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ESTABLISHMENT OF A SORGHUM CLOUDY BEER BREWERY PROJECT IN KENYA

A

FEASIBILITY STUDY REPORT

FINAL REPORT JANUARY, 1995

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A

FEASIBILITY STUDY REPORT

Prepared by

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JANUARY, 1995.

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ACRONYMS

AMG - Amyloglucosidase.

BOD - Board of Directors

CBS - Central Bureau of Statistics.

COMESA- Common Market for Eastern and Southern Africa

CSIR - Council of Scientific and Industrial Research of South Africa

CPA - Certfied Public Acontant

DFCK - Development Finance Company of Kenya

EADB - East African Development Bank

GOK - Government of Kenya

HND - Higher National Diploma

ICDC - Industrial and Commercial Development Cooperation

IDB - Industrial Development Bank

KWS - Kenya Wildlife Service

KBL - Kenya Breweries Limited

KeBS - Kenya Bureau of Standards

KIRDI - Kenya Industrial research and Development Institute

MBA - Masters in Bussiness Administration

MoCI - Ministry of Commerce and Industry

TBI - Traditional Beer Investment

NCPB - National Cereals And Produce Board.

PTA - Preferential Trade Area

SAB - South African Breweries

SA - South Africa

UNIDO - United Nations Industrial Development Organization

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CHAPTER I

1.0 EXECUTIVE SUMMARY

1.1 PROJECT BACKGROUND AND BASIC IDEA

1.1.1 Project Background

The project involves the setting up of a medium sized brewery to produce 18 million litres of sorghum cloudy beer and 1,000 tonnes of Machicha (spent grains after screening the wort) as a by-product per year.

The objective of the project is to produce a hygienic, relatively cheap and high quality sorghum based alcoholic beverage for the low and middle income consumers of beer in Kenya who currently cannot afford the lager beer produced by the Kenya Breweries Ltd.

1.1.2 Project Promoter

The project is being promoted by Mr. H.B. Ng'weno of M/S Stellascope Food Company Limited of P.O. Box 20190, Nairobi - Kenya.

1.1.3 Project History

The history of the project dates back to 1985 when the promoter commissioned the first study for the establishment of a sorghum-based lager beer brewery. The idea of implementing the project as detailed in the feasibility study was shelved due to a number of technicalities.

Efforts to implement the project were revived in 1992. The promoter is now collaborating with UNIDO, KIRDI and CSIR and TBI of South Africa in this second attempt.

1.2 MARKETING ANALYSIS AND MARKETING STRATEGY

1.2.1 The market and Demand Analysis

The project's final product's are targeted for the Western Kenya market which comprises of all the districts in Western and Nyanza Provinces. The market area has a population of about 6.9 million and an estimated per capita beer consumption of about 14 litres/year. The estimated demand for sorghum cloudy beer which is about 15% of the total per capita beer consumption, is projected to increase from 6.8 million litres in 1996 to 27.2 million litres in 2010. The final product of the project is targeted at the low and middle class income earners.

1.2.2 Marketing Strategy:

For the Company to survive in this competitive market, an elaborate marketing strategy will be established. This will be achieved through the setting up of a good distribution network, sales promotion campaign and pricing policy. The sales of the project are expected to increase from 9 million litres in 1997 and stabilize at 16.2 million litres/year within 5 years.

1.4 LOCATION AND SITE

1.4.1 Location

The project will be located in Busia town in Western Province of Kenya. Busia town lies on the Western part of the country close to the Kenya Uganda border. This location has been selected after considering two other alternative locations namely Kisumu Town and Kakamega Town.

1.4.2 Site

The project will be sited on a 8 acre plot in Mundika which is about 8 Km South of Busia Town Centre. The site is well served with all the necessary infrastructure facilities such as roads, water and electricity.

1.3 RAW MATERIALS AND SUPPLIES

1.3.1 Basic raw materials

The plant will utilise 6 major raw materials namely sorghum malt, sorghum grits, finger millet malt, maize grits, enzymes, and yeast. The quantities required for each are:

Sorghum malt	-	1100 tons/year
Sorghum grits	-	480 tons/ "
Maize grits	-	960 tons/ "
Finger millet malt	-	120 tons/ "
Yeast	-	10.8 tons/ "
Enzymes	-	600 litres "

All these raw materials will be sourced locally. The sorghum malt and grits will be sourced from malting plant that will be established as part of the brewing project. The rest will be purchased locally in the open market.

1.3.2 Auxiliary materials

These will be mainly packaging materials and other factory supplies. All the packaging materials will be purchased locally.

1.3.3 Utilities

Water - about 60,000 cu.m/year of water will be required.
Electricity - 2 million KWh per year.
Fuel oil - 25,000 litres per year.

