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GHANA

Technical report: Preparation of a development plan for the food industries sub-sector *

Prepared for the Government of Ghana
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Armin Paulusch,
Agro-based industries adviser

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United Nations Industrial Development Organization
Vienna

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EXPLANATORY NOTES

The value of the local currency - Cedi (¢) during the period of the mission in terms of United States Dollars (US$):

Aug. 1985	-	US $ 1.00 = ¢ 56.0
Nov. 1985	-	US $ 1.00 = ¢ 60.0
Feb. 1986	-	US $ 1.00 = ¢ 90.0
18 Sept. 1986	-	US $ 1.00 = ¢128.0

ABBREVIATIONS

ERP	-	Economic Recovery Programme
GDP	-	Gross Domestic Product
GIHOC	-	Ghana Industrial Holding Company
IDA	-	Internacional Development Association
IMF	-	International Monetary Fund
MIST	-	Ministry of Industries, Science & Technology
NMP	-	National Mobilization Programme
NMC	-	National Mobilization Committee
PNDC	-	Provisional National Defence Council

t/a	-	tons per year
d	-	day
ha	-	hectare
t	-	ton (metric)
G.R.T.	-	gross registered tonnage
A.U.	-	Animal Unit (one cow = 10 sheep/goat)

1. ABSTRACT

This report is based on the findings of an agro-based industries adviser who was stationed in Ghana between 20 September 1985 and 31 October 1986, within the framework of project DP/GHA/82/030 - Industrial Planning within the Framework of Economic Recovery 1984 - 1986. The Mission was supported by the Ministry of Industries, Science and Technology, Ministry of Agriculture, Ministry of Finance and Economic Planning, Bureau of Statistics, State, mixed and private Enterprises, Associations, and Institutions.

The primary objectives of the mission were to prepare a detailed development plan for selected industries of the agro-based industries sub-sector, to identify specific priority investments in the context of strengthening the agro-based industries sub-sector, increasing export earnings and reducing food imports. In pursuing these objectives the mission concentrated on providing the Government with recommendations for a practical programme aimed at implementation and an integrated assessment of the strategic impact on Ghana, of particular policies concerning agro-processing and related investments.

In response to the Government's request, the mission undertook studies of selected agro-industrial opportunities to assess their production potentials and constraints, the dynamics of demand projections and the existing raw material resources at various levels. In carrying out these tasks, the mission compiled extensive background information which was integrated into the report.

TABLE OF CONTENTS

TABLES

FIGURES

1. INTRODUCTION

The agro-based industry sector hinges on agricultural development which is the focus of the current Economic Recovery Programme 1986 - 88. The industrial development strategy of the Plan aims at the expansion of food processing industry based on local agricultural resources. The main objectives of this report are to review the current status of the agro-based industries especially the food processing industry; to assess both the present position of the industry and the related factors contributing to that position and provide elements for planning the further development of this sub-sector within Ghana.

Unlike earlier studies, this report attempts to place more emphasis on analysing the future needs of food and the relationship of consumption and production of food at the national level.

The report starts with a review of the general economic state and the industrial development of Ghana which include also the expected population development and the land use followed by situation report about the agro-based industries especially the foodstuff industry in Chapter 4.

Chapter 5 contains the estimation of the per capita consumption and the expected development of the demand for most important food, beverages and agricultural products.

The necessary development of the processing industry to meet the requirement of food is contained in Chapter 6. This chapter includes also the development of important agricultural products for the processing industries.

Chapter 7 deals with project implementation and shows also the very important role of the small scale and cottage industry within the food processing industry.

2. RECOMMENDATIONS

The project has a very great potential for Ghana and should be continued in the future. The agro-based industries sub-sector is one of the greatest and most important industries of this country with innumerable small scale and cottage enterprises which are playing a very important role to meet the requiremetns of food and other agro-based products. It is not possible to prepare a review about the whole field during a very short term and to make an ample development plan of the agro-based industries sub-sector in only a year's time. To carry on this work, applied reasearch work, planning studies, industrial surveys on the sub-sector and elaboration of methodologies for plan preparation and implementation for determination of Government's direct involvement in the Sub-sector's development will be necessary.

It is not possible to prepare a development plan only by foreigners because of insufficient knowledge about the country. A comprehensive sub-sectoral plan can be prepared only in close collaboration with experienced Ghanaians.

For future activities a combination of well selected counterparts should be appointed which have to work all the time very closely and directly with the international experts which are simultaneous advisers to the Planning Section within the MIST.

Before the next step of planning exercise is undertaken more detailed sub-sectoral strategies and policies have to be prepared and documented by reliable figures. On the basis of this planning phase, a programme for the development of the agro-based industries sub-sector will be refined. These activities should be included into a master plan of industrial development. Phasing of future activities should be as follows:

a) Consolidation of statistical service to promote reliable information inputs;

b) Preparation of policy guidelines for selected industries within the sub-sector;

c) Preparation of a sub-sector plan;

d) Inclusion of sub-sectoral objectives and activities into an industrial plan with proper inter-sectoral linkages.

More attention should be given in planning of the large scale enterprises especially in the field of rehabilitation and development of human resources. The future activities should also consider the following:

- Reduction and recycling of waste;
- Improvement of the management within the enterprises;
- Mangement training;
- Linkages with other industries like metal processing, mechanical engineering, chemistry, etc.;
- Marketing and export promotion;

In order to avoid a delay in the development of the food stuff industry, the preparation of detailed investment studies for each industry should be started immediately. This studies should include:

a) The necessary capacity of the industry and the necessary steps to increase the available capacity and establish new capacities;

b) Detailed demand and market analysis;

c) The availability of raw materials and other inputs, the location of raw material supplier and necessary imports to ensure the necessary production;

d) Determination of location sites for new capacities;

e) Preparation and design of new capacities, selection of equipments, selection of suppliers of equipment and preparation of project layouts such as:
   - Production programme, Supply programme, Technology, Equipment, Civil works and Local conditions, Estimation of investment costs;

f) Manpower demand and qualification

g) Implementation scheduling for development of the industry

h) Financial and economic evaluation of the industry.

3. Economic State and the Industrial Development in Ghana

3.1 History

The Ghanaian economy declined throughout the 1970s but particularly since 1977. The per capita income has fallen by 30%, real export earnings have declined by one half in the same period, import volumes have fallen by two thirds.

The rate of investments has fallen from 12% to 2% of G.D.P. At the same time population growth is estimated at 2.5 %. The burden of this economic decline has fallen on farmers, producers of goods and commodities, and fixed wage earners.

High inflation rates arising from larger Government deficits, a greatly over valued exchange rate, an increasing network of controls (direct price controls, import licence, investment permits, public distribution agencies) have all combined to create strong disincentives for domestic production and exports, increase import dependence, and enforced severe reductions in imports of raw materials and finished goods.

Illegal trading, smuggling and unproductive activities have flourished within a parallel economy. The industrial sector in Ghana was originally established behind high protective barriers with high import capital intensities. Within the period of economic decline, there has been a rapid expansion of administrative state control.

Reduced supplies of inputs, migration of skilled labour, unavailability of spare parts and rising inflation have combined to precipitate a rapid decline in output and efficiency; capacity utilization has fallen well below 30% in many cases; the product mix has changed; the quality of output has been reduced; production costs have risen sharply. These developments have reinforced inflation rates and increased shortage; of basic consumer goods and essential services. Real GDP remained almost stagnant up to 1978 and then declined by an average of 2% per annum during 1979-82.

As a consequence and given the high growth rate of the population, the average Ghanaian's estimated real income in 1982 was about US$360, about two thirds of what it was a decade ago. Despite the growth in health and educational facilities, a large number of people were without access to safe labour and formal education. The sectors which accounted most for the decline of the economy were agriculture, particularly food and cocoa industry. In recent years, most basic commodities including food, have not been readily available except on the black market at prices several times higher than the controlled price. Inflation accelerated rapidly and reached the triple digit level in 1981, among the highes for developing countries. The above situation resulted in shortages of imported raw materials, spare parts and capital goods and consequently in shortages of consumer goods leading to rampant escalating of prices, smuggling, black marketing, deterioration of physical administrative and social infrastructure etc. The economic policies and poor economic management including budget deficits pursued by the then Governments have apparently contributed to this state of affairs. These were manifested in weaknesses in the intensive framework, declining real producer prices, low wage and salary levels, inefficiency and management problems in the public corporations, low public utility prices and negative real interest rate. These together with political instability and, since 1980, drought, outbreak of bush fires, the return of about one million Ghanaians from Nigeria and the declining external image had worsened the prevailing poor economic performance of the country.

In order to improve the above situation, i.e. "restore real growth and maintain financial and monetary discipline", the Government in April 1983, launched the Economic Recovery Programme (ERP) for the period 1984 - 1986 and created the National Mobilization Programme (NMP), including committees

at district sub-division levels, to provide support to the ERP. The National Mobilization Committee (NMC), the implementing agency, is responsible for mobilizing all available resources to achieve maximum production in the priority sectors of the economy, both agricultural and industrial. In respect of human resources, the NMC is concentrating on the development of labour into agriculture, small scale and rural industry, and constructional and social improvement works.

During 1983, the Government focused its attention on consolidating and restructuring the economy, including the restructuring of basic institutions and the establishment of a sound micro-economic framework. The Programme is expected to gradually achieve a realistic exchange rate; establish realistic prices; rehabilitate key sectors of the economy; favour productions sectors in the allocation of domestic and foreign resources; increase salaries and wages etc. Although the implementation of the ERP was, unfortunately, affected by the drought referred to above and by foreign exchange crises of 1983, but 1984 was blessed with favourable weather resulting in increased production of food, export commodities and hydro-electricity.

As a consequence of measures taken by the Government including those required by the IMF' performance criteria, cocoa producers price increased from ₵12,000 in May 1983; ₵30,000 per ton in May 1984 to ₵56,600 in January 1986 as well as tariff rates since April 1983; wages and interests rates were adjusted upwards three times culminating in minimum daily pay of ₵90 and annual interest rate of 21 per cent; and the annual average exchange rate of ₵2.75 to US$ 1 in 1979 - 1982 was raised to ₵35.0 in 1984, ₵60.0 in 1985 and ₵90.0 in February 1986. The downward trend of economic development was reversed with real GDP at constant 1975 prices having increased by 0.7 per cent in 1983 compared with an average rate of decline of 6.1 per cent during 1979 - 1982.

in 1984 the GDP is estimated to have risen by 5.4 per cent as against an expected 6.7 per cent. The budget deficit in real terms declined from 4.6 per cent of GDP in 1982 to 3.9% in 1983. Inflation has decelerated in 1984 from the drought induced 123 per cent level in 1983 to 23 per cent per annum by August 1984. The rehabilitation of these sectors is being supported by IDA and other donors.

The development budget of ₵4,574 million for 1984 lays emphasis on increased agriculture production and rural development. This compares with ₵28,463 million total budget and ₵6,427 million (gross) and ₵2,729 million (net) foreign flow. According to the World Bank's proposal, the adjustment process is to be carried out in three phases leading to sustained real economic growth. These are:

1. Stabilzation phase resulting in reduction in price distortions and halting the declining trend of the economy;

2. Rehabilitation phase resulting in improved capacity utilization of productive units, and

3. Liberalization and growth phase resulting in trade liberalizationand reduced Government intervention in the economy.

It should be noted, that success of the ERP hinges on the availability of foreign exchange as well as the ability of the local banks to extend credit for Cedi coverage of import licence, the nature and timing of external assistance, improvement of productive and social infrastructures, and the strengthening policy framework conditioning the economy's response to the recovery programme. Priority in the allocation of foreign exchange is given to investments leading to:

1. Greater foreign exchange earnings or savings;

2. Improvement in the country's infrastructure which in turn would facilitate production, distribution and export;

3. Higher Government revenues and therefore a reduced budget deficit; and

4. Increased supply of essential consumer goods.

The World Bank has, on its part, proposed the following ingredients of a strategic design for the remaining period i.e. for 1985 - 1986

1. An appropriate incentive framework;

2. A key role for the private sector;

3. A rolling medium-term development programme, and

4. Institutional reforms.

The Government of Ghana is taking steps to strengthen its planning and programming capabilities in order to effect the implementation of its policies within the 1984-1986 time frame. Within a broader programme of re-organizing the structure of Government departments to give greater specialization of function and decentralisation of the administrative system priority is being given to planning, monitoring and evaluation. The MIST is in the process of establishing a new planning cell under the supervision of a very senior official. This planning cell will be responsible for overseeing progress with the ERP in the industrial sector and assessing the medium term implications of the ERP for that sector. The objectives of the ERP 1984-1986 are:

(a) Establishing of appropriate linkages in the industrial sector;

(b) Development of local raw materials, where possible to reduce excessive dependance on foreign inputs;

(c) Promotion and development of small scale and other industries which will make use primarily of local raw materials and assist in developing the rural areas;

(d) Strengthening of management and technical know-how;

(e) Improving labour productivity;

(f) Importation of certain industrial raw materials in bulk as a step towards achieving better economies of scale

(g) Decision over idle industrial capacities;

(h) Better application of research findings to industry.

3.2. The Current Economic Situation

Ghana is able to reach significant growth rates of its economy, because it is endowed with natural resources and human capital that, if efficiently exploited can provide a strong base for the manufacturing sector as a whole and agro-based industries in particular. The country has agricultural land that is potentially capable of producing adequate agriculture suplus that can sustain the agro-based industry. Further, Ghana has strong comparative advantages in the crops such as cocoa, palm oil, rubber, coconut as well as in tobacco, maize and cassava.

With regard to agro-based industries, Ghana has a clear comparative advantage in food processing, citrus products, cigarettes, beer manufacturing, dairy products and animal feed production. The potential of agro-based industry of Ghana warrants special emphasis in the industrial restructuring effort and the drive to promote productive and efficient growth dependent on foreign exchange. Agro-based industry offers good prospects for a larger and more efficient sector, that can contribute significantly to manufacturing value added and to foreign exchange earnings potential. In the present situation, however, the share of primary activities in total production and manufacturing is still considerably lower than the comparable average for all other developing countries, while agricultural performance has dropped badly. Given the close link between agro-based industries and agriculture, the disproportion has effected negatively upon manufacturing as a whole.

These economic difficulties are compounded by persistent balance of payment deficits faced in this country; the external debt of the country increased five-fold during the past decade while external reserves dropped to critically low levels. The expansion of manufacturing output is also hampered by sluggish domestic markets, inadequate raw material supplies for key industries, the lack of skilled and experienced industrial manpower, and shortages of imported materials. The situation is further aggravated by major difficulties stemming from the energy problems facing this country, despite its substantial energy potential. The inadequacy of the Ghana's transport and communication infrastructure coupled with the inefficiency of the services sector are also recognized as major obstacles to the socio-economic development of the country.

The generally stagnant nature of the domestic economy has inevitably depressed industrial investment and in turn, future expansion. The fact that the Ghanaian economy is still at an early stage of development means that certain

"structural" features come into play and condition the environment in which industry operates. Seen from a positive angle, the fact that these economies start from a small industrial base offers potential scope for industrialization, as does the rich natural resource endowment of Ghana. With the effects of unfulfilled promises of global development strategies being more sharply felt than in other countries, Ghana took steps towards the basic restructuring of the economic base of the country. Inspite of the mixed structure of industrial ownership, the main objectives of economic development in Ghana's independence has been to achieve a sustained increase in the standard of living for an increasing proportion of the population. In order to achieve this, the composition of output must shift from primary production to secondary activities i.e. to industrialization. Greater weight must be placed on the processing of local resources; agricultural output must be increased through the provision of such inputs as fertilizers, insecticides and agricultural equipment, while production must be diversified. To this long-term strategy of industrialization can be added the shorter term goals of an accelerated growth in output and the creation of employment opportunities so as to reduce unemployment or under-employment and contribute to the elimination of mass poverty.

3.3 Plans of Action for the Industrial Development

In recent years, new concepts have been incorporated in the economic development strategies. The Government of Ghana has prepared the ERP 1984-1986 in 1983 with above mentioned objectives. This programme has become the key feature of the industrial development of the country.
A major role is accorded to industry reflecting the commitment of the country to change the economic structure and to satisfy the basic needs of its population by exploiting local natural resources and establishing a base for the development of other economic sectors.

Quantitative and qualitative targets are also set in the programme for the industrial integration at the sub-regional levels.

It was expected that by 1984 industries would operate at an average level of 50% of their installed capacity with an eventual increase to 75% by 1986, the end of the ERP 1984-1986. Furthermore, the country will endeavour to lay the foundation for the development of the following basic industries essential to the achievement of self-reliance: agro-based and energy-generating industries.

The programme calls for a firm rejection of the isolated piecemeal planning of the past and a clear shift away from over-preoccupation with foreign exchange problems external to the region. The new approach is predicated upon a decisive move towards the integrated development of the human resources, institutional mechanisms and technological capabilities required to develop and utilize effectively the natural resources and material endowment of the country, expanding local markets, enlarging the range of complementarities and strengthening links between industry and other sectors of the economy.

The programme also emphasizes the importance of such factor inputs as raw materials and machinery, as well as technological, managerial and project planning skills. It maps out actions for both the preparation and implementation phase at the national level. This country is urged to adopt a national strategy based on a set of carefully selected strategic "care" industries appropriate to its resources and raw materials complemented by strategic support projects. During the implementation period of the ERP 1984-1986 under the Ministry of Industry's programme for the year 1986, capacity utilization in the textile industry is to be raised to 30 per cent in 1986 from 19.7 per cent in 1985. Consequently import licence requirements for the sub-sector has been projected at $28 million for the year 1986 against $19 million in 1985.

Capacity utilization in the food sub-sector including output of milk, wheat flour and edible oil is to be raised from an average of 45 per cent in 1985 to an average figure of 55 per cent in 1986. In the case of alcoholic beverages and tobacco, capacity utilization increased from 26 per cent in 1984 to 33 per cent in 1985. As it is a revenue earning sub-sector, the capacity utilization is to go up by about 20 per cent relative to output in 1985, to 40 per cent in 1986.

A new ERP is proposed for the years 1986-1988 which main policy initiatives will not differ much from the ERP 1984-86. The policy initiatives are based on the following:

a) The need to ensure the development of local resources for utilization by industry.

b) The need to promote strategic industries which will make the country more self-reliant.

c) The need to plan the development of industries.

d) The need to establish linkages in industry.

e) The need to reward those industries which contribute to the growth of the economy.

f) The need for industries to maintain reasonable prices.

g) The need for quality products from industries.

h) The important role research has to play in improving technology available to industry.

i) The need for industrial progress at less cost to the environment and the health of the people of the country.

j) The need to develop the managerial and technical competence in the industrial sector.

k) The need to produce for the export to earn foreign exchange.

l) Monitoring the implementation of programme and utilisation of resources allocated; evaluating and reviewing activities in the industrial sector.

m) The need to ensure that there is adequate man-power and logistic support in their implementing agencies to execute the programmes planned in respect of the guidelines.

Furthermore, it is provided to rehabilitate the agro-based industries with about $250.0 million for the three year period. The action programme of this ERP 1986/88 provide a closer co-operation between agriculture and the food processing industry in order to achieve an optimal level of efficiency. A consulting committee has therefore been appointed to promote the production, processing and marketing of each industrial group and foster appropriate linkages. The objective is to ensure a balanced and integrated development of each industry by conscious planning so that the industry can be assured of a firm agricultural resource base.

3.4 Population and National Resources

Ghana, which is divided into ten regions (Western, Greater Accra, Central, Volta, Eastern, Ashanti, Brong Ahafo, Northern, Upper East and Upper West), covers an area of 238,540 km^2. Provisional results of the 1970

census put the total population at 8.5 million and of the 1984 at 12.2 million, which would imply an annual average growth rate of 2.52 per cent.

Table 1 shows the distribution of population in 1970 and 1984, Table 2 shows the development of population from 1960 to the year 2000.

Table 1: Distribution of Population in 1970 and 1984(million)

Name of Region	Enumerated Population 1970	1984	Increase (%)
Western	0.8	1.1	37.5
Central	0.9	1.1	22.2
Greater Accra	0.9	1.4	55.6
Volta	0.9	1.2	33.3
Eastern	1.2	1.7	41.7
Ashanti	1.5	2.1	40.0
Brong Ahafo	0.8	1.2	50.0
Northern	0.7	1.2	71.4
Upper East	0.5	0.8	60.0
Upper West	0.3	0.4	33.8
TOTAL	8.5	12.2	43.6

* The 1970 census showed a high proportion (46.9%) of the population under 15 years of age; 3.6% of the population were aged 65 and over. In 1971 the urban population (localities with a population of 5,000 and over) totalled 2.6 million and the rural population 6.3 million. This figures changed unessentially in 1984/85. The country's economy is predominantly agricultural, involving the production of cocoa, coffee, tobacco, meat, sugar cane, timber, rice, maize, groundnut, coconut, oil palm etc. and employing some 53% of the labour force.

Ghana is also rich in minerals, chiefly gold, diamonds, manganese and bauxite. Considerable reserves of limestone and iron ore deposits remain to be tapped.

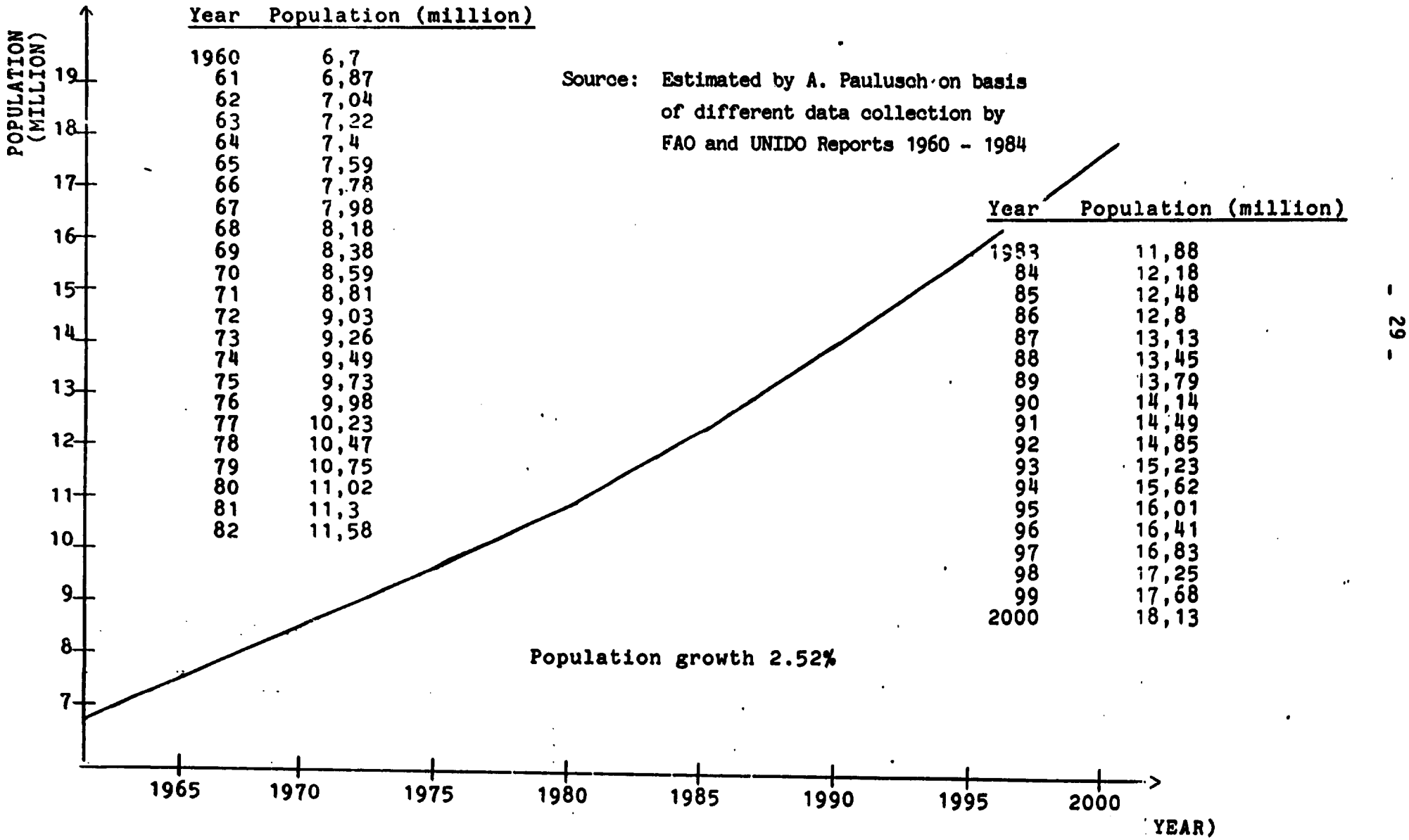
* Source: FAO Yearbook

Table 2: Population Development

Year	Population (million)
1960	6,7
61	6,87
62	7,04
63	7,22
64	7,4
65	7,59
66	7,78
67	7,98
68	8,18
69	8,38
70	8,59
71	8,81
72	9,03
73	9,26
74	9,49
75	9,73
76	9,98
77	10,23
78	10,47
79	10,75
80	11,02
81	11,3
82	11,58

Source: Estimated by A. Paulusch on basis of different data collection by FAO and UNIDO Reports 1960 - 1984

Year	Population (million)
1983	11,88
84	12,18
85	12,48
86	12,8
87	13,13
88	13,45
89	13,79
90	14,14
91	14,49
92	14,85
93	15,23
94	15,62
95	16,01
96	16,41
97	16,83
98	17,25
99	17,68
2000	18,13



Population growth 2.52%

Mining accounts for about 10-15% of the country's export earnings, the largest foreign exchange earners after cocoa. Like agriculture and forestry production, the output of all major minerals has declined steadily in the last decade. The reasons for the decline include shortages of foreign exchange to maintain and rehabilitate the mines, lack of capital investment for exploration and development, poor management, inadequate mining skills, and infrastructure deterioration.

3.5 Industrial Structure

In Ghana, the major thrust in industrialization has been limited to the production of consumer goods to meet demand formerly satisfied by imported goods, although a few export-oriented industries have been established. The industrial sector is still small and largely agro-based. Though once viewed as the major instrument of economic transformation and economic independence, it has failed to grow sufficiently, remaining structurally unchanged and dominated by the manufacture of simple consumer goods. Based mainly on small production units, for the most part import based with poor local linkages, industrial production has been geared to the demands of a comparatively small sector of the urban population: it has failed to integrate effectively the agricultural sector nor has any effective linkage been established with other sectors. Furthermore, the small production units themselves are isolated and since they lack linkage with the major economic sectors, their impact on development is minimal.

The manufacturing industry in the sub-region represents only a small fraction of total output: the overall share of manufacturing in the GDP of Ghana was 13.9% in 1980 at constant (1975) prices. Ghana's economy is dominated by its agricultural sector which, including forestry, accounted for 53% of GDP in 1983. In recent years, cocoa has accounted for about 18% of agricultural GDP,

other crops for 62%, livestock for about 7%, fishing for 3% and forestry for about 10%. Agricultural exports account for about 77% of total merchandise exports with cocoa accounting for 73% and forestry products for 4%. About two thirds of the population lives in rural areas with agriculture employing about 57% of the total labour force. Total gross area of Ghana is 23.8 million hectares and approximately 11% of total land area is under cultivation with cocoa estimated to cover some 50% of the total cultivated land.

The land use is presented in Table 3.

Table 3: Land use in 1000 ha

	1976	1978	1979	1980	1981	1982	1983
Total Area	23,854	23,854	23,854	23,854	23,854	23,854	23,854
Land area	23,002	23,002	23,002	23,002	23,002	23,002	23,002
Arable land	1,050	1,070	1,090	1,090	1,090	1,100	1,100
Perm crops	1,650	1,650	1,660	1,670	1,670	1,670	1,670
Perm pastures	3,520	3,490	3,480	3,470	3,460	3,450	3,440
Forest and Wood	9,180	8,910	8,840	8,770	8,700	8,630	8,560
Other land	7,602	7,882	7,932	8,002	8,082	8,152	8,232

Source: FAO Yearbook 1984

The bulk of the country's agriculture production is by small holders using.

4. The Food Industry in Ghana

Since self-sufficiency in food, the development of industry and the training of human resources are basic priorities in ERP 84/86 and ERP 86/88 the development of viable food processing industries becomes vital.

A food industry development strategy and programme as an integral part of the national policy for economic development based on self-sustainment can substantially reduce food looses, increase food production and supply through improved marketing and distribution and enhance income distribution. Furthermore, the food processing industry can contribute effectively to overall economic development through its widespread internal linkages.

4.1 Current Situation of Food Industry

The food processing industry, especially for staple foods, is characterised by relatively small economies of scale, high labour intensity, and relatively low capital investment. The need for food processing generally exists first from the fact that basic foods most of which are perishable, are produced in locations far away from the centres of high consumption. Secondly, harvest times generally precede the dates of consumption by months. Thirdly, food production, where production depends on rainfall rather than irrigation, is subject to wide variations in harvests - some years witness heavy surpluses and others dismal failures. Given these factors, the introduction of food processing requires far better storage, which reduces food losses by limiting spoilage and cuts costly transportation by dispersion over different parts of the country. As indicated above, this, together with increasing nutritional levels relative to population growth, has the effect of widening and stabilizing the food market and thus stabilizing the prices of production which in turn encourage farmers to produce.

