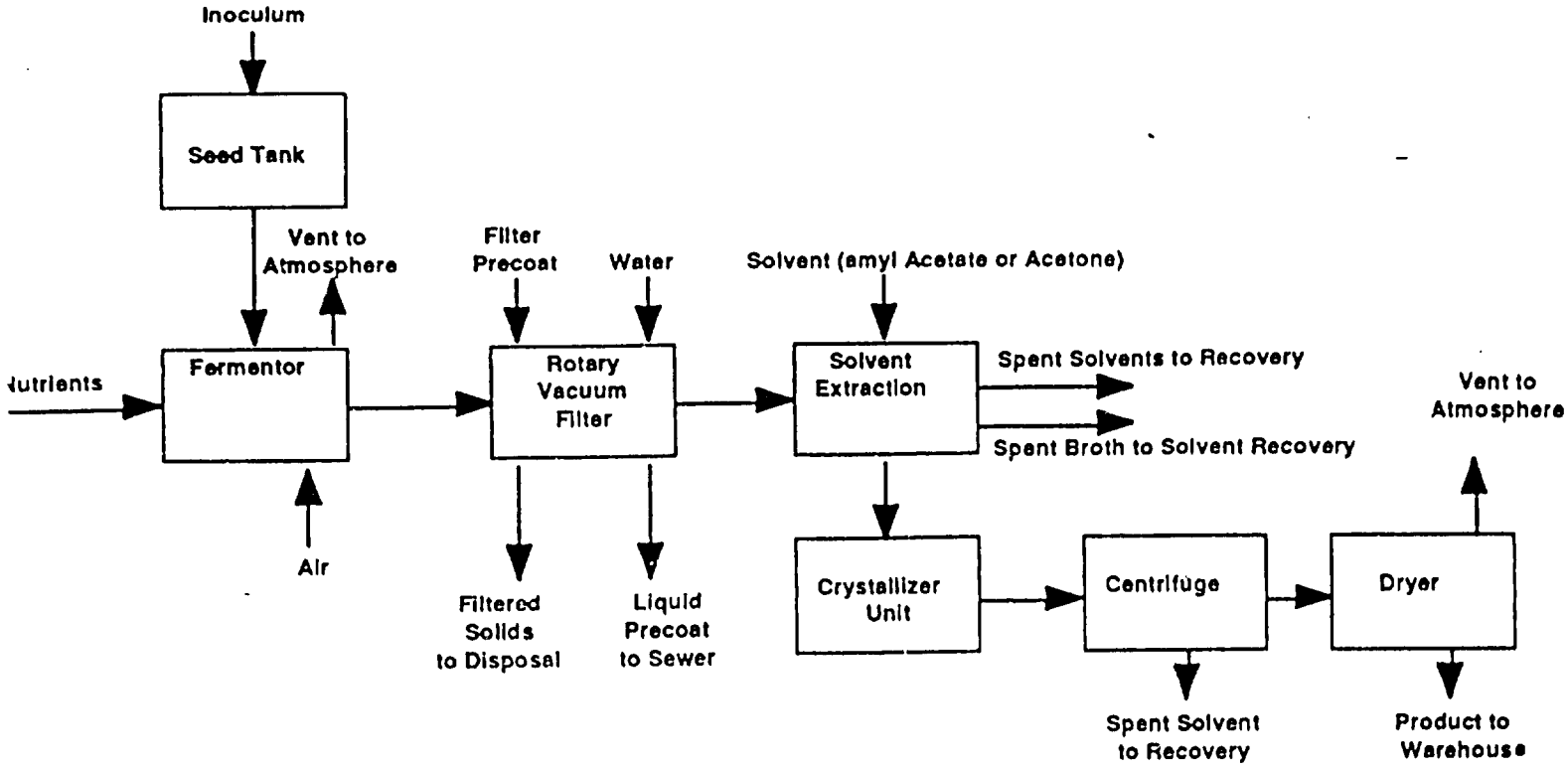
Alternative disposal method may be incineration whereby organic solvent-, and spent activated carbon content is a plus.

Liquid wastes

The extraction plants usually give rise to problems of control of liquid effluents very similar to those of synthesis plants.

Extraction waste waters have typically low BOD, COD and TSS levels and a pH in the range of 6 to 8.

Air emissions
The use of volatile solvents need condensers, scrubbers and ad-, or absorbers. Examples will be given in Part III of this study.


Inoculum
Seed Tank
Vent to Atmosphere
Filter Precoat
Water
Solvent (amyl Acetate or Acetone)
Nutrients
Fermentor
Rotary Vacuum Filter
Solvent Extraction
Spent Solvents to Recovery
Spent Broth to Solvent Recovery
Vent to Atmosphere
Air
Filtered Solids to Disposal
Liquid Precoat to Sewer
Crystallizer Unit
Centrifuge
Dryer
Spent Solvent to Recovery
Product to Warehouse

The product can be obtained from the liquid phase and purified by a combination of various separation processes. In most cases: solvent extraction, precipitation, ion exchange, adsorption, chromatography, ultrafiltration, centrifugal sedimentation.
By solvent extraction, the aqueous filtrate is contacted with the suitable organic solvent, typically methylene chloride or butyl acetate, to transfer the product into the solvent phase.
Downstream processes of the production of most commonly produced pharmaceutical substances and product groups are summarized in Fig.4., and a process flow diagram of a typical fermentation plant may be seen in Fig 5.

Emission sources

The fermentation process usually generates large volumes of wastes such as the spent aqueous fermentation medium and solid cell debris. The aqueous medium is very impure, containing unconsumed raw materials (corn steep liquor, fish meal, molasses). Filtration processes result in large quantities of solids in form of spent filter cake which incudes the solid remains of the cells, filter aid (anorganic minerals), and also small amount of the final product.

Solid wastes

As raw materials of the fermentation are usually of natural origin (agricultural sources, such as corn steep liquor, fish meal, molasses), unconsumed raw materials are frequently utilized as additives to animal food. Residues of the final product in the mycelium may be useful, especially in case of vitamins, amino acids or pharmaceutical substances.
If the utilization for animal feed is not possible, incineration may also be considered. Organic solvent content or spent active carbon prove to be useful.
Solid wastes thus can be used to produce heat energy, but this can also be achieved through biogas generation as well.
Anorganic filter aids are inert and incombustible, so landfill as ultima ratio may be taken into consideration, but only in case if the waste material meets environmental requirements.
In all above cases solid wastes -due to their moisture content - are sticky, which makes their manipulation difficult.
The odor of biomasses has also be taken into consideration especially in the neighborhood of populated districts.

Liquid wastes

After product recovery, spent filtrate, spent solvent from extraction are discharged as waste liquids augmented by waste water from equipment cleaning and fermenter vent gas scrubbing.
Waste waters from fermentation operations typically have high BOD, COD, and TSS levels with a pH range of 4 to 9: while those from solvent extraction have low BOD, COD, and TSS levels, with pH=6-8.

Air emissions

Volatile solvents used in product recovery operations may release vapors to air, so exhaust treatment is necessary.

The usually large volume of the air flow, combined with low concentration values make the recovery of organic solvents difficult. Practical methods and equipment will be shown in other parts of the present study.

NATURAL PRODUCT EXTRACTION

Natural product extraction is the production of pharmaceutical materials (be it [a mixture of] identified compounds, or traditional substances as ''essential oils'') from natural sources such as roots, leaves of plants; animal organs tissues. These pharmaceutical, which exhibit certain pharmacological properties, are in most case well known since centuries, however, the exact identification of their active ingredients is not always simple Separation and analysis of them need expertise and high level instrumentation. The effect of the drug is attributed to ''lead'' components (alkaloids, such as morphine, vincamine etc.) or synergism of - in some cases unidentified - active substances. Anyhow, their therapeutic and preventive efficiency has been proved since generations and confirmed by up to date methods.

One of the characteristics of natural product extraction is that the amount of finished product is small compared to the amount of raw material used. During each process step, the volume of material being worked can greatly diminish to the point where final purification may occur on volumes less than one thousandth of the initial volume. Another characteristic is the various and irregular form of the raw material:
fiber-like materials from various parts of plants; or formless, sticky consistence of animal organs. Handling of such materials is one of the most sophisticated problem of the process.
Because of these properties of the materials, conventional batch-, or continuous processes and equipments used in other fields of the chemical or pharmaceutical industry are not suitable for natural extraction processes.

Typical steps of processes in an extraction plant are:

- preparation
- extraction
- concentration - purification

Preparation

Raw materials are generally easily degradable. Animal organs must be kept cool and need to be immediately processed, some herbs may be stored only in dried state, however, materials of natural origin tend to loose content of active substance with time.
Storage of solvents and other auxiliary activities are similar to those already discussed in the section of synthesis plants.

The first step in the process is to prepare the raw material for extraction. This step is determined by the purity and physical form of the incoming raw material. Cleaning, washing, drying and usually

disintegrating, milling (which their ancillary processes such as screening, sedimentation, drying) are the most common procedures.

Extraction

may be carried out continuously, using specially designed equipment. One of them - dedicated for the extraction of alkaloids - is demonstrated in Fig. 6.

In continuous extractors the direction of flow of the two media, - the raw material and the solvent - may be parallel or counter current. Due to economy, counter current extractors are used widely.

A continuous counter current extractor takes in fresh raw material and solvent at opposite ends and transports them in opposite directions, so the nearly saturated solvent is met with the fresh raw material and the nearly fully extracted raw material meets the fresh solvent before leaving the extractor, consequently the difference of concentration of the active ingredient between the two phases is always at maximum resulting in high efficiency.

The solvent may be water, ethyl alcohol, some ketone, alkane, or a number of other solvents.

The active substance is leaving the equipment dissolved in the liquid phase.

Extraction may also carried out by batch operation, or semi continuously in multi stage (cascade of stirred) extractors.

Concentration-purification

A series of concentration and purification steps such as liquid-liquid extractions, precipitation, filtration, sedimentation, distillation etc., may be required to isolate the desired product. Once the final product has reached the desired purity, it is recovered by processes such as crystallization, filtration, and drying. For heat sensitive products thin film evaporators, ultrafiltration, freeze-drying or recently extraction by ultracritical CO_2 are used to remove the solvent.

Emission sources

Solid wastes

of natural product extraction include spent raw materials such as leaves, roots, animal tissues. The treatment of spent material is a major problem because of its bulk in relation to the quantities of product. Concerning landfill - the most usual, cheapest, however in some cases rather questionable method, as seen in other parts of the present study - some authorities set a limit of 3% by weight of the organic solvent content of wastes. Minimization of residual organic solvent content is of first priority.

Alternative disposal method may be incineration whereby organic solvent-, and spent activated carbon content is a plus.

Liquid wastes

The extraction plants usually give rise to problems of control of liquid effluents very similar to those of synthesis plants.

Extraction waste waters have typically low BOD, COD and TSS levels and a pH in the range of 6 to 8.

Air emissions
The use of volatile solvents need condensers, scrubbers and ad-, or absorbers. Examples will be given in Part III of this study.

REDUCTION OF EMISSIONS
COST EFFECTIVE POLLUTION CONTROL

END OF PIPE WASTE TREATMENT

Industrial pollution control in general - and also in the pharmaceutical industry - traditionally has been carried out essentially on an end-of-pipe basis.
Such *end-of-pipe waste treatment* is in most cases a destructive system, i.e. they provide no return for the company in terms of process efficiency.

The size (and cost) of waste treatment equipment bears a direct relationship to the volume to be treated and also to the concentration of pollutant.
For example most physical and chemical treatment (neutralizing, oxidation, reduction, flocculation, sedimentation etc) parameters and sizes of equipment are determined by hydraulic factors such as surface loading rate and retention time; or biological treatment is similarly depending on pollution load, such as COD (chemical oxygen demand).