All these utilities will be obtained locally. The water will be obtained from the local supply system and from a bore-hole. Electricity will also be sourced from the national power supply plus a stand-by generator.

1.5 ENGINEERING AND TECHNOLOGY

1.5.1 Production capacity and Programme

The plant will have an installed capacity to produce 18 million litres of sorghum cloudy beer/year, when operating on 2 shifts of 10 hours each for 312 days a year. Initially, the plant will produce at 60% capacity and gradually increase to 90% during the fourth year and maintain this production level in the successive years.

1.5.2 Technology

The traditional sorghum cloudy beer processing technology that exist in Eastern and South African region will be adopted for the project. In order to up-date the technology to acceptable commercial level, technological inputs will be obtained from South Africa, where the efficacy of the technology has been industrially demonstrated.

1.5.3 Plant, Equipment and Machinery

The plant and machinery for the project include souring tanks, cookers, fermenters, pumps, boilers, and electrical control panels. With the exception of the packaging plant most of the equipment will be sourced locally at an estimated cost of US$ 2,701,000

1.5.4 Building, infrastracture and Civil Works

The sorghum brewery/building will have a floor area of 3,500m2. The total cost of the building and civil works is estimated at US$ 432,000.

1.6 ORGANIZATION AND OVERHEAD COSTS

1.6.1 Organizational Structure

The project will be managed by a board of Directors which will be the policy making organ while the day-to-day plant operation will be under a General Manager.

The operations of the plant will be divided into 4 departments namely Production, Marketing, Accounts and Personnel

1.6.2 Organization Overhead Costs

With this organizational structure a total overhead cost of US$ 1,176,250 will be incurred annually.

1.7 HUMAN RESOURCES

1.7.1 Labour and staff

The project will employ 104 persons categorised as follows:

(i)	Direct labour	-	36
(ii)	Management and staff	-	66
(iii)	Expatriate	-	2

1.7.2 Human Resource Cost

The total labour and staff costs per year are estimated to be US$ 383,000.

1.8 IMPLEMENTATION PLANNING AND BUDGETING

The implementation of the project will take one year from the start of execution in January 1996. A total of US$ 33,000 pre-operational expenses will be incurred during this period.

1.9 FINANCIAL APPRAISAL

1.9.1 Investment

A total investment outlay of US$ 4,550,000 is envisaged categorized as follows:

	US$ ('000)
Land	10
Infrastructure	192
Design & Equipment	164
Building	240
Service Equipment	127
Transport Equipment	518
Plant, Machinery & Equipt.	1,642
Office Furniture and other Equipt.	414
Pre-production Capital Exp.	285
Working Capital	796
Contigencies (5% of fixed assets)	162
Total Investment	**4,550**

1.9.2 Financing Plan

The project will be financed as follows:

Source	Amount US$	Interest % p.a.	Repayment (Yrs.)	Grace Period
Long/Med. term loan	2,771	12%(Local) 21%(foreign)	8	1
Short term loan	591	21%(Local) 12%(Foreign)	3	0
Equity	1,688	-		
Total	**4,550**	-	-	-

1.9.3 Financial Analysis

(a) Payback Period

The pay back period of the project of the project is 4 years.

(b) Simple rate of return

The Return on Investment for the project increases from 15% during second year to a maximum of 43.4% in year seven. The Return of Equity and Return of Sales will also increase from 40.4 and14.9% to 116.9% and 28.7% respectively over the same period.

(c) Net Present Value

Discounted at 21% the net present value of the project is US$ 4,11,000 for the duration of the project estimated at 15 years.

(d) Internal Rate of Return

The internal rate of return of the project is 50% which is higher than the interest rate of short term loan which is 21% or interest on saving which is 19% p.a.

(e) Break-Even Point (BEP)

The project has favourable BEP as from the fourth year which at 39% is lower than the planned capacity utilisation of 95 percent.

1.10 ECONOMIC EVALUATION

1.10.1 Economic Benefits

The project will employ 104 persons directly and over 2000 persons indirectly. Substantial amount of income will also be generated through the project which would benefit the local farmers and businessmen. The Government will also gain substantially from the project in terms of tax earnings which are estimated at US $ 1.06 million p.a. The other economic and social benefits accruing from the project are foreign exchange earnings, improvement on human nutrition and animal feed availability.

1.10.2 Social Costs

The project will have very limited negative impact. The social risks that are to be borne as a result of the project are environmental cost as a result of using fertilizers and pesticides in the anticipated improved agricultural activity; and a negative foreign exchange in the initial years of the project. These costs are however very minimal.

1.10.3 Conclusion

The project is a worthwhile investment and the investors are encouraged to implement.