The formulation of a "food policy" as an integral part of the self-reliance and self-sustaining development process would thus enable the country to identify and choose food products for processing with a view to the nutritional needs of the majority of the population in different ecological zones of the country. The choice of a flexible, but wide national "diet-basket" and its promotion would thus tie food research to production by the majority of the rural population under different ecological regimes so as to generate rural incomes. This income and production policy would, in turn, through proper marketing and distribution, promote the domestic market for processed and unprocessed foods. By making potential demand effective, this widened national food market would be a reliable incentive for farmers to adopt new production techniques and increase productivity. In this way, by producing what they consume the Ghana economy would become their own best and most reliable market, thereby initiating the internal feedback required for self-sustaining development.

In aiming at the priority goal of food self-sufficiency, it must be recognized that the food production - processing - marketing system represents an integrated and inter-dependent relationship since no area can be developed in isolation. Viable food industries depend on steady supplies of raw materials of suitable quality, based on a demand for the final products. The interdependence inherent in this food "system" means that several government ministries, agencies and other bodies are involved, and requires an effective own system of organization and management.

The development of agro-based industries is critical to Ghana's attainment of self-sufficiency in food production and a priority of the ERP. Their development would help greatly to reduce post-harvest losses, increase food availability and contribute to food security in the country. The development of this sub-sector would also help to reduce imports, increase the value of raw materials, augment export revenues, raise employment levels and improve incomes.

It would also increase opportunities for investment in agriculture (farming and stockbreeding) and associated processing industries, as well as stimulate the development of the allied sub-sectors, such as engineering and energy.

4.1.1 Food Processing

This sector was largely established during the period 1960-71 and engaged a growth period that reached peak production around 1976/77. A decline in production has followed to date, the principal constraints being the restrictions occasioned by a diminishing availability of foreign exchange. A reduction in the import of raw materials and spare parts has permitted a decline in overall processing accompanied by a rapidly deteriorating condition of process plant. The companies that were sampled operated at an annual average capacity utilization from 12% to 25%. The sharpest decline in output between 1975 - 83 took place in sugar production. In 1975 11,347 t of sugar were produced in Ghana. Production reached 12.130 t in 1976 and declined continuously to 56 t in 1982. No sugar is produced today. Wheat flour production reached the level of 92,960 t in 1979 only to decline to 25,401 t in 1982. Between 1975 and 1983 production of milk declined by an annual average of 13.7% and cocoa products declined by an average of 8%.

4.1.2. Brewing and Spirits Industries

In 1975, 63 million liters of brewed beer and stout were produced in Ghana. Production reached a peak level during 1976-77 with 77.5 million liters. Since then production fell continuously to a level of 31 million liters in 1983. The fall-off in the level of production since 1977 has been caused by the combination of inadequate replacement spare parts, aging plants and low levels of imported raw materials.

The breweries are now operating at approximately 30% of original rated capacity as approximately 50% of feasible

capacity. That is an improvement compared to recent years, attributed mainly to some improvement in the availability of raw material supply. Raw materials for the industry are almost wholly imported.

Production of distilled and blended spirits was halved between 1977 and 1981 and today that activity in Ghana consists of blending of imported concentrates while virtually no distilling is taking place in modern sector plants.

4.1.3. Vegetable Oils and Fats

Data for the edible oil production are very difficult to collect in Ghana. However, there are strong indications that production of all oils and fats experienced sharp declines or stagnated between 1970 - 1979. Furthermore, production of margarine declined between 1975 - 1983 by 22%. Production of cocoa butter, cocoa liquor and cocoa declined between 1975 - 1983 by an average of 7.4%, 8.2% and 7.2% respectively. The drop in production resulted mainly from inadequate supply of cocoa beans. Capacity utilization in the industry ranges from 5% to 50%, and most of the problems are associated with shortages of raw material, frequent breakdown of old machinery and the lack of spare parts.

Vegetable oil extraction in Ghana is performed at different levels: by the traditional village method; through small scale rural mills; and by the modern large scale mills. Most of the crude vegetable oil comes from oil palm, coconuts and groundnuts. Palm oil is the most preferred oil with groundnut oil and coconut oil being the main but less acceptable substitutes for domestically consumed oil in Ghana. Sheanut is also an important source of oil in the northern part of the country and there are some experiments involving oil extraction from other seeds such as cotton seed, soyabean, cashewnut, sesam and sunflowers.

4.1.4. Flour Milling

Ghana has been importing increasing quantities of wheat for milling. While in 1975, 83.200t of wheat were imported, in 1982 imports increased to 120,000t. Climatic conditions are not favourable for the growing of wheat in Ghana. But under the influence of urbanization, consumers tastes, particularly of the higher income groups, are gradually switching usually from the traditional staple foodstuff made from maize, sorghum, millet and cassava, toward western convenience food such as white biscuit and biscuit made from imported wheat.

In 1984/85 Ghana imported 100,000t of wheat, but the demand for wheat has been estimated at about 275,000 t.

The total milling capacity of wheat in Ghana is at present 210,000 tons. The actual capacity utilization in 1985 was, however, only about 35%, lack of spare parts and wheat being the main reasons.

4.1.5. Citrus Products

The industry is processing lime fruits from local farms to produce lime juice, lime oil and dried lime peel. The products are almost all exported. The industry operated until 1981 when it was forced to shut down mainly because of the over valued exchange rate prevailing. The industry resumed operations in 1983 and immediately began exporting its products.

There were around 4,000 to 5,000 acres under lime trees in the neighbourhood of the processing plant, all of which are operated by private farmers. Most of the farmers are small-scale with about one acre each. As a consequence of the close-down, no fruits were purchased from November 1981 all through 1982. More than 3,000 lime farmers lost the most important market for their fruits and stopped maintaining their farms.

The new ownership rehabilitated the plant facilities and initiated a campaign to rebuild the relations with the farmers. The lack of maintenance of the farms since late 1981 as well as the drought in 1983 produced only a meagre lime crop in that year.

In 1984 lime fruit was collected from 2,000 acres only while it is estimated that in the short-run the potential area will be 3,000 acres. There are three reasons for the poor performance of the farming and collection of lime:

- the neglect of lime farms and the lack of maintenance by farmers;

- the mistrust of the farmer in the processors following the year long closure of the plant;

and

- the poor state of the processor's transport equipment.

4.1.6. Animal and Meat Production

The general objectives of the livestock industry in Ghana are to increase the quantity and quality of livestock production in order to achieve maximum self-sufficiency in meat and animal products. The magnitude of the tasks is revealed by the fact that in 1976, about one third of the estimated total meat consumption of the country came from external sources. The demand for livestock production was assumed to increase at a rate of four to seven per cent per annum creating a widening gap between demand and production. Table 4 shows the livestock production development between 1978 to 1984.

Table 4: Livestock Development (1000 heads)

	1978	1979	1980	1981	1982	1983	1984
Cattle	900	930	950	950	970	1002	1014
Milk Cows	135	140	143	143	146	150	154
Pigs	390	400	415	415	435	435	450
Sheep	1600	1650	1700	1700	1750	2000	2000
Goats	1900	2000	2100	2100	2150	2150	2150
Poultry	11000	11500	12000	12500	12000	13000	13000

*

The slaughtered animals are illustrated in Table 5 and the meat production in Table 6. Although overall production is expected to increase, demand is expected to increase faster creating excess demand in all meat. In order to achieve the

Table 5: Slaughtered Animals (1000 heads)

	1978	1979	1980	1981	1982	1983	1984
Cattle	108	112	114	114	118	118	118
Pigs	312	320	332	332	348	350	350
Sheep and Lamb	420	420	435	445	450	450	450
Goats	580	600	635	635	650	650	650
Poultry	11000	11500	12000	12000	12500	13000	13000

*

objectives of self sufficiency in meat, priority should be given to the planning and programming of livestock development and adequate funds allocated for this purpose.

The poultry industry has expanded rapidly since its inception in the mid 1960s with the establishment of a commercial hatchery in Accra. While in the 1960s Ghana was

* Source: Ministry of Agriculture

Table 6: Meat Production ('000tons)

	1978	1979	1980	1981	1982	1983	1984
Beef and Veal	12	13	13	13	14	14	14
Pork	9	9	9	9	10	10	10
Mutton	5	5	5	5	5	6	6
Goat Meat	6	6	6	6	6	6	6
Chicken	14	16	18	18	19	20	20

*

importing day old chicks, in 1978 production from the hatcheries totalled 4.6 million day old chicks per year and in 1984 production is estimated to exceed 9 million day old chicks per year representing substantial foreign exchange savings to the country. The aggregate capacity of the hatcheries in Ghana is adequate to meet the needs of the nation's poultry industry. However, the service they provide to growers is sufficient in spite of delays in distribution, and low quality of chicks. Furthermore, the poultry industry is reported to be capable of meeting the meat and egg requirements of the country provided that adequate supplies of the day-old chicks, vaccines, drugs, feed meal and feed supplements are available.

4.1.7. Dairy Products

The production of dairy products is very low in Ghana. Only two enterprises are equipped to process fresh milk. One of these is with an own cattle farm. All other visited enterprises are processing imported milk powder into milk drinks, reconstructed milk and ice cream. Furthermore, some small scale enterprises produce butter, cheese, yoghurt and drinking milk from fresh milk, which they buy fresh from small holders and small farms. Big cattle farms are not existing in Ghana. Milk is a perishable product which is produced essentially in villages far away from centres of

* Source: Ministry of Agriculture

of high consumption. The poor traffic connections from the farmers to the consumers and processing industries is a main reason for non-availability of locally produced fresh milk and dairy products.

4.1.8. Sugar Production

The sugar industry constituted the largest single investment in Ghana's agriculture products processing sector. Until the early 60s refined sugar was not produced in Ghana, though increasing quantities were being imported. Until 1982 sugar cane processing was carried out in the large scale factories in Asutsuare and Komenda. Sugar cane is also processed, using traditional methods to produce juice for local gin called akpeteshi.

It was estimated that up to 1978 an equivalent of approximately US$50 million has been invested into Ghana's sugar industry. Its total production continuously declined from 11,347 t in 1975 to 56 t in 1982. Since 1982 the sugar mills have been out of operation. Without any output of domestic granulated sugar, imports nave been only sources of supply reaching 43,500 t in 1982.

Because of very low sugar can supply and problems with equipments, the factories have never operated at the designed capacity. Maximum daily throughput in Asutsuare has once been 1,600 t of cane, while the plant is designed for 2,500 t per day. Underutilisation of equipment and the frequent factory interruptions contributed to increased wear and tear and general deterioration of plant and machinery. Critical shortages of spare parts contributed to the accelerated deterioration.

4.1.9. Animal Feed

This industry principally grinds, mixes and packages an assortment of ingredients to produce a balanced animal feed

for the livestock industry, mainly for poultry and pig production. The feed mills depend mainly on locally produced maize, wheat bran, fish meal,oyster shells, groundnut, sorghum and coconut cake and on imported pre-mix, vitamins and minerals. The major constraints on the industry, which operates at a capacity utilisation of about 25% - 30%, are the shortages of imported inputs and the irregular maize supplies. The industry is in direct competition with human consumption of maize and frequent shortages of maize cause low capacity utilisation and increases in the domestic price level.

The feed requirements of the livestock industry are very high and the production of poultry and pigs in Ghana depends critically on the adequate supply of animal feed and concentrates. There are a total of seven commercial feed mills in Ghana with total milling capacity estimated at 50,000 t per year. In addition to these units, both the breweries and the flour mills sell some of their by-products directly to poultry growers. In 1975/76 the total feed requirements were 75,000 t of which 40,000 t were maize. In 1984 a bumper crop year, total production of maize was about 500,000 t and the demand for maize as poultry feed is estimated to be 30,000 t.

4.1.10 Cocoa and Cocoa Processing

Exports of agro-industrial products from Gnana are dominated by cocoa products, i.e. cocoa butter, paste and cake. Export of cocoa butter and paste continuously declined during 1973 to 1983 as a result of the over-valuation of the currency and shortages of cocoa beans. Export of cocoa cake recovered in 1982 but is still well below the level reached in the early 1970s.

Although the production of cocoa beans has been increased (160,000t in 1983; 188,000t in 1984; 195,000t in 1985 and in 1986 is expected to produce 220,000t of cocoa beans) and

the capacity of the processing industry is 40,000t cacoa beans per year, it is not possible to meet the requirements for the own consumption and export of cocoa products. The industry is well managed and has high technical expertise in all aspects of production. However, the omission of capital investments in terms of replacement machinery will create a critical situation in the future.

4.1.11. Fish and Fish Processing

Fish and fish products are one food of the highest priority of nourishment in Ghana. The per capital consumption of fish and fish products are estimated at 26 kg/a in 1985, compared with meat (12.0kg/a in 1985), fish products are the biggest source of animal protein in this country. The catching results for fresh fish are summarised in Table 7.

The Ghanaian fishery resources are harvested by three fleets: the traditional canoe fleet, the inshore fleet of medium-range motorized fishing vessels; and the deep-sea fleet. The most important resources exploited at present are the sardinellas, and mackerels. The abundant tuna resources of Ghana have, so far, been exploited mainly by foreign and Ghanian manned vessels operating under licence. Shrimps resources are currently under investigation for commercial

Table 7: Catch quantities of fisheries in 1000t

	1978	1979	1980	1981	1982
Fresh water fish	36,3	39,4	40.0	40.0	40.0
Brackish water fish	9.0	4.0	4.3	4.1	3.9
Sea fish	211.5	183.3	178.4	185.3	179.9
Crustacean	0.8	0.4	0.7	0.7	0.6
Molluscs	0.7	0.3	0.7	0.5	0.5
Total	258.3	227.4	224.1	230.6	224.9

Source: Ministry of Agriculture

exploitation. In addition, the inland waters of the country, particularly the Lake Volta reservoir, yield some 44,000t of fresh water fish and molluscs, per annum. Being a fish eating country with a high consumer acceptance for traditionally smoked and dried products, the per capita consumption is with 25,8 kg remarkably high, even in the interior of the country and is one of the highest in Africa.

The fish processing industry is very poorly developed. There is one factory for the production of smoked fish with a capacity of 2,400t/a utilized with 10%, and three canneries with a capacity of 14,000 t/a from which one is utilized with 90%, the second with 15% and the third has never worked after completion.

4.1.12 Agriculture - Industry Linkages

Although agriculture remains the major source of employment, food, industrial raw material and foreign exchange for the country, its decline had to be compensated by substantial imports of food, which increased the drain on limited foreign exchange resources. Total food production dropped more than 1.28% per year in the period 1974 to 1984, while the Ghanaian population expanded at an average annual rate of 2.52 per cent. As a result, per capita food production dropped at an average annual rate of about 3,7 per cent in the same period. Table 8 shows the production indexes of agricultural products.

Agricultural exports decreased in all traditional groups and the resultant low level of rural incomes has led to a massive exodus to urban areas. These conditions have been exacerbated by inclemency of weather, in particular drought during recent years, while other contributing factors are poor farming methods and problems related to the procurement and distribution of agricultural inputs, as well as the failure to develop industries with forward linkages to agriculture.

Furthermore, the neglect of agriculture has led to foreign exchange shortages and a reduced investment surplus so that many industries now face difficulties in obtaining imported raw materials, intermediates, replacement machinery and equipment, spare parts or adequate financing for investment. This situation must be improved basically to allow a transformation of the present imperfect linkages between industry and agriculture into positive ones, so that industry and agriculture grow together in harmony.

4.2. Objectives for the development of food industries

The action programme of the MIST has identified the following nine objectives, given in the ERP 1986-1988:

a) reduction of post-harvest food losses (during processing, preservation, storage, transportation and marketing);
b) identification of new areas for small-scale industries to process agricultural products;
c) rehabilitation of the transportation system to provide inputs to the farmers, and to deliver the crop with minimum losses to storages and factories;
d) attainment of national food security;
e) training for technical and managerial staff;
f) inter-country co-operation, including food trade, marketing and distribution as well as training;
g) local manufacturing of simple food processing machines, especially for small-scale enterprises, but also for bigger plants;
h) development of primary agro-based industries to ensure intermediate materials inputs for further stages of processing industries;

Table 8: Agricultural Production Indexes (1974 - 76 = 100)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Gross											
Food total	108.77	100.18	91.05	85.12	84.08	89.11	86.81	87.35	84.86	81.37	95.82
Agriculture	108.46	100.25	91.29	85.36	84.16	88.80	86.64	87.18	84.75	80.72	94.81
Crops	109.84	99.96	90.4	81.13	79.62	84.73	81.4	81.26	77.58	71.40	87.39
Livestock	98.12	101,89	100.08	117.91	121.88	124.03	132.48	138.49	144.25	171.70	152.49
Cereals	114.58	89.91	95.51	94.21	82.71	106.89	89.36	99.53	66.13	41.56	108.13
Per Capita											
Food total	111.54	100.12	80.07	80.07	76.64	78.66	74.21	72.30	68.01	63.12	71.94
Agriculture	111.23	100.20	88.30	88.30	76.71	78.30	74.06	72.16	67.92	62.62	71.20
Crops	112.42	99.89	87.70	76.31	72.56	74.79	69.58	68.25	62.16	55.38	65.61
Livestock	100.72	102.02±	97.26	111.13	111.31	109.69	113.46	114.81	115.80	117.86	114.72
Cereals	117.49	89.86	92.65	88.62	75.39	94.36	76.39	82.37	52.99±	32.24	81.20

Source: FAO Year book 1983, 1984

i) Utilization of external assistance for selected fields of agro-based industries (investment, technical assistance and training).

The main project ideas are related to:

- Meat, milk and dairy products
- Cereals production and grain milling
- Marine products, inland fishery
- Feed production
- Baking and biscuit production
- Cocoa processing
- Sugar production
- Edible oil production
- Fruit and vegetable processing

4.2.1 Meat, Milk and Dairy Products

The development of the meat industry which is considered to have a high potential in Ghana, can only be successful, if all the aspects of the industrial production as supply of suitable raw material, handling, processing, packaging, storage, distribution and marketing form an integral whole. Failure of even one of the production stages can easily result in adverse effects on the viability of the whole process.

The meat industry is still at an early stage of development in Ghana, which is reflected by the few industrial slaughter houses and meat processing industries and their small production of meat and, in particular, of processed meat products. It is necessary to increase the livestock, especially for cattle, pig and poultry to meet the demand for meat in the future. Furthermore, it is possible to improve the milk production to reduce the import of milk powder and dairy products.

Considerable amounts of dairy products are imported to Ghana from developed countries. Thus, investment of milk and dairy product processing can save foreign exchange provide employment and reduce production costs.

4.2.2. Cereal Production and Grain Milling

The change of the consumption habit to consume white bread raised the import volume of wheat at an average annual rate of 10 per cent (1975 - 85), totalling over 270,000t in 1984/85. Sixty per cent of these imports are used in the manufacturing of bakery and biscuit products.

It is estimated that there are no possibilities to change the situation. The only way to minimize import costs is to purchase wheat during the harvest season at low prices. In this case it is necessary to erect new cereal storages and to widen present milling capacity.

The erection of a cereal storage system is not only important for imported wheat, it reduces also the post-harvest losses of local food grains like rice, maize, millet and sorghum and improves the seed situation of local cereals.

The objectives of providing suitable storage facilities for food grains are these:

a) conservation of food grains by minimizing qualitative and quantitative post-harvest losses;

b) attainment of self-sufficiency in food-grain requirements;

c) regulation and possibly minimizing of private intermediaries in procurement, handling, storage and distribution;

d) establishment of public-sector storage facilities:

   i) stabilization of consumer prices and protection of the interests of low-income groups;

   ii) assurance of reasonable prices to producers as an incentive for increased production;

   iii) maintenance of stocks as a buffer against periodic and unforeseen shortages and consequent high prices;

e) research and development of technologies:

   i) increased use of local raw materials in building storage facilities of different scales and designs suited for different purposes, especially at farms and in villages;

   ii) development or adaptation of technologies that farmers can afford to install and use;

f) generation of increased employment opportunities in the building of low-cost structures at the farm and village levels.

4.2.3. Marine Products, Inland Fishery

Fish, crustacean and other marine food and inland fish products represent an important source of protein which, in general, is only available in coastal and Volta lake areas. Owing to the rapid spoilage of fish, a system must be developed for the chilling, cold storage and refrigerated transportation of fish, as well as its processing by salting, smoking, and canning; provision should also be made for the production of fish meal. Such a system would preserve the fish and permit its distribution to more distant regions.

4.2.4. Feed Production

The main objectives of the animal feed industry are to deliver the animal producers with a balanced animal feed with a high quality and in sufficient quantity. However, the present milling capacity at 50.000 t/a is not sufficient to meet the feed requirements now and in future.

The task of the animal feed industry is to utilize the installed capacity and to erect new feed factories to produce feed especially for the poultry, cattle and pig production. Furthermore, the mills would like to purchase appropriate transportation to distribute their finished feeds over a wide area and return to the mill with locally purchased raw material. Ghana's self-sufficiency in animal feed is attainable, and necessary variations in formulation can be achieved using the processing by-products of the commodities like cereals, roots, vegetable oil seeds, fruit and vegetables.

4.2.5. Bakery and Biscuit Production

Bread is the most important product derived from wheat flour. Bread making ranges from one person bakeries to medium-scale factories with an estimated total capacity of

more than 250.000 t/a and a capacity growth on an average of 15,000 t/a in this country. With the above mentioned increase of the capacity it is possible to cover the demand of bakery products.

Although many bakeries produce biscuits and two biscuit factories with a capacity of 4,000 t/a exist, it is not possible to meet the demand for buiscuits. The actual capacity utilization in 1985 was, however, only about 18%, lack of spare parts and raw material being the main reasons. A third biscuit factory with a capacity of 5000 t/a has never started to produce because of interruption of investment in 1981.

The bakeries and biscuit factories are highly dependent on imported raw materials, especially on flour, yeast, sugar and fats. Nearly 30% of wheat flour, 50% of sugar and 100% of yeast at the demand are purchased on the parallel market only from the bakeries. The rehabilitation of the sugar industry, the establishment of a yeast factory which is also very important for the animal production, the continuation of the investment of the biscuit factory, immediate supply of spare parts for bakeries and biscuit factories and supply of adequate raw materials should be considered.

4.2.6. Cocoa Processing

Ghana has two cocoa processing plants with an installed capacity of 40,000 t basic cocoa butter per year. This industry which is equipped with second hand technologies, has been established in 1965 and is also equipped to produce in addition to cocoa butter, cocoa cake, cocoa paste and chocolate.

The cocoa industry is running at about 30% utilization on cocoa butter. The highest production was of 21,000 t in 1977.

Both process plants, because of shortages of spare parts and lack of investments, are in a very bad state of repair. A study of the whole process should be carried out to develop cocoa production from the farming up to the processing industry to meet the requirements for exports and for local consumption.

4.2.7. Sugar Production

Although Ghana is able to produce sugar in sufficient quantity to meet the requirement of the sugar consumption, and two sugar factories with a capacity of about 45,000 t/a are installed, the whole sugar is imported. The sugar mills have been out of operation since 1982. In order to reduce the very high expenses of sugar imports (between US$40 million and US$60 million) the rehabilitation of the sugar industries should be considered.

It has also become increasingly clear in recent years that the future of the sugar industry depends on successful utilization of sugar by-products. The by-products considered are bagasse and molasses.

The big factories can be a source of energy supply for both the industry and the community since they generate steam from burning bagasse and use this in turn to generate electricity. Furthermore, a sugar mill processing 1,500 - 2,000 t of cane per day can produce a bagasse surplus of 10-15 per cent beyond its own fuel requirements. With higher thermal efficiency, surplus bagasse production could rise as high as 25 per cent of the total. This bagasse can be used as raw material to produce fibrous pulp for manufacture of paper and cardboard.

Molasses, the liquid residue from the process of sugar crystallization, is a source of carbohydrate, which can be used to produce animal feed, single-cell protein, ethyl alcohol or dextron.

4.2.8 Edible Oil Production

A characteristic of the edible oil processing industry in Ghana is that a significant percentage of the oil is produced in small-scale enterprises using traditional technologies. The annual per capita consumption of oils for food is very high and has been reported to be 11.2 kg in Ghana. The most important raw material is the fruit from the oil palm tree. Apart from processing oil, leaves and trunks of the tree also provide material for construction and household items, while tapping of the tree is a source of palm wine. On the industrial side, palm oil is an important ingredient for soap and margarine manufacturing.

The vegetable oil industry presents widely varying plant sizes and production capacities. Establishments vary from small-scale, simple oil-seed crushing units to large enterprises with modern technologies.

In general, traditional technologies have tended to have a low degree of raw materials utilisation. Considerable improvements could be brought about in oil extraction, refining, margarine production, as well as in the utilization of by-products such as oil-seed cake and meal. The employment potential is quite large and the industry tends to increased decentralisation. Oil-palm processing should be performed within the cultivation area, because of the rapid deterioration of the fresh fruit branches; however, even other oil-seed could be processed conveniently close to the production of the raw material.

For the development of a sound oils and fats industry, the following factors should be taken into account:

a) Efficient utilization of indigenous oil-bearing raw materials for the production of oils and fats, and the maximum utilization of their by-products;

b) Fuller utilization of installed capacity for vegetable oil extraction, refining, processing;

c) Utilization of oil-seed cake and meal as sources of protein for the development of animal-feed industries;

d) Establishing or strengthening of national technological institutes for the selection, development, application and transfer of technology, and for the provision of extension services and information, including the development of design and engineering capabilities to manufacture the equipment and machinery required for the industry.

4.2.9. Fruit and Vegetable Processing

Both domestic demand and export opportunities for processed fruits and vegetables are good. However, this particular sector often lacks reliable supplies of raw material in a quality that meets the requirements of export. Furthermore, in the villages and areas with low density of yields, attention should be given to mobile processing units.

This industry uses a high share of local raw material in its products. Two of these factories, which are located in Nsa[illegible] producing orange juice, pineapple juice, pineapp[illegible]es, grapefuit juice, orange squash and lemon juice drinks, are very well equipped.

4.2.10 Beer Brewing

The four breweries in Ghana with a present total installed capacity of about 1,800 thousand hl of beer are operating at relatively high level of capacity utilization which moved around 55%. That is an improvement compared to recent years, attributed mainly to some improvement in the availability of raw material supply. Raw materials for this industry are almost wholly imported. The most restrictive elements in terms of process continuity are the bottle lines. They consist of a bottle washing facility, filling section and pasteurizing process. Sometimes bottles have been improper cleant and overfilled, falling off the line conveyor system due to insufficient maintenance and supervision. This situation is extremely wasteful of the imported ingredients utilized in the brewing process and is increasing the bottle shortage.

A problem facing the beer production, is the supply of bottles for the breweries. The GIHOC Glass Factory was unable to cover the local demand and was forced to import bottles. The beer manufacturers tried different schemes to have used bottles returned to the factories, however, unless the GIHOC Glass Factory increases its production for the beer industry the breweries will not be able to significantly increase production.

Costs for spare parts for these ageing plants are proving to be expensive since suppliers have to manufacture many of them especially. Original spares are not available from the stocks. This special manufacture results in cost increases and delays of up to eight months from date of order to delivery.

The efficiency and reliability of steam generating boilers is critical for the brewing process. In this respect, production depends fully on the continuous supply of steam produced economically and safely. The general condition of steam generating equipment in most cases is poor in both safety aspects and the efficient use of fuel and power.

The following conclusions can be derived as regards to this industry:

a) Immediate supply of spare parts;

b) Rehabilitation of the steam generating equipment and bottle lines;

c) Undertake a study of the constraints on increased production of bottles by GIHOC Glass Factory.

4.3. Necessary Activities to Develop The Food Industry

Among the activities that need to be undertaken are:

a) Formulation of national nutritional targets and food industry policies;

b) Enactment of appropriate legislation to encourage and facilitate investment in the food industry at the national levels;

c) Continuous review of projected demand for processed foods as well as of prices and subsidies so that agricultural production of basic crops can be stimulated, and food processors are ensured a reasonable profit;

d) Formulation of national food industry development programmes establishing effective links between food research and food processing activities, and the introduction of research results into production paying serious attention to ensure linkages between agro-industries and the other industrial sub-sectors;

e) Continuous supply of raw materials of a suitable quality and in requisite quantities;

f) Formulation of development programmes for the support, establishment and strengthening of indigenous food-processing and distribution companies;

g) Integration of food production, processing and marketing into one system, control over that system in day-to-day government activity, and appropriate organisation and management so that food supply and demand are balanced;

h) Provision of financial sources needed to increase implementation and volume of investment;

i) Preparation of labour training courses and appropriate co-ordination of eduction and training programmes to meet the technical and managerial needs of the food industry.

5. Demand Development of Important Foodstuffs and Beverages in Ghana

5.1. Introduction

The process of developing industrial plans consists of a number of stages that are closely linked with each other. The first of these is the pre-planning stage which consists primarily of preparing the informational and statistical base.

Industrial plan preparation requires in the first place a comprehensive statistical basis to analyse past and current industrial activities and evaluate necessary indicators, moreover, implementation of plans also depends on up-to-date indicators to help evaluate progress and introduce readjustments.

Thus, staticial data about past and current activities constitute the necessary initial materials for the preparation of the industrial plan. Moreover, the higher the quality and scope of available statistical informations the greater the extent to which it is expressed in operational terms, the more it contributes to the quality of the industrial plan, particularly in ensuring its internal consistency as well as coherence among different objectives and real opportunities of industrial development.

Planning in the food and beverage industry in Ghana is handicapped by the lack of a comprehensive informational and statistical base. There is a lack of reliable up-to-date information about national income, consumption, accumulation investment, capital formation and employment. It is even more difficult to find relevant data on sectorial activities such as agriculture and manufacturing industries.

However, Ghana should not abstain from industrial planning under the pretext that comprehensive statistical data do not exist. The planning process itself generate additional data and qualitative information. Therefore if we postpone the planning process, we might also risk postponing the right development of the country. It is extremely important that officials, engineers and economists at different administrative levels as well as managers and workers should participate in the process of collecting the necessary data and information for plan preparation.