It is evident therefore that the reduction of waste quantities have a significant impact on the size and cost of an end-of-pipe system. Increased environmental pressure, on the other hand, require industry to meet tighter regulations which in increasing number of cases can not be met by conventional end-of-pipe solutions without seriously impacting the economical viability of the individual process.
Accordingly, new approaches have emerged in recent times, such as -

- *source management* defined as ''the development of full understanding of the nature of all waste streams, (liquid, gaseous, or solid) and the exact circumstances by which they are generated in order to eliminate or minimize pollution before it arises.''
- *waste prevention and reduction* posing the questions: how can the generation prevented, or the volume reduced, or the reuse, or recovery of the waste be realized.

This progressive shift from waste treatment towards waste prevention has the following benefits:

- waste quantities are reduced
- raw material consumption and therefore resp. costs are reduced
- waste treatment costs are reduced
- pollution potential is reduced
- working conditions may be improved
- process efficiency can also be improved

WASTE AUDIT

In order to prevent, reduce waste generation or to consider recycle or reuse it the process itself is to be examined thoroughly to identify the origins of wastes, the operational problems and those areas where improvements can be made.

A waste audit is the starting point therefore to approach problem identification and solving.

A properly organized and executed waste audit enables to take a comprehensive look at the site or process to facilitate the understanding of material flows and focus the attention on areas where waste reduction and cost saving is possible.

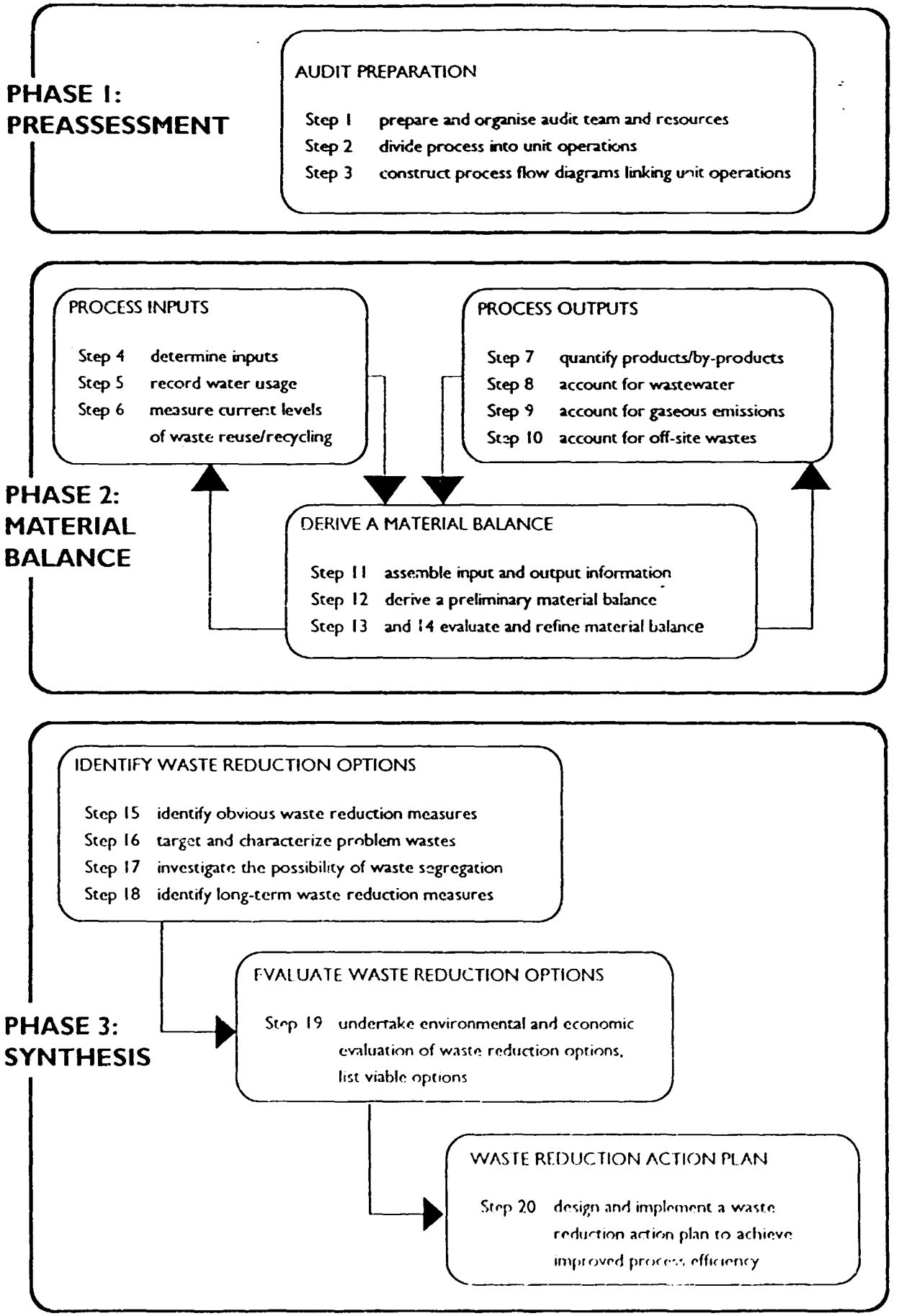
Undertaking a waste audit involves observing, measuring, recording data, collecting and analyzing waste samples. To be effective it must be done methodically and with full management and operator support.

A good waste audit

- defines sources, quantities and types of waste being generated
- collates information on unit operations, raw materials, products, water usage and wastes
- highlights process inefficiencies and areas of poor management
- helps set targets for waste reduction
- increase knowledge of the process
- helps to improve process efficiency

The waste audit procedure can be applied on various scales. At plant level, wastes can be traced to particular processes allowing allocation of treatment charges where necessary; and at the process level the exact origins of wastes can be identified enabling waste reduction measures to be established.

A waste audit approach leading to the implementation of a waste reduction action plan has been elaborated by UNDO/UNEP [29] is illustrated in the form of a flow diagram in Fig. 7.


PHASE 1:
PREASSESSMENT
AUDIT PREPARATION
Step 1 prepare and organise audit team and resources
Step 2 divide process into unit operations
Step 3 construct process flow diagrams linking unit operations
PHASE 2:
MATERIAL
BALANCE
PROCESS INPUTS
Step 4 determine inputs
Step 5 record water usage
Step 6 measure current levels of waste reuse/recycling
PROCESS OUTPUTS
Step 7 quantify products/by-products
Step 8 account for wastewater
Step 9 account for gaseous emissions
Step 10 account for off-site wastes
DERIVE A MATERIAL BALANCE
Step 11 assemble input and output information
Step 12 derive a preliminary material balance
Step 13 and 14 evaluate and refine material balance
PHASE 3:
SYNTHESIS
IDENTIFY WASTE REDUCTION OPTIONS
Step 15 identify obvious waste reduction measures
Step 16 target and characterize problem wastes
Step 17 investigate the possibility of waste segregation
Step 18 identify long-term waste reduction measures
EVALUATE WASTE REDUCTION OPTIONS
Step 19 undertake environmental and economic evaluation of waste reduction options, list viable options
WASTE REDUCTION ACTION PLAN
Step 20 design and implement a waste reduction action plan to achieve improved process efficiency

COST EFFECTIIVE POLLUTION CONTROL

Based on a properly executed waste audit the optimal solution can be selected in two steps, by integrated source control followed by optimized end-of-pipe waste treatment.

Integrated source control
embrace a number of key technical, management and operational initiatives:

- application of cleaner processes
- enhanced housekeeping practices
- water conservation, incl. reuse and recycle
- waste avoidance or minimization
- materials recovery and,or reuse
- disciplined monitoring of performance

Needless to say is that the management of the company has definitive role: its initiative is a precondition of the success. This include awareness, commitment, training at all levels of the hierarchy and also a management structure that positively links production, pollution control and environmental management.

Optimized end-of-pipe control
Integrated source control in isolation is not sufficient to achieve the overall objective of cost effective pollution control or cost effective environmental management. This requires detailed consideration of optimized end-of-pipe treatment of wastes, reduced to minimum by integrated source control.

Key technical issues concerning optimized end-of-pipe treatment could include provision of the following:

- effective segregation of waste-water streams for optimized pre-treatment, energy recovery, etc.
- effective flow and load pre-balancing
- control systems to prevent the overdosing of reagents
- upgrading of existing facilities

Management and operational initiatives are the same as identified for integrated source control(i.e. commitment at all levels, better training to ensure efficient operation and performance monitoring of end-of-pipe systems).

An overall summary of the principal components of cost effective pollution control and benefits are illustrated in Fig.8.

CASE STUDY I
SOURCES OF EMISSIONS AT THE SYNTHESIS OF NALIDIXIC ACID

Nalidixic acid is a generic anti-infective quinoline derivate, developed about 30 years ago (first publication: USP 3 149 104 [Sterlig Drug; granted 15.09.1964; priority:03.01.1961]).

There are various synthesis options for the synthesis, one of the most frequently used will be summarized.

The aim of the present summary is not to give a description of the process for direct use for production, but to demonstrate the places where by products, waste are generated; identify the wastes and give recommendation for their treatment.

Consequently the process description does not contain know-how elements of the production. These can be obtained from process donors or from UNIDO.

PROCESS DESCRIPTION

Step I. Condensation of 2-amino-6-picoline (2-amino-6-methylpyridine)with diethylmalonate and trietoxy-methane (ortho-formic-acid triethylester) at 110°C. Product: Intermediate I = PAMM (Picolylamino-methylene-malonate).

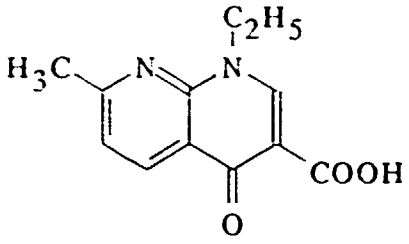
Step II. Cyclisation of the open chain PAMM obtained in the first step in Diphyl (Diphenyl-ether) at 250°C, isolation of Intermediate II= Naphtiridinester (4-hydroxi-7-methyl-1,8-naphtiridine-carboxylicacid-ethylester).

Step III. Intermediate II is ethylated by triethylphosphate in petrolether at 70-80°C, hydrolysed at 100°C for 3-4 hours, dissolved in water and acidified to obtain nalidixic acid. This is purified with activated carbon in acetic acid, concentrated, centrifuged and dried.