CHAPTER II

2.0 PROJECT BACKGROUND AND BASIC IDEA

2.1 THE PROJECT IDEA

The project involves the setting up of a medium sized brewery based on Sorghum as opposed to the conventional barley-based breweries. As it is not possible to use 100% sorghum malt, the brewery will also use sorghum and maize grits as adjuncts and for each of these, the amount of fat will have been considerably reduced in order to give the final product desirable quality characteristics namely the beer 'head' and long keeping quality.

The brewery will produce 180,000 hectolitres of sorghum cloudy beer per year which is akin to the traditional sorghum beer called Busaa [1]. In order to give the market product choice, the amount of Sorghum malt and/or use of finger millet will be varied to produce a product fitting the local taste. This will change the flavour characteristics but not in a highly significant manner. The project will also produce 1,000 tons of Machicha[2] per year as a by-product.

The plant is proposed to be located in Busia Town in the Western Province of Kenya. The location is well known for its suitability for production of sorghum and the tradition of consuming sorghum/finger millet cloudy beer is well entrenched. Furthermore, the site is within reach of the market in the high-population-density neighbouring districts of Western Kenya. The site is also close to Uganda which can not only be a source of raw material but also provide a market for the final product. In addition, the site of the project

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1 Busaa is a traditional cloudy beer produced from Sorghum, millet and maize

2 Machicha is the spent grains that are obtained when screening and/or centrifuging wort from the mixture of sorghum and maize grit, sorghum malt and water.

is also the home of the entrepreneur who enjoys 'Social Capital',an important ingredient in the acceptability and community support to the project.

The proposed project will source all its basic raw material (sorghum) from the immediate locality as well as the neighbouring districts of Siaya, Kisumu, Kakamega and Homabay.

The target market of the final product will mainly be Western Kenya. This region is densely populated and the tradition of consuming traditional cloudy beer is well established.

It is intended that between March and August 1995, the investor should have carried out negotiations with the co-investors on the joint venture and agreed on the issues such as share holding, project management and technology transfer. The ground clearing, site preparation, tendering for equipment and services will take place in October 1995 and by September 1996 the plant would have been completed. The brewery will be commissioned in October 1996 for a trial period of two (2) months and with the normal production expected to start in January 1997.

2.2 PROJECT OBJECTIVE AND STRATEGY

The project objectives are:-

- to set up a brewery to provide a hygienic, relatively less expensive and high quality sorghum cloudy beer for the middle and low income alcoholic beverage consumers in Kenya.

- to introduce new technology in the brewing industry that would utilize locally available raw materials that conventionally are not used for brewing at industrial scale.

- provide a commercial market for sorghum and improve the income earnings of small-scale sorghum farmers.

- create employment opportunities in the rural areas specifically in Busia town which currently does not have any sizeable manufacturing firm.

The project strategy is to offer low and middle income earners a high quality and hygienic product at reasonably low prices. It is intended also to maintain a significant price parity between the sorghum cloudy beer and the competitors so as to increase its market share of the alcoholic beverage industry. In addition, the product will be marketed not only as an alcoholic beverage but also as one of nutritional value in that it provides minerals, vitamins and carbohydrates.

This project idea is being promoted in line with the following government industrialization and general development policies:-

- In the 1994/1996 Development Plan the Government has stated that it "will encourage research into local brews and alcohols so as to encourage their commercial production. Research and development in this field will be aimed at ensuring that the brews meet the required standards in terms of safety and alcohol content. This will also provide competition to the monopoly held by the Kenya Breweries Ltd". (GOK p. 162). Based on the above Government policy statement, KIRDI has strengthened its research work in the area of local brews especially those from sorghum and millet and this project falls within KIRDI's efforts in the implementation of the above policy.

- The Government policy on rural industrialization and the rural-urban balance strategy in development as spelt out in the Sessional Paper No. 1 of 1986 on "Economic Management for Renewed Growth" is partinent to this

project. First, this project aims at achieving the rural industrialization policy in that it would be located away from present major industrial towns of Nairobi, Mombasa, Nakuru, Thika and Kisumu. Secondly, under the rural urban balance strategy, the plant will be located in one of the identified "Rural Trade and Production Centres (RTPCs)", this is Busia town, which is supposed to be the link of promoting developing of the rural parts of the region. Through the sourcing of raw materials locally within the region, this project is therefore, envisaged to have a trickle-down effect on employment and income generation to the local inhabitants especially the small-scale farmers and business men.

2.3 PROJECT PROMOTER

The project promoter is Mr. Hilary Boniface Ng'weno who is promoting the project under the business name of M/S Stellascope Food Company Limited of P. O. Box 20190, Nairobi Kenya. Presently, the company has a token share holding of Ksh. 2,000 (US$ 500.00) which is expected to be increased to Ksh. 5,000,000 (US$ 125,000) through increased sale of shares.

The project will be financed through a joint venture between M/S Stellascope Food Co. Ltd and local investors on the one hand and Traditional Beer Investments of South Africa. The local investors other than Mr. H. Ng'weno include but are not limited to BUPA (Busia Professional Association) and individual investors.