Experienced personnel can often help to analyse a situation and overcome some obstacles connected with deficiencies of data.

Planning is a perpetual process which can never be completely perfect; hence the informational and statistical data base required for planning is also never complete. The established minimal information and data base for starting the planning process should, therefore, be developed so as to meet future planning needs. This must in any case be computerized. In this connection some organizational efforts are required to facilitate a proper collection, transmission, storage and retrieval of information.

The base of the following data in this chapter particularly the trend of the per capita consumption are statistical materials from the Central Bureau of Statistics, Ministry of Agriculture, Ministry of Trade, Ministry of Industries, Science and Technology, FAO, UNDP, Associations and Enterprises which include such figures like consumption, production, imports, exports, the level of stocks at the beginning of the year and the level of stocks at the end of the year during the years 1970 - 1985. Data and gaps, which were not available, have been estimated in order to obtain

a trend to calculate the development of the per capita consumption and the demand for food and beverages.

Although, the demand for the most important products is ascertained, on the base of new knowledge, modification of living conditions, change of food habits etc, a constant improvement of the fiures will be necessary.

5.2. Demand

5.2.1. Changing Characteristics of Food Demand

Despite its quantitative importance in total industrial production, food processing is not a dynamically expanding sector. In company with other traditional branches of light manufacturing it has exhibited a lower growth of value added than has manufacturing as a whole.

The pattern of demand for the products of the food industry, and therefore the development of the sector as a whole, depends on such factors as climatic conditions; level and distribution of income; structure of population; urbanization; culture and tradition. What people eat is also affected by what is available to them. Supply factors, including transport, trade opportunities and more particularly, the marketing and promotion policies of local prices are combined with government policies and other socio-economic aspects, to form the dietary practices that underlie the demand for food.

Differences in the relative importance of these considerations over time have led to sharply contrasting patterns of demand for food in developing and developed countries. Thus, the value of resources required to sustain per capita food consumption in developed market economy countries is about two and one-half times as great as in developing countries. In part these differences reflect the simple fact, that higher per capita income permit people to consume more and qualitative better food in developed than in developing countries; an average of 3,400 calories per person per day in developed countries, as compared with 2,300 calories per person per day in developing countries. The income differential also makes it possible to eat more expensive food - more meat, for instance. Over two-thirds of food expenditures in developed market economy countries is concentrated on protein rich items such as meat, eggs and dairy products while only about 10% is direct consumption of corn, cereals and pulses. For developing countries the corresponding figures are on third and 40 per cent.

Rising domestic consumption of commercially processed foods in place of fresh, unprocessed products corresponds both to the increasing commercialization of agriculture and to the expansion of population in the cities, where longer distances from the point of production and perishability render it technically unfeasible for primary producers to supply food directly to large masses of people. To some extent, raising incomes and other socio-economic changes associated with city life have also contributed.

Large parts of the population of Ghana still live in rural areas and either produce their own staple foods or obtain them from local producers. In the cities, where self-supporting is less feasible, the poor rely on a few

staples for the bulk of their diet and only a small proportion of the food they purchase such as flour, rice, bread and dried fish - undergoes more than an elementary processing. The market for higher processed, usually branded foods, is confined mainly to families with higher incomes who can afford the higher unit cost in comparison with relatively unprocessed food. Through advertising and product differentiation techniques, manufacturers of some processed products such as beverages and confectionery have succeeded in selling to lower income consumers, thus shifting demand somewhat from unprocessed staples.

The application of technology in the food industry has gone far beyond fulfilment of the mere function of preventing spoilage and increasing the storageability of food which were originally its main functions. In its efforts to overcome the natural tendency for appetites to reach statiation, the industry has sought new means to compete for its share of rising consumer expenditures. It has made available a greater, and to some extent specious, diversity of products to lower and middle class families and has utilized advertising media and brand identification to promote and differentiate them in the consumer's mind. In doing so, the food industry has benefited not only from rising incomes but also from changes in living and working conditions with their resulting effects on food consumption habits, the increased employment opportunities for women outside the home and the need to consume food away from home because of longer distances and traffic bottlenecks between home and the place of employment. In general, the trend has been toward products whose consumption saves time and which seem to embody additional or more complex attributes for the same amount of time spent on consumption. This tendency applies not only to food but to other consumer goods as well.

5.2.2. Per Capita Consumption of Foodstuffs and Beverages

The per capita level of consumption of specific industrial products provide a useful means of gauging the extent to which a population's basic needs are being met. Although level of income is usually the decisive determinant of the pattern of consumption, a variety of other factors contribute to change the consumption. In the case of certain food items, consumer preferences (in the form of dietary or cultural factors) sometimes exert an important influence on the pattern of consumption.

The influence of these factors as well as the more general impacts of substantial differences in purchasing power or per capita income - gives rise to the wide divergencies in the consumption patterns of different areas of Ghana.

Inspite of very low per capita income (Table 9) and real wages in the same period (Table 10), the per capita consumption grew constantly between 2% and 3.5% by nearly all food stuffs between 1979 and 1984. This trend continues in 1985 and it can be expected, that the growth rate of the per capita consumption will be constant for the next 10 years. In table 11 the present growth rates of important food and beverages are summarized.

Table 9: Economic Indicators

	1979	1980	1982	1983	1984
GDP in 1975 constant prices Total (million cedis)	5654	5428	4849	4884	5212
Per cent change over previous year		- 4.0	-7.7	0.7	6.7
Per capita income in 1975 constant prices (cedis)	526	493	423	411	428

Source: Central Bureau of Statistics

Table 10: Nominal and Real Wage (1977 = 100)

Year	Combined Consumer Price Index	Nominal Wage		Real Wage	
		¢ per day	Index	¢ per day	Index
1974	22.8	2.00	67	8.77	292
1975	29.6	2.00	67	6.76	225
1976	46.2	2,00	67	4.33	144
1977	100.0	3.00	100	3.00	100
1978	173.7	4,00	133	2.30	77
1979	267.3	4.00	133	1.50	50
1980	401.2	5.33	178	1.33	44
1981	868.6	12.00	400	1.38	46
1982	1,062.4	12.00	400	1.13	38
1983	2,367.4	25.00	833	1.06	35
1984	3,304.9	40.00	1333	1.21	40
1985	4,626.9	70.00	2333	1.51	50
1986	4,832.6	90.00	3000	1.86	62

Source: Central Bureau of Statistics, Economy Survey
Draft: December, 1985

Table 11: Growth rates of per capita consumption for foodstuffs in per cent

Production groups	%/a	Production groups	%/a
Wheat flour	3,0	Fruit processed	3,0
Fat	3,0	Starch	2,0
Paste products	5,0	Rice	2,0
Groundnut oil	3,0	Sugar, household	
Coconut oil	3,0	consumption	2,8
Palm oil	3,0	Fresh milk	2,0
Soap	2,0	Butter	2,0
Fresh fish	0	Cheese	2,0
Smoked fish	0	Dried milk	2,0
Tinned fish	3,0	Yoghourt	2,0
Bread	3,0	Condensed milk	2,0
Biscuit	2,0	Beef and veal	3,11
Sweets	3,0	Mutton	3,87
Confectionery	3,0	Pork	3,0
Chocolate	3,0	Chicken	3,0
Beer	3,0	Goat meat	0
Wine	3,0	Soft drinks	2,56
Distillates	-	Mineralwater	2,0

Table 12: The Possible Development of Per Capita Consumption for foodstuff in Kg/a, I

Year	Production Groups									
	Fresh Milk	Butter	Cheese	Dried Milk	Yoghourt	Condensed Milk			Tinned Fish	
1985	15.5	4.05	1.35	1.28	8.0	5.12			1.8	
1986	15.8	4.13	1.38	1.31	8.16	5.22			1.85	
1987	16.1	4.21	1.40	1.33	8.32	5.33			1.91	
1988	16.4	4.30	1.43	1.36	8.49	5.43			1.97	
1989	16.8	4.38	1.46	1.39	8.66	5.54			2.03	
1990	17.1	4.47	1.49	1.41	8.83	5.65			2.09	
1991	17.5	4.56	1.52	1.44	9.01	5.77			2.15	
1992	17.8	4.65	1.55	1.47	9.19	5.88			2.21	
1993	18.2	4.75	1.58	1.50	9.37	6.00			2.28	
1994	18.5	4.84	1.61	1.53	9.56	6.12			2.35	
1995	18.9	4.94	1.65	1.56	9.75	6.24			2.42	
1996	19.3	5.04	1.68	1.59	9.95	6.37			2.49	
1997	19.7	5.14	1.71	1.62	10.15	6.49			2.57	
1998	20.1	5.24	1.75	1.66	10.35	6.62			2.64	
1999	20.5	5.34	1.78	1.69	10.56	6.76			2.72	
2000	20.9	5.45	1.82	1.72	10.77	6.89			2.80	

Table 13: The Possible Development of per Capit.
Consumption of Foodstuff in Kg/a,II

Year	Production Groups								
	Bread	Biscuit	Sweets	Confectio-nery	Chocolate	Beef and Veal	Mutton	Pork	Chicken
1985	15.2	0.4	0.3	0.3	0.3	3.15	0.88	0.54	1.5
1986	15.6	0.408	0.309	0.309	0.309	3.25	0.91	0.556	1.545
1987	16.1	0.416	0.318	0.318	0.318	3.35	0.95	0.573	1.591
1988	16.6	0.424	0.328	0.328	0.328	3.45	0.98	0.590	1.639
1989	17.1	0.433	0.338	0.338	0.338	3.56	1.02	0.608	1.688
1990	17.6	0.442	0.348	0.348	0.348	3.67	1.06	0.626	1.739
1991	18.1	0.450	0.358	0.358	0.358	3.73	1.11	0.645	1.791
1992	18.7	0.459	0.369	0.369	0.369	3.9	1.15	0.664	1.845
1993	19.2	0.469	0.380	0.380	0.380	4.02	1.19	0.684	1.900
1994	19.8	0.478	0.391	0.391	0.391	4.15	1.24	0.705	1.957
1995	20.4	0.488	0.403	0.403	0.403	4.28	1.29	0.726	2.016
1996	21.0	0.497	0.415	0.415	0.415	4.41	1.34	0.747	2.076
1997	21.7	0.507	0.428	0.428	0.428	4.55	1.39	0.770	2.139
1998	22.3	0.517	0.441	0.441	0.441	4.69	1.44	0.793	2.203
1999	23.0	0.528	0.454	0.454	0.454	4.83	1.50	0.817	2.269
2000	23.7	0.538	0.467	0.467	0.467	4.98	1.56	0.841	2,337

Table 14: The Possible Development of per Capita Consumption for Foodstuff in Kg/a, III

Year	Production Groups										
	Wheat Flour	Fat	Paste Products	Fruit Processed	Starch	Rice	Groundnut Oil	Coconut Oil	Palm Oil	Sugar, Households	Soap
1985	15.86	1.27	0.080	4.1	0.6	9.8	1.9	2.95	6.37	5.29	0.4
1986	16.34	1.31	0.084	4.22	0.612	10.0	1.96	3.04	6.56	5.44	0.408
1987	16.83	1.35	0.088	4.35	0.624	10.20	2.02	3.13	6.76	5.59	0.416
1988	17.33	1.39	0.093	4.48	0.637	10.40	2.08	3.22	6.96	5.75	0.424
1989	17.85	1.43	0.097	4.61	0.649	10.61	2.14	3.32	7.17	5.91	0.433
1990	18.39	1.47	0.102	4.75	0.662	10.82	2.2	3.42	7.38	6.07	0.442
1991	18.94	1.52	0.107	4.90	0.676	11.04	2.27	3.52	7.61	6.24	0.450
1992	19.51	1.56	0.113	5.04	0.689	11.26	2.34	3.63	7.83	6.42	0.459
1993	20.09	1.61	0.118	5.19	0.703	11.48	2.41	3.74	8.07	6.6	0.469
1994	20.69	1.66	0.124	5.35	0.717	11.71	2.48	3.85	8.31	6.78	0.478
1995	21.31	1.71	0.130	5.51	0.731	11.95	2.55	3.96	8.56	6.97	0.488
1996	21.95	1.76	0.137	5.68	0.746	12.19	2.63	4.08	8.82	7.17	0.497
1997	22.61	1.81	0.144	5.84	0.761	12.43	2.71	4.21	9.08	7.37	0.507
1998	23.29	1.87	0.151	6.02	0.776	12.68	2.79	4.33	9.35	7.57	0.517
1999	23.99	1.92	0.158	6.20	0.791	12.93	2.87	4.46	9.64	7.79	0.528
2000	24.71	1.98	0.166	6.39	0.808	13.19	2.96	4.6	9.92	8.0	0.538

Table 15:

Per Capita Consumption for Production Groups Without Noticeable Advance

Venison	4.9 kg/a
Maize	45.0 kg/a
Sorghum	14.8 kg/a
Cassava	204.2 kg/a
Cigarettes	185 pieces/a
Millet	11.0 kg/a
Yam	55.4 kg/a
Goat meat	0.98 kg/a
Fresh fish	11.9 kg/a
Smoked and dried fish	12.7 kg.a

Table 16:

The Possible Development of Per Capita Consumption for Beverages in liter per Year

Year	Production Groups				
	Beer	Wine	Distil-lates	Soft Drink	Mine-ral-water
1985	7.5	0.33	0.25	17.4	5.7
1986	7.73	0.340	0.25	17.8	5.81
1987	7.96	0.350	0.25	18.3	5.93
1988	8.20	0.361	0.25	18.8	6.05
1989	8.44	0.371	0.25	19.3	6.17
1990	8.69	0.383	0.25	19.7	6.29
1991	8.96	0.394	0.25	20.2	6.42
1992	9.22	0.406	0.25	20.8	6.55
1993	9.50	0.418	0.25	21.3	6.68
1994	9.79	0.431	0.25	21.8	6.81
1995	10.08	0.443	0.25	22.4	6.95
1996	10.38	0.457	0.25	23.0	7.09
1997	10.69	0.471	0.25	23.6	7.23
1998	11.01	0.485	0.25	24.2	7.37
1999	11.34	0.499	0.25	24.8	7.52
2000	11.68	0.514	0.25	25.4	7.67

Table 17:

Development of Demand for Important Food

	'000 tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Beef	41.6	44.0	46.4	49.1	51.9	54.8	57.9	61.3	64.8	68.5	72.4	76.6	80.9	85.5	90.4
Pork	7.12	7.52	7.94	8.38	8.85	9.35	9.86	10.42	11.01	11.62	12.26	12.96	13.68	14.44	15.25
Mutton	11.7	12.5	13.3	14.1	15.0	16.1	17.1	18 1	19.4	20.7	22.0	23.4	24.8	26.5	28.2
Goat Meat	12.5	12.9	13.2	13.5	13.8	14.2	14.6	14.9	15.3	15.7	16.1	16.5	16.9	17.3	17.8
Chicken	10.78	20.89	22.04	23.28	24.59	25.95	27.40	28.94	30.57	32.28	34.07	36.00	38.00	40.12	42.37
Bread	199.7	211.4	223.3	235.8	248.9	262.3	277.7	292.4	309.3	326.6	344.6	365.2	384.7	406.6	429.7
Biscuit	5.23	5.46	5.70	5.97	6.25	6.50	6.82	7.14	7.47	7.81	8.16	8.53	8.92	9.34	9.76
Wheat Flour	209.2	221.0	233.1	246,2	260.0	274.4	289.7	306.0	323.2	341.2	360.2	380.2	401.8	424.2	448.0
Rice	128.0	133.9	139.9	146.3	153.0	160.0	167.2	174,8	182.9	191.3	200.0	209.2	218.7	228.6	239.1
Sugar (house-holds)*	69.6	73,4	77.3	81.5	85.8	90.4	95.3	100.5	105.9	111.6	117.7	124.0	130.6	137.7	145.0
Cassava	2614	2681	2746	2816	2887	2959	3032	3110	3190	3269	3351	3437	3522	3610	3702
Yam	709	727	745	764	783	803	823	844	865	887	909	932	956	979	1004
Sorghum	189	194	199	204	209	214	220	225	231	235	243	249	255	262	268
Millet	141	144	148	152	156	159	163	168	172	176		185	190	194	199
Maize	76	591	605	621	636	652	668	685	703	720	738	757	776	796	816

*For total demand of sugar refer to Table 62.

Table 18: Development of demand for important food and beverages

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fat	'000t	16,8	17,7	18,7	19,7	20,8	22,0	23,2	24,5	25,9	27,4	28,9	30,5	32,3	33,9	35,9
Paste products	'000t	1,08	1,16	1,25	1,34	1,44	1,55	1,68	1,80	1,94	2,08	2,25	2,42	2,60	2,79	3,01
Fruit processed	'000t	54,0	57,1	60,3	63,6	67,2	71,0	74,8	79,0	83,6	88,2	93,2	98,3	103,8	109,6	115,8
Starch	'000t	7,83	8,19	8,57	8,95	9,36	9,80	10,23	10,70	11,19	11,70	12,24	12,81	13,39	13,98	14,65
Groundnut oil	'000t	25,1	26,5	28,0	29,5	31,1	32,9	34,7	36,7	38,7	40,8	43,2	45,6	48,1	50,7	53,7
Coconut oil	'000t	38,9	41,1	43,3	45,8	48,4	51,0	53,9	57,0	60,1	63,4	67,0	70,9	74,7	78,9	83,3
Palm oil	'000t	84.0	88.6	93.6	98.9	104.4	110,3	116,3	122.9	129.8	137.0	144.7	152.8	161.3	170.4	179.8
Sweets	'000t	3,97	4,20	4,44	4,69	4,95	5,22	5,49	5,79	6,09	6,40	6,89	7,24	7,59	7,96	8,47
Confectionery	'000t	3,97	4,20	4,44	4,69	4,95	5,22	5,49	5,79	6,09	6,40	6,89	7,24	7,59	7,96	8,47
Chocolate	'000t	3,97	4,20	4,44	4,69	4,95	5,22	5,49	5,79	6,09	6,40	6,89	7,24	7,59	7,96	8,47
Beer	Mio l	98,9	104,5	110,3	116,4	122,9	129,8	133,6	144,7	152,9	161,4	170,3	179,9	189,9	200,5	211,8
Wine	Mio l	4,35	4,60	4,86	5,12	5,42	5,71	6,03	6,37	6,73	7,09	7,50	7,93	8,37	8,82	9,32
Distillates	Mio l	3,20	3,28	3,36	3,45	3,54	3,62	3,71	3,81	3,91	4,00	4,10	4,21	4,31	4,42	4,53
Soft drinks	Mio l	227,8	240,3	252,9	266,1	278,6	292,7	308,9	324,4	340,5	358,6	377,4	397,2	417,5	438,5	460,9
Mineralwater	Mio l	74,4	77,9	81,4	85,1	88,9	93,0	97,3	101,7	106,4	111,3	116,3	121,7	127,1	132,3	139,1
Venison	'000t	62,7	64,3	65,9	67,6	69,3	71,0	72,8	74,6	76,5	78,4	80,4	82,5	84,5	86,6	88,8
Cigarettes	Mio pieces	2368	2429	2488	2551	2616	2681	2747	2818	2890	2962	3036	3114	3191	3271	3354

Table 19: Demand for Dairy Products

	'000 tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fresh Milk	202.2	211.4	220.6	231.7	241.8	253.6	264.3	277.2	289.0	302.6	316.7	331.6	346.7	362.4	378.9
Butter	52.9	55.3	57.8	60.4	63.2	66.1	69.1	72.3	75.6	79.1	82.7	86.5	90.4	94.4	98.8
Cheese	17.7	18.4	19.2	20.1	21.1	22.0	23.0	24.1	25.1	26.4	27.6	28.8	30.2	31.5	33.0
Dried Milk	16.8	17.5	18.3	19.2	19.9	20.9	21.8	22.8	23.9	25.0	26.1	27.3	28.6	29.9	31.2
Yoghourt	104.4	109.2	114.2	119.4	124.9	130.6	136.5	142.7	149.3	156.1	163.3	170.8	178.5	186.7	195.3
Condensed Milk	66.8	70.0	73.0	76.4	79.9	83.6	87.3	91.4	95.6	99.9	104.5	109.2	114.2	119.5	124.9
Milk demand for dairy products	1972.0	2061.0	2153.7	2252.0	2355.7	2464.1	2574.8	2694.7	2816.8	2947.8	3082.6	3224.1	3369.8	3520.8	3684.2
Fresh Milk	202.2	211.4	220.6	231.7	241.8	253.6	264.3	277.2	289.0	302.6	316.7	331.6	346.7	362.4	378.9
Butter	1392	1455	1521	1589	1663	1739	1818	1902	1989	2081	2176	2276	2378	2484	2600
Cheese	102.1	106.2	110.8	116.0	121.7	126.9	132.7	139.0	144.8	152.3	159.2	166.2	174.2	181.8	190.4
Dried Milk	60.0	62.5	65.4	68.6	71.1	73.9	77.8	81.4	85.4	89.3	93.2	97.5	102.1	106.7	111.4
Yoghourt	104.4	109.2	114.2	119.4	124.9	130.6	136.5	142.7	149.3	156.1	163.3	170.8	178.5	186.7	195.3
Condensed Milk	111.3	116.7	121.7	127.3	133.2	139.4	145.5	152.4	159.3	166.5	174.2	182.0	190.3	199.2	208.2

Table 20: Demand of Fish Products

	'000 tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fresh Fish	152.3	156.2	160.1	164.1	168.3	172.4	176.7	181.2	185.9	190.5	195.3	200.3	205.3	210.4	215.7
- fresh sale	45.7	46.9	48.0	49.2	50.5	51.2	53.0	54.4	55.8	57.2	58.6	60.1	61.6	63.1	64.7
- chilled or frozen	106.6	109.3	112.1	114.9	117.8	121.2	123.7	126.8	130.1	133.3	136.7	140.2	143.7	147.3	151.0
Smoked	162.6	166.8	170.8	175.1	179.6	184.0	188.6	193.4	198.4	203.3	208.4	213.7	219.1	224.5	230.3
- smoked	65.0	66.7	68.3	70.0	71.8	73.6	75.4	77.4	79.4	81.3	83.4	85.5	87.6	89.8	92.2
- dried	97.6	100.1	102.5	105.1	107.8	110.4	113.2	116.0	119.0	122.0	125.0	128.2	131.9	134.7	138.1
Tinned fish	23.7	25.1	26.5	28.0	29.6	31.2	32.8	34.7	36.7	38.7	40.9	43.3	45.5	48.1	50.8

Table 21: Fresh Fish Demand for the Production of Fish Products

	'000 tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fresh Fish	152.3	156.2	160.1	164.1	168.3	172.4	176.7	181.2	185.9	190.5	195.3	200.3	205.3	210.4	215.7
Smoked and dried Fish	487.8	500.4	512.4	525.3	538.8	552.0	565.8	580.2	595.2	609.9	625.2	641.1	657.3	673.5	690.9
Tinned Fish	67.7	71.7	75.7	80.0	84.6	89.1	93.7	99.1	104.8	110.6	116.8	123.7	130.0	137.4	145.1
Total Demand	707.8	728.3	748.2	769.4	791.7	813.5	836.2	860.5	885.9	911.0	937.3	965.1	992.6	1021.3	1051.7

Table 22: Demand of Cocoa Products

	'000 Tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Local Consumption															
Chocolate	4.0	4.2	4.4	4.7	4.9	5.2	5.5	5.8	6.1	6.4	6.9	7.2	7.6	8.0	8.5
Export															
Cocoa Paste	25.3	26.6	27.9	29.3	30.8	32.3	33.9	35.6	37.4	39.2	41.2	43.3	45.4	47.7	50.1
Cocoa Butter	21.0	22.0	23.2	24.3	25.5	26.8	28.1	29.5	31.0	32.6	34.2	35.9	37.7	39.6	41.6
Cocoa Cake	38.8	39.6	40.4	41.2	42.0	42.8	43.7	44.6	45.5	46.4	47.3	48.2	49.2	50.2	51.2
Cocoa Beans	91.5	93.3	95.2	97.1	99.0	101.0	103.0	105.1	107.2	109.4	111.5	113.8	116.0	118.4	120.7

Table 23: Demand of Raw Cocoa to Cover the Local Requirement and Export

	'000 Tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Chocolate	2.1	2.2	2.3	2.5	2.6	2.7	2.9	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.5
Cocoa Paste	31.6	33.2	34.9	36.6	38.5	40.3	42.4	44.5	46.8	49.0	51.5	54.1	56.8	59.6	62.6
Cocoa Cake	97.0	99.0	101.0	103.0	105.0	107.0	109.2	111.5	113.8	116.0	118.2	120.5	123.0	125.5	128.0
Cocoa Beans	91.5	93.3	95.2	97.1	99.0	101.0	103.0	105.1	107.2	109.4	111.5	113.8	116.0	118.4	120.7
Total	222.2	227.7	233.4	239.2	245.1	251.0	257.5	264.1	271.0	277.8	284.8	292.2	299.8	307.7	315.8

The basis of the figures of per capita consumption shown in the Tables 12 - 16 is the consumption during the years 1970 - 1985 divided by the number of population in the adequate years. The consumption (Co) is given by:

$$Co = P + (I - E) + (So - Sc)$$

where P is the production during the period; I is the import; E is the export; So is the level of stocks at the beginning of the period; and Sc is the level of stocks at the end of the period. From 1985, the figures of per capita consumption are multiplied by the growth rates according to table 11.

In this connection should be stated, that there was no change of the per capita consumption in such typical food like venison, goat meat, fresh fish, smoked and dried fish, cassava, sorghum, millet, yam and maize during the period 1980 - 1985 (table 15) and a noticable increase has not been assumed for the future.

5.2.3. Forecast of the Demand 1986 - 2000

In Ghana exist few forecasts of future demand for food and beverage like vegetable oils and fats, fish, beer, cereal and cereal products etc. in different reports, papers, minutes of meetings and statistical materials, however, with very wide variations of data which are not comparable in many cases.

A new forecast of the demand is not only necessary with regard to above mentioned requirements, some other reasons should also be considered.

First, there have been some major changes in Ghana's economic performance, that were not foreseen in former estimations. The pace of Ghana's economic activity has changed and prices of food have increased. These are important variables in the determination of the future profiles of food demand and supply functions.

Second, few if any of the previous forecasts generated future data under consideration of export opporunities for processed food.

Third, although several previous forecasts were made on the basis of econometric estimation of demand and supply equations, most of these studies were not used in practical planning exercises.

The material required for demand forecasting and the extent to which this is available should be considered. The basic data include general economic indicators having a bearing on product demand such as population, per capita income, growth of per capita consumption and behavioural data such as consumer habits and responses, individual and collective, which are mainly considered in the per capita consumption adequate tables 12 to 16.

Tables 17 - 23 contain the calculated demand of food and beverages from 1986 to 2000. This demand figures are the results of the per capital consumption multiplied by the population.

In Ghana the consumption is projected to increase at an annual average rate of 4.4 per cent until 2000 and thereafter it will slow down because, around the year 2000 the per capita demand of the most food items will be satisfied. The projected consumption levels are based upon expected increases in populations and incomes, taking into account relationship between consumption and income.

6. Necessary Development of the Food Processing Sector

6.1. Introduction

The food processing industry is an important factor for economic growth and for increase of the living standard of people in Ghana. Many food raw materials in these country are not fully utilized, locally in principle available food are imported, food shortages exist, and diets are inadequate. But Ghana has many opportunities to develop their food resources more extensively and to pursue effective processing with minimum losses.

The benefits from the food processing industry reach far beyond calories and nutrition. Food imports can be reduced or eliminated and food products exported on the basis of mutual advantage. The larger markets and the higher prices created by food processing stimulate higher and more efficient agricultural production. Employment will increase not only in food factories and agriculture, but also in activities related to food processing and in extending intra- and intersectoral linkages.

Some branches of the food industry are directly linked with and dependent upon agricultural production. Perishable commodities, such as fruit and vegetables, milk, meat, fish and poultry require immediate processing. Economic data indicate that an efficient agricultural sector and the production of food on the scale required to feed millions of people, as is the case in Ghana, depend on the existence of a well developed processing industry.

On the other side, industry provides at least 50% of all direct inputs to agricultural development. The interdependency of both sectors is obvious. The relationship between agricultural and industrial productivity is displayed in figure 1.

In the past, Ghana has not paid sufficient attention to the fact, that the agricultural sector supplies raw materials to the industrial sector for processing. Indeed, in Ghana agriculture is the largest input component for the industrial sector. The size and growth of both the agricultural and industrial sector are determined by the size and growth of the domestic market which absorbs the bulk of production and provides the bulk of factor inputs (management, manpower for procurement, production and distribution; raw and intermediate materials, equipment and spare parts, implements and tools, technology, physical institutional infrastructure and services, especially consultancy.) In order to achieve an economic development in Ghana that domestic markets and export trade could absorb increasing volumes of processed agricultural products, it will be necessary to take up specific measures for effective processing, transportation and storage.

This chapter includes not only the necessary development of the food industry but also the development of the agricultural production to meet the requirement of the adequate processing industry. Not included are, however, the primary support industry for agricultural and processing industries like engineering industries, chemical industries, fertilizer industries, plastic industries, steel and aluminium industries and packing industries which are very important to meet the input need of these industries like equipment, irrigation, fertilizers and pesticides, transportation, packing materials etc.

Industry also provides secondary indirect inputs to agricultural and food production through the development of transport and communications, health and housing and social services, manpower development and energy.

Given the extent of these primary and secondary inputs, the essentiality of industrialization to agricultural and food production is apparent.