The following description will contain:

- Data on Nalidixic acid USP XXII
- Flow charts
- Flow sheets

NALIDIXIC ACID USP XXII



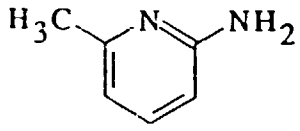
Molecular Weight: 232.23
Formula: $C_{12}H_{12}N_2O_3$
CA-Number: 389-08-2

Names:
CA: 1,8-Naphthyirdene-3-carboxylic acid, 1-ethyl-1,4-dihydro-7-methyl-4-oxo-
INN: Nalidixic Acid

Other names: 1-ethyl-1,4-dihydro-7-methyl-4-oxo-1,8-naphtyridine-3-carboxylic acid

Indication: Anti-infective, quinolin-derivative

PREPARATION

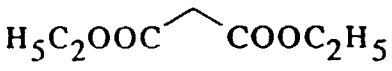


2-Amino-6-methylpyridine

MW = 108,14

$C_6H_8N_2$

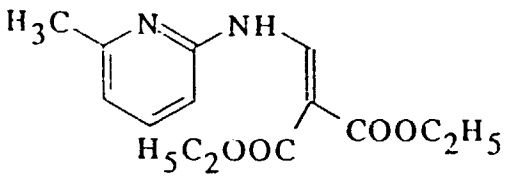
+



Diethyl malonate

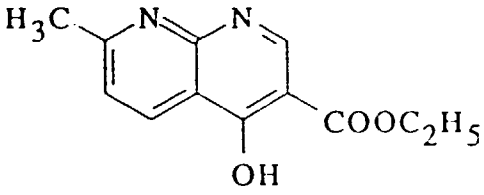