Mr. Hilary B. Ng'weno, who is a professional Journalist, Author, Editor, Publisher and Video/Television Producer shall be the chairman of the Board of Directors which will be in charge of the management of the project. Until recently, the promoter was the Editor in-Chief and Publisher of the Weekly Review and Rainbow magazines. He is presently the chairman of

the Kenya Wildlife Service (KWS) and a member of the World Bank Council of African Advisors, the African Population Advisory Committee, the Technical Advisory Board of the African Long Term Perspective Studies, the Advisory Committee on Population (the Mac Arthur Foundation, Chicago U.S.A).

2.4 PROJECT HISTORY

The history of the project dates back to the 1980's when the promoter mooted the idea of establishing a Sorghum Brewery in Western Kenya. It was at this time that Mr. H. B. Ng'weno formed the Stellascope Food Company Ltd. to implement the project idea. In achieving this, he approached the Kenya Industrial Research and Development Institute (KIRDI) to carry out a feasibility study on the project.

In 1984-1985, KIRDI undertook laboratory experiments and production of lager beer from 'Serena' and 'Seredo' varieties of Sorghum. During these technical production trials, problems in malting sorghum were exposed. Based on these successful experiments, KIRDI prepared a feasibility study for the project whose final report was completed in February, 1986.

According to the feasibility study reports, the project was planned to produce thirty (30) million litres of lager beer per year at an estimated total project investment cost of Ksh. 515.8 million (approximately US$ 34 million as at 1986). However, the entrepreneur, Mr. Ng'weno, on studying the report felt that some aspects of the project were not well covered in the study, since KIRDI had used the conventional barley malting technology for the sorghum-based project.

Having realised the above shortcomings in the study, the initiator of the project shelved its implementation and instead started seeking for assistance from the suppliers of the sorghum malting technology, which he considered, rightly, the crucial component of the project. In his endeavour to get

this assistance, Mr. Ng'weno approached the Ministry of Commerce and Industry in Kenya to further appraise the feasibility study and to link him to the companies which could offer such assistance.

The Ministry of Industry in 1988 linked Mr. Ng'weno to a Belgian Company, Abbey Ltd., which specialises in sorghum brewering technology. The company in the same year submitted to the promoter of the project a proposal for a 50,000 hecto litre/year Brewery and Sorghum Malting Plant.

According to the proposal, the total cost of investment of the plant estimated at Belgium Francs 258.684 million (foreign cost component) and Ksh. 46.512 million (local cost components). The costs of the proposal were however, higher than the promoter had anticipated and therefore, could not go on with the plan. As a result therefore, he sent another appeal to the Ministry of Commerce and Industry to identify an affordable technology offer.

It is noteworthy to mention that even if the technicalities of production of lager beer from sorghum had been overcome and that the investment costs were within the capability of the investor in 1980's, the monopolistic environment prevalent by then would have blocked the establishment of the project.

Ever since the Ministry of Commerce and Industry have kept the project apparently unable to do much and it was not until the launching of the UNIDO IIP project, DP/KEN/86/064 that the Ministry started to actively promote the project again.

It was at this same period (1992), following the democratization of South Africa that KIRDI got in touch with the Council of Scientific and Industrial Research (CSIR) of South Africa which had been closely working with Sorghum Breweries and Malting Plants. With new South Africa contacts therefore, KIRDI renewed the efforts to pursue further the sorghum brewery project with Mr. Ng'weno.

However the original concept of setting up a brewery producing lager beer from sorghum was shifted to that of producing sorghum cloudy beer. There are two reasons for this shift:

- KBL has lost about 30% of her market share due to high product prices. Hence it would have been futile to add more lager beer into a market whose effective demand was reduced.

- the government policy of promoting traditional beer industries began to be pursued just at a time as the technology of commercial sorghum brewing became available from South Africa.

This study is therefore, the second effort between KIRDI and the promoter of the project to establish a Sorghum Brewing Plant in Western Kenya.

2.5 COST OF PREPARATORY STUDIES

The costs of the preparatory studies of the project may be categorized into two groups:-

(i) Pre-investment studies:-
These include opportunity study, raw material and market survey and feasibility study have been undertaken through funds born by a third party (UNIDO). A total of US$ 10,400 have been spent on these studies.[3]

(ii) Preparatory Investigations:-
These studies include land surveys, quantity surveys experts (consultants and Engineering fees) and other support studies that will be borne as part of the implementation investment costs.

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3 These costs although reflected in the report they have not been taken into account in the project financial analysis.