6.2 Meat Production

6.2.1 Situation

Ghana's meat consumption is around the average level of the per capita consumption of developing countries. In 1985 the per capita consumption has been 10.45 kg per year consisting of 30.1% beef, 8.4% mutton, 5.2% pork, 9.4% goat meat and 46.9% venison. Demand will, however, increase as the economic status of consumers will improve. During the past period, production of mutton and goat meat grew, similarly population growth. It can be expected that the growth rate increase in the same level also in the future until 1995 or 2000.

In the case of beef and pork it is different. Also, the production of beef and pork is expected to increase but the demand is expected to increase faster. The tables 24 - 27 demonstrate the expected development of meat and the necessary development of livestock until the year 2000. To meet the demand of beef and pork, it is necessary to improve the present husbandry to reach a higher growth rate and to establish new cattle farms with a total population of 32,000 animals and new pig farms with a total population of 21,400 animals.

6.2.2 Livestock

(a) Cattle

Over 80% of the estimated 1,014 million head of cattle

RELATIONSHIP BETWEEN AGRICULTURAL AND INDUSTRIAL PRODUCTIVITY

Based on data from
United Nations Research Institute for Social Development,
Research Data Bank of Development Indicators,
Volume II Compilation of Indicators for 1970
with Adjustments for Age Structure,
prepared by the Statistical Unit of the Institute, Geneva 1976.
Report No. 76.2, pages 64 and 52.

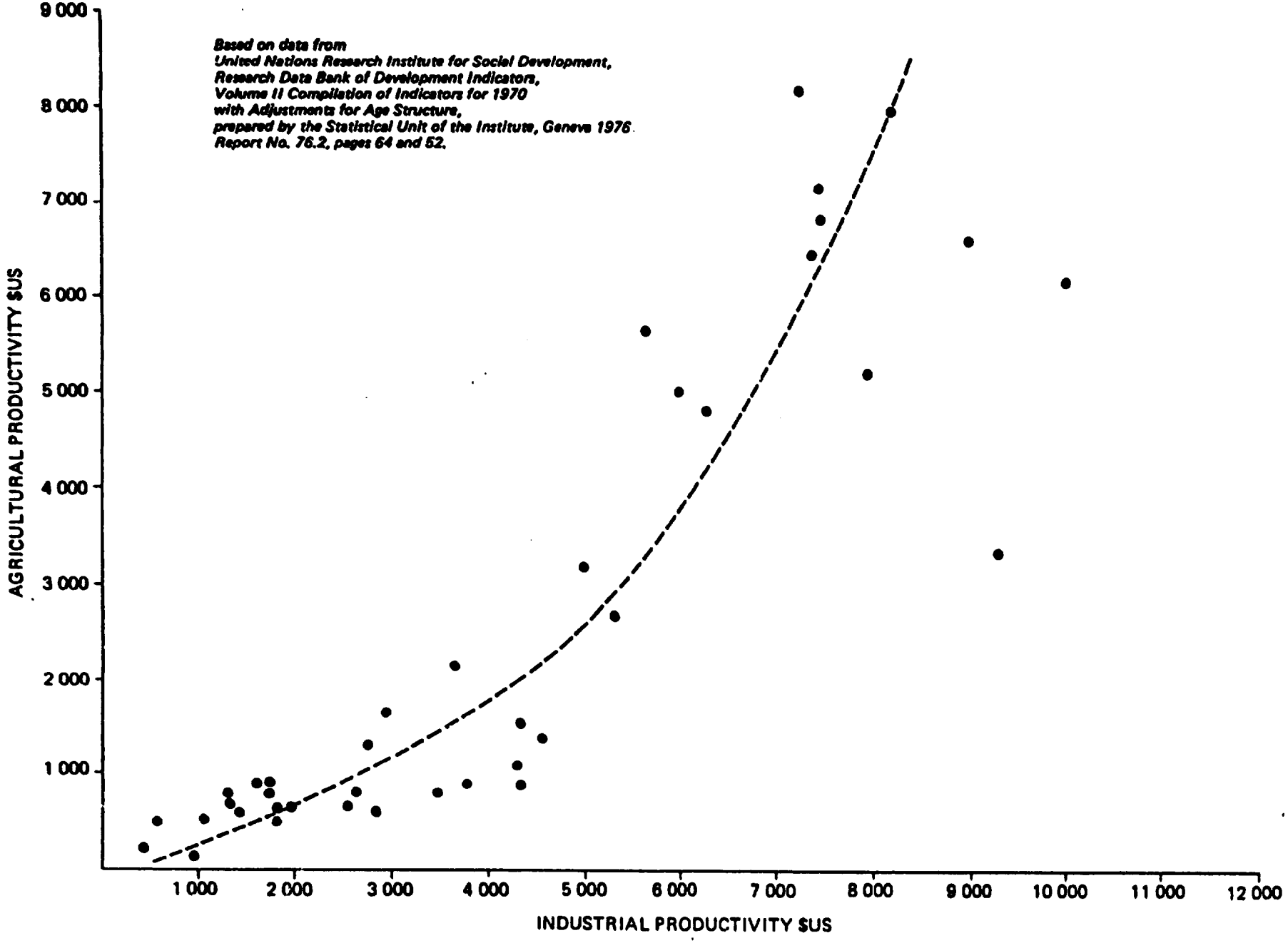


Figure 1

in Ghana in 1984 were of the West African shorthorn type, on of the smallest cattle breeds in the world. The remainder of the herd are Ndamas, Zulus and Songhas. Today, most of the cattle population is owned by sedentary farmers or urban dwellers and grazed on land which is available communally.

Productivity under existing management conditions is poor. Calving rates are estimated at about 55%, whilst mortality rates are estimated at about 5% for adults, 20% to 30% for calves and 8% for immature animals. These mortality rates permit an annual offtake of 8 to 9%. The Ministry of Agriculture undertook an annual survey of the national herd and these indicate that the total number of beef cattle has grown from 950,000 in 1981 to 1,002,000 in 1983, an annual increase of about 2.7%.

The production characteristics of the main types of livestock are summarized in Table 28.

(b) Sheep and Goats

The total population of sheep according to the Ministry of Agriculture census was about 2,000,000 and goats 2,150,000 in 1984. The number of sheep is growing at the rate of about 3.8% per year and of goats at about 2% (measured over the 1978 - 84 period).

The predominant sheep is the West African Dwarf, with a mature live-weight of about 18 kg. These are sometimes crossed with the bigger Sudan sheep. The local sheep has an average lambing rate of 90% and a fast rate of growth but is susceptible to health problems such as worm infestation and foot rot.

Ownership of sheep is spread very widely throughout the country and is not restricted to stock farmers. During the last few years there has been an increasing tendency to

Table 24: Demand of Beef and necessary development of livestock of cattle

Description	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Beef Demand	'000t	41.6	44.0	46.4	49.1	51.9	54.8	57.9	61.3	64.8	68.5	72.4	76.6	80.9	85.5	90.4
Households	'000t	33.3	35.4	37.6	40.1	42.7	45.3	48.1	51.2	54.3	57.7	61.3	65.1	69.1	73.4	78.0
Schools	'000t	7.3	7.5	7.7	7.9	8.1	8.4	8.6	8.9	9.2	9.5	9.8	10.1	10.4	10.7	11.0
Hotels	'000t	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Hospital	'000t	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9
Neccesary livestock to cover the demand	1) 1000	1138	1204	1269	1344	1420	1499	1584	1677	1773	1874	1981	2096	2213	2339	2473
Livestock development - small and medium	1) 1000	1138	1201	1267	1338	1412	1490	1572	1659	1751	1848	1950	2058	2172	2293	2420
Milk Cows	1000	388	409	432	456	482	508	536	566	597	630	665	702	741	782	825
Bulls	1000	12	12	13	14	14	15	16	17	18	19	20	21	22	23	25
Calves	1000	333	352	371	392	413	436	460	486	513	542	571	603	636	672	709
Livestock 1...2 years	1000	320	338	356	376	397	419	442	466	492	519	548	578	610	644	680
Livestock over 2 years	1000	85	90	95	100	106	112	118	124	131	138	146	154	163	172	181
Meat Production	'000t	41.6	43.9	46.3	48.9	51.6	54.5	57.5	60.6	64.0	67.5	71.3	75.2	79.4	83.8	88.5
New Cattle Farms 2)	number	-	-	1	1	2	2	3	4	5	6	6	8	9	10	11
Animals, new farms	1000	-	-	2	3	5	5	7	12	13	17	18	23	25	28	32
Meat Production by new farms	'000t	-	-	0.1	0.2	0.3	0.3	0.4	0.7	0.8	1.0	1.1	1.4	1.5	1.7	1.9
Imports	'000t	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Total meat	'000t	41.6	44.0	46.4	49.1	51.9	54.	57.9	61.3	64.8	68.5	72.4	76.6	80.9	85.5	90.4
Milk Production	'000t	310	327	348	368	390	414	436	463	490	519	550	582	613	649	689
Small and medium	'000t	310	327	345	365	385	406	428	452	477	504	532	561	592	625	660
Milk Production by new farms	'000t	-	-	3	3	5	8	8	11	13	15	18	21	21	24	29
Total Livestock	1000	1138	1201	1269	1341	1417	1495	1579	1671	1764	1865.	1968	2081	2197	2321	2452

1) Based on Ndama Cattle

2) Based on Black and White Cattle

Table 25: Demand for Pork and Necessary Livestock of Pig

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
[illegible]emand	'000t	7.12	7.52	7.94	8.38	8.85	9.35	9.86	10.42	11.01	11.62	12.26	12.96	13.68	14.44	15.25
[illegible]holds	'000t	5.66	6.0	6.34	6.70	7.09	7.49	7.92	8.38	8.87	9.37	9.90	10.49	11.08	11.71	12.39
Schools	'000t	1.3	1.36	1.43	1.50	1.58	1.66	1.74	1.83	1.92	2.02	2.12	2.22	2.33	2.45	2.57
Hospital	'000t	0.1	0.1	0.11	0.12	0.12	0.13	0.13	0.14	0.15	0.16	0.16	0.17	0.18	0.19	0.2
Hotels	'000t	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.09
N[illegible] li[illegible]k to [illegible] the [illegible]nd	1000	328	347	366	386	408	431	455	480	508	536	565	597	631	666	703
Live[illegible] deve[illegible] ment	1000	328	346	361	378	395	412	431	450	471	492	514	537	561	587	613
Possible meat prod.	'000t	7.12	7.51	7.83	8.2	8.57	8.94	9.35	9.76	10.22	10.67	11.15	11.65	12.17	12.73	13.30
Meat imports	'000t	-	0.01	-	-	-	-	-	-							
New farms		--	-	1	2	2	3	3	4	5	6	7	8	9	10	12
Livestock	1000	-	-	1.8	3.5	3.5	5.4	5.4	7.1	8.9	10.7	12.5	14.3	16.0	17.8	21.4
Meat prod.	'000t		-	0.17	0.36	0.36	0.52	0.52	0.69	0.87	1.04	1.21	1.38	1.55	1.73	2.08
Total meat	'000t	7.12	7.52	8.0	8.56	8.93	9.46	9.87	10.45	11.09	11.71	12.36	13.03	13.72	14.46	15.38
Balance	'000t	-	-	0.06	+0.18	+0.08	+0.11	+0.01	+0.03	+0.08	+0.09	+0.10	+0.07	+0.04	+0.02	+0.13

Table 26: Demand of Mutton and necessary livestock of sheep

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Mutton demand	'000t	11,7	12,5	13,3	14,1	15,0	16,0	17,1	18,2	19,4	20,7	22.0	23,4	24.9	26.5	28.2
Households	'000t	8,6	9,3	10,0	10,7	11,5	12,4	13,4	14,4	15,5	16,7	17,9	19.2	20.5	21.9	23.5
Schools	'000t	2,0	2,0	2,1	2,2	2.3	2,3	2,4	2,5	2,5	2,6	2,7	2,7	2,8	2.9	3,0
Hotels	'000t	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,3
Hospitals	'000t	0,9	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,2	1,2	1,2	1,3	1,3	1,4	1,4
Necessary livestock to cover the demand	1000	1943	2076	2209	2342	2492	2658	2840	3023	3223	3438	3654	3887	4136	4402	4684
Livestock development	1000	1943		2209	3342	2492	2658	2840	3023	3223	3438	3654	3887	4136	4402	4684
Possible meat pro.	'000t	11,7	12,5	13,3	14,1	15,0	16,0	17,1	18,2	19,4	20,7	22,0	23,4	24,9	26,5	28,2

Table 27: Demand of goat meat and Necessary Livestock Development

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand of meat	'000t	12.5	12.9	13.2	13.5	13.8	14.2	14.6	14.9	15.3	15.7	16.1	16.5	16.9	17.3	17.8
Households	'000t	9.6	9.8	10.0	10.3	10.5	10.7	11.1	11.3	11.5	11.9	12.2	12.5	12.7	12.9	13.3
Schools	'000t	2.0	2.1	2.2	2.2	2.3	2.4	2.4	2.5	2.6	2.6	2.7	2.8	2.9	3.0	3.1
Hotels	'000t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hospitals	'000t	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.4	1.4
Necessary livestock to cover the demand	1000	1760	1816	1858	1901	1943	1999	2056	2098	2154	2210	2267	2323	2380	2436	2506
Livestock development	1000	1760	1816	1858	1901	1943	1999	2056	2098	2154	2210	2267	2323	2380	2436	2506
Possible meat	'000t	12.5	12.9	13.2	13.5	13.8	14.2	14.6	14.9	15.3	15.7	16.1	16.5	16.9	17.3	17.8
Meat Import	'000t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 28: Meat Production Characteristics of main types of Cattle

Breed	Average first calving (years)	Average Calf weight (kg)	Average Weight of 3 yr old animal (kg)		Average Meat weight (kg)	
			male	female	male	female
West African Short-horn	3.4 - 4	18 - 20	250	195	160	130
Ndama	3 - 3.5	19	295	250	190	160
Sanghas	3 - 3.5	24	330	300	210	195
Sakata Gudali	3.5	24 - 25	540	330	350	210

suburban farmers to develop small sheep flocks, often using communal grazing facilities and holding the animals in pens overnight. The largest flocks of sheep, however, are found in the Northern and Upper Regions where the bulk of the country's livestock herd is concentrated.

The indigenous dwarf goat weighs about 16 kg at maturity. It is very fertile and frequently produces twins and triplets and it is capable of reproducing more than once a year under favourable conditions. Mortality rates of kids are high, at up to 30% mainly as a result of internal parasites and pneumonia. The ownership structure of the country's goat herd is similar to that of sheep but commercial development is even less advanced since management problems under controlled conditions are severe.

(c) Pigs

The pig industry is also divided between a "traditional" and a "modern" sector. The indigenous Ashanti Black Pig is found throughout Ghana. This is a hardy, small, long-bodied, black animal with good disease resistance. It is kept mainly as a scavenger on small-holdings; its average weight at slaughter is 45 kg. At different times attempts have been made to keep the indigenous pig under commercial conditions and in the north of Ghana there are a number of semi-commercial enterprises using this animal. Ghana's total pig population was estimated to be 450,000 in 1984.

6.2.3. Slaughtering and Meat Processing

There is only one big and modern slaughter house with a capacity of 7,000 t/a of meat and meat products from cattle and pig. Its output amounted, however, to only about 5,300 t in 1985. Some modern medium scale enterprises with a total capacity of 5,600 t which are also processing cattle and pig have a capacity utilization between 10 - 30%. Plenty of animals especially sheep and goats but also cattle and pigs are slaughtered in

abattoirs which are not generally of the highest hygienic standards. Their total capacity is estimated around 10,500 t/a. But most animals are slaughtered by small butchers with a capacity of 1....3 animals per day and by households in the rural areas.

Most of the meat is sold fresh and only a small portion is processed to ham, bacon, sausages and other products, including canned meat and khebab, a typical national dish, roasted meat slices on a stick, spiced with salt and hot red pepper.

The estimation of slaughtering capacity is summarized in Table 29.

6.2.4. Development of Livestock to Meet the Demand of Meat

Although the present growth rates of pig and cattle lie below the necessary level to meet the required meat production, the availability of meat could be increased by better animal husbandry, such as purposeful breeding of animals for meat production and by improved management in the animal farms. In this matter it is possible to reach an annual growth of about 5.6% for cattle and 4.5% for pigs.

Futhermore, it is necessary to establish new farms for the production of cattle and pigs. To increase the animal production to meet the required demand of meat, an additional growth of around 3,000 cattle and 1,800 pigs per year is necessary.

Table 29; Estimated Slaughtering Capacity 1985

	Capacity ('000t)
Large Scale industry	7.0
Medium Scale industry	5.6
Small Abattoirs	10.5
Small Butchers	9.5
Households	45.0
Total	77.6

The figures in table 29 were estimated by GHIHOC Meat Production Ltd., Meat Marketing Board, UTC of Ghana Ltd.

There have to be established either one cattle farm with 2,800 animals or two farms with 1.300 .. 1,500 cattle each and either one pig farm with 1,800 or two big farms with 900 animals each.

The main advantages of keeping big animal herds in industrial farm complexes are:

- Keeping and breeding of efficient animals;
- Production of maximum meat and milk with less expenses of time and manpower;
- High animal performance by using genetic suitable animals;
- High labour productivity;
- Optimum disposition of food
- Exactly organized production flow in the farm.

For the extension of the animal production, following animal farms are acceptable:

(a) Cattle farm, 1500 animals

(i) Animal material: Black-and-white cattle for the production of milk and beef.

(ii) Farm Capacity:

- 565 places for cows - loose barns;
- 54 places for cows - calving house;
- 25 places for calves - calving house;
- 240 places for calves - calf house;
- 415 places for heifers - loose barns;
- 194 places for beef bulls - stanchion barns;
- 7 places for bulls;

(iii) Production:

- milk production	:	1,300 t/a
- meat, slaughtered	:	86 t/a
- meat production, live weight	:	132,5 t/a

(iv) Feed demand:

- Hay	:	1,000. t/a
- Silage	:	3,750 t/a
- Green feed	:	14,000 t/a
- Mixed feed	:	375 t/a

(v) Specifications:

- Manpower	:	180
- connected load	:	450 kW
- water demand	:	220 m^3/day
- dry feed storage capacity	:	5,000 m^3

It should be recommended to establish a dairy within the cattle farm to process the raw milk into certified milk, yoghourt and butter. Following production is possible:

- certified milk	886 t/a
- yoghourt	370 t/a
- butter	14.8 t/a

This capacity is sufficient to meet the demand of 50,000 people with yoghourt and fresh milk. The layout for a complete cattle farm is shown in figure 2.

(b) Pig Production Farm, 170 t/a meat

(i) Farm capacity:

- Boars	:	18 animals
- Sows	:	235 animals
- Weaners	:	480 animals
- Young and fattening pigs	:	1,052 animals
- Suckling piglets	;	393 animals

(ii) Production

- Production of pigs for slaughter with an average weight of 110 kg after fattening
- Animal production of pigs (live weight)
  - . from fattening : 221.6 t/a
  - . from selection : 54.7 t/a
  - . total slaughtered meat : 173.0 t/a

(iii) Feed demand: Mixed feed : 1.533 t/a

(iv) Specification

- manpower : 15
- power connection : 130kW
- water demand : 25.0 m^3/d

(c) Sheep and goat production

At present the demand of mutton and goat meat is covered and the necessary growth rates are reached between 1984 and 1986. It can be estimated that the present growth rates (sheep: 6.3% and goat: 3%) continue, although the production of animals in farms, especially sheep have priority.

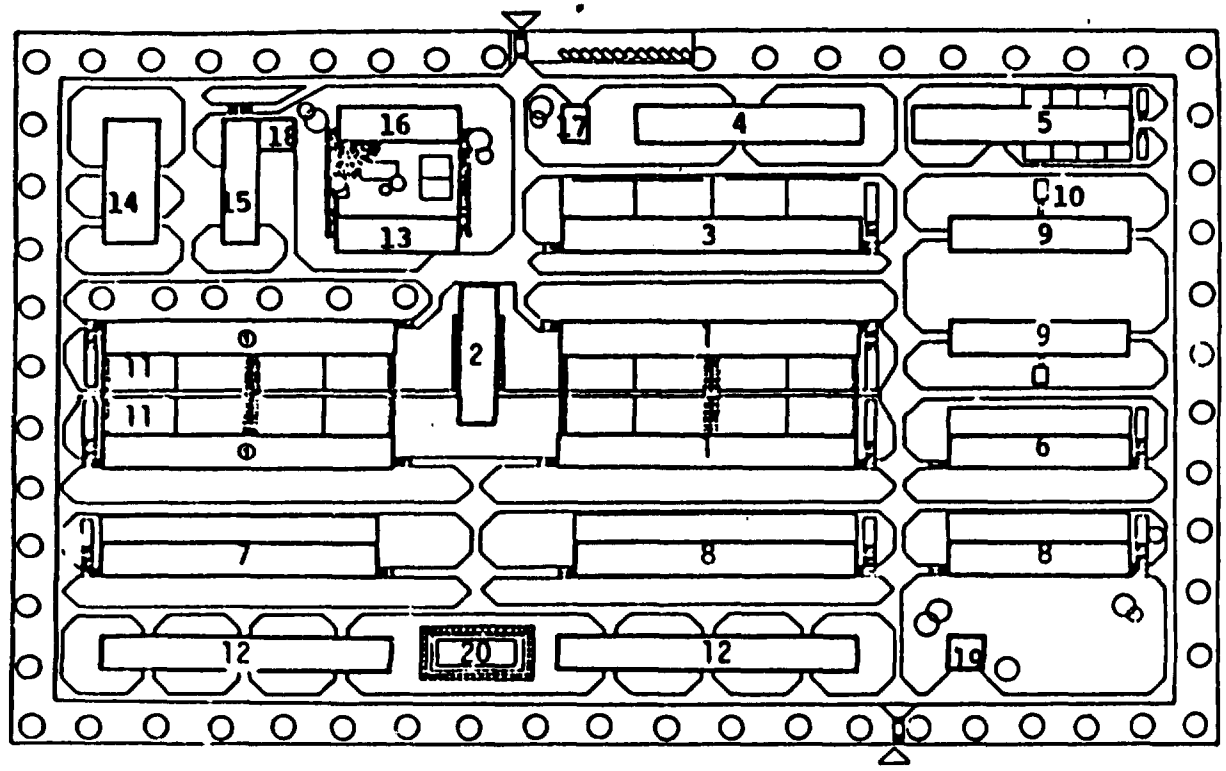
(d) Game

Venison plays a very big role regarding supply of meat in Ghana, especially in the rural areas. It is estimated that the consumption of venison runs around 46% of the meat consumption as a whole. Has the consumption of venison been 61,000 t in 1985, the estimated consumption will be 89,000 t in 2000.

A preservation of the game stock should be recommended.

6.2.5 Slaughtering capacity

More than 70% of the consumed meat is processed by butchers and households at present. Only 30% of the animals are slaughtered by large and medium enterprises and abattoirs while almost 100% of games are slaughtered by



layout for the complete plant

1 stable for lactating cows (4 x 128 places)
2 milking house and store for concentrates
3 stable for dry cows (1 x 128 places)
4 stable for calving and cattle treatment
5 stable for calves (288 places)
6 stable for young cattle (7 – 12 months)
7 stable for young cattle (13 – 20 months)
8 stable for heifers (21 – 30 months)
9 stable for fattening bulls (2 x 100 places)
10 collecting basin for manure
11 open yard
12 storage hall for hay and straw
13 dairy and laboratories
14 feet mill - capacity 5 t/h - with storage hall
15 workshop, garage lockers, weighing machine
16 building for administration and services
17 transformer station
18 oil-fired heating
19 carcass house
20 extinguish pond

Figure 2: Cattle Farm, 1,300 animal places

households. It will be expected that with the enlargement of the demand, there will be a corresponding growth in the slaughtering capacity of the butchers and households. The growth rate of this position is estimated at 2.52%.

In Table 30 is shown the necessary development of the slaughtering capacity until the year 2000. To meet the requirement of beef, pork, mutton and goat meat it is necessary to establish 6 new slaughter houses with a total capacity of 60,000 t/a.

6.3. Chicken Production

6.3.1. Situation

The backyard poultry industry at present produces about 60% of the total poultry production. Its future growth is limited by its slow supply response. The backyard poultry is based on scavenger and indigenous flock which will exist in rural areas in the future and its rate of growth would probably be the same as that of the rural population. This industry therefore will not able to meet the future requirements for poultry production. Thus the commercially based farms have to be developed faster and should be promoted.

The most important issue consists in the provision of adequate parent stock. If the present parent stock problem (which is mainly because of import licence difficulties) is solved, Ghana has sufficient hatchery capacity, at least enough for the requirements of the coming two years.

The second issue identified is the need for a clear cut stratification (specialization as pedigree breeding, commercial breeding, hatchery, broilers, laying hens etc.) of the industry which at present is not properly developed, but could contribute substantially to the efficiency of the sector.

Table 30: Necessary development of the capacity for slaughtering and meat processing

	'000 tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Meat demand	72.9	76.9	80.8	85.1	89.6	94.4	99,5	104.8	110,5	116,5	122,8	129,5	136,4	143,7	151,7
Beef and veal	41,6	44,0	46,4	49,1	51,9	54,8	57,9	61,3	64,8	68,5	72,4	76,6	80,9	85,5	90,4
Mutton	11,7	12,5	13,3	14,1	15,0	16,0	17,1	18,2	19,4	20.7	22.0	23,4	24.9	26.5	28,2
Goat meat	12,5	12,3	13,2	13,5	13,8	14.2	14,6	14,9	15,3	15,7	16,1	16,5	16,9	17,3	17,8
Pork	7,1	7,5	7,9	8,4	8,9	9,4	9,9	10,4	11,0	11,6	12,3	13,0	13,7	14,4	15,3
Slaughtering and processing capacity	77,6	78,9	80,4	81,8	83,3	84,9	86,4	88,0	89,6	91,3	93,1	94,8	96,6	98,4	100,3
Large scale ind.	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0	7,0
Medium scale ind.	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6	5,6
Abattoirs	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5	10,5
Butchers	9,5	9,7	10,0	10,2	10,5	10,8	11,0	11,3	11,6	11,9	12,2	12,5	12,8	13,1	13,4
Households	45,0	46,1	47,3	48,5	49,7	51,0	52,3	53,6	54,9	56,3	57,8	59,2	60,7	62,2	63,8
Number of new slaughter houses	-	-	-	1	1	1	2	2	3	3	3	4	4	5	6
Capacity	-	-	-	10	10	10	20	20	30	30	30	40	40	50	60
Products by new slaughter houses	-	-	-	3,3	6,3	9,5	13,1	16,8	20,9	25.2	29,7	34,7	39,8	45,3	51,4

The third issue is the provision of required quantity and quality of different concentrate feeds. It needs to be realized that certain feed ingredients i.e. vitamins,trace elements etc. have to be imported but the bulk of the basic requirements can and should be produced locally.

Certain disease problems which are encountered at present have to be effectively handled and import difficulties of essential drugs and vaccines have to be solved.

The present commercial poultry industry is able to meet the meat and egg requirements of the country in 1986 provided that the existing operational problems (production of parental-day-old chicks, importation of vaccines, drugs, feed supplements) are solved. After 1986 the commercial poultry industry has to be expanded to 4.5 million laying hens, 16.2 million broilers and 52 million hatche apacities in order to meet the projected demand for eggs and poultry meat in 2000.

6.3.2. Analysis of Production Possibilities - Targets

Table 31 shows the expected demand of chicken meat during the period 1986 - 2000 while the number of the livestock development presents necessary slaughtered animals. In table 32, is shown the poultry production to meet the requirement of meat and eggs. The production of the new farms are included in commercial production.

As shown in table 32 the commercial poultry sector has to grow faster to meet the future demand for poultry production. The commercial poultry industry produces about 5 - 6 million daily chicks at present and it will double in a short time. The commercial poultry industry would account for 51% of the total poultry meat in 2000.