MW = 160,17

$CH(OEt)_3$



$C_{14}H_{18}N_2O_4$ MW = 278,31

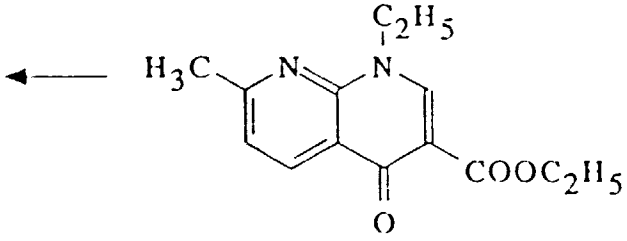
Diphenyl-ether

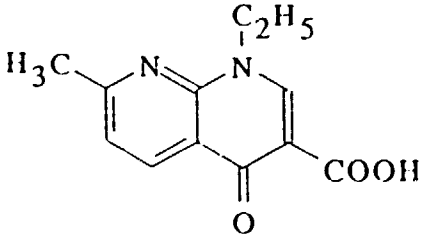


$C_{12}H_{13}N_2O_3$ MW = 233,25

Et_3PO MW = 134,16

Triethylphosphate

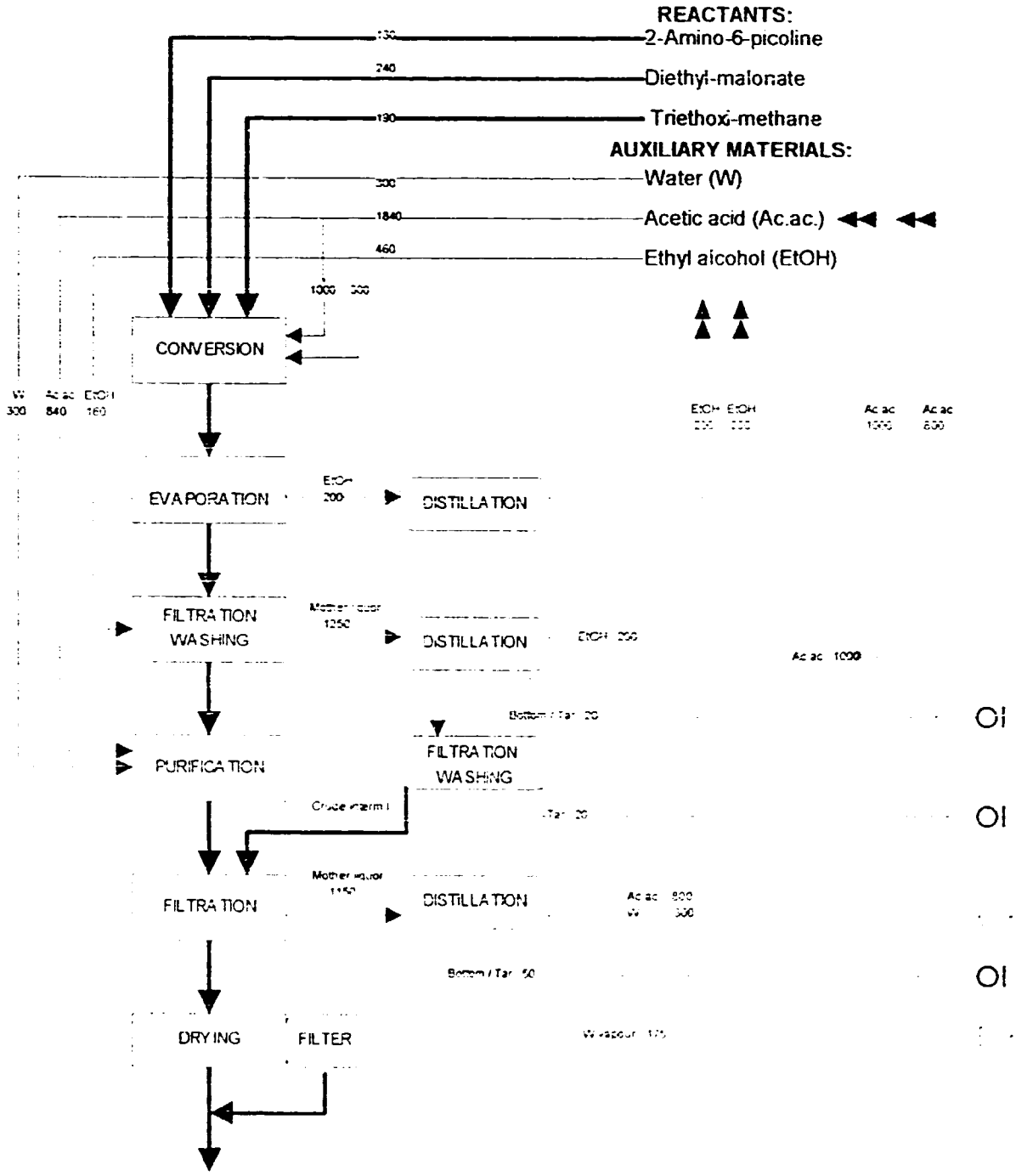




Nalidixic Acid

NALIDIXIC ACID
FLOW CHART

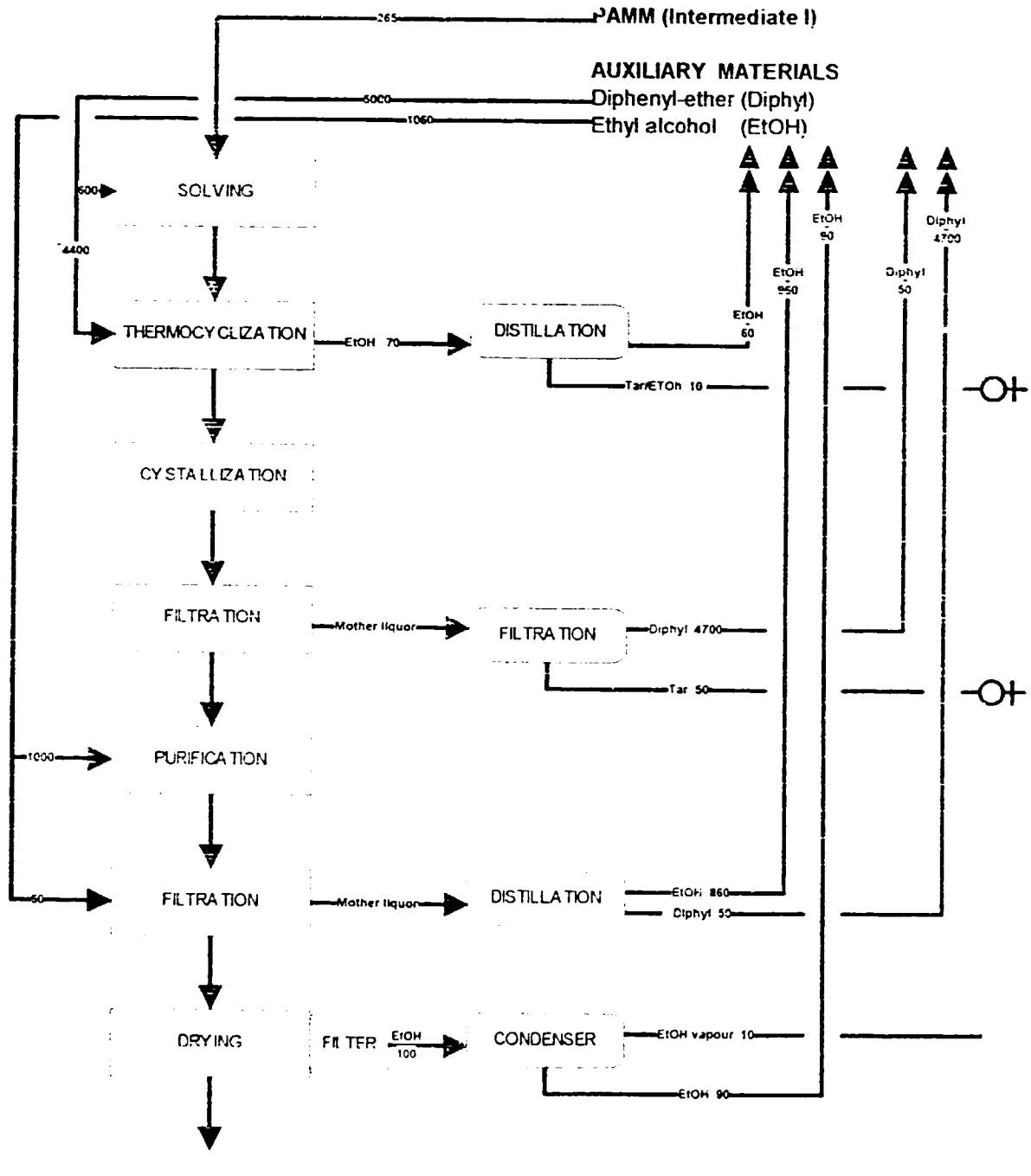
Step 1



265
Intermediate I = PAMM
(Picolylamino-methylene-malonate)

NALIDIXIC ACID
FLOW CHART

Step 2

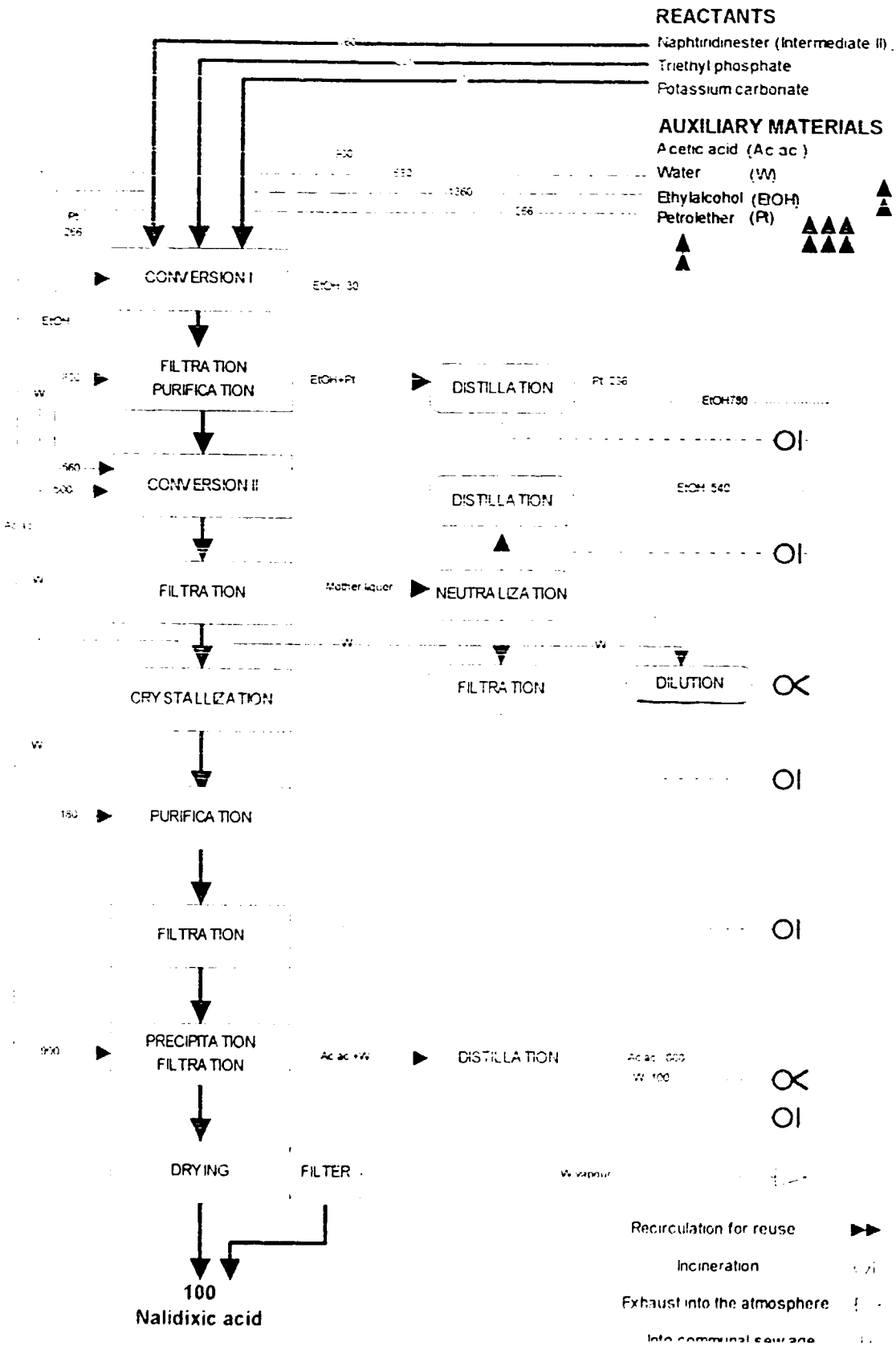


160

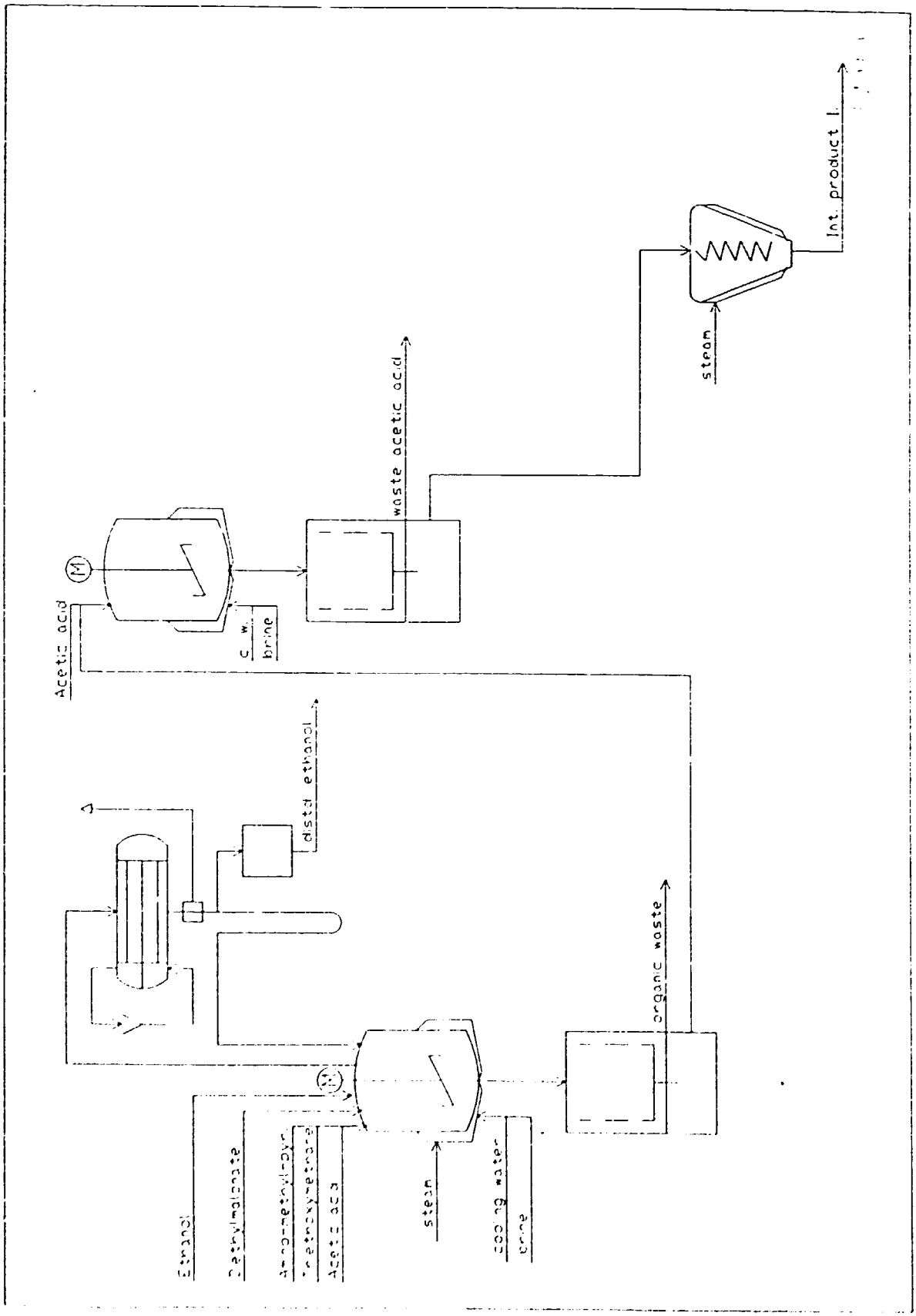
Intermediate II = Naphtiridin-ester

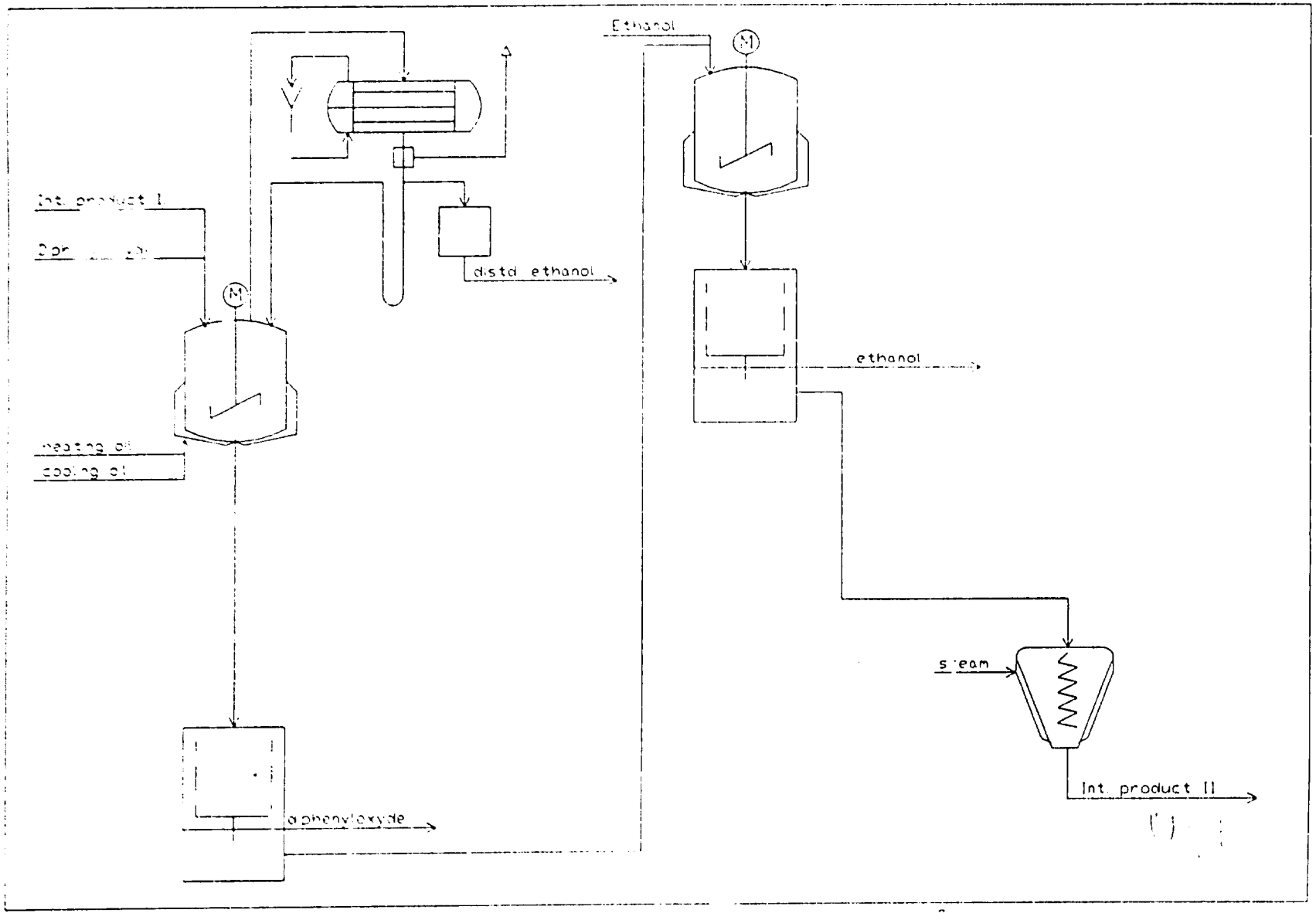
(4-hydroxi-7-methyl-1,8-naphtiridine-carboxylicacid-ethylester)