CHAPTER III

3.0 MARKET ANALYSIS AND MARKETING STRATEGY

3.1 THE MARKET OF BEER IN KENYA

The market of beer in Kenya has been dominated by a single firm, the Kenya Breweries Ltd.(KBL) until 1988. The KBL had absolute monopoly in this sector and apart from spirits and wines, no other type of industrially produced alcoholic beverage was allowed in the country. During this period, KBL has been able to embark on a major expansion programme and set up new brewing plants in Mombasa, Kisumu and Nyeri to cater for the tourist clientele at the Coast (Mombasa), the large population in Western Kenya (Kisumu) and the faithful clientele in Mount Kenya Region (Nyeri and Meru).

In 1988 and 1990, however, Chibuku Products, a subsidiary of Lonrho International and Umoja Breweries were respectively established in Nairobi. These two Breweries unlike KBL are producing cloudy beer products from maize, sorghum and millet, lactic acid and enzymes.

Since the 1990s, the corsumption of lager beer from KBL has been gradually declining as shown in the appended graph I. This is mainly due to:-

- an ever increase in the beer price which was ranging between Ksh.4-5 per half litre in 1985 to ksh.30 - 36 per half litre currently.

- Decrease in the disposable income of the consumers due to inflation and depreciation of the Kenya currency. This trend has however now changed as inflation has drastically reduced and the Kenyan currency has since june 1994 appreciated by over 45 percent.

- Change of attitude of the consumers whereof lager beer has lost its "Status Symbol"position due to familiarity and revaluation of role of beer in society.

- Shift of consumption from the KBL products to the Umoja Breweries and Chibuku Products and traditional beer (Busaa[4] and Chang'aa[5]) especially for the low and middle income earners due to financial reasons.

The trends in beer consumption, and market survey conducted reveal that there is a great demand, among the population surveyed, to have an alternative alcoholic beverage which is affordable and of high quality in Western Kenya. Since the Kibuku and Umoja breweries products are not widely marketed\distributed, the need to fill this market niche is even more pressing.

3.2 THE MARKET ANALYSIS: DATA AND METHODS OF EVALUATION

In the market analysis of the cloudy sorghum beer project, there are two methods of relevance in the evaluation of the data.

These are:-

(i) analysis of the actual sales trends several years prior to the study.

(ii) estimation of sales based on current and projected consumption patterns of the population.

---

4 Busaa is a traditional cloudy beer produced from sorghum, millet and maize

5 Chang'aa is a traditional spirit which is distilled from a mixture of fermented sorghum, maize and millet.

In the period of study, there are no data in existence that would be useful and reliable enough to the market analysis of the study. Production of cloudy beer in Kenya is a fairly recent development and the national statistics bureau has not started keeping data on the production and sales of these companies. Possibly this is due to the government's non-commitment to this industry and the bias towards supporting the KBL which has been a source of substantive revenue to the exchequer as sales tax and excise duties. Consequently in this study, the data evaluation for demand projections is based on the estimated per capita cloudy beer consumption and population size of the market.

The data used to analyze the market analysis of cloudy sorghum beer has been obtained from:-

(i) field visits to Busia, Kakamega, Homabay, Kisumu and Nairobi districts.

(ii) Ministry of Planning and National Development.

(iii)Ministry of Agriculture (Provincial and District agricultural reports).

(iv) advertisements, publications, sessional paper No.1 of 1986 and sessional paper No.4 of 1994 on food policy.

(v) discussions with responsible government officials.

(vi) interviews with sample of consumers of sorghum-based alcoholic beverages and KBL products in the field.

In the study the specific aspects thus covered are:-

- the market population and population growth.

- the beer consumption patterns based on KBL products and records.

- the pattern of consumption of cloudy beer in Southern and Central Africa.

- product image.

- the economic trends and changes in disposable income in the country.

- product quality.

- the product price.

- tastes and habits of the targeted market.

3.2.1 The Target Market Population

The sorghum cloudy beer is targeted for the market in Western Kenya which is comprised of Busia, Kakamega[6], Bungoma[7], Siaya, Kisumu and South Nyanza[8] districts. (Map I). This region has a total population of about 6.9 million people (Table I). This population is projected to increase to 7.8 million people by the year 2000 given a rate of growth of 3.5% p.a.

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6 Kakamega district is now divided into two districts, Kakamega and Vihiga. The reference here is made to the original district before the division.

7 Bungoma district as referred in this report comprises of the present Mt. Elgon and Bungoma district which were originally one.

8 South Nyanza district comprises of the present Homabay and Migori.

TABLE I POPULATION PROJECTION OF THE TARGET MARKET DISTRICTS

DISTRICT	1989	1994	1996	2000	Growth Rate
Busia	308,842	498,871	534,871	613,242	3.2%
Bungoma	511,969	881,716	945,677	1,072,659	2.8%
Kakamega	1,129,574	1,201,729	1,269,972	1,418,295	3.15%
Siaya	639,437	749,071	796,674	900,151	3.5%
Kisumu	664,086	790,678	844,538	969,128	3.6%
S/Nyanza	1,066,584	1,347,541	1,440,203	1,492,050	3.6%
Kisii	1,137,504	1,423,739	1,827,490	2,105,203	3.6%
Total	**5,458,001**	**6,893,345**	**7,659,425**	**7,760,726**	**3.5%**

Source :CBS Population Census 1989.
District Development Plans 1993-1996.