Table 31: Demand of Chicken and Necessary Development of Livestock

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand	'000t	19.78	20.89	22.04	23.28	24.59	25.95	27.40	28.94	30.57	32.28	34.07	36.00	38.00	40.12	42.37
Households	'000t	14.62	15.57	16.56	17.64	18.77	19.97	21.24	22.58	24.03	25.55	27.14	28.86	30.64	32.54	34.61
Schools	'000t	4.55	4.69	4 83	4.97	5.12	5.27	5.43	5.60	5.76	5.94	6.11	6.30	6.49	6.68	6.88
Hotels	'000t	0.22	0.22	0.23	0.24	0.25	0.25	0.26	0.27	0.28	0.28	0.29	0.30	0.31	0.32	0.33
Hospitals	'000t	0.39	0.41	0.42	0.43	0.45	0.46	0.47	0.49	0.5	0.51	0.53	0.54	0.56	0.58	0.6
Animals for slaughter	10^6	13.19	13.93	14.69	15.52	16.4	17.30	18.27	19.29	20.38	21.52	22.71	24.00	25.33	26.75	28.25
Livestock development small and medium farms	10^6	6.2	6.51	6.84	7.18	7.54	7.91	8.31	8.72	9.16	9.62	10.10	10.60	11.13	11.69	12.28
Livestock development households	10^6	6.9	7.25	7.61	7.99	8.39	8.81	9.25	9.71	10.19	10.70	11.24	11.80	12.39	13.01	13.66
Total Livestock	10^6	13.1	13.76	14.45	15.17	15.93	16.72	17.56	18.43	19.35	20.32	21.34	22.40	23.52	24.70	25.94
New farms		-	2	3	5	6	7	9	11	13	15	17	20	22	25	28
Livestock of new farms	10^6	-	0.17	0.24	0.35	0.47	0.58	0.71	0.86	1.03	1.20	1.37	1.60	1.81	2.05	2.31
			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balance	10^6	-0.09														
Egg Production	10^6	526	557	589	621	656	691	728	771	816	862	910	960	1012	1070	1131

Table 32 : Poultry production

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand																
Poultry meat	'000t	19,8	20,9	22,0	23,3	24,6	26,0	27,4	28,9	30,6	32,3	34,1	36,0	38,0	40,1	42,4
Eggs	10^6	526	557	589	621	656	691	728	771	816	862	910	960	1012	1070	1131
Production																
1. Traditional																
- Total flock	10^6	5,7	6,0	6,3	6,6	7,0	7,3	7,6	8,0	8,5	8,9	9,3	9,8	10,3	10,8	11,4
- Slaughter	10^6	6,9	7,2	7,6	8,0	8,4	8,8	9,3	9,7	10,2	10,7	11,3	11,8	12,4	13,0	13,7
- Poultry meat	'000t	10,4	10,8	11,5	12,1	12,6	13,3	14,0	14,8	15,4	16,2	17,0	17,7	18,8	19,9	20,6
- Egg production	10^6	277	289	305	321	337	353	369	389	410	430	450	474	499	524	550
2. Commercial																
- Laying hens	10^6	1,9	2,1	2,2	2,3	2,5	2,6	2,8	2,9	3,1	3,3	3,6	3,8	4,0	4,2	4,5
- Broiler prod.	10^6	7,1	7,6	7,9	8,4	9,0	9,6	10,1	10,6	11,4	11,7	12,8	13,8	14,4	15,2	16,4
- Poultry meat	'000t	9,4	10,1	10,5	11,2	12,0	12,7	13,4	14,1	15,2	16,1	17,1	18,3	19,2	20,2	21,8
- Egg production	10^6	249	268	284	300	319	338	359	382	406	432	460	486	513	546	581

6.3.3 Slaughtering

There are three modern slaughter houses for the production of poultry meat with an average capacity of 1500 chicken per day each. The total capacity of these slaughter houses runs to around 600 t/a meat which are part of the big poultry farms. Also, the medium and small poultry farmers have their own slaughter capacities. The estimation of the slaughtering capacity for poultry is summarized in Table 33.

Table 33: Slaughtering Capacity of Poultry Meat in 1986

Large scale enterprises	600 t/a
Medium and small farms	12,000 t/a
Households	15,000 t/a
Total	27,600 t/a

Source: Estimated by Meat Marketing Board.

It is recommended that with the establishment of new poultry farms the slaughtering capacity should be widened.

6.4 Dairy Products

6.4.1 Milk Production

Information on milk production does not exist. Cattle in Ghana are known to be very low milk yielders. Under improved feeding conditions the milk yield can go up to 1200 kg. Under farming conditions the lactation period ranges from 200 to 240 days. In most cases 400 kg of milk is consumed by the calves and some estimates indicate that about 800 kg/cow/lactation is a representative figure for milk available for human consumption. There are 560,000 cows in the country and assuming that 70% are lactating, these cows would produce about nearly 310,000 t/a milk. Table 19 (para. 5.2.3.) summarizes the milk demand for the production of fresh milk, butter, cheese, dried milk, yoghourt and condensed milk in Ghana. The possible milk production is shown in Table 24.

As it appears in the tables, the most critical commodity is milk to meet the demand of the required dairy products.

Ghana has to depend on foreign sources for milk throughout the planning period. Neither the traditional nor the commercial dairy is able to produce sufficient milk to meet future demand. The milk deficit is 3,000 thousand tons in 2000. It is assumed that achieving complete self-sufficiency requires building up an exotic dairy cow herd of 10.6 million, which under Ghanaian conditions and existing problems is impossible. However, on the basis of the experience to be gained within the next years, further expansion could be made depending on the import possibility of exotic cow/heifers.

Up to now, there is little dairying experience in Ghana. There are some farms, - Amarhia on the Accra plain, Nungua farm and the University of Ghana Agriculture Reasearch Station - where certain results have been achieved. According to researchers adaptability of exotic breeds to local conditions is not a serious problem if proper husbandry/management, health supervision and feeding are provided. In an improved tropical pasture in suitable places (probably one on the Accra plain, one near Kumasi and one near Ho,) a total of 3,000 lactating exotic cows and the appropriate dairy industry could be established by 1991. Milk production from these enterprises is estimated at around 8,000 t/a. In order to build up the dairy herd size it would require about 1500 cow/heifers importation by 1988 - 1990. Its economic feasibility deserves detailed calculation and experience gained during 1988 and 1991 would show this and it might become economically feasible beyond 1990.

6.4.2. Production of Dairy Products

Although the demand of dairy products like butter, cheese, yoghurt, drinking milk, dried milk and also condensed milk (shown in Table 19) is very high, there is no large industry for milk processing in Ghana. There are only some small

enterprises which produce drinking milk, butter, cheese, yoghourt and curd. The capacity of these enterprises is estimated around 28,000 t/a processed raw milk, which purchase the raw milk mainly from farmers. Only one dairy (Sam and Sam) has his own cattle farm, but also this dairy purchases raw milk from several farms. Almost 95% butter, 60% cheese and 100% of dried milk are imported. The imported dried milk is used for the production of reconstructed milk, biscuits and some dried special drinks based on cocoa and others. Around 49% of raw milk produced in Ghana are sold as drinking milk, 25% processed to cottage cheese and 26% processed to yoghurt by the animal holders.

Within the limited economic opportunities of the country, more dairies should be erected with Government assistance, in order to limit the import costs and to create growth centres for a balanced development of small-, medium and large-scale animal husbandry.

In table 34 is shown the necessary development of the processing capacity of raw milk and in table 35 the necessary imports to meet the demand of dairy products during the period 1986 and 2000.

6.5. Fish Production and Processing

6.5.1. Situation of Fish Catching

Fish is one of the most important and one of the cheapest sources of animal protein in the diet of most of the people living in Ghana. About 90% are caught in sea and lagoons, only 10% are caught in lakes and rivers. In 1985 was caught 650,000 t/a of fish in sea and lagoons and 35,000 t/a in lakes and rivers. About 36% were caught by deep sea vessels, 4% by distant vessels, 3% by trawlers, 2% by inland vessels and 55% by canoe.

Table 34: Possible milk processing on basis raw milk

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Raw Milk production	310	327	348	368	390	414	436	463	490	519	550	582	613	649	689
Raw milk consumption	310	327	348	368	390	414	436	463	490	519	550	582	613	649	689
for: - fresh milk	152	160	170	180	191	203	214	227	240	254	270	285	300	318	337
- butter	1	1	5	5	5	5	6	7	7	7	7	8	9	9	10
- cheese	76	80	83	88	93	99	104	110	117	124	131	139	146	155	164
- yoghourt	81	86	90	95	101	107	112	119	126	134	142	150	158	167	178
Dairy capacity	310	325	350	371	393	416	436	466	492	520	553	583	615	652	691
+ households	282	297	314	331	349	368	388	410	432	456	481	507	535	564	595
+ small scale industries	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Number of new dairies	-	-	2	3	4	5	5	7	8	9	11	12	13	15	17
+ Capacity of new dairies	-	-	8	12	16	20	20	28	32	36	44	48	52	60	68
Production of new dairies	-	-	6	9	13	18	20	25	30	35	41	47	50	57	66
Balance	-	-2	+2	+3	+3	+2	0	+3	+2	+1	+3	+1	+2	+3	+2

Table 35: Balance sheet of dairy products, local production and necessary import to meet the demand

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand															
Fresh milk	202	211	221	232	242	253	264	277	289	303	317	332	347	362	379
Butter	52,9	55,3	57,8	60,4	63,2	66,1	69,1	72,3	75,6	79,1	82,7	86,5	90,4	94,4	98,8
Cheese	17,7	18,4	19,2	20,1	21,1	22,0	23,0	24,1	25,1	26,4	27,6	28,9	30,2	31,5	33,0
Dried milk	16,8	17,5	18,3	19,2	19,9	20,9	21,8	22,8	23,9	25,0	26,1	27,3	28,6	29,9	31,2
Yoghourt	104	109	114	119	125	131	136	143	149	156	163	171	178	186	195
Condensed milk	66,8	70,0	73,0	76,4	79,9	83,6	87,3	91,4	95,6	99,9	104,5	109,2	114,2	119,5	124,9
Local production															
Fresh milk	152	160	170	180	191	203	214	227	240	254	270	285	300	318	337
Butter	0,04	0,04	0,19	0,19	0,19	0,19	0,23	0,27	0,27	0,27	0,27	0,30	0,34	0,34	0,38
Cheese	13,2	13,9	14,4	15,2	16,1	17,2	18,0	19,1	20,3	21,5	22,7	24,1	25,3	26,9	28,4
Dried milk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yoghourt	81	86	90	95	101	107	112	119	126	134	142	150	158	167	178
Condensed milk	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Necessary imports															
Fresh milk	50	51	51	52	51	50	50	50	49	49	47	47	47	44	42
Butter	52,86	55,26	57,61	60,21	63,01	65,91	68,87	72,03	75,33	78,83	82,43	86,2	90,06	94,06	98,42
Cheese	4,5	4,5	4,8	4,9	5,0	4,8	5,0	5,0	4,8	4,9	4,9	4,7	4,9	4,6	4,6
Dried milk	16,8	17,5	18,3	19,2	19,9	20,9	21,8	22,8	23,9	25,0	26,1	27,3	28,6	29,9	31,2
Yoghourt	23	23	24	24	24	24	24	24	23	22	21	21	20	19	17
Condensed milk	41,8	45,0	48,0	51,4	54,9	58,6	62,3	66,4	70,6	74,9	79,5	84,2	89,2	94,5	99,9

The Structure of the fishing fleet is summarized in Table 36.

Table 36: Fishing Fleet (Onshore and offshorte fishing vessels with 100 and more G.R.T.)

Kind of Vessel	Number of Vessel
100 - 499 GRT	56
500 - 999 GRT	10
1000 - 1999 GRT	19
2000 - 3999 GRT	2
Total Vessels	87

There are nearly 8000 canoes and motor boats along the coast, as well as 12 000 canoes and boats in rivers and lakes, providing livelihood for about 110 000 fishermen. The main catch areas for these fishermen are:

a) Ewe Region: The stretch of coast extending from the Eastern portion of Ghana at Aflao to the Volta River estuary is inhabited by the Ewe people, who specialize in beach fishing or drag-netting. The Ewe people do not confine their fishing activities to this section of the coast, but seasonally move in organized comparies along the whole length of the Ghana coast and to adjoining territories both East and West of Ghana. A part of the Ewe community also fishes the Volta lake and lagoons.

b) Ga-Adangbe Region: From the town of Ada at the West bank of the Volta River estuary the Ga-Adangbe area extends westward to the village of Fele, approximately 30 miles west of Accra. There are some very large fishing villages in this area and although Ga-Adangbe people have now adopted many other types of fishing, they were the main traditional fishermen at the coast.

c) Fanti Area: The Fanti district extends to the west, to Sekondi and includes many very large fishing communities. The Fanti people are known as the traditional "herring" fishermen, and fish for the two species of sardinella (aurita and cameronensis) which form the biggest single fishery in Ghana.

d) Ahanta-Nzima Region: Westward from Sekondi is the Ahanta-Nzima district. Sekondi/Takoradi are close to Tema the main centre for the motor fishing fleet, but in the remaining areas there are no specialized fishery as compared with the other sections of the coast, although each village has its fleet of canoes working with inshore mesh nets and a limited number of herring nets.

There are three fishing harbours in Ghana. The main and biggest is the Tema Fishing Harbour situated 18 miles east of Accra which is the only harbour for the deep-sea fishing fleet; a canoe beach is also provided within the harbour for the use of all types of canoes.

A second fishing harbour utilizing a natural lagoon is at Elmina, 46 miles east of Takoradi. This harbour is restricted to the use of small motor fishing vessels of maximum beam of 14 feet in the inner harbour. A naturally sheltered cave is located near Miema, 7 miles east of Axim. This cave provides safe mooring facilities for up to 20 motor fishing vessels.

6.5.2. Fish Processing

Although Ghanaians prefer fresh and canned fish to smoked or dried fish, more than 65% of the caught fresh fish is dried, smoked or canned, and 24% are chilled or frozen.

Around 97% of the total processed fresh fish are processed by small scale industries and households mainly by the women of the fishermen.

At present, traditional methods used in processing fish in Ghana are smoking, sun-drying, fermenting and drying. All these methods are aimed at preserving the fresh fish so that it will not perish even under the prevailing cilimatic conditions.

There are two main types of smoked fish available in Ghana, namely hot smoked and smoke-dried. In both processes the smoking is done at a temperature of about $80^{o}C$ to ensure that complete heating of the fish takes place. The main

difference is that whereas hot smoking is carried out for a shorter length of time of about one to three hours, smoke-drying takes about four or more hours, and sometimes even days to complete. Hot-smoked fish therefore has a higher moisture content of 35 - 68% and has usually a better taste. Smoke-dried fish, on the other hand, is hard and dry, with a moisture content of 10 - 18%.

The difference in moisture content affects the possible duration of storage of the two types and this is reflected in their utilization and consumption patterns. Thus, for example, it has been observed that among the coastal population where fish is more abundant, the preference is for the hot smoked and therefore more tasty fishes. On the other hand, the smoke-dried variety which is of a lower moisture content and therefore has longer storage qualities under the local climatic conditions can be easier handled and transported over long distances with very little or no loss. This also accounts for the preference for it in the inland.

Sun-drying is another method of processing fish which is widely applied in Ghana, especially in the Volta Region. The process involves spreading of fresh harvested fish in the sand along the beach to sun-dry it. The moisture content of sun-dried fish usually range from 8% to 19%. The product has a good storage ability because of its comparatively low moisture content. This makes its handling and transportation up country very easy. Added to this is the fact that the process, being dependent on solar energy, has wide application. Consequently, sun-dried fish is very widely consumed in the inland ranging from the South to the Northern parts of Ghana. In recent times, it was also marketed as a source of protein for the poultry industry.

Another method used in processing fish in Ghana, is salting combined with sun-drying. After salting, the fish is spread out to dry in the sun for 3 - 6 days either on the ground or at raised platforms.

Fermented fish (stink-fish), unlike the other types of processed fish, is used solely for flavouring of soups, stews and certain specific Ghanaian dishes.

Frying is also used as a means of preserving fish. It is however, used more in towns and villages along the coast and in big cities where fresh fish is readily available. Traditionally fried fish is consumed with pepper sauce, but it is also used in gravy, stews and soups.

In the early 1960s trade in the frozen fish started in Ghana. Local catches, principally tuna and small pelagics produced by the national fleets, as well as by joint ventures are kept in cold storages of landing centres. The most commonly used freezers are of the sharp freezer and air-blush types (-20°C to -25°C).

For domestic distribution of frozen fish in Ghana, female fish traders collect their supply from central cold storages and transport them to inland markets by open trucks without insulated boxes. The frozen fish are often thawed upon arrival at local markets, then sold as fresh. Thawed fish which cannot be sold on the day of arrival at markets without cold facilities are sometimes grill-dried for sale on later days.

Although the Ghanaian likes canned fish only a small part of fresh fish (not more than 2%) are processed to canned fish.

6.5.3. Necessary Fish Production to Meet the Demand of Fresh Fish

In the Tables 20 and 21 paragraph 5.2.3. are summarized the expected development for fish products and the necessary fresh fish which is required for the processing industry to meet the demand of fish products between 1986 to 2000. In Table 37 is shown the development of the catching capacity.

The production of sea fish is internationally limited owing to over exploitation of the sea. The expected catching growth rate is estimated around 1.0% - 1.5% until 2000, but with big expenses in contrast to the present expenses. Also the catching rate of the natural inland fish resources is limited.

Clear estimates of the quantity of fish produced from inland water and aquaculture are hard to obtain because of the manner of reporting these items. But it is estimated that the maximum inland catching yield are not more than 55,000 tons at present.

As mentioned earlier, Ghana's fish consumption per capita is comparatively high in Africa. Despite improvement in fishing methods in the past, it was not possible to increase fish production sufficiently to satisfy the national demand.

In future more attention should be given to inland fishery and fish farming in cages and ponds to reach the necessary growth rate of fish.

In table 37 is shown the necessary development of fish production by inland fishery. It is obvious that demand for fresh fish will ever increase over the years as long as there is population growth. The possibilities of further increasing total fish production targets to meet the estimated demand can mainly be reached by production through aquaculture. In Ghana it is not difficult to achieve an annual production of 5 t/ha through intensive aquaculture. This is possible in new dams which should be erected and also in numerous lagoons along the coast.

6.5.4 Possible Exploitation of Lagoons in Ghana

Several lagoons occur along the coast of Ghana, streching from Half Assini in the West to Aflao in the east, a distance of approximately 550 km (Fig.3). There are approximately 50 lagoons with a total surface area of about 40,000 ha, but most of them are small and inimportant in terms of fish production. The most important lagoons are Keta and Angaw situated in the east, and the Aby Lagoon on the western border between Ghana and the Ivory Coast. In between these extremely situated lagoons are some other important lagoons, even though they are smaller in size; these are the Amansuri; Brenu, Benya, Fasu, Amisa, Nakua, Sakum I, Kpeshie, Sakum II and Sangaw.

Table 37: Development of fish production ('000t)

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand	707,8	728,3	748,2	769,4	791,7	813,5	836,2	860,5	885,9	911,0	937,3	965,1	992,6	1021,3	1051,7
Production, sea	664,6	675,7	686,7	698,1	710,0	722,1	734,8	747,3	761,8	774,1	788,1	802,3	819,4	831,5	847,0
Vessel with 100 ... 499 G.R.T.	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3	133,3
Vessel with 500 ... 999 G.R.T.	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2	38,2
Vessel with 1000 ... 1999 G.R.T.	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6	72,6
Vessel with 2000 ... 3999 G.R.T.	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8	12,8
Small scale fishery	407,7	418,8	429,8	441,2	453,1	465,2	477,9	490,4	504,9	517,2	531,2	545,4	562,5	574,6	590,1
Production inland fish	41,2	42,4	43,7	45,0	46,4	47,8	49,2	50,7	52,2	53,8	55,4	57,0	58,7	60,5	62,3
Total production	705,8	718,1	730,4	743,1	756,4	769,9	784,0	798,0	814,0	827,9	843,5	859,3	878,1	892,0	909,3
Sea production through new vessels	2,-	10,2	12,8	21,3	30,3	34,4	34,7	43,3	49,7	60,9	71,1	77,9	82,8	95,5	106,2
Number of new vessels															
100 .... 499 GRT	-	-	-	3	5	5	5	7	7	7	9	10	10	11	11
500 .... 999 GRT	-	-	-	1	2	2	2	3	3	4	5	5	5	7	8
1000 .. 1999 GRT	-	-	-	1	2	2	2	2	2	3	3	3	4	5	5
2000 .. 4000 GRT	1	2	2	2	2	2	2	2	3	3	3	4	4	4	5
Development of inland aquaculture in '000t	-	-	5,0	5,0	5,0	9,2	17,5	19,2	22,2	22,2	22,7	27,9	31,7	33,8	36,2

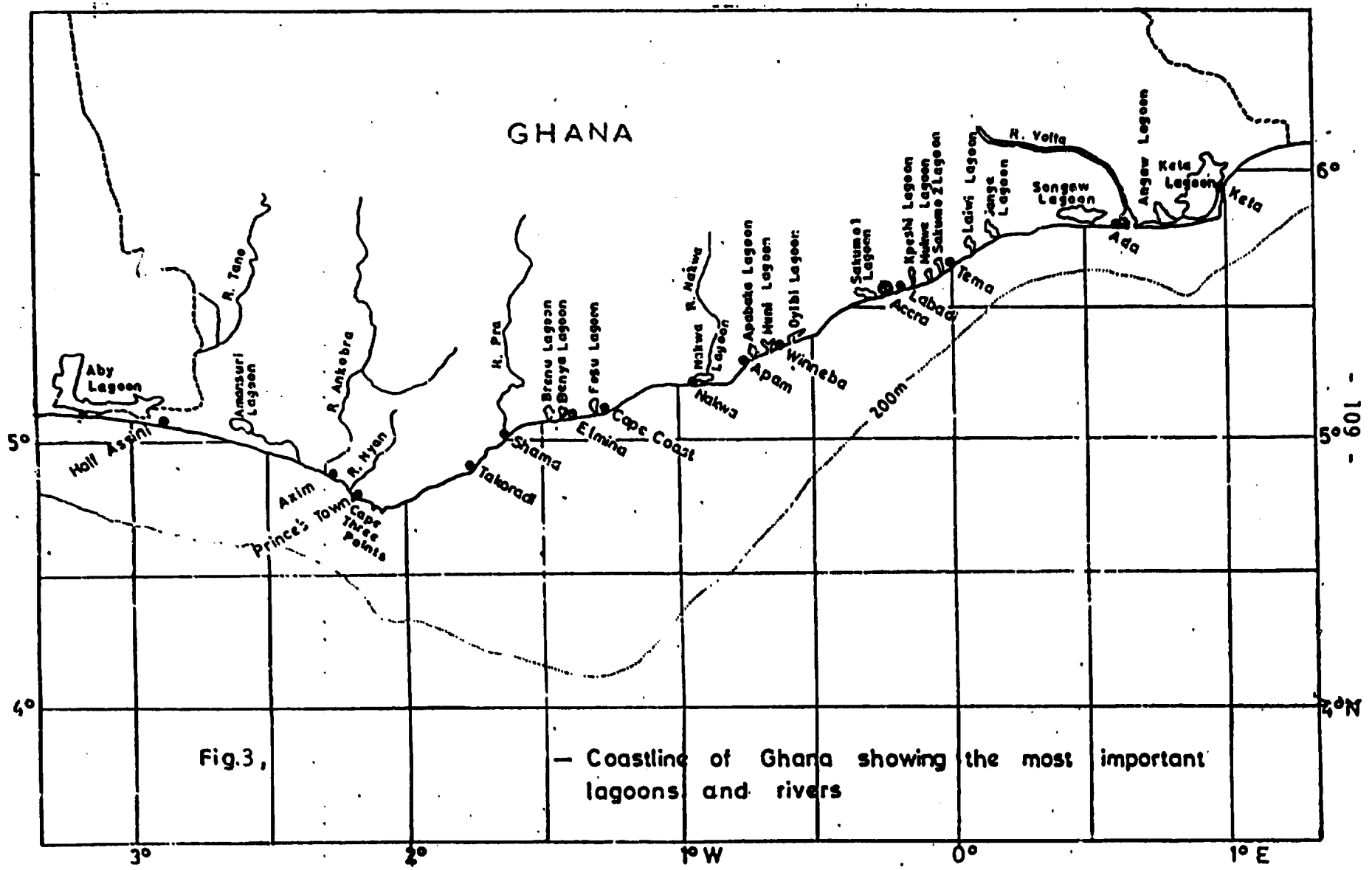


Fig.3, — Coastline of Ghana showing the most important lagoons and rivers

All these lagoons may be classified in two categories:-in closed and open lagoons. The first type, narrow and brackfish, lies immediately behind a sand barrier and has many widely separated temporary openings. It is usually not associated with large river systems. It was described as "closed" lagoons for the reason that they are closed off from the sea by sand bars for the greater part of the year. In Ghana, most of these types occur in the eastern coastal region where the annual rainfall is relatively low.

The second type described as "open" lagoons is normally fed by a large river or rivers during most part of the year. In Ghana, examples of this type are the Angaw, fed by the Volta River, the Keta Lagoon fed by the Kplika and Aka rivers, the Aby Lagoon fed by the Tomo River and the Sakumo I Lagoon fed by the Densu River. These lagoons also have direct and indirect connection with the sea.

Most of these costal lagoons are nursery grounds for marine fish species and shrimps and often sustain significant fisheries.

The most important lagoons are described below:

a) Sakumo Lagoon I (Fig. 4)

This occurs 11 km west of Accra and lies in the Densu Valley. It is about 5 km long and 140 km wide. Its depth during the dry season ranges from 50 cm to 10 cm in its lower reaches. Its estuary is fringed by extensive marshes. Fed by the Densu River, it is an example of an "open" lagoon.

b) Mukwe Lagoon (Fig. 5)

Lying east of Accra, it is 2 km long and has a surface area of about 4 ha;' an example of a "closed" lagoon, separated from the sea for nearly 10 months of the year. During the remaining 2 months of heavy rains, it is opened to the sea. The flood waters cause the sand bar at the mouth to be broken, allowing lagoon waters to flow into the sea and thus emptying the lagoon of its water. During this period

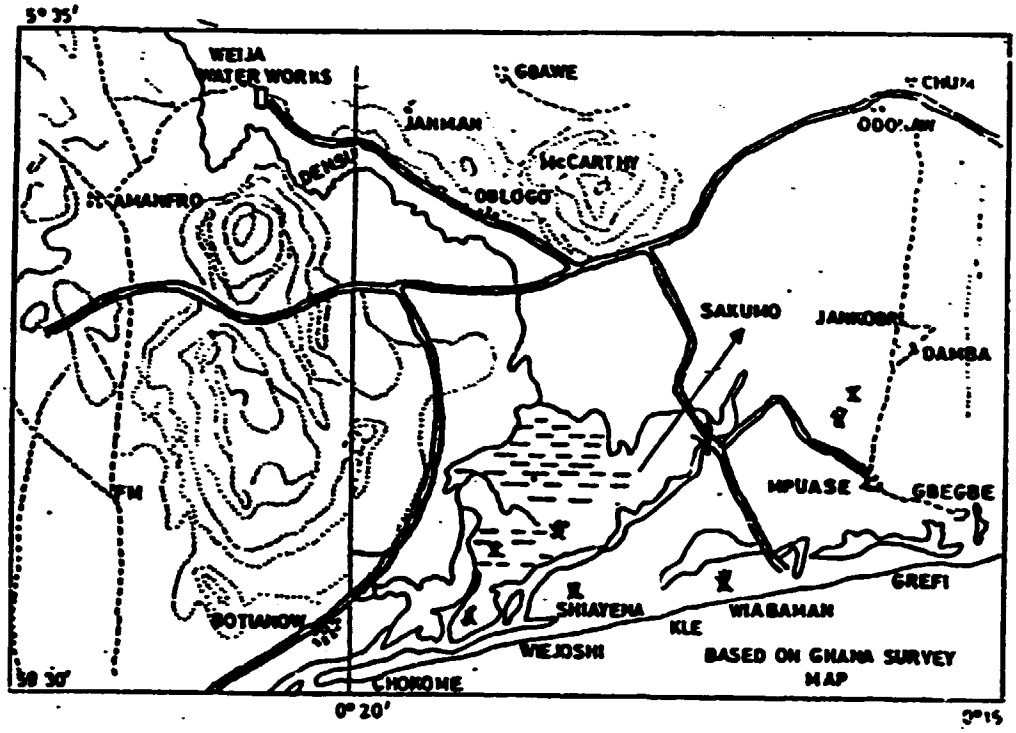


Fig. 4 (From Kwei) - Map of the Sakumo Lagoon Accra

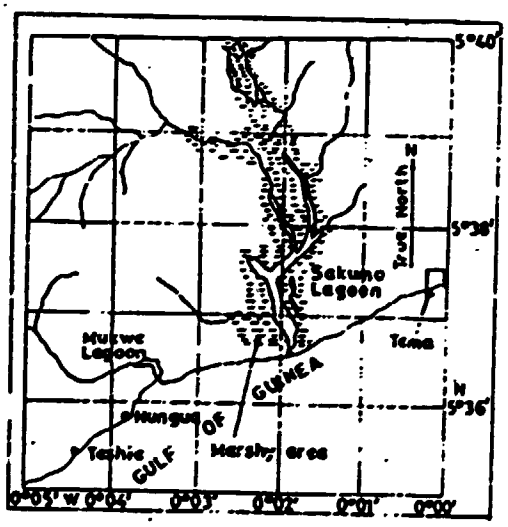


Fig. 5 (Kwei) — Map showing the geographical location, and relative positions of Mukwe and Sakumo 2 lagoon

tidal currents flow into and out of the lagoon periodically for a few weeks. It is a shallow lagoon having a depth of 0.5 - 1.5m.

c) Sakumo Lagoon II (Fig 6)

It lies some 2 km west of Tema. It is 4.42 km long and has a surface area of about 53 ha. Its maximum depth under tidal influence is 0.9 m. It was originally a "closed" lagoon, but in order to prevent any possible flooding of the Accra-Tema trunk road, the lagoon is made open by two parallel culverts which permit exchange of sea water during high tide. Sakumo II has thus become an "open" lagoon.

d) Keta Lagoon (Fig 6)

This is the largest in Ghana with a surface area of 2,120 ha. There is no reliable information on the tidal effect on the lagoon, neither is there any published information on its ecological, biological, chemical and hydrological characteristics. It has an indirect connection with the Volta estuary and the sea through the Angaw Lagoon. The main sources of its water supply is the Aka and the Kplikpa rivers and the Denu lagoon. It was quite deep in places and navigable by fair-sized motor launches. But in recent years, it has become shallow after the building of the Akosombo Dam. This dam has prevented the flooding of the Volta River, thus checking its floodwaters from entering the lagoon. It has caused the reduction in fishing activities on the lagoon. The water has become very brackish in recent years, resulting in the production of large quantities of salt at the marginal areas. Annual evaporation rate is 1524 mm. Most of its marginal areas are now dry and could be reclaimed for the construction of fish ponds. The lagoon had a direct connection with the sea through a canal at Kedzi, created by heavy floods in 1963 and 1968. During the period, there was migration of marine fish species and juvenile shrimps from the sea into the lagoon resulting in a flourishing fishing industry in the lagoon. The fishing industry was badly reduced when the canal was closed by the Public Works Department, aided by the sand bars in order to reconnect the trunk road which was cut off by the canal.