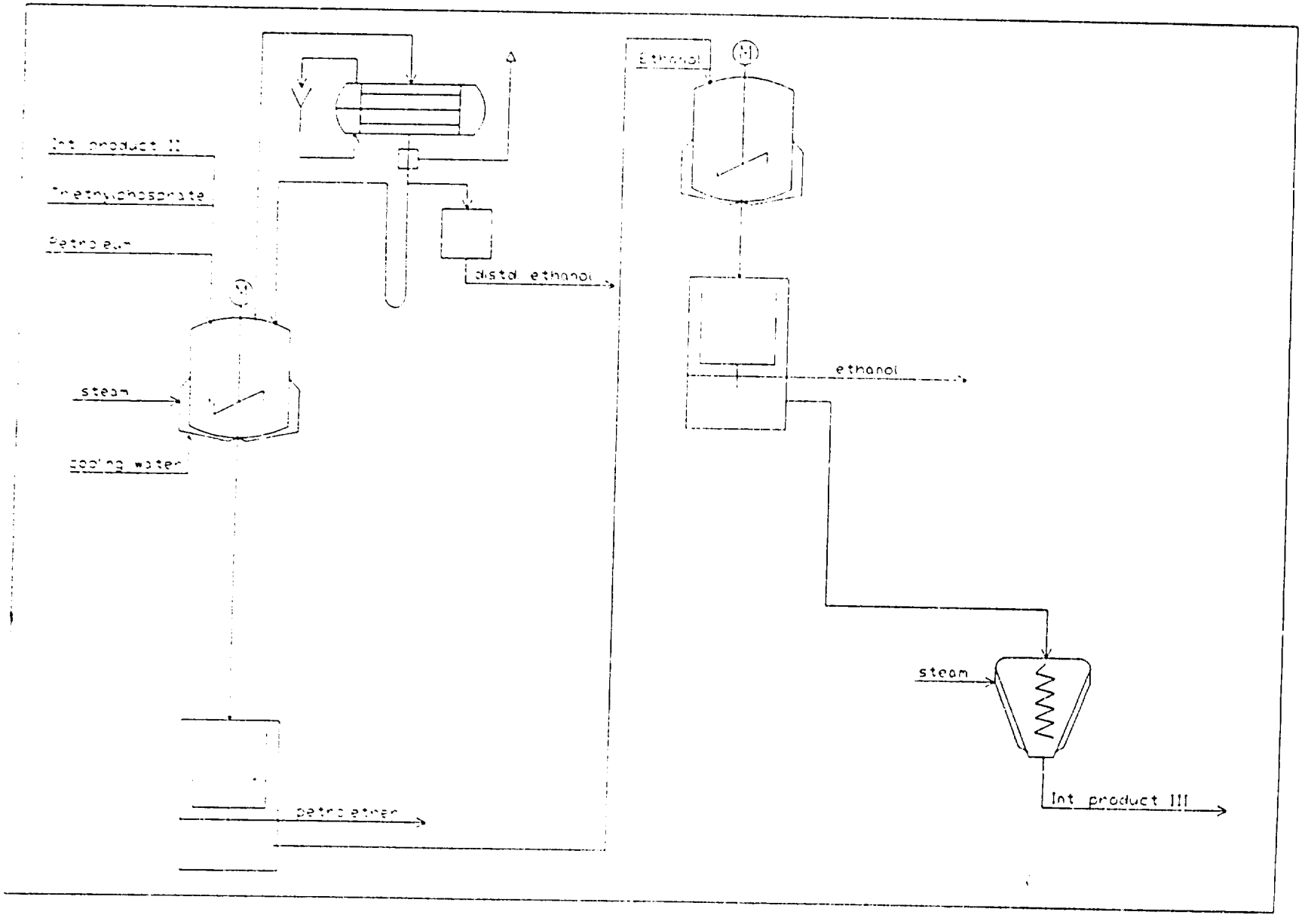
FLOW CHART
Step 3

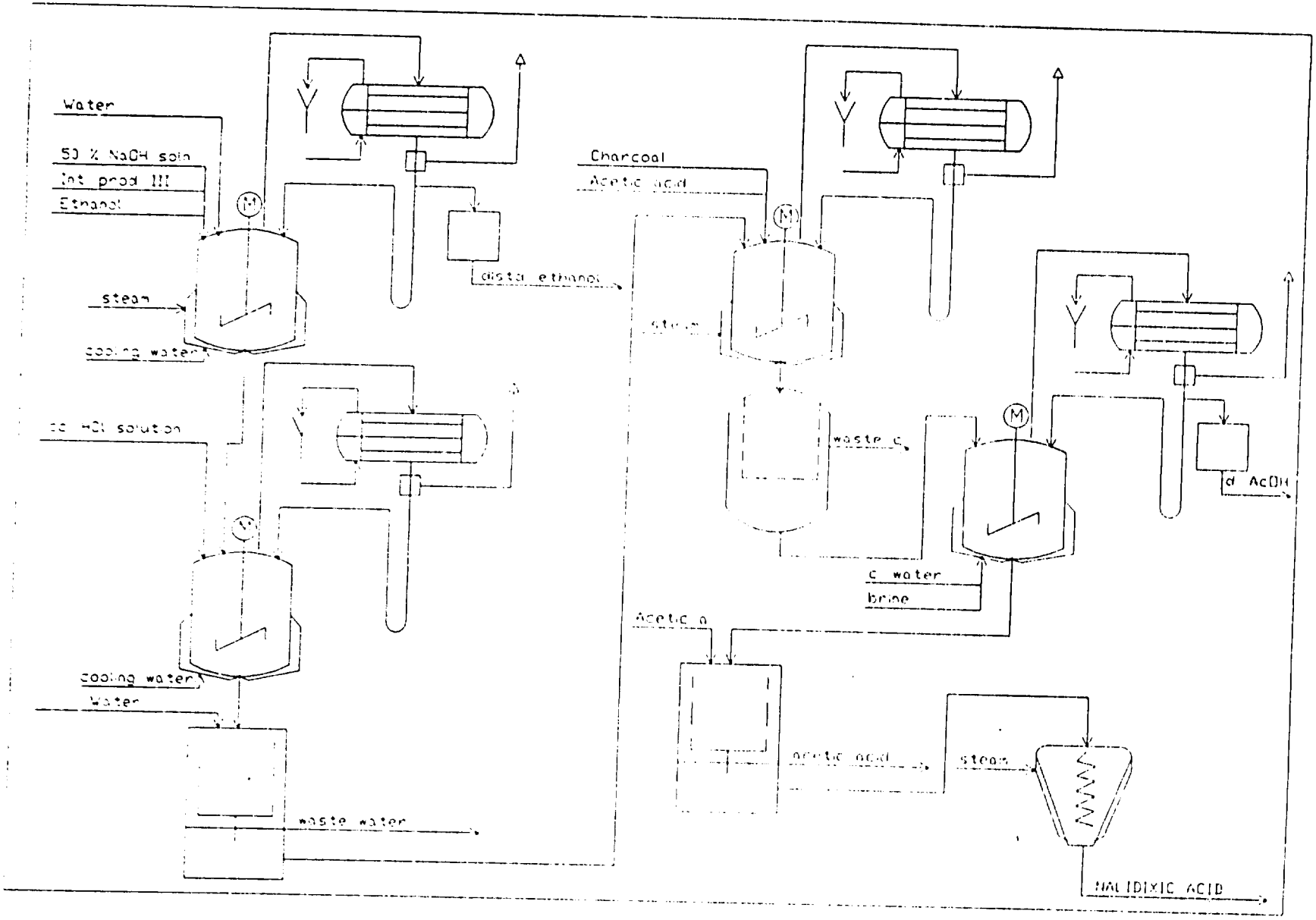


Step 1. N-alkylation




Ethanol
M
Int. product I
Dar
distd. ethanol
M
ethanol
heating oil
cooling oil
steam
Int. product II
phenylexyde


Int product II
Triethylphosphate
Petroleum
steam
Cooling water
distd ethanol
Ethanol
ethanol
steam
Int product III
petroleum


Water
50 % NaOH soln
Int prod III
Ethanol
steam
cooling water
distil ethanol
Charcoal
Acetic acid
steam
waste c
c water
brine
d AcOH
Acetic a
acetic acid
steam
HALIDIXIC ACID
cc HCl solution
cooling water
Water
waste water

CASE STUDY II

SOURCES OF EMISSIONS AT THE FERMENTATION OF PENICILLIN G

SOURCES OF EMISSIONS
AT THE FERMENTATION OF PENICILLIN G

The present case study is relating to a total volume of 760 m^3.
The volumes of the individual fermenters are 50 and 63 m^3.
Cycle of fermentation is 220 hours (10 days).
The total amount of fermentation broth for harvest, taking into account the partial harvest over the latter period of the fermentation (when some broth is withdrawn to make room for the sugar and other feeds), is thus between 50 m^3 and 65 m^3 per day.

In the fermentation sugar feed is stopped 12 hours before harvest and this will significantly reduce the unused dextrose in the medium. Typical levels of these materials at the end of the fermentation cycle might be

sugar: 2,000-4,000 mg/l
phenylacetic acid: 600-1,200 mg/l
ammoniacal-Nitrogen: 200-700 mg/l

At the end of the fermentation the mycelium (together with partial harvest) is killed with formaldehyde and flocculated with flocculating agent. The mycelium is then removed by filtration using rotary drum filters without the use of precoat. The occasional partially lysed batch may require some precoat but this is a very rare occurrence.
The recovery process is illustrated overleaf.

Wastewater arise from:

- spent broth
- solvent extraction (butyl acetate recovery)
- butanol distillation (azeotropic water-butanol mixture)
- crystallization blow down
- spent caustic from carbon rinsing

Solid wastes comprise:

- dewatered mycelial wastes at around 17% dry solids that are currently introduced back into the wastewater stream
- waste activated carbon containing caustic soda residues and traces of butyl acetate, disposed to landfill

A summary on the environmental profile of Penicillin G can be found overleaf.

PENICILLIN G ENVIRONMENTAL PROFILE

Broth: 153m³/day
No Batches/day: 1

POLLUTION

Discharges to Water m³/day	
Waste water	517
Washing water	292
Total	809

Emissions to Air	
Air + micro-organisms	1,032 Nm³/day
Butyl acetate	132kg/day
Butanol	201kg/day
Acetone	1,438kg/day

RESOURCES

Energy	
Electric Kwh/day	45,497
Thermic Gcal/day	351
Air Hm³/day	1,032

Raw Materials kg/day	
Biosynthesis	50,513
Processing	5,264
Solvents	8,594
Total	64,371

Water m³/day	
Drinking	811
Industrial	1,316

PROCESSES

BIOSYNTHESIS → FILTRATION → EXTRACTION → CRYSTAL-LIZATION → FILTRATION DRYING → REGENERATION SOLVENTS

PRODUCTS

Products	
Penicillin G	4,000 MUI/day (2,572kg/day)

OTHER PROCESS CONSEQUENCES

Recovered Solids kg/day	
Diluent	6,980

Special Waste Solids kg/day	
Waste for cremation	9,332

Solid Disposals kg/day	
Mycelium	36,950 (s.u.-16.7%)
Charcoal	1,086 (s.u.-30%)

Liquid	

Energy	

Land Contamination	

basin (12).

15. Chemical treatment I.
The treatment is carried out in stirred tank by adding of proper quantities of $Ca(OH)_2$ of any form (slaked lime, or lime water).

16. Chemical treatment II.
The second step is realized in a similar tank, also equipped with stirrer. The treatment is consisting of the addition of $Al_2[(SO)_4]_3$.
The treated was water is then pumped into the final sedimenter mixed with properly selected flocculent (in most cases a polyelectrolyte).

17. Final sedimenter.
After the final sedimentation the cleared waste water is leaving the system through a measuring (18) channel to the municipal sewage system.
The sludge is pumped into the sludge thickener.

18. Flow measuring channel

19. Sludge thickener.

20. Filter press.
The thick sludge is fed into a filter press. The dewatered filtercake is partly fed back to the adsorption process (8), the excess is transported for incineration.

CASE STUDY III

FODDER MEAL PRODUCTION FROM RESIDUE OF EXTRACTION OF ANIMAL ORGANS

Courtesy of Chemical Works of Gedeon Richter Ltd.
Hungary, 1103. Budapest. Gyömrõi-út. 19-21

Chemical Works of Gedeon Richter Ltd.

Hungary, 1103. Budapest. X. Gyömrői ut 19-21.
Tel.: 574-566/830 Technical Cooperation Department

Telex: 22-5067 richt

R D S

for Producing Fodder Meal and Pharmaceutical Raw Material

C O N T E N T S

I. Process Description

1. For Processing Soft Protein Waste to Fodder Meal

Description of Advantages

Chemical Works of Gedeon Richter Ltd. - busy since its existence, for over 80 years, with the utilization of wastes of animal provenience - have developed a new process and planned main equipment necessary for realizing the transformation of slaughterhouse wastes into fodder meal. Based on an abundance of analytical and "in vivo" resorption examinations of the products made by this process, it can be stressed that the quality of fodder meals produced by this equipment BY FAR EXCEEDS requirements of the Hungarian Standards for first class mixed meat meal of animal provenience and even those for the very best imported fish meal. Based on the essential features of the process /SHORT-TIME, INTENSIVE, CONTINUOUS HEAT TRANSFER/, advantages are given such as HIGH CONTENTS OF DIGESTIBLE PROTEIN AND USEFUL LYSIN, simultaneously with the REDUCTION IN FATS AND BACTERIA. Our product may be stored for an indefinite period, it is not objected to under the veterinary aspects and represents a protein fodder of excellent quality.

Materials to be processed

All kinds of soft internal waste arising during the processing of domestical animals, cuttings, confiscated animal organs unproper for consumption and other processing, slaughterhouse liquor residues, by-products arising during the manufacturing of edible fat, "red products" unsuitable for being put on the market, organ residues after extraction processes.