Traditionally, most of the people in Western Kenya consume alcoholic beverages, both industrially and traditionally produced. However, not all people take alcoholic beverage for this is only a preserve of the adults, that is, those above 18 years of age. This therefore, means that out of the total population, only 45% (according to the 1989) are potential consumers, since 55% of the population is below 18 years of age. The market population for the sorghum cloudy beer is therefore, only 3.0 million people of whom only 70% are potential consumers as according to the market survey only 7 out of 10 people consume some kind of alcoholic beverage.

3.2.2 Patterns of beer consumption

In the last five years, KBL records show that volume of lager beer consumed has risen from 307.5 million litres to 331.1 million litres. However in 1991, the consumption had dropped to 314 million litres. The decreasing tendency has accelerated up in 1994, by which period, KBL has lost about 30% of the market share. This is mainly attributable to ever

increasing prices of the lager beer and decrease in the disposable income of consumers.

The table below gives the per capita beer consumption in Kenya for the last five years.

TABLE II: PER CAPITA BEER CONSUMPTION IN KENYA

Year	Population ('000)	Total Consumption (Million Litres)	Per Capita Consumption (litres)
1987	20,600	307.5	14.93
1988	21,321	314.4	14.75
1989	21,444	315.4	14.71
1990	23,242	337.1	14.50
1991	24,055	314.0	13.05

The per capita consumption has been relatively steady until 1989, when it started falling drastically.

3.2.3 Consumption of Sorghum based beverages

Sorghum based alcoholic beverages are popular products in most parts of Southern and Eastern Africa. Available data from the Southern Africa countries show that Botswana has the highest per capita consumption of sorghum-based beverage called "Maheu", followed by South Africa and Swaziland (Table III).

TABLE III: CONSUMPTION OF SORGHUM BASED ALCOHOLIC BEVERAGE IN SOUTHERN AFRICA

Country	Population (Million)	Per Capital litres/year
South Africa	37.27	1.61
Botswana	1.21	3.97
Swaziland	0.68	0.71
Lesotho	1.62	0.30

Although similar data from the Eastern Africa countries, i.e. Tanzania, Uganda, Kenya, Malawi and Zambia, does not exist,there is evidence that sub- antial amount of these products are consumed. It is however, important to note that while most of the sorghum based alcoholic beverage consumed in Southern Africa are industrially\commercially produced, most of those in Eastern Africa are produced in the homesteads using traditional methods and are considered "illicit". The only exception being in Kenya and Malawi where sorghum breweries have been established.

In Kenya, the two sorghum beer breweries produce an average of 19.5 million litres annually which calculates to 0.72 per capita litres per year. The current consumption seems negligible because these products are not yet widely distributed in the country and a majority consume the traditional alternative, of which official statistics are not available.

3.2.4 Product Image and Quality

According to the market survey conducted in August, 1994, the following conclusions were drawn:-

- that the product is predominantly seen by customers to be an African product with deep rooted historical and cultural significance. This gives a feeling of identity to the consumers.

- that the consumption of the traditional brew is being used as measure of adherence to the African heritage which together with other commodities is classified as "Kienyeji[9]" products.

- that the product is deemed by consumers as both a food and a drink which has high nutritional value.

- that whereas a traditional brew (Busaa)is indeed desired by many consumers, its present manner of production is suspect to many potential consumers due to poor hygienic conditions under which it is prepared.

Using samples of Kibuku International beer, a product of Kibuku Food Ltd., which has similar characteristics as the intended project product, the following assessments were made:-

- International beer is generally more acceptable in terms of hygiene, taste, colour, though the odour was unpleasant.

- The packaging of International Beer was not popular with the customers. Plastic bottles were used which gave same resemblance to industrial inedible products such as motor

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[9] Kienyeji is a Swahili word which literally can be translated to mean original or ancestral.

oils and acids. A more appealing and food like packaging packets were recommended.

- Important information such as date of manufacture and expiry were not indicated on the package and customers were suspect of the commodity.

The consumers indicated that once the above shortcomings were corrected, then the product will be more acceptable to the consumers of Busaa and KBL products.

3.2.5 Product Price

The price of sorghum-based alcoholic beverage in Kenya is relatively much lower compared to lager beer based on barley. Currently, sorghum beer, commercially produced, retails at KSh.14.00 (US$ 0.35) per half litre while KBL products sells at KSh.35.00 (US $ 0.95) per half litre bottle. Due to the high price difference, the sorghum beer is becoming increasingly popular as a result of clients dropping from the lager beer clientele.