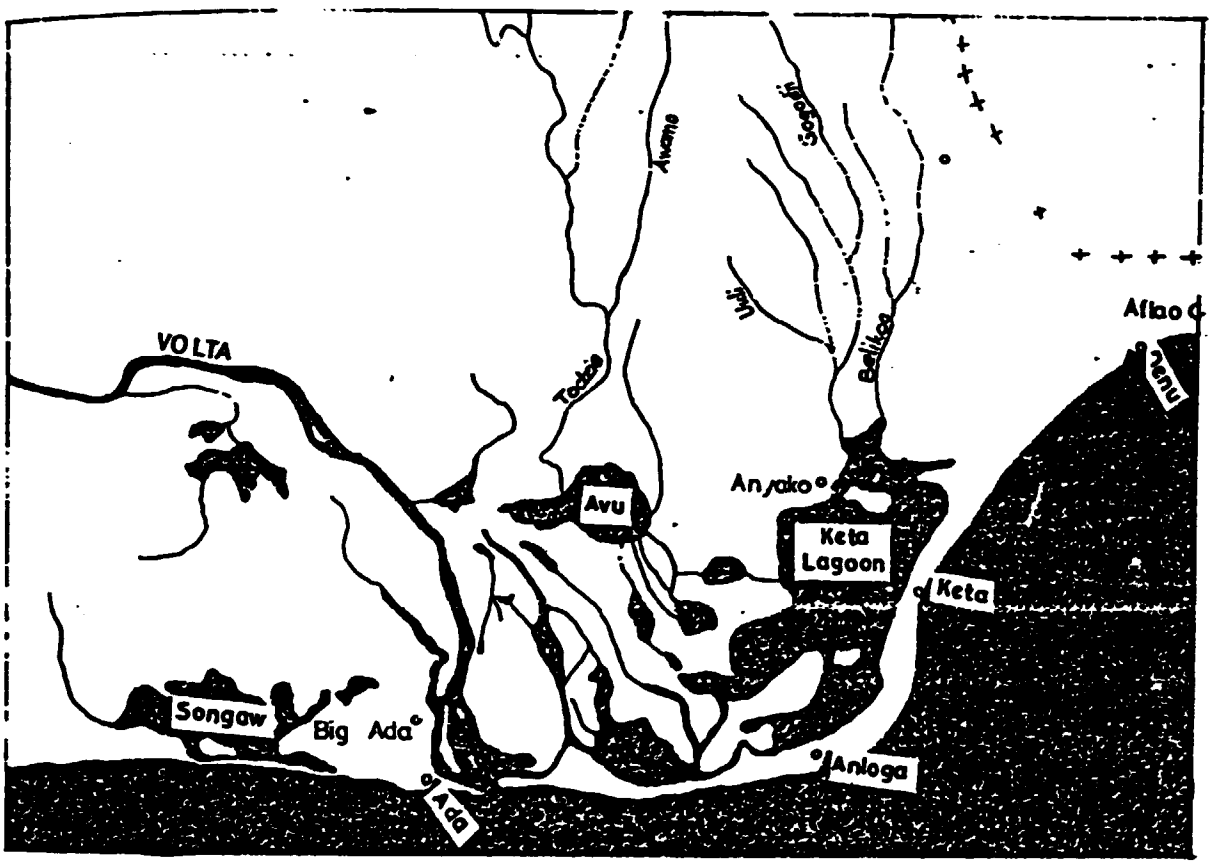


Fig. 6 — Map of Keta, Agaw & Songaw lagoons

e) Angaw Lagoon (Fig. 6)

This lagoon, situated west of the Keta Lagoon has a direct connection with the Volta estuary and the sea. It is under the influence of tidal waves which are semi-diurnal and measure approximately 1m at a time. It is fringed extensively by swamps and mangroves. This lagoon is known to support a large fishery,mainly of grey mullet and shrimps. No detailed studies are known to have been conducted on this lagoon. It is connected to the Keta Lagoon through a narrow channel by a culvert, under the Sroegboe-Dabala Highway.

f) Aby Lagoon

This lagoon, situated on the extreme west of the country, is the largest next to the Keta Lagoon, but has its larger portion in the Ivory Coast. It is fed by the Tano River. Its depth ranges from 1.5 to 3 m. The water of this lagoon remains fresh during the rains, but becomes brackish during the dry month, when there are tidal effects. A narrow belt of evergreen papyrus is found along the margin with water depths of about 1 m. Along this belt there is relatively high ground which is swampy. The soil of this swampy ground consists mainly of a layer of silt of about 1 m thickness, with a sandy subsoil. Excavation should be at least 1 m when it is considered for pond culture.

A properly planned commercial aquaculture programme should be elaborated, since this is the only way of increasing fish production in order to satisfy the country's demand in fish. The programme should set up a target of some 50,000t of fish to be produced annually by 2000 through aquaculture. This means some 10,000 ha of fish ponds , should be completed to be in operation by that time. It is therefore necessary to conduct detailed surveys of several selected lagoon areas with a view of finding suitable swap areas and soils for brackish water fish farming.

The Government will have to invest quite substantial capital in setting up pilot projects. The main constraints

of implementing such programmes are financing and the lack of trained extension personnel. There is also not enough machinery and equipment available in the country at the moment for the construction of such ponds.

The Government should therefore request some external assistance in this field.

6.5.5 Development of the Fish Processing Industries

The fish processing industry in Ghana is very poorly developed. There are three canneries with a total capacity of 14,000 t/a and one medium fish smoking plant with a capacity of 2,400 t/a. The utilization of the smokery is only 3%. Nearly 100% of the consumed smoked and dried fish are produced by small scale enterprises and by households, partly under very bad hygienic conditions.

a) Fish Smoking and Drying

The Table 38 shows the development of the smoked fish demand, the available smoking capacity and the necessary development of new capacities.

The production indexes of small-scale and cottage industries are estimated on the basis of the equipment. Most of these small enterprises have a smoking capacity of between 50 to 150 kg per day and producing not more than 100 - 350 kg per week, but some times only 100 kg per month. However, average annual production is not more than 5 - 8 t.

Dried fish and smoked and dried fish is only produced by households.

b) Fish canning

In Table 39 is summarized the necessary development of fish canning in Ghana. To meet the required demand of canned fish new capacities of about 39.000 t/a are to be erected until the year 2000.

Table 38: Necessary development of the fish smoking industry

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand	65,0	66,7	68,3	70,0	71,8	73,6	75,4	77,4	79,4	81,3	83,4	85,5	87,6	89,8	92,2
Production															
- Small scale and cottage industries (households)	54,5	55,3	56,1	56,9	57,8	58,7	59,6	60,5	61,4	62,3	63,2	64,1	65,1	66,1	67,1
- Medium industries	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4	2,4
- Number of new enterprises	-	-	2	2	3	3	3	3	3	3	3	4	4	4	4
- Capacity of new enterprises	-	-	12,0	12,0	12,0	18,0	18,0	18,0	18,0	18,0	18,0	24,0	24,0	24,0	24,0
- Production of new enterprises	-	-	9,8	10,7	11,6	12,5	13,4	14,5	15,6	16,6	17,8	19,0	20,1	21,3	22,7
- Balance	-8,1	-9,0													

Table 39: Necessary development of fish canning industry

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand	23,7	25,1	26,5	28,0	29,6	31,2	32,8	34,7	36,7	38,7	40,9	43,3	45,5	48,1	50,8
Installed capacity	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0	14,0
Number of new factories	-	-	1	1	2	2	2	3	3	3	3	4	4	5	5
Capacity of new factories	-	-	15,0	15,0	21,0	21,0	21,0	27,0	27,0	27,0	27,0	33,0	33,0	39,0	39,0
Production of new factories	-	-	12,5	14,0	15,6	17,2	18,8	20,7	22,7	24,7	26,9	29,3	31,5	34,1	36,8
Necessary import	9,7	11,1	-	-	-	-	-	-	-	-	-	-	-	-	-

c) Ice Production and Cold Store Capacity for Fish Processing

In Tables 40 and 41 are shown the demand for ice and the cold storage capacities between 1986 and 2000.

The production of ice and ice blocks is far below the demand. Whilst the demand of ice is 179,000t in 1986, the installed capacity is only 140,000t. There is a shortage of ice of about 39,000 t in 1986. An accelerated extension of the ice production capacity is necessary.

As shown in Table 41 an excess capacity of cold storage is existing. The ascertained cold store capacity amounted to about 25,000 t, whereas the requirements are only 14,500 t. Only in 1998 is an extension of the capacity necessary.

6.6 Feed Production

6.6.1. Sources of Animal Feed

Feeds and feeding being an important issue, have to be divided into two separate parts. One is related to the proper use and improvement of extensive natural grazing areas and the other is the use of crop by-products and concentrate feed issues.

Ghana has about 14 to 15 million hectares of natural grazing area and presently, probably only one fifth of it is used. It provides the total feed demand of all ruminants and equines. The natural grasslands are very large in comparison to the small size of the national herd (less than 1.5 million animal units). Some parts of the grazing areas are infested by flies and parasites. Lacking water resources and demage from range fire are other hazards. Even under these conditions, the existing grazing land could support at least three to four times the number of animals existing at present (assuming 9 - 10 million ha of grazing lands with an unimproved carrying capacity of 3 - 4 ha/animal).

Large scale improvements of natural pasture would not be possible as it would involve high costs. Reseeding for changing grass cover of rangelands clearing, water supply, fertilization etc. would cost very much to the country. Pasture improvement should be accomplished in areas where breeding/feeding ranges are established. Where pasture improvement is implemented, the most important issues are the provision of an adequate supply of stock drinking water and of dry season roughage which have to be dealt with very carefully. All the planned production of the cattle/sheep farms cannot be accomplished unless these two important problems are solved. Provision of water is a matter of investment and maintenance, but provision of dry season roughage needs careful planning and effective measures, i.e. organization of production lines with appropriate grazing forage conservation, prevention of range fires and use of agricultural crop residues.

In the case of concentrate feeds, maize at present constitutes the most part. From the energy feed as a source, there is no difficulty since these crops are locally produced. But the important question is to produce feed grains at a price which could make them available cheaply enough to be used in the livestock industry. The most difficult problem is the availability of protein source feed, cake, fish meal etc. Slaughterhouse by-products are not used as feed. At present feed protein deficiency is a serious problem and this in future would be a major bottleneck for intensive livestock production enterprises. Therefore a way should be found to overcome the problem. There is also a deficiency in concentrate feed additives, vitamines, minerals, etc. which have to be imported, but feed protein from crop or animal sources should be produced locally.

6.6.2. Present Situation, Feed Demand

Because of the limited availability of statistical infor-

Table 40: Necessary development of ice-production capacities for fish chilling

	t/d														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1994	1997	1998	1999	2000
Demand of ice for fish chilling	179	185	191	197	204	211	218	226	234	242	250	259	268	277	287
Production capacity	140	140	140	140	140	140	140	140	140	140	140	140	140	140	140
Number of new factories	-	-	1	1	2	2	2	2	3	3	3	3	4	4	4
Capacity of new factories	-	-	60	60	90	90	90	90	120	120	120	120	150	150	150
Production of new factories	-	-	51	57	64	71	78	86	94	102	110	119	128	137	147
Balance	-39	-45	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 41: Necessary development of cold store capacity for fish

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cold store requirement	14,5	15,2	15,9	16,6	17,4	18,2	19,0	19,9	20,9	21,8	22,8	23,9	25,0	26,2	27,4
Installed capacity	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0
Number of new cold stores	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Capacity of new cold stores	-	-	-	-	-	-	-	-	-	-	-	-	5,0	5,0	5,0
Storage in new cold stores													0,5	1,2	2,4

Table 42: Necessary cold store room

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Volume	'000m³	20,7	21,7	22,7	23,7	24,8	26,0	27,2	28,5	29,8	31,2	32,6	34,1	35,7	37,4	
area incl. paths	'000m²	10,3	10,8	11,3	11,8	12,4	12,9	13,5	14,2	14,8	15,5	16,2	17,0	17,8	18,6	19,5

Storage height: 3m

mation on feed supply and feed use, it is difficult to make a feed balance analysis for the present situation. However, an effort is being made to present the feed and feeding situation at least on a very rough basis.

At present all the ruminant animals in Ghana are dependent on grazing resources for feed. This includes grazings in crop areas whatever residues are left. There are about 1.2 - 1.3 million animal units (one animal unit is equivalent to a cow or 10 sheep/goat) which at present use the available extensive grazing areas. Based on an estimation of 3 - 4 ha/animal unit (A.U), the equivalent grazing areas would be about 3 million ha. There is a shortage of drinking water and forage in the dry season. The yearly water requirement of the stock would amount to 8 - 10 million m^3 of which probably 70% should be provided through small dams. It is reported that the existing number of small dams for stock watering purposes (about 240 in total) does not supply the required water.

It is estimated that about 2.7 million tons of straw (Table 43) is available in the country. Part of it is grazed off and none is conserved for the dry season requirements and a considerable part of the natural forage is burned and these altogether cause an acute feed deficiency in the dry season.

The overall problems for the feed requirements and feed balance of ruminant stock is that in the rainy season there is an abundance of forage, but in the dry season there is a shortage in certain areas. If more water points are made available on a large scale and if range burning could be prevented, the problem regarding the shortage of forage could be solved. The problem of improving the grassland is yet to be solved. The overall feed balance is sufficient but there exists a severe seasonal shortage which causes weight loss in animals, and reduces herd productive capacity.

Table 43: Availability of Feed in 1986

Wheat bran	35,000 t
Rice bran	12,000 t
Maize bran	18,000 t
Millet/Sorghum bran	8,000 t
Feed concentrates	40,000 t
Palm oil cake	30,000 t
Groundnut cake	36,000 t
Coconut cake	2,000 t
Maize	130,000 t
Rice straw	12[illegible],000 t
Maize straw	2,100,000 t
Millet straw	200,000 t
Sorghum straw	350,000 t
Cassava	165,000 t
Total	3,246,000 t

Feed balance analysis with regard to concentrate feeds, results in the conclusion that again the data base is very weak. The total present concentrate feed production from feed mills is not known accurately. All feed mills are operating below their capacities and production varies year by year. An estimate of agro-industrial by-products based on maize and other feeds is summarized in Table 43. There is no information available on imported feedstuffs. An effort is made to estimate the feed demand in the Tables 44 to 47.

6.6.3. Future Situation

The cattle, sheep, goat population in terms of animal units would reach 3.2 million in 2000. About 30% of these animals would be kept under improved, commercial and breeding centre schemes and the remaining 70% would be under the traditional system.

The improved system of ruminant farming would require about 1.4 million ha of good grazing area. The dry season water and forage problems have to be overcome. It is estimated that about 180 small dams should be constructed

to supply about 1.8 million m^3 of water over the whole year. Out of 1.4 million of grazing area, about 0.6 million ha has to be improved in terms of grass coverage and management. The rest of the herd (2.24 miliion A.U.) remains in the traditional sector which needs 3.2 million ha of grazing area to be provided with sufficient water points.

It is assumed that the above range improvement measures together with the concentrates summarized in Table 47 would be sufficient to supply the required feed for the ruminant farming.

With respect to the concentrate feed requirements in 2000 the following analysis is made.

The backyard poultry industry according to the estimates will produce 20.6 thousand tons of meat and 22 thousand tons of egg. The feed equivalent of this level of production would be around 192 tons of which 15% would account for concentrate feed sources.

The commercial poultry industry will produce 21.6 thousand tons of meat and 23.2 thousand tons of eggs. With feed conversion rates of 1:2.9 for meat and 1:6 for eggs, the total concentrate feed requirements would be 202 thousand tons concentrate feed sources.

For the backyard pig industry, the 84,000 head basic herd would consume the equivalent of 136,000 tons of concentrate feed and 44,000 tons of feed would be required in order to produce 5,700 tons of meat in 2000. It is assumed that the backyard pig will consume 15% of its requirements from concentrate feed source, which amounts to 27 thousand tons. About 157,000 tons are feed mix which includes grain, cassava, vegetable residues, grass, bran, household wastes, sugar cane etc.

The commercial pig industry with a 18,300 basic stock will consume 33,000 tons of concentrate feed, and fattening pigs to about 60 kg liveweight will consume 53,000 tons of concentrate feed. Total feed requirements

Table 44: Feed demand for poultry and inland fish production

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Poultry livestock	10^6	13,1	14,0	14,7	15,5	16,4	17,3	18,3	19,3	20,4	21,5	22,7	24,0	25,3	26,7	28,3
- backyard	10^6	6,9	7,3	7,6	8,0	8,4	8,8	9,3	9,7	10,2	10,7	11,2	11,8	12,4	13,0	13,7
- commercial	10^6	6,2	6,7	7,1	7,5	8,0	8,5	9,0	9,6	10,2	10,8	11,5	12,2	12,9	13,7	14,6
Feed demand																
1. backyard																
- Feed	'000t	83,1	86,3	89,7	94,4	98,3	103,0	107,9	112,5	117,3	122,0	126,6	132,2	138,9	145,6	152,1
- Concentrate	'000t	14,6	15,2	15,9	16,7	17,4	18,2	19,1	19,9	20,8	21,6	22,4	23,4	24,6	25,8	26,9
2. Commercial																
- Feed	'000t	35,2	37,7	39,5	41,2	43,8	46,5	49,2	52,2	55,3	57,9	61,4	64,9	68,6	72,7	76,5
- Concentrate	'000t	52,7	56,5	59,3	61,8	65,7	69,8	73,8	78,3	83,0	86,9	92,1	97,4	102,9	109,1	114,8
Inland fish production	'000t	-	-	5,0	5,0	5,0	9,2	17,5	19,2	22,2	22,2	22,7	27,9	31,7	33,8	36,2
Concentrate	'000t	-	-	11,5	11,5	11,5	21,2	40,2	44,2	51,1	51,1	52,2	64,2	72,9	77,7	83,4

Table 45: Feed demand for Cattle farming

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Livestock small and medium scale	1000	1138	1201	1267	1338	1412	1490	1572	1659	1751	1848	1950	2058	2172	2293	2420
Hay	'000t	194	205	216	228	240	254	268	283	298	315	332	350	370	391	412
Silage	'000t	562	614	648	684	722	761	803	848	895	944	996	1052	1110	1172	1237
Mixed feed	'000t	77	82	87	91	96	102	107	113	119	126	133	140	148	156	165
Grazing land	'000 ha	969	1023	1079	1140	1203	1269	1339	1413	1490	1574	1661	1753	1850	1953	2061
Livestock new farms	1000	-	-	2	3	5	5	7	12	13	17	18	23	25	28	32
Hay	'000t	-	-	1	2	4	4	5	8	9	12	13	16	18	20	22
Silage	'000t	-	-	5	8	13	13	19	32	34	45	48	61	66	74	85
Green feed	'000t	-	-	20	29	46	49	69	118	128	167	177	226	246	275	314
Mixed feed	'000t	-	-	1	1	1	1	2	3	3	4	5	6	6	7	8
Total mixed feed	'000t	77	82	88	92	97	103	109	116	122	130	138	146	154	163	173

Table46 : Feed demand for sheep and goat production

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Livestock	1000	3703	3892	4067	4243	4435	4657	4896	5121	5377	5648	5921	6210	6516	6838	7184
Green feed	10^6t	51,8	54,5	56,9	59,4	62,1	65,2	68,5	71,7	75,3	79,1	82,9	86,9	91,2	95,7	100,6
Grazing land	10^6ha	1,30	1,36	1,42	1,49	1,55	1,63	1,71	1,79	1,88	1,98	2,07	2,17	2,28	2,39	2,51

Source: A. Paulusch

Table47 : Feed demand for pig production

	UNIT	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Livestock	1000	328	346	363	382	399	417	436	457	480	503	527	551	577	605	634
- Backyard	1000	203	213	222	233	243	252	264	275	288	300	313	326	340	356	370
- Commercial	1000	125	133	141	149	156	165	172	182	192	203	214	225	237	249	264
Feed demand																
1. Backyard																
- miscellaneous feed	'000t	84	88	92	96	100	104	109	114	119	124	129	135	140	147	153
- concentrate	'000t	15	16	16	17	18	18	19	20	21	22	23	24	25	26	27
2. Commercial																
- miscellaneous feed	'000t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- concentrate	'000t	41	43	46	48	51	54	56	59	62	66	70	73	77	81	86

Table 47a: Demand for production of feed concentrate ('000 t)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1. Demand	200	213	237	248	261	284	317	337	360	378	398	428	457	483	511
- Poultry farming	67	72	75	79	83	88	93	98	104	109	115	121	128	135	142
- Cattle farming	77	82	88	92	97	103	109	116	122	130	138	146	154	163	173
- Inland fishing	-	-	12	12	12	21	40	44	51	51	52	64	73	78	83
- Pig farming	56	59	62	65	69	72	75	79	83	88	93	97	102	107	113
2. Capacity	155	158	281	284	287	290	353	356	419	422	425	489	493	497	561
- Small scale	90	93	96	99	102	105	108	111	114	117	120	124	128	132	136
- Medium and large enterprises	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
- New factories: capacity	-	-	120	120	120	120	180	180	240	240	240	300	300	300	360
: production	-	-	76	83	94	114	144	161	181	196	213	239	264	286	310
- Number of new factories	-	-	2	2	2	2	3	3	4	4	4	5	5	5	6
3. Production	155	158	237	248	261	284	317	337	360	378	398	428	457	483	511
Balance	-45	-55													

would be 86,000 tons.

There is no production of fish feed for fish breeding in the country. But to meet the requirement of fish in the future, Ghana has to start with fish breeding as soon as possible. The feed concentrate demand for the fish production in dams is 2.5 kg/kg fish, which amounts to 83.4 thousand tons in 2000.

6.6.4. Concentrate Production

There is a need for a separate programme to cover the whole aspect of feeds and feeding which are emphasized in different production programmes and to ensure that feed development is adequately handled in the overall programming of livestock development. This should include two sub-programmes: one for the concentrate feeds which should include a detailed study of feed materials, quantities, locations and feed compositions and anotner one with an assessment of the feed processing plants, capacity, efficiency and the need for new plants.

Resulted from the concentrate demand and the production capacity of available feed mills, calculated above, 6 new feed mills are necessary with a capacity of 60,000 t/a each to meet the feed

concentrate requirement in 2000. The demand of feed concentrate and development of the production capacity are summarized in Table 47 a, where the growth rate of the capacity of the small scale industry is estimated at 3% p.a.

6.7. Bakery and Biscuit Production

In Table 48 is shown the expected development of the consumption of bakery products and biscuits. Although there is no basis for the production of wheat in Ghana and the processed wheat has to be imported, the consumption of the bakery products and biscuits are growing permanently. The growth rate of these products has been 5% p.a. since 1979.

It is estimated that about 87,000 bakeries exist in Ghana with a capacity of more than 600,000 tons of finished bakery products. 10,181 bakeries are located in the Greater Accra Region. The estimated structure of the bakeries in Ghana in 1985 is summarized in Table 49.

All these bakeries produce bread in addition to pastries, cakes and biscuits etc., although two big biscuit factories exist with a total capacity of 3,000 t/a. But these factories are operating at approximately 30% capacity utilization. A third biscuit factory with a capacity of 6,000 t/a, which was partly constructed in 1978 has never been completed. Although there is no shortage in bakery products and biscuits, it should be recommended to continue and to accomplish the uncompleted investment, as the equipment and the buildings of the existing biscuit factories are in very bad condition and need substitution.

In this uncompleted biscuit factory in addition to equipment for the production of biscuits are also included equipment for the production of wafer which could be used in connection with the cocoa processing industry, a new and prospective foreign exchange earner. Filled and with chocolate plated wafers are internationally in good demand.

However more than 98% of the raw materials for the production of bakery products and biscuits are imported or produced from imported commodities and there seem to be no possibilites to change the situation because of the trend in increasing the requirement of sweet products and products made from wheat flour.

Table 48: Development of the Consumption of Bakery Products and Biscuits

Year	'000t	
	Bakery Products	Biscuits
1986	199.7	5.2
1987	211.4	5.5
1988	223.3	5.7
1989	235.8	6.0
1990	248.9	6.3
1991	262.3	6.5
1992	277.7	6.8
1993	292.4	7.1
1994	309.3	7.5
1995	326.6	7.8
1996	344,6	8,2
1997	365.2	8.5
1998	384.7	8.9
1999	406.6	9.3
2000	429.7	9.8

Source: A. Paulusch

Table 49: Structure of the Bakeries of Ghana in 1985

Description	Size of enterprise employees	Bakeries No	%	Estimated production t	%	Estimated capacity t	%
Industrial bakeries	20 and more	260	0.3	2.200	1.2	18.000 12.2%*	3,0
Medium Scale bakeries	6 - 19	6.000	6.9	33.500	18.6	150.000 22.3%*	24.8
Small Scale bakeries	1 - 5	46.000	53.2	108,200	60.1	350.000 30.9%*	58.0
Doughnut and pastry bakeries	1	34.200	39.6	36.200	20.1	86.000 42.1%	14.2
Total		86.460	100.0	180.100	100.0	604.000	100.0

Source: Estimated by Greater Accra Zonal Co-op. Bakers Union Limited

* Capacity utilization

In Table 50 and 51 the needs for raw materials to meet the requirements of bakery products and biscuits are summarized. The Tables present the whole demand for sugar, yeast, raisins, baking powder, egg powder, milk powder, aroma, and the wheat flour up to the year 2000. All the materials are imported or purchased on the parallel market. From 64 visited bakeries 16 purchased the raw material on the parallel market, including flour.

In Ghana there is no immediate need for widening the capacity of the bakeries but the government should prepare a programme for the supply of sufficient raw materials in high quality to the bakeries and biscuit factories, based on promotion of local production for commodities as sugar, yeast and egg powder, as well as introduction of substitutes as composite flour and dried fruits.

Table 50: Necessary Raw Materials for bakeries

RAW MATERIALS	t/1000 t	'000 Tons														
		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Sugar	39,85	8,0	8,4	8,9	9,4	9,9	10,5	11,1	11,7	12,3	13,0	13,7	14,6	15,3	16,2	17,1
Salt	1,84	0,37	0,39	0,41	0,43	0,46	0,48	0,51	0,54	0,57	0,60	0,63	0,67	0,71	0,75	0,79
Fat	0,64	0,13	0,14	0,14	0,15	0,16	0,17	0,18	0,19	0,20	0,21	0,22	0,23	0,25	0,26	0,27
Yeast	1,30	0,26	0,27	0,29	0,31	0,32	0,34	0,36	0,38	0,40	0,42	0,45	0,47	0,50	0,53	0,56
Raisins	0,37	0,074	0,078	0,083	0,087	0,092	0,097	0,103	0,108	0,114	0,121	0,128	0,135	0,142	0,150	0,159
Oil	0,184	0,037	0,039	0,041	0,043	0,046	0,048	0,051	0,054	0,057	0,060	0,063	0,067	0,071	0,075	0,079
Baking Powder	0,076	0,015	0,016	0,017	0,018	0,019	0,020	0,021	0,022	0,024	0,025	0,026	0,028	0,029	0,031	0,033
Flour	620,0	123,8	131,1	138,4	146,2	154,3	162,6	172,2	181,3	191,8	202,5	213,7	226,4	238,5	252,1	266,4

Table 51: Raw material demand for biscuit production

	'000 tons														
	1986	987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Flour	3,2	3,4	3,5	3,7	3,9	4,0	4,2	4,4	4,7	4,8	5,1	5,3	5,5	5,8	6,1
Sugar	1,6	1,7	1,8	1,9	2,0	2,0	2,1	2,2	2,3	2,4	2,5	2,6	2,8	2,9	3,0
Fat	1,6	1,7	1,8	1,9	2,0	2,0	2,1	2,2	2,3	2,4	2,5	2,6	2,8	2,9	3,0
Egg powder	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,3	0,3	0,4	0,4	0,4	0,4
Baking powder	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,3	0,3	0,4	0,4	0,4	0,4
Milk powder	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,3	0,3	0,3	0,3	0,4	0,4	0,4	0,4
Aroma	0,02	0,02	0,0	0,02	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,04

6.8 Flour Milling

6.8.1 Wheat Flour

In Ghana there are three existing wheat flour mills with a total capacity of 210,000 t/a which can produce not more than 100,000 t/a due to the bad state of the equipment. The imports of wheat have been 60,000 t in 1983; 25,000 t in 1984 and 72,530 t in 1985. In addition Ghana got from the World Food Programme 25,000 t wheat in 1985. As such the imported wheat could not yield more than 70,500 t flour but the consumption of wheat flour has been around 190,000 t in 1985 that is to say 63% of the consumed wheat flour are purchased in the parallel market.

In Table 52 a summary of the demand in wheat flour from 1986 to 2000 and the necessary development of the milling capacity is tabulated.

In spite of full utilization of the available capacity 132,600 t has to be imported in 1986. Table 53 shows the necessary wheat and flour imports in the case of widening the milling capacity and Table 54 shows the wheat and flour import with constant milling capacity based on 1986.

In Table 55 the development of the import costs adequate to the variants shown in Table 53 and 54 are compared.

6.8.2 Maize Flour

Maize is the most important cereal product in Ghana. The per capita consumption of this crop has been constant 45 kg since the last 5 years. It is used as food and also as animal feed.