Products

- Fodder meal containing at least 70 per cent of overall protein and min. 85 per cent of digestible matter, of a quality better than the highest standardized requirements
- pharmaceutical basic material produced from hog intestines,
- industrial fat, fodder fat

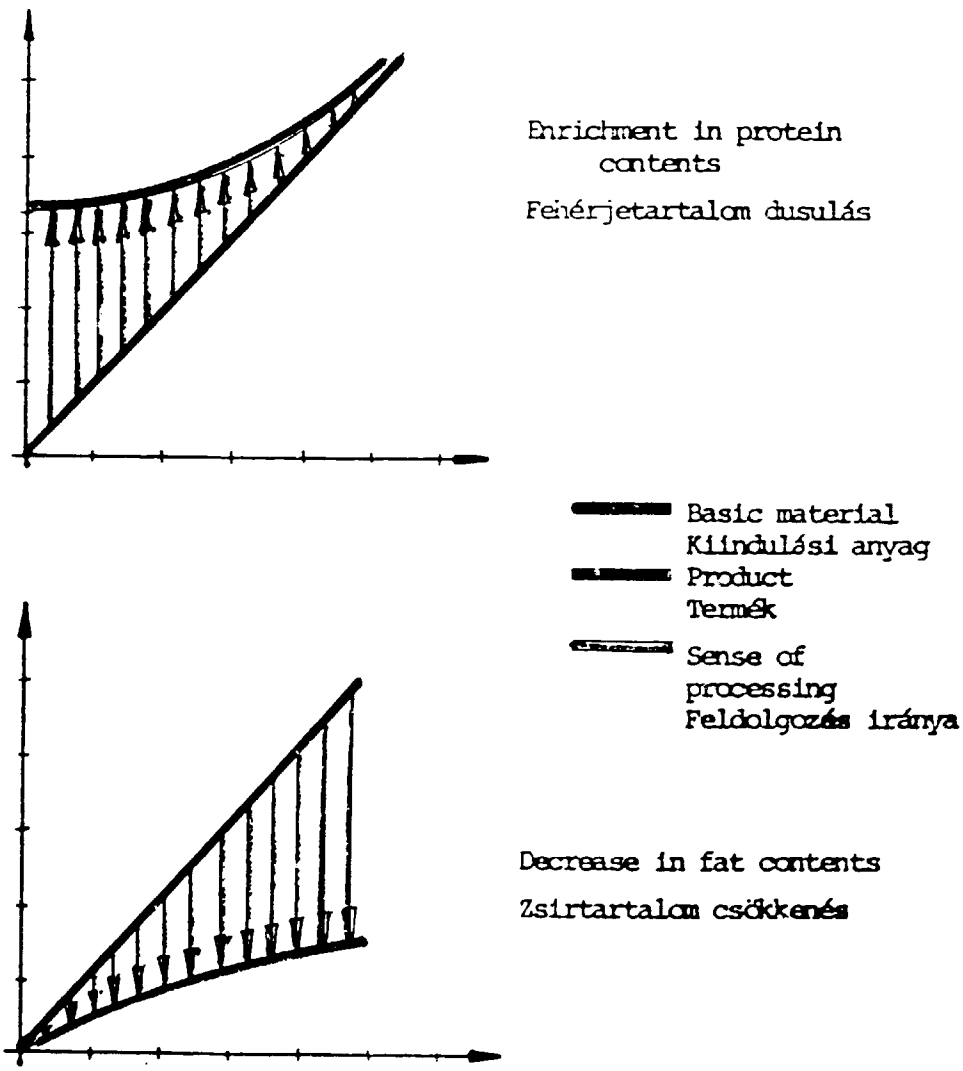


Fig. 1

Increase in overall protein contents, decrease of fat contents during processing, in % of totale dry matter

1./ Collecting tank
2./ Crusher /grinder/
3./ Conveying scren
4./ Delutung tank
5./ Recirculating pump
6./ Dosing pump
7./ Instant-heater
8./ Filter
9./ Airlock
10/ Drier
11/ Airlock
12/ Product storage bin
13/ Balance
14/ Dustfilter
15/ Heat-economizer
16/ Air-heater
17/ Condenser
18/ Hot water tank
19/ Wasch-water pump
20/ 3 phase separator
21/ plate type cooler

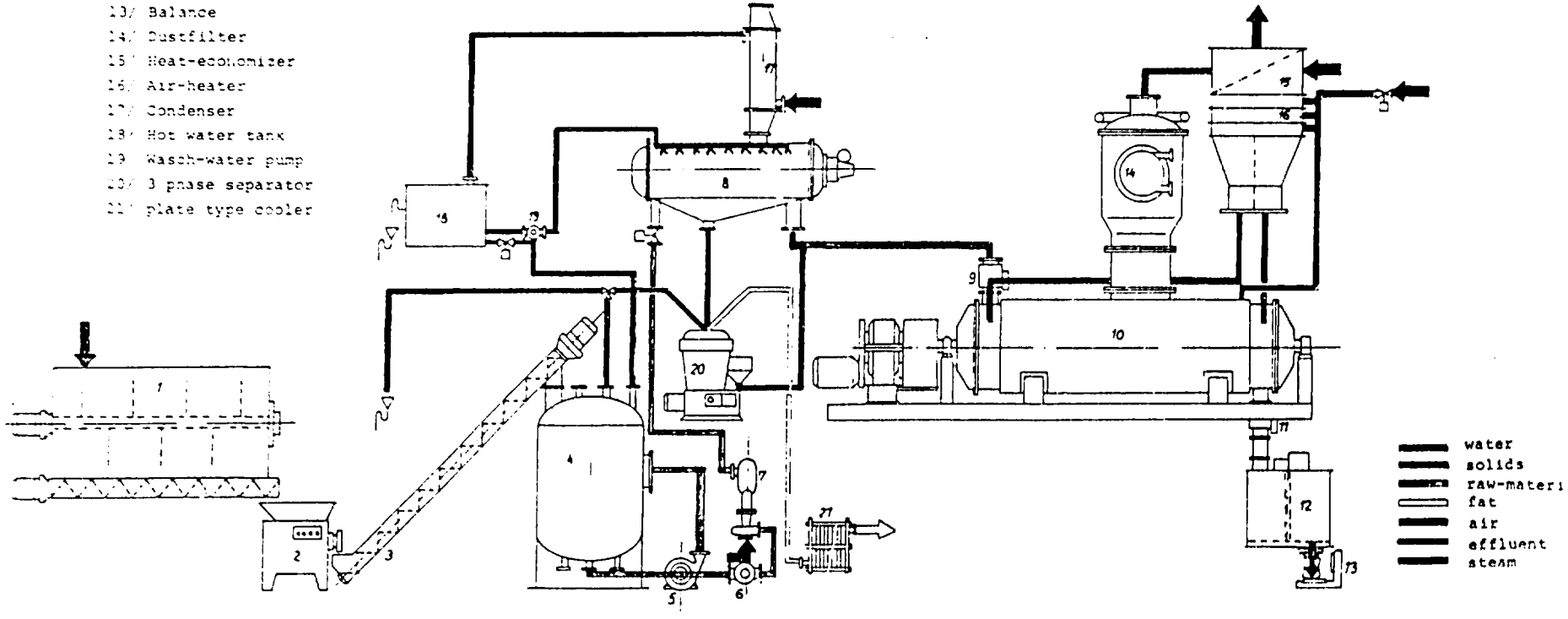


Fig .2.

Technological Description

Fig. 2 Technological Flow-Sheet For Processing Soft Residues /See next page/

In order to prepare the basic material, the residues arising on different spots and at different times in the slaughterhouses are collected by a pneumatic, pumping or container system and stored, according to the capacity of the processing line, in containers or silos.

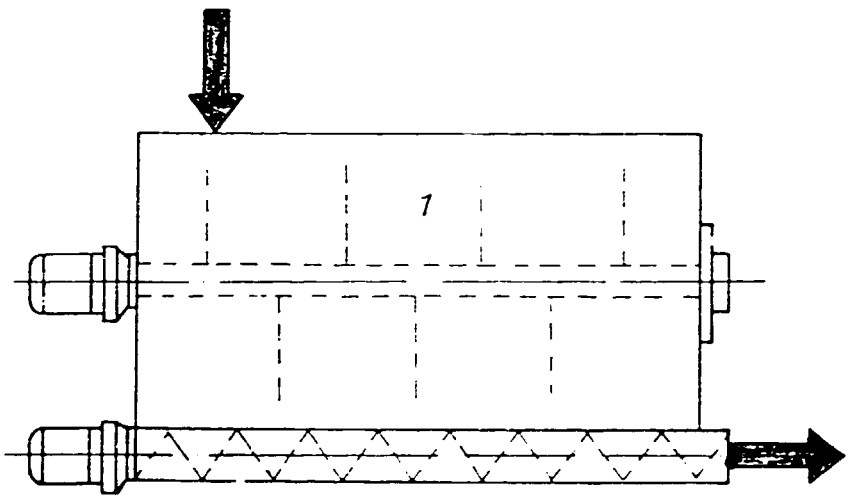


Fig. 3 Raw Material Collecting System

The preparation of the raw material aims at establishing the "particle size" and water contents which are necessary for the process and indispensable for the values guaranteed in the description of the advantages. The cutting operation is performed with an industrial meat mincer having a final screen dimension of 4 mm whereas the 2-15 per cent dry content of the diluted slurry is adjusted in an agitated tank.

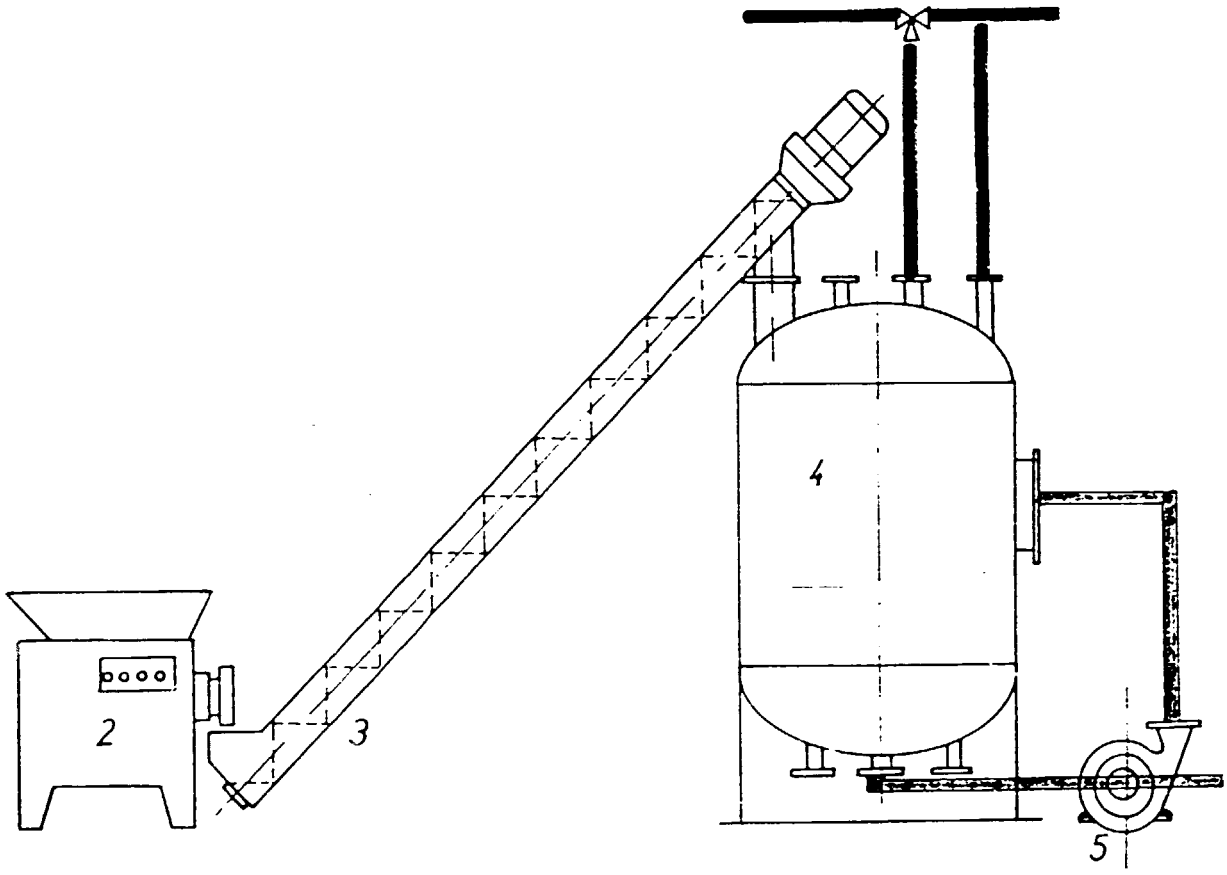


Fig. 4 Raw Material Preparing Equipment

The process forming the essence of the technolgy starts, in accordance with the slaughterhouse capacity, and with the rate of formation of raw material, depending on the processing pressure in the system, with a speed-regulated feeding pump HYPRO /high-pressure/ or JABSCO /low-pressure/; this pump forwards the prepared mixture to the instant heater denaturating unit of direct heating. After being pre-heated to the suitable temperature /incase of low-pressure to - 95°C, in case of high-pressure to 145°C/, the material goes into a pipe coil where : the particles are co agulated, and on the other hand the number of micro-organisms is reduced, during the some minutes of dwelling, to a level satisfying the official prescriptions; i.e a continuous sterilizing

process is being performed. The pipe coil ends in an expansion valve, through which the material is forwarded to the filtering unit.