As a result of the observed trends, the project should capture a large part of the lager beer market segment.

3.2.6 Tastes and Habits of Target Market

The tradition of consuming sorghum based alcoholic beverage is well entrenched in the target market. Sorghum beer is served in social gatherings, and ceremonies such as weddings, circumcisions, harvests and merry making. Furthermore, sorghum beer drinking venues serve as an opportunity to make friends and pass time.

At present, this potential market for sorghum beer is served by illicit brewers and therefore, establishment of the project would provide a legalised channel for sourcing the product.

3.2.7 Pattern of Income Distribution and Economic trends

The income distribution patterns in Kenya are such that inequality is being more pronounced with time. Furthermore the economic trends indicate that whereas the nominal wage bill has marginally increased over the last few years, the real income (disposable) has been decreasing. This is mainly due to inflationary pressures which have eroded average real earnings by over 8.3% in 1991. Presently estimates show that over 46% of the rural population has been pushed below the poverty line by economic pressure.

Even though beer is not an essential commodity, its consumption has been found generally unavoidable. With this economic set up, a population of the lager beer consumers is be compelled to look for an alternative cheap and hygienic product such as sorghum cloudy beer.

3.3 MARKET DEMAND ANALYSIS OF SORGHUM BEER

The major factors that influence the demand and consumption of sorghum beer and other types of alcoholic beverages in general are:

- Population size and growth rate
- Income levels
- Price of the product
- Taste, habits and tradition.

Based on these factors and the findings of the field market survey the following demand projections are made for fourteen years after the plant commissioning.

TABLE IV: PROJECTIONS OF THE DEMAND OF SORGHUM CLOUDY BEER

Year	Population	Estimated per capita (p.a.)	Total Demand Cons.(litres
1996	7,659,425	2.0	6,893,348.5
1998	8,187,324	2.5	9,210,739.5
2000	8,570,728	3.0	11,570,482.8
2002	9,181,178	3.5	14,460,355.3
2004	9,835,108	4.0	19,916,093.7
2006	10,535,613	4.5	21,334,616.3
2008	1,286,012	5.0	25,393,527.0
2010	12,089,858	5.0	27,202,180.5

3.4 MARKETING STRATEGY

3.4.1 Strategic Plan

The principal marketing strategy of the proposed project is to establish a brewery in a location where the tradition of sorghum cloudy beer consumption is deeply entrenched and the project will concentrate her sales efforts in availing a high quality hygienic and well packaged product.

The marketing of alcoholic beverages is considered highly competitive. For instance the KBL operates a chain of depots in Western Kenya and has a brewery in Kisumu. Other breweries such as Kibuku Food Ltd. and Umoja Breweries Ltd. have shown interest in penetrating the market in the region. In the first half of 1994, KBL has spent about KSh.34 million in sales promotion in order to maintain her market niche.

Due to the nature of the marketing of alcoholic beverages, the project will have necessarily to establish an efficient distribution network, pricing policy, and advertising/promotional programmes particularly those geared towards community support.

3.4.2 Distribution Network

The marketing of sorghum cloudy beer requires a well organised distribution network. For example KBL which has the most developed distribution network in the region has over 11 appointed depots/stockist and over 700 retail points in the region (Table V).

The project would therefore have to establish a similar distribution network so that the products can be as close as possible to the consumers.

TABLE V: KBL DISTRIBUTION AND RETAIL NETWORK IN SELECTED DISTRICTS IN WESTERN KENYA

DISTRICT	CATEGORY	NO
Busia	Retailers (Bars & Restaurants)	188
	Distributors/Stockist	2
Kakamega	Retailers (Bars & Restaurants)	284
	Distributors/Stockist	4
Kisumu	Retailers (Bars & Restaurants)	233
	Distributors/Stockist	3
HomaBay	Retailers (Bars & Restaurants)	94
	Distributors/Stockist	2
TOTAL	**Retailers (Bars & Restaurants)**	**799**
	Distributors/Stockist	**11**

Source: KIRDI Field Survey 1994.

In synchrony with the major beer markets in the region, it is recommended that the project establish distribution depots in

Kakamega, Vihiga, Bungoma, Siaya, Kisumu and Homabay. In these market centres the management of the company should appoint local business to be distributors.

3.4.3 Pricing

Pricing is very crucial in marketing. In order for the projects product to be in competitive edge over the other products in the market, its product should be fairly low priced. The current prevailing ex-factory prices of sorghum based alcoholic beverages are Ksh. 22.00 (US $ 0.55) per litre and the retail prices are shown in section 3.2.3. The unit production of the sorghum cloudy beer to be produced by this project is US $ 0.40 when the plant is operating at 50% capacity and reduces to US $ 0.25 when operating at 90% capacity (detailed analysis in section 10.2 Table XIII). Based on the prices of the other sorghum breweries and the unit cost of production, it is therefore, recommended that the products be sold at an ex-factory price of Ksh.20.00 (US $ 0.50) per litre so that it has a competitive edge of about 10% over similar products.