The consumption of maize was 560,000 t in 1985 and the area under crop has been really 300,000 ha which corresponds with the traditional yield of maize at 1.8 t/ha in the area of West Africa. Around 32% are used in households for food and 68% for animal feed.

Table 52: Necessary Development Of Production Of Wheat Flour To Cover The Demand

DEMAND	'000 TONS														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Households	81,9	86,5	91,3	96,5	101,9	107,6	113,6	120,0	126,7	133,9	141,4	149,2	157,7	166,5	175,9
Bakeries	123,8	131,1	138,4	146,2	154,3	162,6	172,2	181,3	191,8	202,5	213,7	226,4	238,5	252,1	266,4
Biscuits	3,2	3,4	3,5	3,7	3,9	4,0	4,2	4,4	4,7	4,8	5,1	5,3	5,5	5,8	6,1
Total Demand	208,9	221,0	233,2	246,4	260,1	274,2	290,0	305,7	323,2	341,2	360,2	380,9	401,7	424,4	448,4
Available Capacity	151,2	151,2	151,2	151,2	196,2	241,2	286,2	331,2	331,2	376,2	376,2	421,2	421,2	466,2	466,2
PRODUCTION															
Existing enterprises	76,6	151,2	151,2	151,2	151,2	151,2	151,2	151,2	151,2	151,2	151,2	151,2	151,2	151,2	151,2
New mill I	-	-	-	-	25,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0
New mill II	-	-	-	-	-	25,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0
New mill III	-	-	-	-	-	-	25,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0	45,0
New mill IV	-	-	-	-	-	-	-	19,5	37,0	45,0	45,0	45,0	45,0	45,0	45,0
New mill V										10,0	29,0	45,0	45,0	45,0	45,0
New mill VI												4,7	25,5	45,0	45,0
New mill VII														3,2	27,2
Total Production	76,6	151,2	151,2	151,2	176,2	221,2	266,2	305,7	323,2	341,2	360,2	380,9	401,7	424,4	448,4
Import	132,3	69,8	82,0	95,2	83,9	53,0	23,8	0	0	0	0	0	0	0	0

Table 53: Necessary Wheat and Flour Imports in case of widening of the milling capacity (variant I)

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Wheat	106.4	210.0	210.0	210.0	244.7	307.2	369.7	424.6	448.9	473.9	500.3	529.1	558.0	589.5	622.8
Flour	132.3	69,8	82.0	95.2	83.9	53.0	23.8	-	-	-	-	-	..	-	-

Table 54: Necessary Wheat and Flour Imports without extention of the milling capacity (variant II)

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Wheat	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4	106.4
Flour	132.3	144.4	156.6	169.8	183,5	197,6	213.4	229.1	246.6	264.6	283.6	304.3	325.1	347.8	371.8

Source: A. Paulusch

Table 55: Development of Import Costs for Wheat and Flour

	MILLION US $														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Variant I	41.7	35.8	38.7	41.9	42.3	40.5	39.0	38.2	40.4	42.7	45.0	47.6	50.2	53.0	56.1
Variant II	41.7	44.5	47.5	50.7	54.0	57,4	61.2	65.0	69.3	73.6	78.2	83.2	88.3	93.7	99.0

Average World Market Price in 1985:- Wheat : US $/t 90
Flour : US $/t 242

At present, there are only small scale enterprises for the production of flour and meal from corn, but there are no data available about capacity or production of these products.

The development of maize demand is shown in Table 56, which is a trend estimation based on consultations of inhabitants of villages and cities and of related enterprises. These consultations have shown that around 380,000 t of maize have been processed by small scale enterprises which produce an average of 13 t/a. Because of this there exist in Ghana 29,200 small scale enterprises which process sorgum and millet in addition to maize. Around 100,000 t of maize are processed in the households to flour and corn meal.

The big enterprises which produce especially animal feed and food items process their need of maize in their own factories.

In Ghana there is a need for corn flour, corn rice, corn flakes and corn meal, but there is only one enterprise which produces corn flakes. The capacity for corn flakes is 1,000 t/a in this enterprise.

The estimation of the demand for corn products is summarized in Table 57 and the necessary maize demand for the production of these items is included in Table 56.

At present one factory to produce the above mentioned products is planned to be built in Kumasi. The capacity of this new enterprise is:

- corn flour 5,600 t/a
- corn rice 60 t/a
- corn meal 250 t/a
- corn flakes 300 t/a

For the development of the maize processing industry a study should be accomplished which has to include all aspects of maize used in the food processing industries, animal food production and the production of starch and starch products from maize flour.

Table 56: Maize Demand

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand for Maize	576.0	591.0	605.0	621.0	636.0	652.0	668.0	685.0	703.0	720.0	738.0	757.0	776.0	796.0	816.0
Flour production	178.8	183.4	187.8	192.6	197.5	202.4	207.4	212.7	218.1	223.6	229.2	235.0	240.9	246.9	253.2
Poultry feed conc.	20.1	21.6	22.8	24.3	25.8	27.0	28.5	30.3	32.4	33.6	36.3	38.7	40.5	42.9	45.6
Pig feed concentr.	33.6	35.4	37.2	39.0	40.8	42.6	45.0	47.4	49.8	52.8	55.2	58.2	61.2	64.2	67.8
Inland fish feed	-	-	7.2	7.2	7.2	12.6	24.0	26.4	30.6	30.6	31.2	38.4	43.8	46.8	49.8
Meal for feed	319.6	325.1	322.7	329.3	334.3	335.1	329.2	332.1	333.8	339.0	343.2	341.3	341.7	344.4	345.8
Cattle feed conc.	19.2	20.5	22.0	23.0	24.5	26.0	27.2	29.0	30.8	32.5	34.5	36.5	38.5	40.8	43.2
Food Industry	4.7	5.0	5.3	5.6	5.9	6.3	6.7	7.1	7.5	7.9	8.4	8.9	9.4	10.0	10.6

Table 57: Demand for Corn Products

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Corn Flour	122	125	128	132	135	138	142	146	149	153	157	161	165	169	174
Corn Rice	52	53	55	56	58	59	60	62	64	65	67	69	70	72	74
Corn Flakes	75	77	79	81	83	85	87	89	92	94	96	99	101	104	107
Corn Meal	210	211	212	214	215	216	217	219	220	221	223	224	225	226	228

6.9 Rice Production and Milling

6.9.1 Rice Production

Today, Ghana does not produce rice in sufficient quantity to meet the demand of the country. The demand for polished rice was 170,000 t in 1985 and the domestic production has only been 90,000 t. About 21,000 t was imported. The reason for the insufficient production of domestic rice are the low yield (traditional 1.2 t/ha) and the very high production costs. Most of Ghana's rice production is carried out by small farmers under shifting cultivation. Human labour is the main source of power, supplemented by small numbers of draught animals.

Rice production in Ghana has been encouraged during the past few years. The production shown in Table 58, has been increased, but the production costs of about US $ 800 is much too high, compared with imported rice of about US $ 250.

Table 58: Rice Production

	UNIT	1983	1984	1985
Area	'000 ha	40	56	67
Production	'000 t	40	66	90

Source: Ministry of Agriculture.

In order to increase the production of rice and to reduce the production costs, rice researchers, policy makers and those responsible for the design and implementation of rice development programmes need to have practical knowledge about rice production techniques and the appropriate farming systems in which rice farmers will have to operate, if potentially productive farm-level changes are to occur.

The agro-economics of rice production can be expected to vary a great deal among land types, farmers, production systems and regions. Some of the principal factors responsible for these variations are climate, soils, topography, production alternatives, existing production techniques, yields, management, resource constraints, product prices farmers face for inputs and the nature and degree of government support to farmers.

In order to identify, measure and understand the importance of these factors, reliable information on the environment in which rice farmers operate is to be obtained. The basic information that is required is;

a) description of the land-type;
b) farm size and area devoted to rice;
c) size of the household and the number of men, women and children available for farm work;
d) degree to which own labour of the farmer and his family is supplemented with hired labour and the wages paid;
e) identification of the crops and livestock comprising the farming systems and the relative importance of each in terms of land area, production, home consumptions and market sales;
f) description of existing production techniques;
g) estimated quantities of inputs used in the production of major groups and cost of purchased inputs;
h) yield and total output of the principal crops;
i) the agricultural calendar and the identification of seasonal peak demands for labour;
j) major production constraints for principal crops; as viewed by farmers;
k) estimated costs and returns for major crops.

Rice is becoming an increasingly important crop in Ghana. It has been an important food crop for several decades. Despite its increasing importance, average national yields are low. In addition, in Ghana the

domestic productions of rice has not kept pace with demand and consequently much rice is imported. Nevertheless there is a considerable potential to increase the production of rice.

Since most farmers in Ghana are smallholders, biological research and production campaigns need to be geared to the production goals and farm level resources of smallholders; to their cropping systems, production constraints, resource flexibility, production techniques, output yields and income. From information gained, it is possible to elaborate a national action programme to reach substantial increases in domestic rice production.

Table 59: Rice Imports

1983	:	31,000 t
1984	:	10,660 t
1985	:	20,800 t

Source: Ministry of Agriculture

The Ministry of Agriculture expects a growth rate of paddy rice production of about 6% p.a., but to meet the demand, the growth rate must be 15%. In table 60 the demand and the necessary production growth of paddy is shown.

Steps should be undertaken to increase the rice production like above mentioned.

6.9.2. Rice Milling

There are no data available about the number of small scale enterprises which use the traditional small power rice mills. Hand pounding and hand milling is still also in use. These methods of milling are extremely labour-intensive, with productivity rarely exceeding 5 kg/h. Compared with the total production of paddy and the production of the commercial rice mills, the capacity of these kind of rice mills together with the small power mills are between 120,000 and 130,000 t/a.

Table 60: Development of rice demand and necessary development of the milling capacity

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand paddy	197.5	206.6	215.9	225.7	236.1	246.9	258.0	269.7	282.2	293.9	308.6	322.8	337.5	352.7	368.9
Demand rice	128.0	133.9	139.9	146.3	153.0	160.0	167.2	174.8	182.9	191.3	200.0	209.2	218.7	228.6	239.1
Paddy production	94.9	109.1	125.5	144.3	165.9	190.8	219.5	252.4	282.2	293.9	308.6	322.8	337.5	352.7	368.9
Rice production	61.9	70.9	81.6	93.8	107.8	124.0	142.6	164.1	182.9	191.3	200.0	209.2	218.7	228.6	239.1
Rice imports	66.1	63.0	58.3	52.5	45.2	36.0	24.6	10.7	-	-	-	-	-	-	-
Milling capacity	248.2	251.8	255.4	259.2	263.2	267.2	271.3	275.6	304.0	308.5	313.2	342.0	347.0	376.0	381.3
Small Scale	119.2	122.8	126.4	130.2	134.2	138.2	142.3	146.6	151.0	155.5	160.2	165.0	170.0	175.0	180.3
Medium scale	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0	129.0
Number of new mills	-	-	-	-	-	-	-	-	1	1	1	2	2	3	3
Capacity of new mills	-	-	-	-	-	-	-	-	24.0	24.0	24.0	48.0	48.0	72.0	72.0
capacity reserve	+153.3	+142.7	+129.9	+114.9	+97.3	+76.4	+51.8	+23.2	+21.8	+14.6	+4.6	+19.2	+9.5	+23.3	+12.4

The larger commercial mills which are able to produce 1 t/h, 2 t/h and 5 t/h have a total capacity of 129.000 t/a. At present utilization of all commercial rice mills are between 15% and 30%. The main reason of this under utilization are the low domestic production and the high production costs of paddy.

The necessary development of the milling capacity is shown in Table 60. It is assumed that Ghana attains self-sufficiency in rice and the paddy production should grow as outlined in that table. In this case a extension of milling capacities is necessary from 1994 onwards.

6.10. Grain Storage

6.10.1 Situation

Post-harvest losses in threshing, drying, transport and storage are estimated to be from 20% to 40%. Storage losses alone are about 5%. Thus, when examining the storage technology of food grains, due attention should be paid to related decrease post-harvest losses.

Ghana' food grains are carried, transported and stored mainly in bags. Bulk storage systems account for a very small proportion of the total storage capacity. Accordingly, the entire marketing and storage system is based on carrying. The food grain cycle for imported grain consists of evacuation, horizontal transfer, storage and milling. Three silo complexes exist in Ghana: two in Tema and one in Takoradi for wheat. In Tema, wheat would be unloaded directly with a pneumatic suction unloader and conveyed to the silos (17,000 t capacity) outside the port area and from there to processing in the mills. In the case of maize, it is unloaded from the vessels by pneumatic suction unloader conveyed to the silo complex but instead of storing in the silos, it by-passes these and is loaded into waiting trucks outside the port area to be transported to inland stores.

The pneumatic evacuation system at Tema is working only with 25% to 30% capacity utilization mainly because of the constantly decreasing state of repair of the mechanical installations as a result of chronic lack of spare parts and suitable types of lubricants. Since the deterioration of the system is proceeding rapidly, it is only a matter of time before the system comes to a stand-still, thus shutting down most of Ghana's food grain import facilities, leaving only the possibilities to import via neighbouring countries.

There was no information on the Takoradi pneumatic evacuation system available.

In Tema and Accra are two big silo systems with an estimated total store capacity of 200,000 t, which have never worked because of discontinuing the investment in the past.

About 65% of food grain are stored in the households and farms and the capacity of the commercial storages are estimated at 120,000 t, which include 100,000 t warehouse capacity and 20,000 t of silo capacity which does not include the unloading silos in Tema and Takoradi.

6.10.2 Necessary Development of the Food Grain Store Capacity

Ghana has two harvests for maize, millet, and sorgum and one rice harvest per year. The yield of the main harvest is 85% formaize, millet and sorgum.

The production of food grain has been around 1.1 million tons in 1985. In connection with above mentioned, the grain store capacity is estimated to be:

-	store capacity by households and farms	715,000 t
-	commercial enterprises	120,000 t
-	grain processing industry	90,000 t
-	total capacity	925,000 t

In Table 61 is shown the necessary development of the food grain store capacity.

Table 61: Necessary Development of the Food Grain Store Capacity

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Food grain demand	1282	1413	1455	1490	1562	1662	1763	1859	1926	1932	2064	2139	2215	2295	2379
Maize	622	630	654	670	687	704	722	740	759	778	798	818	838	859	881
Rice (paddy)	197	207	216	226	236	247	258	270	282	294	309	323	338	353	369
Wheat	106	210	210	210	245	307	370	425	449	474	500	529	558	590	623
Sorgum	205	210	215	220	226	232	237	243	250	256	262	269	276	283	291
Millet	152	156	160	164	168	172	176	181	186	190	195	200	205	210	215
Necessary Store Capacity	1133	1270	1301	1331	1400	1495	1593	1684	1746	1809	1876	1946	2017	2091	2171
Maize	527	542	556	569	584	598	614	629	645	661	678	695	712	730	749
Rice	197	207	216	226	236	247	258	270	282	294	309	323	338	353	369
Wheat	106	210	210	210	245	307	370	425	449	474	500	529	558	590	623
Sorgum	174	178	183	187	192	197	201	206	212	218	223	229	235	240	247
Millet	129	133	136	139	143	146	150	154	158	162	166	170	174	178	183
Available Store Capacity	925	940	1240	1540	1560	1580	1600	1760	1780	1940	1970	1990	2150	2180	2200
Warehouse	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Silo	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Grain processing industry	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Farmers and cott-ages	715	730	750	770	790	810	830	850	870	890	920	940	960	990	1010
Number of new storages	-	-	2	4	4	4	4	5	5	6	6	6	7	7	7
New store capacity	-	-	280	560	560	560	560	700	700	840	840	840	980	980	980
Balance	-208	-330	-61	+209	+160	+85	+7	+76	+34	+131	+94	+44	+133	+89	+29

6.11. Sugar Production

6.11.1 Sugar

During the assignment of the expert, a report has been prepared called "Policy Guidelines for the Development of the Sugar Industry in Ghana", dated March 26, 1986.

In this study, it was expressed that Ghana should develop the sugar industry to reach self-sufficiency in sugar production in the future. The most important facts of the study are repeated in this paper.

The expected development of sugar demand is summarized in Table 62. In Ghana exist two sugar factories, located at Asutsuare and Komenda, with a total capacity of 45.000 t/a. The highest production reached by these factories was in 1976 when 12.000 tons of sugar was produced. Since 1982 the sugar mills have been out of operation. The officially imported sugar is far below the demand and amounted to 16.400 t in 1983, 30.000 t in 1984 and 30.100 t in 1985, whereas the demand was 134.000 t in 1985. The necessary development of the sugar industry to reach self-sufficiency is shown in Table 63.

Ghana has favourable conditions for producing sugar to meet the requirement of the country. The yield of cane depends on rainfalls, cultivation methods and irrigation facilities. In above mentioned paper, an average yield of 25 t of cane for one hectar is planned but 48 t is possible in Ghana and on irrigated areas even 62 t.

Sugar production is an agro-industry providing considerable employment in both agriculture and industry. Moreover, sugar cane is by far the crop with the highest claorific value, compared to any other crop, sugar is a vital food stuff. Furthermore, it has become increasingly clear in recent years that the future of the sugar industry depends on effective utilization of sugar by-products.

Table 62: Development of Sugar Demand

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Households	69.6	73.4	77.3	81.5	85.8	90.4	95.3	100.5	105.9	111.6	117.7	124.0	130.6	137.7	145.0
Distilleries	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7
Breweries	3.0	3.3	3.5	3.8	4.1	4.5	4.8	5.2	5.5	5.9	6.4	6.9	7.5	8.0	8.5
Soft Drinks	3.4	3.6	3.9	4.1	4.4	4.7	5.0	5.3	5.6	5.9	6.4	6.8	7.3	7.7	8.2
Lime	12.7	13.1	13.6	14.0	14.4	15.2	15.9	16.7	17.4	18.2	19.1	19.9	20.8	21.6	22.5
Bakeries	8.0	8.4	8.9	9.4	9.9	10.5	11.1	11.7	12.3	13.0	13.7	14.6	15.3	16.2	17.1
Fruit processing	32.7	34.5	36.4	38.4	40.6	42.8	45.2	47.7	50.3	53.1	56.1	59.2	62.5	65.9	69.6
Biscuit factories	1.6	1.7	1.8	1.9	2.0	2.J	2.1	2.2	2.3	2.4	2.5	2.6	2.8	2.9	3.0
Sweets	3.7	4.0	4.2	4.5	4.7	5.0	5.3	5.5	5.8	6.1	6.5	6.9	7.3	7.7	8.1
Confectionaries	1.6	1.7	1.7	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9	3.1	3.2	3.4
Cocoa processing	2.6	2.7	2.9	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.5	4.7	5.0	5.2	5.5
Milk processing	3.3	3.5	3.8	4.0	4.3	4.7	5.1	5.4	5.8	6.2	6.8	7.3	7.9	8.4	9.0
Wine production	0.4	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.9	0.9
Total	143.0	150.7	158.9	167.4	176.3	186.2	196.7	207.5	218.7	230.5	243.8	257.3	271.6	286.1	301.5

Source: Policy Guidelines for the Development of Sugar Industry in Ghana, March 26, 1986, A. Paulusch

Table 63: Production and Supply Programme for Sugar

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Demand	143.0	150.7	158.9	167.4	176.3	186.2	196.7	207.5	218.7	230.5	243.8	257.3	271.6	286.1	301.5
Small Scale mills	-	1.2	2.4	4.4	4.4	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Komenda	-	-	-	6.0	9.5	13.5	14.5	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Asutsuare	-	-	-	-	-	12.0	20.0	27.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
New factory I	-	-	-	-	-	-	30.0	48.0	60 0	60.0	60.0	60.0	60.0	60.0	60.0
New factory II	-	-	-	-	-	-	-	--	30.0	48.0	60.0	70.0	70.0	70.0	70.0
New factory III	-	-	-	-	-	-	-	-	-	-	30.0	48.0	60.0	70 0	70.0
New factory IV	-	-	-	-	-	-	-	-	-	-	- -	-	30.0	36.1	51.5
Balance	-143.0	-149.5	-156.5	-157.0	-162.4	-155.7	-127.2	-112.5	-78.7	-72.5	-43.8	-29.3	-1.6	0	0

Source: Policy Guidelines for the Development of Sugar Industry in Ghana
March 26, 1986, A. Paulusch

The by-products of cane sugar which have found an industrial utilization are listed in Figure 7. The main products are bagasse and molasses. Bagasse is composed of cellulose, pentosans and lignin. Essentially, it can be said that paper can be obtained from cellulose, furfural from pentosans and plastics from lignin.

Molasses, being rich in sugar, is used as chemical raw material and as nutrient for micro-organisms producing either yeast and similar products through their own proliferation, or a number of organic compounds such as ethanol, butanol, acetic acid, citric acid, glutamic acid, etc. through their specific catalytic action.

The individual economic importance of these by-products has varied very much during the last decades, when fermentation products from molasses have been almost ousted by synthesis from petroleum derivatives, while the utilization of bagasse for paper and particle board has been slowly built up. However, in the last ten years a major change has taken place as energy crisis has gathered momentum and petroleum based chemical feedstocks became less competitive. The world wide trend has given increased importance to renewable agricultural products, and the efficient utilization of biomasses with modern technological methods is rapidly increasing.

The production of particle board from bagasse is already well established and the day may not be far off when newspaper will be commercially produced from that by-product.

The production of surplus electricity from the sugar factory is a development of growing importance. In a well-designed modern factory about 1.000 Megajoule (MJ) per tonne of cane is required to produce sugar from canes arrived in the factory yard. Since the bagasse available has

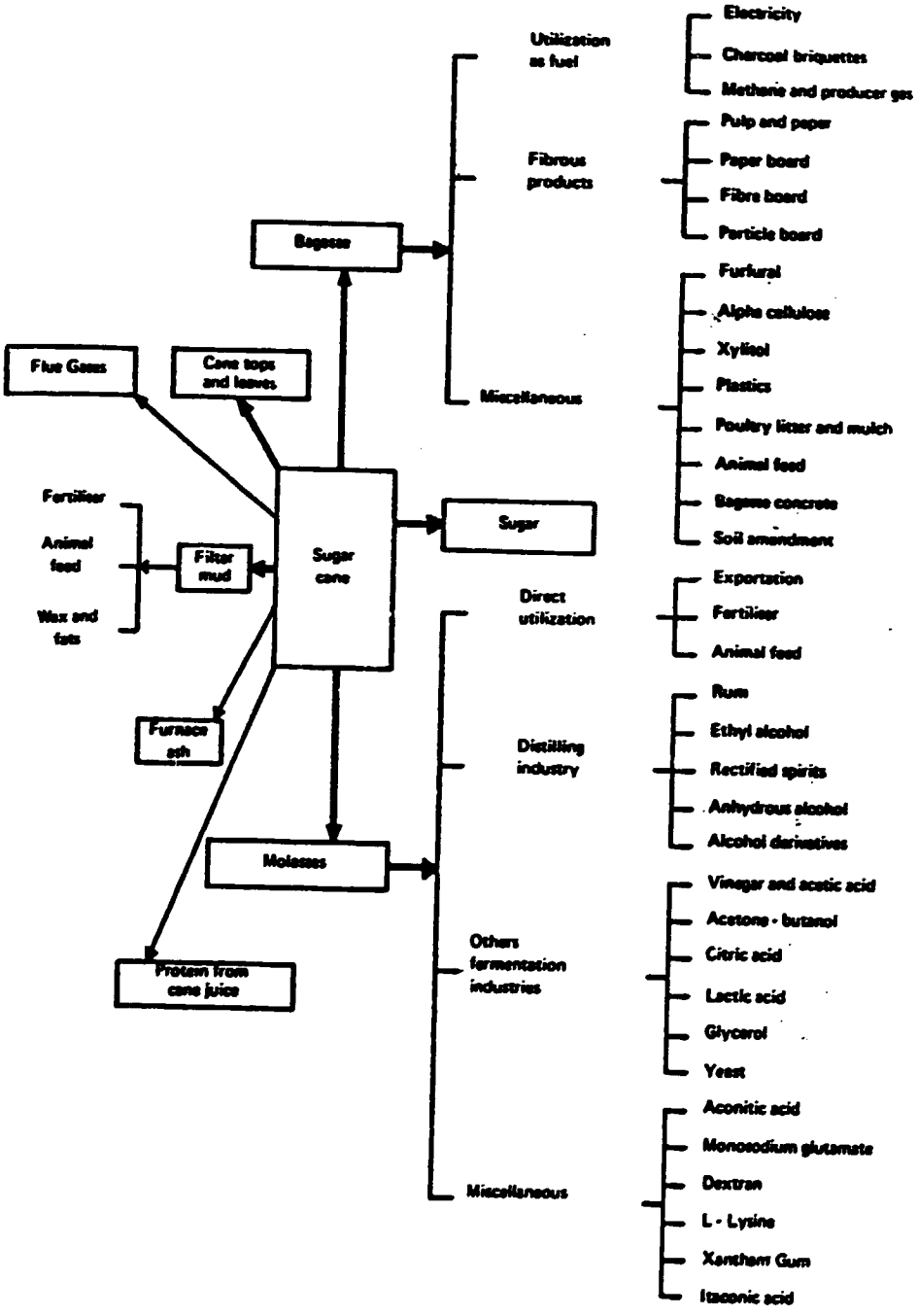


Fig. 7 By-products of the cane sugar industry

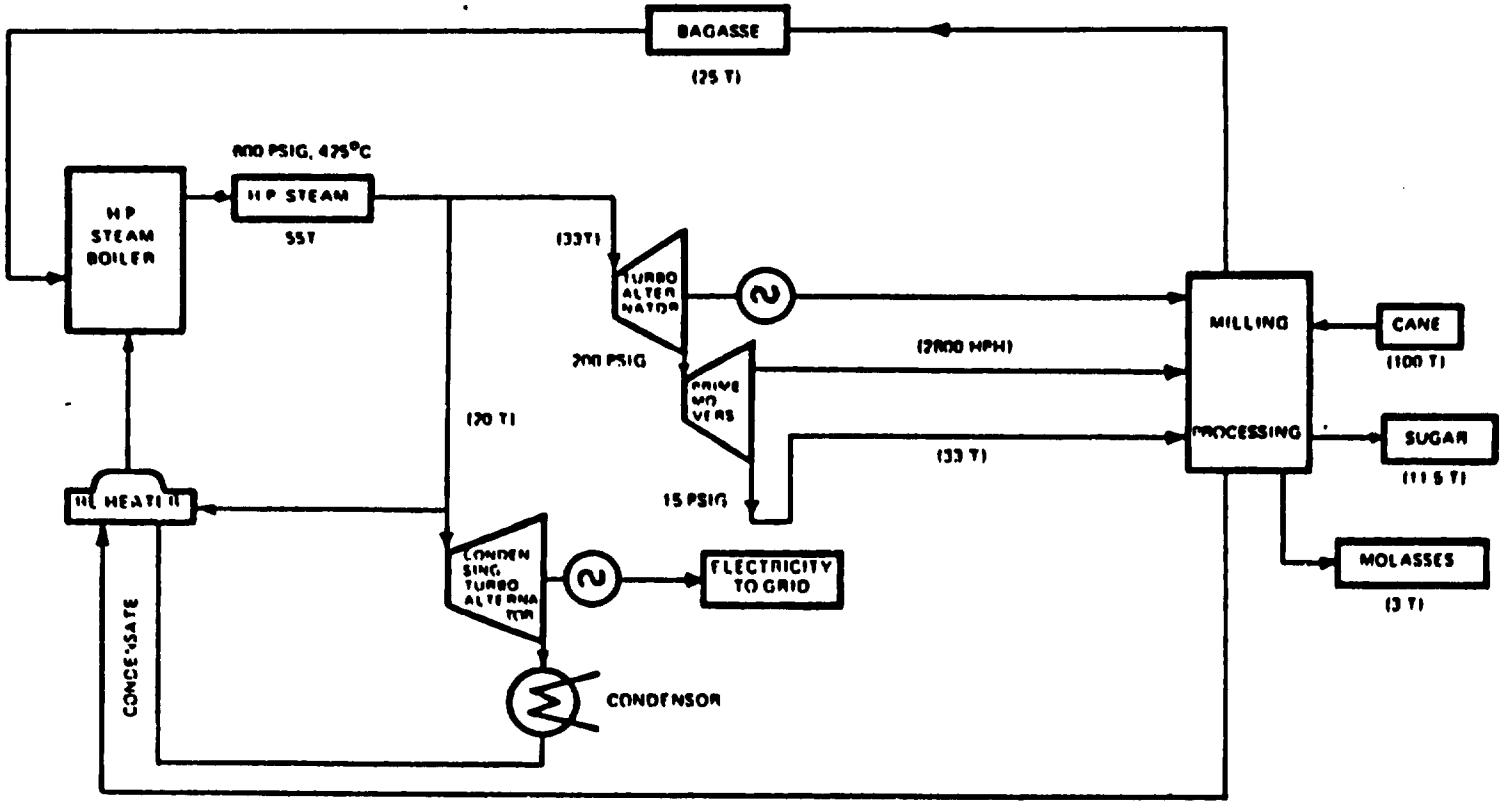


Fig. 8 Schematic flow sheet of a modern sugar factory producing raw sugar, molasses and electricity

a potential of 2,000 MJ, there is an energy surplus of about 1,000 MJ per tonne of cane, which can be utilized either to produce about 150 kwh surplus electricity per tonne of cane or about 125 kg of surplus wet bagasse per tonne of cane as raw material for production of paper or cardboard.

6.11.2 Yeast Production

There is no yeast production in Ghana at present. Almost 100% of the yeast needed is purchased on the parallel market and only a small portion of bakery products are produced with palm wine yeast. Fodder yeast as animal feed is not used.