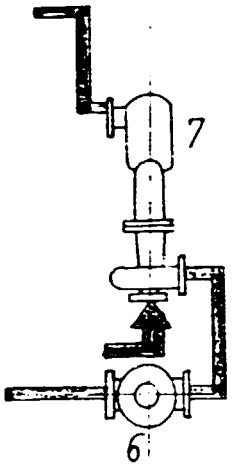


Fig. 5 Feeding, instant heater and St rilizing System

In the zig-zag filtering equipment, the denaturated and coagulated particles are /in the steam atmosphere, protected from reinfection/ continuously separated from the clear liquor and the melted fat, while they are driven towards the dryer. The separated liquid phase is forwarded to the fat line .

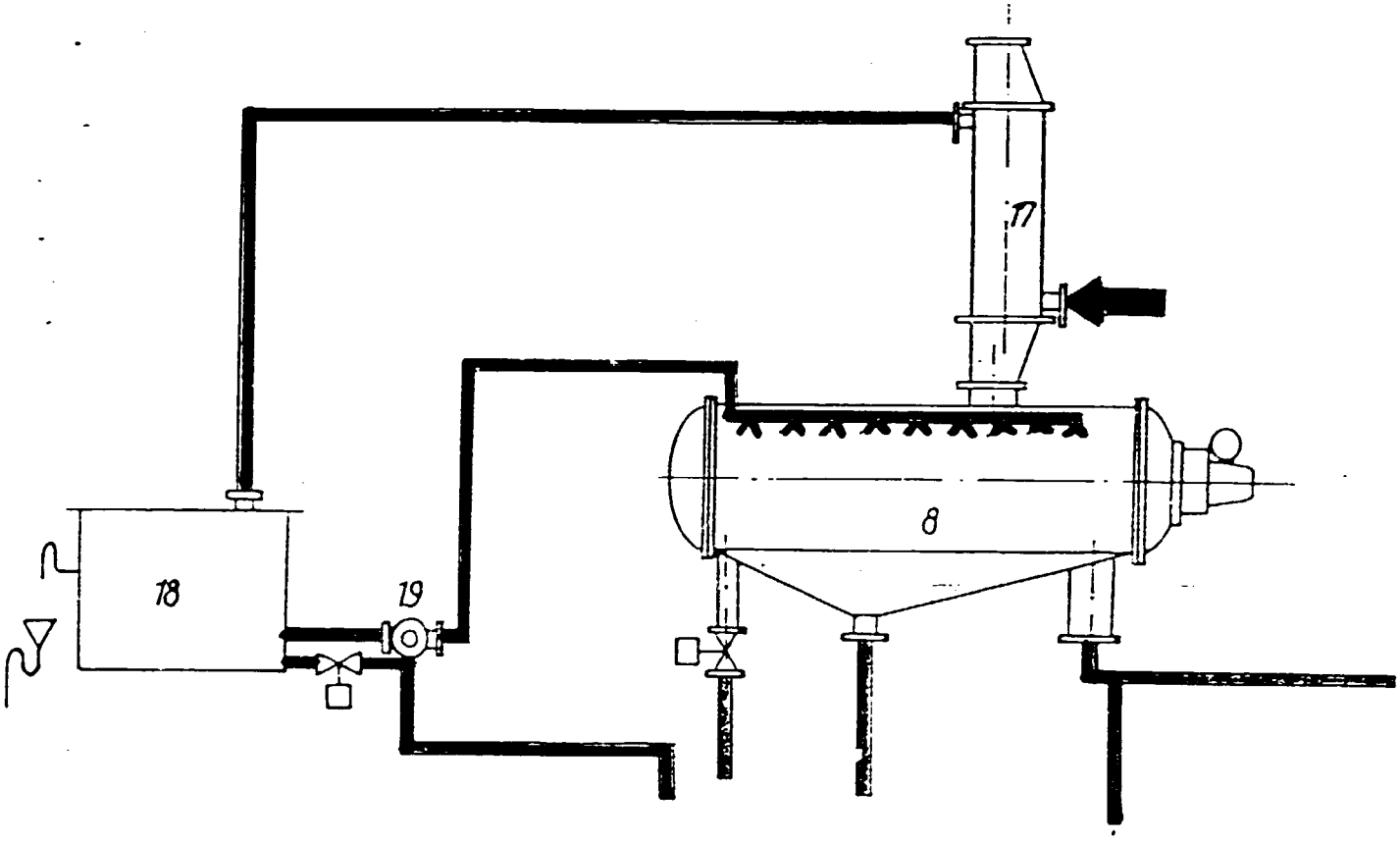


Fig. 6 Filter Equipment

The dryer is a horizontal double-wall agitated vessel heated by steam and hot-air-circulated, from which - depending on the output of the RDS systems - 15-300 kg per hour of fodder meal met the standard requirements are forwarded into the bag filling - ready-packing unit.

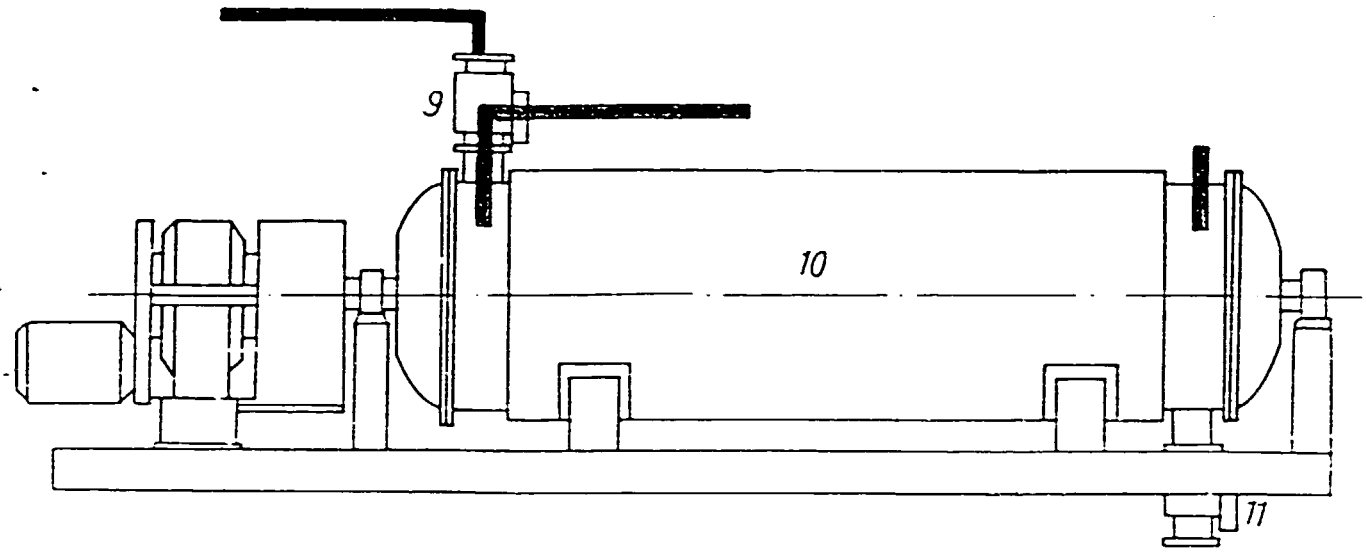


Fig. 7 Drying Unit

In the systems of higher capacity /such as RDS 1000, RDS 1500/, the dried fodder protein comes into a collecting and feeding container under which the optical balance needed for exact weighing of sacks is installed.

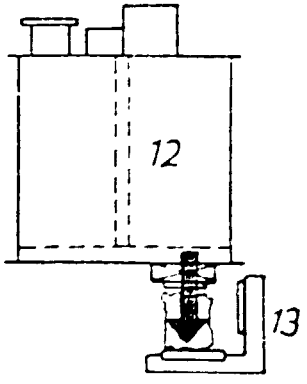


Fig. 8 Bag Filling - Ready-packing Unit

The auxiliary units for the RDS systems are:

The suspension leaving the filter is forwarded into a continuously operating, three-phase separator where the melted fat is separated. The water phase leaving the separator is being used up in part or entirely for dilution in the raw-material preparing line while the protein sludge enters the dryer.

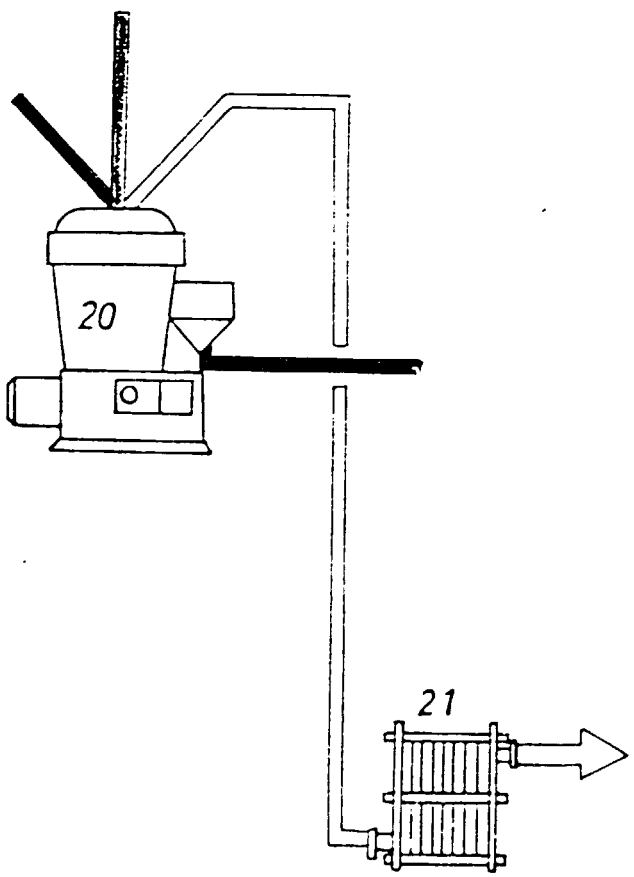


Fig. 9 Industrial Fat Line

In the higher-capacity systems /RDS 1000 and RDS 1500/, the air leaving the pneumatically cleaned dust separator goes into an economizer unit which pre-heats the fresh air entering the heat exchanger /calorifer/ heated by steam or natural gas.