Ghana's demand in yeast is not known with accuracy due to non-availability of data. The estimated future demand shown in Table 64, is calculated based on flour consumption for bakery yeast and based on livestock for fodder yeast.

In case of rehabilitation of the sugar industry, a yeast production should be established. Especially the fodder yeast production is one of the most important animal feed for cattle, poultry and pig fattening but also for the milk production. The possible development of the yeast industry is also shown in Table 64 which is dependent from the development of the sugar industry and the supply of molasses, summarized in Table 64.

Table 64: Yeast Demand and Possible Development of Yeast Production

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Bakery Yeast	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	1.0
- Bakeries	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.6
- Households	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4
Fodder Yeast	6.5	6.8	7.3	7.7	8.2	8.6	9.0	9.7	10.2	10.6	11.4	12.0	12.7	13.5	14.2
- Poultry	2.2	2.3	2.5	2.6	2.8	2.9	3.1	3.3	3.5	3.6	3.9	4.2	4.4	4.6	4.9
- Pig	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.3	3.5	3.7
- Cattle	2.5	2.6	2.8	3.0	3.2	3.4	3.5	3.8	4.0	4.2	4.5	4.7	5.0	5.4	5.6
Number of new factories for bakery yeast production	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1
Production	-	-	-	0.5	0.5	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	1.0
Capacity	-	-	-	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Balance bakery yeast	o.5	0.5	0.5	-0.7	+0.7	+0.7	+0.6	+0.5	+0.5	+0.5	+0.5	+0.5	+0.4	+0.3	+0.2
Number of new factories for fodder yeast	-	-	-	-	1	1	1	1	2	2	2	2	2	2	2
Capacity	-	-	-	-	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Production	-	-	-	-	0.3	1.8	5.3	7.6	10.2	10.6	11.4	12.0	12.7	13.5	14.2
Balance fodder yeast	-6.5	-6.8	-7.3	-7.7	-7.9	-6.8	-3.7	-2.1	0	0	0	0	0	0	0

Table 65: Possible Molasses Production and Molasses Demand for Yeast Production

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Possible Molasses production	-	-	-	2.2	3.5	9.4	23.7	33.2	49.8	56.4	71.9	82.3	97.7	104.0	109.9
Molasses Consumption															
- bakery yeast pr.	-	-	-	2.2	2.3	2.3	2.7	3.2	3.2	3.2	3.2	3.2	3.7	4.1	4.6
- fodder yeast pr.	-	-	-	-	1.2	7.1	21.0	30.0	39.9	41.5	44.6	46.9	49.7	52.8	55.6
Balance	-	-	-	-	-	-	-	-	+6.7	+11.7	+24.1	+32.2	+44.3	+47.1	+49.7

6.12. Edible Oil Production

The most edible oils used in Ghana are groundnut oil, palm oil and coconut oil. The development of the demand is shown in Table 66. Also important are sheanut which are mainly exported. Only a small portion of the sheanut is processed into butter or sheanut oil. Soya beans and cotton seed oils are not important products in Ghana at present because there is a limited local market and these kinds of oils are not used in local diet. Experiments are done involving oil extraction from seeds such as cotton seed, soya bean, cashewnut, seasame and sunflower.

Data for the production of edible oils are very difficult to collect. A big portion of oils especially groundnut oil but also palm oil are produced in cottages and small scale enterprises which are not registered. A trend calculation based on visits to 104 small scale enterprises and cottage industries has been done to estimate the capacity of this industry. The input of raw material of these enterprises are 280 - 700 kg/day with a oil output at 110 - 280 kg/day which produces 150 - 200 days per year. The number of these small enterprises is estimated at about 2,950 in 1985 with a total capacity of 100,000 t/a which have a growth rate of the capacity expansion of about 4% per year. The capacity of the commercial enterprises are 39,500 t/a. In Table 66 the necessary development of the edible oil industry until 2000 is shown.

6.13. Agricultural Linkages

Agro-based industries link agriculture and industry. This connection has special contemporary significance because it is of basic importance for survival of the population and improval of living conditions.

To put agricultural production into the right perspective, it is helpful to examine some of its determinants. Table 3 in para 3.5 of this paper shows the effective area

In Ghana which was 6.21 million ha including permanent pasture and more than 8.2 million ha was unused in 1983. Data about the development of the effective area are not available for 1984 and 1985 but it is estimated that although the agricultural production increased in 1984/85, the effective area has not changed substantially. In Table 67 the agricultural production and the area harvested in 1981-84 is shown. As shown in this table, the harvested agricultural area without palm kernel was about 5.2 Mio ha in 1982 and 1983, but rose to 5.44 Mio ha on by 4.7% in 1984.

The agricultural production forecast for Ghana is adequate to meet the requirements in food, animal feed and raw materials for the agro-based industry up to the year 2000. Agricultural experts estimate, that not much more than 10 million hectars of land can be used for agricultural production in Ghana. Around 2.5 million ha are provided for afforestation and around 2 million hectars are unsuitable for agriculture.

To meet the requirements of agricultural products nevertheless, the country has not only to extend the effective area, it also has to improve its basically fertile soil. In Table 68 is shown the yield possibilities for important agricultural products which can be obtained by irrigation, fertilizing and other improvement of the soil.

In the case of a systematic improvement of the soil an increase of the yield is possible like projected in Table 69.

The Table 70 shows the necessary production of important agricultural crops and Table 71, the necessary areas under crop to produce sufficient agricultural products.

Based on the above mentioned facts and Table 71, an extension of the effective agricultural areas by about 3.4% p.a. is necessary to meet the requirement of the country. In spite of improvement of the soil, agricultural land is finite in Ghana, as time goes on. Measures should be introduced to cultivate unused land for agricultural production and for improvement of the soil condition.

Table 66: Edible Oil Production

	'000t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Edible Oil Demand	148.0	156.4	164.9	174.2	183.9	194.2	204.9	216.6	228.6	241.2	254.9	269.3	284.1	300.0	316.8
Palm Oil	84.0	88.8	93.6	98.9	104.4	110.3	116.3	122.9	129.8	137.0	144.7	152.8	161.3	170.4	179.8
Coconut Oil	38.9	41.1	43.3	45.8	48.4	51.0	53.9	57.0	60.1	63.4	67.0	70.8	74.7	78.8	83.
Groundnut Oil	25.1	26.5	28.0	29.5	31.1	32.9	34.7	36.7	38.7	40.8	43.2	45.6	48.1	50.7	53.7
Processing Capacity	140.3	144.3	168.5	192.9	197.4	202.1	207.0	232.1	237.5	243.0	268.7	274,7	300.9	307.3	334.1
Commercial Enterp.	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5	39.5
Cottages	100.8	104.8	109.0	113.4	117.9	122.6	127.5	132.6	138.0	143.5	149.2	155.2	161.4	167.8	174.6
Number of new factories	-	-	1	2	2	2	2	3	3	3	4	4	5	5	6
Capacity	-	-	20.0	40.0	40.0	40.0	40.0	60.0	60.0	60.0	80.0	80.0	100.0	100.0	120.0
Balance	-7.7	-12.1	+3.6	+18.7	+13.5	+7.9	+2.1	+15.5	+8.9	+1.8	+13.8	+5.4	+16.8	+7.3	+17.3

Table 67: Production of Cereal, roots and others

	Area harvested 1000 ha				Production 1000 t			
	1981	1982	1983	1984	1981	1982	1983	1984
Paddy rice	82	61	40	57	71	36	40	66
Maize	372	373	400	486	378	346	172	534
Millet	157	171	175	220	119	76	40	132
Sorgum	198	216	220	230	131	86	56	114
Cassava	210	260	210	250	1652	1976	1729	1900
Yam	116	111	113	112	473	588	866	880
Cocoyam	134	146	147	150	1128	628	720	730
Coconuts	175	189	165	161	160	160	160	160
Palm kernel	n.a	n.a	n.a	n.a	30000	30000	30000	30000
Vegetables and melons	567	632	684	702	411	458	496	509
Fruits without melons	257	274	262	258	772	884	771	773
Cocoa beans	n.a	406	350	380	n.a	203	160	188
Plantains	n.a	235	215	217	n.a	745	600	650
Coffee	n.a	10	9	10	n.a	2	1	1
Tobacco	n.a.	2	2	2	n.a.	1	1	1
Green Feed	2300	2100	2200	2200	80.5	73.5	77.0	80.5
Sugar Cane	n.a	3	3	3	n.a	110	100	100
Total (without palmkernel)		5189	5195	5438				

Source: FAO Yearbook 1983/84

Table 68 Yield For Important Agricultural Groups In Ghana

a)	RICE		
	Traditional	1000	kg/ha
	Improved	1400	kg/ha
	Advanced	2000	kg/ha
	Irrigated	3500	kg/ha
b)	MAIZE		
	Traditional	1800	kg/ha
	Advanced	2400	kg/ha
c)	CASSAVA		
	Traditional	8500	kg/ha
	Improved	9780	kg/ha
d)	YAM	5000	kg/ha
e)	SORGUM AND MILLET		
	Traditional	600	kg/ha
	Improved	1100	kg/ha
f)	GROUNDNUT		
	Traditional	800	kg/ha
	Improved	1200	kg/ha
g)	COCONUT		
	Traditional	1000	kg/ha
	Improved	1500	kg/ha
	Advanced	3000	kg/ha
h)	OIL PALM	7000	kg/ha
i)	COCOA	500	kg/ha
j)	SUGAR CANE		
	Traditional	48000	kg/ha
	Irrigated	62000	kg/ha
k)	TOBACCO	750	kg/ha

Table 69 Estimated yield development in consequence of soil improvement and irrigation

	KG/ha														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Paddy rice	1000	1070	1140	1220	1300	1390	1480	1580	1690	1800	1930	2060	2200	2350	2510
Maize	1800	1810	1830	1840	1860	1870	1880	1900	1920	1930	1940	1960	1980	1990	2010
Cassava	8500	8570	8640	8720	8790	8860	8940	9010	9090	9160	9240	9320	9400	9480	9560
Yam	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Sorghum	600	610	625	640	655	671	688	706	724	741	760	775	790	810	830
Millet	600	612	627	642	659	674	692	709	725	743	756	772	791	811	832
Groundnut	800	810	830	840	860	870	890	900	920	940	950	970	980	1000	1020
Coconut	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400
Oil Palm	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000	7000
Cocoa	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Sugar cane	48000	48500	49000	49500	50000	50600	51100	51600	52100	52700	53200	53800	54400	54900	55500
Tobacco	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750

Table 70: Demand of Non-Processed Agriculture Products Including Losses and Wastes

	'000 Tons														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Paddy rice	197,4	206,6	215,8	225,6	237,1	245,9	256,6	270,2	282,0	293,9	308,9	322,0	338,0	351,9	369,2
Maize	622,1	638,1	653,6	669,3	687,2	704,2	721,7	740,2	759,1	778,0	797,5	817,9	838,4	859,2	881,1
Cassava	274 4	281 5	288 4	295 7	303 2	310 7	318 4	326 6	334 9	343 4	351 8	360 8	369 8	379 1	388 7
Yam	744,6	763,8	782,4	802,2	822,6	842,9	863,8	885,9	908,6	931,4	954,6	979,0	100 3	102 8	105 5
Sorgum	204,6	209,8	215,0	220,4	226,0	231,6	237,4	243,4	249,7	255,8	262,3	269,0	275,7	282,6	290,8
Millet	152,1	156,0	159,8	163,8	168,0	172,1	176,4	180,9	185,6	190,2	195,0	199,9	204,9	210,0	215,4
Groundnut	55,0	58,3	61,6	65,9	68,4	72,7	76,3	80,7	85,1	89,8	95,0	100.3	105,8	111,5	118,1
Coconut	121,6	128,4	135,3	143,1	151,2	159,4	168,4	177,8	187,8	198,1	209,4	221,2	233,4	246,9	260,6
Oil palm	375,8	397,5	420,0	444,0	468,8	494,2	521,2	552,0	582,0	615,0	648,8	685,5	726,8	763,5	305,5
Cocoa	222,2	227,7	233,4	239,2	245,1	251,1	257,5	264,1	271,0	277,8	284,8	292,2	299,8	307,7	315,8
Sugar cane	750.	764	778	871	912	1105	1558	1854	2377	2586	3074	3400	3888	4074	4254
Tobacco	1,7	1,7	1.9	1,9	1,9	2,0	2,0	2,1	2,1	2,2	2,2	2,3	2,3	2,4	2,6

Table 71: Necessary area under crop for important agricultural products to cover the demand

	'000 ha														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Paddy rice	197	193	189	185	182	177	173	171	167	163	160	156	154	150	147
Maize	346	353	357	364	369	377	384	390	395	403	411	417	423	432	438
Cassava	323	328	334	339	345	351	356	362	368	375	381	397	393	400	407
Yam	149	153	156	160	165	169	173	177	182	186	191	196	201	206	211
Sorghum	341	344	344	344	345	3[illegible]	345	345	345	345	345	347	349	349	350
Millet	254	255	255	255	255	2[illegible]	255	255	256	257	258	259	259	259	259
Groundnut	69	72	74	78	80	84	86	90	93	96	100	103	108	112	116
Coconut	122	117	113	110	108	106	105	105	104	104	105	105	106	107	109
Oil Palm	54	57	60	63	67	71	74	79	83	88	93	98	104	109	115
Cocoa	444	455	467	478	490	502	51[illegible]	528	542	556	570	584	600	615	632
Sugar Cane	16	16	16	18	18	22	30	36	46	49	58	63	71	74	77
Tobacco	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Fruits	274	282	290	299	308	317	327	336	346	357	368	379	390	402	414
Vegetable	745	767	790	814	838	863	889	916	943	971	1000	1031	1062	1094	1127
Plantains	230	237	244	252	259	267	275	283	291	300	309	319	328	338	348
Coffee	11	11	12	12	12	13	13	13	14	14	15	15	16	16	16
Pasture and Feed	2551	2685	2811	2958	3097	3258	3417	3572	3778	3931	4122	4325	4538	4769	5009
Total	6128	6327	6515	6732	6941	7179	7420	7661	7956	8198	8489	8797	9105	9435	9778

Attention must also be given to birth control, or family planning. With a continued population growth-rate of 2.5 - 3% the population of Ghana will be between 18 and 20 million, up to the year 2000, which will be a heavy burden for the whole economy of the country, to supply the people with sufficient agricultural products.

7. On Implementation of Industrial Plans

7.1. Implementation of Industrial Projects

The development of Ghana's food industries, as set forth in the preceding chapters constitutes an immense challange of organizing its resources and making decisions affecting industrial development in order to meet the expanding requirements of its society. To reach this intention, some basic statements about the implementation of industrial projects should be done, based on recent observations and experience in former assignments.

The implementation of a project starts with the decision to pursue an objective, and it ends with the accomplishment of that objective or with the decision to abandon it. A project must be considered this way, because the planning and preparation of project's management information must start at the very beginning. One of the first and most important tasks the responsible individual (project manager, project planner, project co-ordinator,) must carry out is to divide the project into a series of suitable phases, each of which will be further subdivided into stages. Each stage has its own particular characteristics and thus requires information and control procedures suited to it. On the basis of the maximum available knowledge about the entire project in a given project stage, the remaining stages must be planned and replanned so that at the end of each stage an acceptable, realistic final plan to implement and control the succeeding stage is available, plus a revised version of the preliminary plans for all future project stages. As the project passes through the various stages, the planning for the last and often most critical stage becomes more and more comprehensive and precise, and eventually permits improved control of the pertinent project activities. A clear identification of the project stages and pertinent objectives permits the responsible project initiator or other body to assign responsibilities systematically.

Table 72 indicates the project phases and stages, together with their objectives, that are typical of most industrial projects. The planning structure may have to be adapted

Table 72: Places, Stages and Objectives of Industrial Projects

Phase	Stage	Objective
Preparation or initiation	1. Identification of project idea (preliminary analysis)	Project(s) and programme goals identified and analysed. Project objectives and preliminary global schedule and cost estimate determined.
	2. Preliminary selection	Ideas for possible solutions development into alternative concepts; desirable technical solutions identified and classified.
	3. Feasibility (formulation)	Feasibility of the envisaged concepts or solutions and relevant alternatives assessed, evaluated and classified.
	4. Evaluation (post feasibility evaluation) and decision-to-invest	Decision on adoption of the most promising alternative solution, funding provided
Implementation (construction)	5. Initial project implementation, scheduling and detailed project design	All detailed drawings, specifications, bills of materials, schedules, plans, cost estimate and other relevant documentations checked and approved.
	6. Contracting and purchase.	Appropriate manpower, machinery, manufacturing and construction facilities, utilities, materials, documentation and all other relevant infrastructure components mobilised and available
	7. Facility construction and pre-operations	Completed, tested and accepted product, facility or system. Optimum performance, time and cost.
Operation	8. Operation (not a project phase but listed for interface purposes and programme continuity)	Product, facility or system operational at all times and at optimum cost.

to the needs of the various projects; for sometimes, the stages overlap. As many tasks as possible should be systematically organised throughout the initiation and implementation of the project.

As a project evolves from the identification stage and passes through the succeeding stages, the prime responsibility for decision making and management changes from one level to the other in the project initiator's and participants hierarchy. The decision making bodies in the project hierarchy are indicated below:

- Higher authorities (development strategy and policy, target approval)
- State planning board
- Project execution agency
- Project manager/project co-ordinator
- Assistant project manager
- General contractor, Contractor
- Sub-contractor
- Supplier

The project stages can be classified into two major phases: project preparation or initiation and project implementation. Since project implementation is primarily based on project preparation, deficiencies in preparation will affect implementation. The event that forms the interface between these major project phases is approval of the project for implementation and authorization to allocate appropriate funds.

7.2 Relationship of small-scale to large enterprises

Although this paper includes only the food industries, the implementation of the identified projects sets up very high claims to the country, the government and also to the implementation personnel. In order to meet the requirements of food Ghana has not only to extend the capacity of the large processing

industry but it also has to strengthen the small scale and cottage industry. More than 60% of all processed food are produced by these small enterprises and by small farms even 85%. In Table 73 and 74 are indicated the necessary growth of the capacity of some important small scale industries and animal farms.

In case of developing individual industries, attention should be given to the small scale industry already during the preparation phase.

The Tables 75 and 76 show the initiation of new capacities for important industries. Although the development of these industries are very challenging, the preparation should be started immediately. Every day lateness in starting a systematic development of the food industry takes revenge in shortage of food and more expenses for imports in the future.

7.3. Planning and Organisation of Industrial Investment Projects

The development of the sub-sector should be started with a sector opportunity study for every branch of the industry to be followed by feasibility studies for every factory. The opportunity study for branches of industries should be prepared by the planning cell of the MIST or in the case of agricultural projects by the planning section of the Ministry of Agriculture.

It is advisable to prepare such a study by a joint team of national and international experts. Short-term consultants should be used whenever possible. As a general rule, the team should consist of as many as foreign experts/consultants as necessary and of as many as local specialists as possible, to cover the major substantive fields of the project. Depending on the situation, any large project would ideally comprise the following team members:

- one industrial economist (preferably as team leader)
- one market analyst,
- one or more technologists/engineers specialised in the appropriate industry,
- one mechanical and/or industrial engineer,
- one civil engineer (if needed),
- one industrial management/accounting expert,
- one adviser in industrial training.

Table 73: Necessary Development of the Capacities by Small Scale Industries

	'000 t														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Fishing	408	419	430	441	453	465	478	490	505	517	531	545	562	575	590
Fish smoking	54	55	56	57	58	59	60	60	61	62	63	64	65	66	67
Animal feed production	90	93	96	99	102	105	108	111	114	117	120	124	128	132	136
Rice Milling	119	123	126	130	134	138	142	147	151	156	160	165	170	175	180
Corn Milling	320	322	324	326	328	329	331	333	335	337	339	341	343	345	347
Sugar production	-	1	2	4	4	5	5	5	5	5	5	5	5	5	5
Butchers and households	55	56	57	59	60	62	63	65	66	68	70	72	74	75	77
Milk processing	310	325	342	359	377	396	416	438	460	484	509	535	563	592	623

Table 74: Necessary Development of Livestock by Small Animal holders

	1000														
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cattle	1138	1201	1267	1338	1412	1490	1572	1659	1751	1848	1950	2058	2172	2293	2420
Sheep	1943	2076	2209	2342	2492	2658	2840	3023	3223	3438	3654	3887	4136	4402	4684
Goats	1760	1816	1858	1901	1943	1999	2056	2098	2154	2210	2267	2323	2380	2436	2506
Poultry	6200	6510	6840	7180	7540	7910	8310	8720	9160	9620	0100	10600	11130	11690	12280
Pigs	328	346	359	374	391	407	426	443	462	481	501	523	545	569	592

Table 75: Initiation of Industry Projects

Industry \ Year of initiation	Capacity of new projects in '000t													
	87	88	89	90	91	92	93	94	95	96	97	98	99	10
Slaughter houses			10			10		10			10		10	1
Dairies		8	4	4	4		8	4		8	4	4	8	
Fish breeding		5			4	8	2	3		1	5	4	2	
Fish smoking		12			6						6			
Fish canning		15		6			6				6		6	
Ice Production		60		30				30				30		
Cold Storage													5	
Feed mill		120				60		60			60			6
Flour mill				45	45	45	45		45		45		45	
Corn mill	6		60						60	60			60	
Oil mill		20	20				20			20		20		2
Rice mill								24			24		24	
Cereal silo		240	240				120		120			120		
Sugar mill			15		30	60		70		70		70		
Bakery yeast			1											
Fodder yeast				10				10						

Table 76: Initiation of Animal Production Projects

Project \ Year of initiation	Capacity of new projects in 1000 animals													
	87	88	89	90	91	92	93	94	95	96	97	98	99	00
Cattle farm		3	-	3		3	3	3	3	-	6	3	3	3
Pig farm		2	2		2		2	2	2	2	2	2	2	
Poultry farm	170	70	160	80	80	160	160	160	160	160	240	160	240	240

This team should additionally be assisted by short-term consultants such as land surveyors, soil specialists and laboratory advisers.

After preparation and confirmation of the study, a project team or project unit should be established, which is responsible for the realization of the project programme shown in Figure 9. The minimum organisation of such project unit should at least consist of: project manager, planning and commercial manager, manager for maintenance and training.

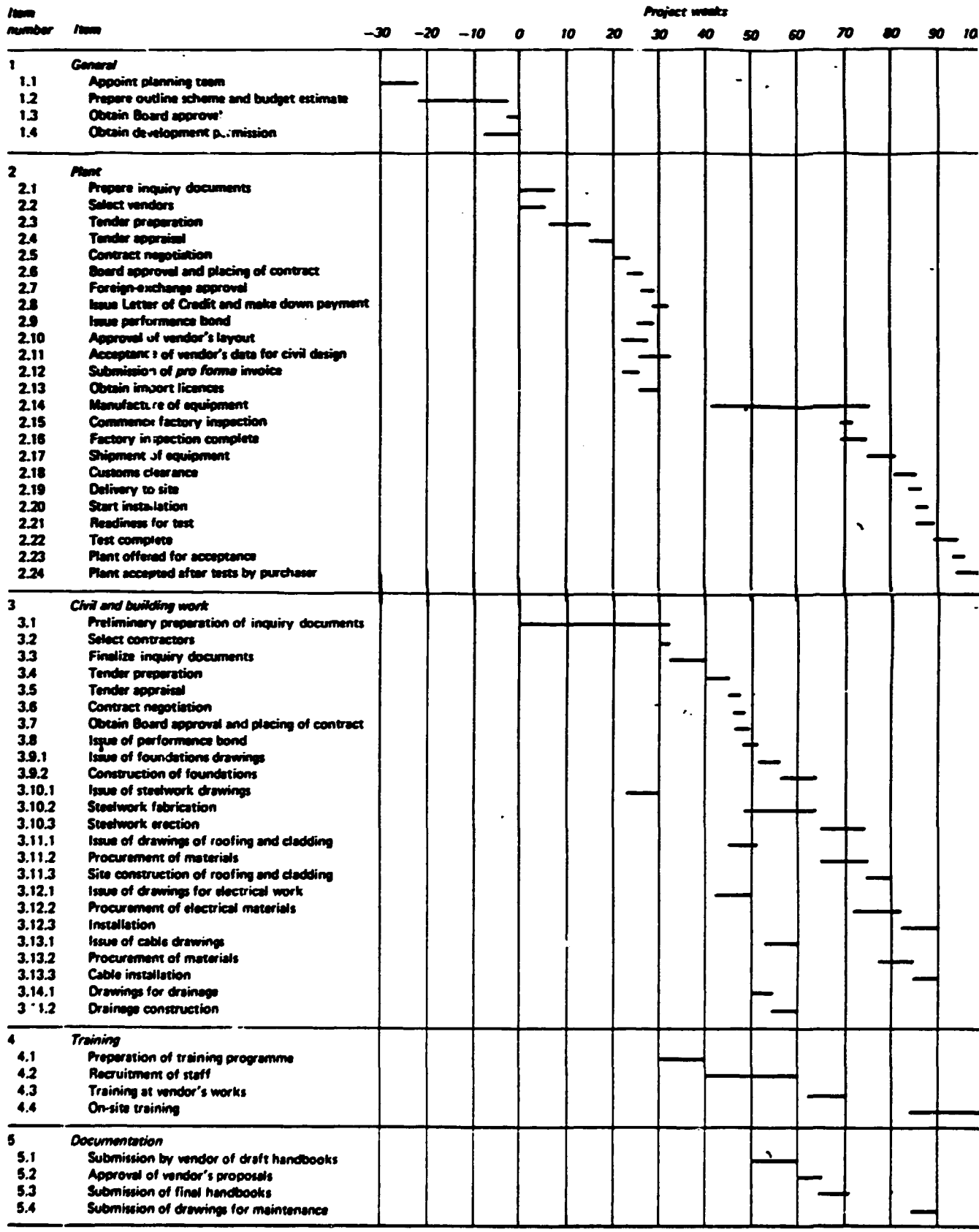
These personnel should be responsible for the functions described below:

Project Manager

Responsible to the supervising authority

- Management and control of all new construction work including schemes for modernisation and extension of existing facilities;
- Planning of project to achieve optimum methods of construction;
- Ensuring that all projects are completed in time, keeping expenses and according to specifications;
- Reporting on the progress and cost of all projects on a regular and periodical basis and informing in time on any deviations from the programme, with details of corrective action taken or proposed;
- Negotiation of contractor's claims for additional payment within the limits of his delegated authority;
- Presentation of purchaser's claims for damages as additional costs against the contractor and their settlement within the limits of his delegated authority;

Figure 9: Overall Programme for project



Source: UNIDO Contract Planning Organisation, New York, 1974

Planning Manager

Responsible to the project manager for:

- The technical planning of new construction work, including schemes for modernisation and extension and preparation of the project programme in liaison, as necessary, with specialist engineers and others concerned;
- Acting as senior project engineer responsible for the supervision and control of one or more contractors;
- Supervising, as necessary, the work of one or more project engineers assigned to the project unit for a particular project to take charge of individual contracts;
- Ensuring the preparation of technical specifications for tender;
- Advising on the list of vendors/contractors to be invited to tender;
- The technical appraisal, in conjunction with engineering specialists of vendors'/contractors' proposals and recommending the tenderer selected;
- Assistance to the Commercial Manager in contract negotiations;
- The supervision and control of individual contracts, including the holding of contract-review meetings and the preparation of progress and cost-commitment reports;
- The issue of variation orders within the limits of his delegated authority and obtaining approval from the project manager for those outside his authority;
- Certifying payments to the contractor on contracts for which he is responsible,

- Representing the projects department of the acceptance tests and advising the supervising authority on signing the acceptance certificate;
- Assistance to the commercial manager on claims and negotiations thereto;

Commercial Manager

Responsible to the project manager for:

- Commercial and contract planning of new contacts;
- Advise on vendors/contractors to be invited to tender; maintenance and review of lists of suitably qualified vendors and contractors; maintenance of records of their performance;
- In conjunction with the legal bodies preparation of invitations to tender including contract conditions, and advising on such matters as penalty provisions and insurance requirements;
- Commercial appraisal of tenders received and recommendation of the tenderer to be selected;
- In conjunction with the planning manager and the legal department, negotiation of contracts with the selected tenderer;
- Ensuring performance of all financial and commercial obligations to be performed by the purchaser, such as opening Letters of Credit, and releasing the approved payment;
- Advise the engineers in charge of a contract on interpretation,
- Ensuring keeping proper records of payment;
- Expediting all contracts for implementation;
- Commercial negotiations with the vendors/contractors on variations in contracts;
- Negotiation of claims initiated either by the purchaser or the vendor/contractor;
- Negotiation of final settlement with the vendor/contractor at the conclusion of the contract and advising on the release of any performance or guarantee bonds held by the purchaser.

Manager, maintenance and training

Responsible to the project manager for:

- The preparation of training programmes, ensuring the provision of adequate training facilities and supervising training;

- The recruitment of staff for maintenance in conjunction with the operating department;
- The preparation of maintenance documentation, including handbooks;

- The review of manufacturer's list of spare parts, deciding on those to be ordered and advising the commercial manager accordingly;
- Ensuring the availability of adequate test gear for maintenance and testing and that it is properly maintained in good working order;
- Reviewing defects arising during the manufacturer's warranty period and advising the commercial manager on the submission of warranty claims.
- The review of experience with the equipment supplied by the manufacturers and advising the project manager and the commercial manager on its reliability and suitability for standardisation.

The organisation described above could easily be expanded as suggested in Figure 10.

Figure 10: Organization for Project Implementation