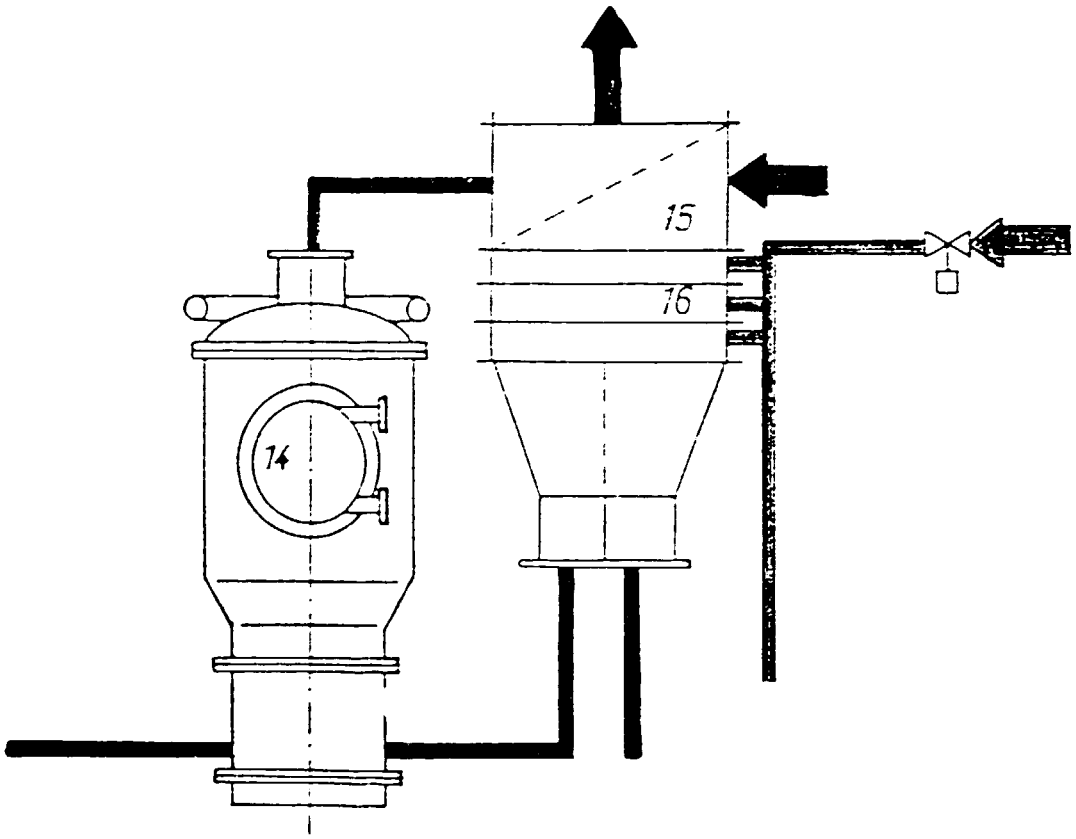


Fig. 10 Air Technique

Fig. 11 Technological Data of RDS Systems for Soft Wastes

	RDS 400	600	1000	1500
Machinery Units				
Raw-material Collecting System	min. 1.5 m^3	min. 3 m^3	min. 6 m^3	min. 12 m^3
Raw-material Preparation System: mincer	150 kg/h	300 kg/h	1000 kg/h	3000 kg/h
Raw-material Preparation System: suspension tank	1 m^3	2 m^3	4 m^3	8 m^3
Feeding and Dosing System: Instant heater	100-750 l/h	200-1500 l/h	670-5000 l/h	2000-15000 l/h
Filter Capacity in Denaturated Matter	100 kg/h	300 kg/h	1500 kg/h	1500 kg/h
Drying Equipment capacity in dry matter	15 kg/h	30 kg/h	100 kg/h	250 kg/h
Storage Tank of Bag Filling/ Ready Packing System	-	-	2 m^3	2 m^3
Capacity of Fat Line	3 kg/h[X]	8 kg/h[X]	20 kg/h	60 kg/h
Capacity of Economizer System	8000 kcal/h[X]	15000 kcal/h[X]	35000 kcal/h	80000 kcal/h

[X] Technical necessity does not exist, delivered only upon special order.

2. For Processing Blood to Produce Blood Meal

Blood collected on the Slaughtering lines of Slaughterhouses may be processed after removal of plasma or together with it, in the above described RDS system. The produced blood meal shows extraordinarily high contents of total and digestible protein, meeting at the same time the veterinary aspects. As compared to the above, the process is simpler as the mincing and raw-material preparation line as well as the dilution are unnecessary and also the fat processing may also be omitted.

Fig. 12 Blood Meal Processing. Technological Flow-Sheet

/See next page/

4. Collecting tank
5. Recirculating pump
6. Dosing pump
7. Instant-heater
8. Filter
9./ Airlock
10/ Drier
11/ Airlock
12/ Product storage bin
13/ Balance
14/ Dustfilter
15/ Heat-economizer
16/ Air-heater
17/ Condenser
18/ Hot water tank
19/ Wash-water pump

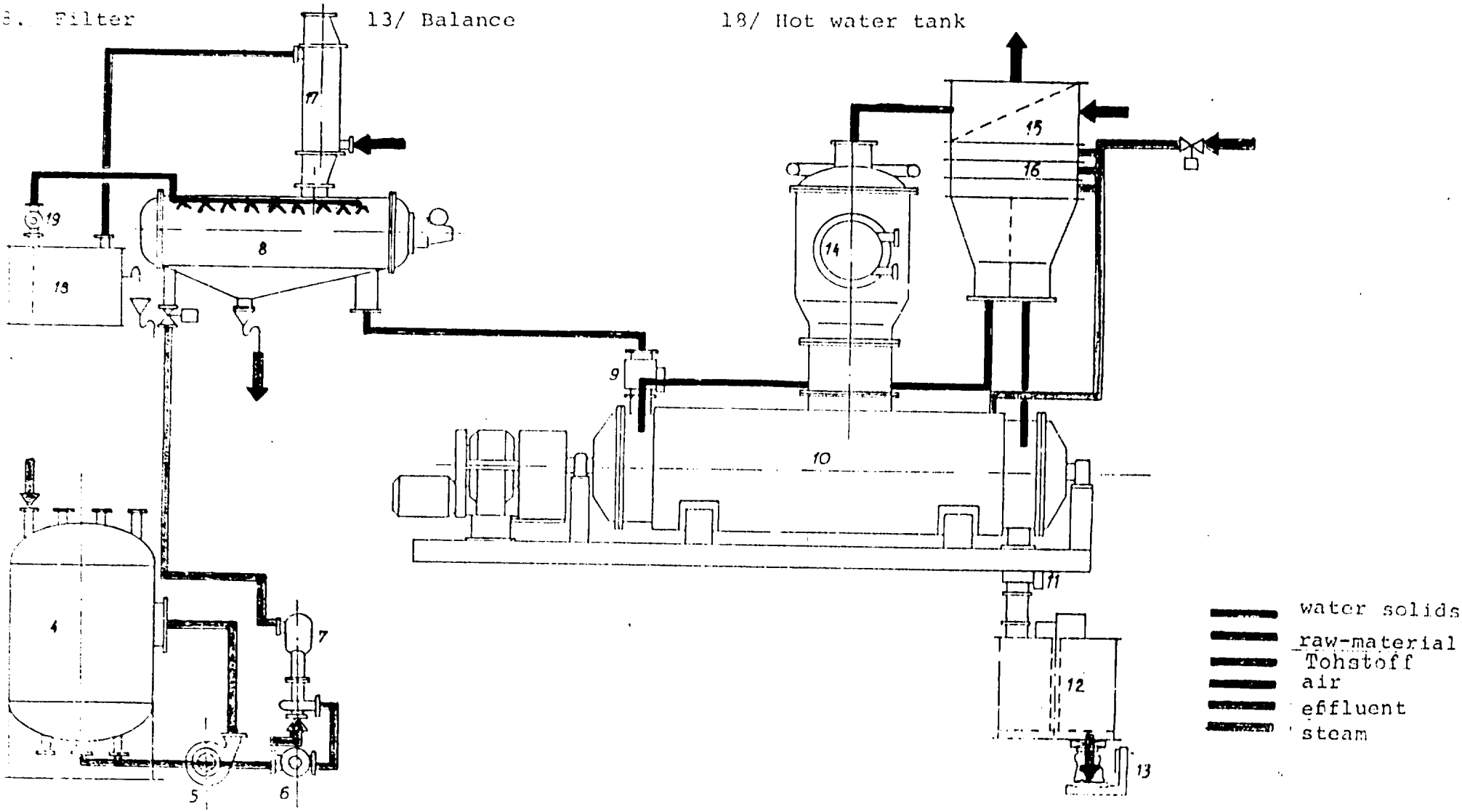


Fig. 12.

Fig. 13 Technological Data of RDS Systems for Processing Blood

RDS 400	600	1000	1500
Machinery Units			
Raw-material Collecting System	500 l	1000 l	3000 l	6000 l
Feeding and Instant heater System	60-120 l/h	150-300 l/h	400-900 l/h	1000-2700 l/h
Filter Capacity in Denaturated Matter	80 kg/h	150 kg/h	500 kg/h	1500 kg/h
Drying Equipment Capacity in dry Matter	15 kg/h	30 kg/h	100 kg/h	250 kg/h
Economizer System Capacity	8000 kcal/h*	15000 kcal/h*	35000 kcal/h	80000 kcal/h

* Due to small size delivered only upon request.

3. For Processing Bony Wastes to Fodder Meal

A great part of slaughterhouse wastes is arising as bony waste products, which may be processed by the technology described under 1, in case of an appropriate modification of the preparing lince, i.e., by substituting pre-crushing and hammer mills instead of the industrial mincers. Otherwise, the process is quite identical to the processing of soft waste materials. The total and digestible protein contents of the resulting product are lower than those of the purely soft wastes in the same proportion as bony waste is introduced but will not be lower than the value indicated for the start. The capacity of the RDS systems will be, in this case, between 20-500 kgs per hour.

4. For Processing Fermentation Liquor Residues

From the above said, the idea emerges by itself to extend the application of the system to the utilization of all sorts of protein-cortaining waste being denaturalized by heat to produce valuable fodder meal and also for further processing of residues arising during different fermentation processes, ensuring at the same time those advantages which are given by the continuous process instead of the batch-wise ones. Since these raw-material sources are the results of widely varying techniques, technological flow-sheets and data schemes similar to the above indicated ones can be presented only on the basis of previous experiments made for every single case.

II. Installation and Operation of RDS Systems

1. Requirements for installation of the System

According to their size, the RDS systems may be installed in two different layouts. The smaller RDS systems such as RDS 400 and RDS 600 allow a block-like layout, the system RDS 400 being even liable to be supplied and installed in a containerized layout. The various units of the technology are condensed into blocks in the following arrangement:

A : Raw-material collector and preparation
B : Quick instant heater and sterilizer
C : Air technique and economizer unit
D : Electrical and instrumental regulating and control system

This layout allows the simple installation of the systems RDS 400 and RDS 600 in existing slaughterhouses, on one level and with relatively low inner height.

For the BIGGER SYSTEMS RDS 1000 and RDS 1500, the size of the machine-units does not allow any more the installation in blocks. With such systems, there is a possibility to accommodate the equipment in independent steel structures on different levels, meeting the technological requirements, whereas for new slaughterhouses the necessary layout requirements may be considered already in the stage of preparing the projects.

The product being classified, under the aspects of inflammability, as belonging to Class "C", the requirements against the independent building must meet the prescriptions of the Hungarian Standard 595 and, under the fire-fighting aspect, to the decrees of OTSZ 4/1980 - Kl.25-BM while meeting the sanitary prescriptions of the decree

ÉÜM 2/1981 - II.7. The social and service establishments are governed by the prescriptions of the decrees Nr. 12/1980 III.4 ÉVM and Nr. 18/1981 - VI.29 ÉVM.

Required public utilities in connection with the installation:

- water and sewage systems
- steam and/or natural gas
- electrical energy
- pneumatic auxiliary energy