3.4.4 Sales Promotion

The principal competitor to the project will be KBL with Umoja Breweries and Kibuku Food Ltd. giving lesser competition. The project will have to undertake aggressive sales promotion campaign by way of:-

(a) Radio advertising.

(b) Print media - i.e. newspaper and magazines.

(c) Other advertising tools e.g. calendars, brochures, T-Shirts, painting of buildings etc.

3.5 MARKETING COSTS

The marketing costs will consist of two major components namely:-

(a) Distribution costs.

(b) Sales promotion costs.

3.5.1 Distribution Costs

The sub-elements in the distribution costs include:

(i) Operation and service costs of delivery trucks owned by the project.

(ii) Sub-contracted and Hired delivery trucks.

(iii) Hired depots.

(iv) Depot labour costs.

TABLE VI: COSTS OF BEER DISTRIBUTION

Element	NO.	Unit Cost (US $)	Total Distance	Total Amount P.A (US $)
Company Trucks	3	.075/Km per ton	300 Km	56,160
Hired Trucks	5	.075/Km per ton	500 Km	93,600
Hired Depot	5	125 per month	-	7,500
Depot Managers	5	375 per Month		22,500
Depot attendants	10	125 per month		18,000
Total				197,760

3.5.2 Sales Promotion Costs

The sales elements in the sales and promotion costs include:-

(i) Operation of sales vans owned by the project.

(ii) Sales labour costs.

(iii) Samples.

(iv) Advertising costs.

TABLE VII: SALES PROMOTION COSTS

Element	No.	Unit Cost US $)	Quantity required	Total Costs(US$)
Sales Vans	2	.0375/Km	200 Km	46,800
Sales labour	4	375 per month	-	18,000
Free Samples	4	6.75/crate	-	2,106
Advertising				
* Radio	30	50/entry		18,000
* Print Media	10 entries	10/entry		12,000
Total per month				96,906

The estimated total marketing costs therefore per year is US$.294666.

CHAPTER IV

4.0 RAW MATERIALS AND SUPPLIES

4.1 UNPROCESSED AND SEMI PROCESSED RAW MATERIALS

The sorghum cloudy beer brewery would require the following materials in varying proportions:-

(i) Sorghum malt
(ii) Sorghum Grits
(iii) Maize Grits
(iv) Finger millet malt/grits
(v) Yeast
(vi) Enzymes
(vii) Lactic acid (sour)

4.1.1 Sorghum Malt and Grits:

Sorghum has been a traditional staple food crop for the people of Eastern Africa, particularly those living in low potential agro-ecological zones. Its not until the 16th century that maize, a native cereal of Mexico, was introduced by the Portuguese to the region. Other than its use as a food crop, sorghum has been put into other multiple uses, the second most important being as a raw material for brewing of traditional alcoholic beverages.

With the introduction of maize and other temperate type of cereals such as barley and wheat, which the commercial farmers were familiar, government policy and marketing support as well as research input were tilted towards these newly introduced crops. The end result is that production of sorghum and other traditional cereals such as finger millet have declined. Further the technological aspects of processing sorghum into alcoholic beverages has stagnated.

The potential of cultivation of sorghum in the low potential agro-ecological zones is immense. This commodity has been selected as major basic raw material so as to promote the production and commercialization of this hitherto neglected crop.

As a raw material sorghum will be utilised in the project in two forms:

(a) Raw sorghum which has been dehulled to reduce the tannin and other organic compounds that are a hinderance to the production of good quality cloudy beer: This will be milled into sorghum grits.

(b) Sorghum malt: this is sorghum which has been cleaned and developed into malt by controlled germination conditions to fully develop the amylases and other desirable quality characteristics such as free amino Nitrogen. The malt is then ground into a meal.

At 100% capacity the following sorghum based semi processed raw materials will be required.

(i) Sorghum malt - 1100 tons

(ii) Sorghum grits - 480 tons

4.1.2 Maize Grits

Maize is the second major input into the recipe. Maize which has been broken into grits is used and forms about 40% by proportion. It is essential that the fat content of the maize be reduced to a level of less than 1% in order to give a good quality product. Fat content has effect on the 'head' of beer; any fat content in excess of 1% will lead to the instability of the 'head' of beer.

Maize is known to have an endosperm which is rich in carbohydrates which are readily converted into sugars that form the substrate for yeast to produce alcohol. Inclusion of maize grits therefore ensures that there will be sufficient substrate for high alcohol content (in beer) to be reached. A cloudy sorghum of good quality should reach between 3.8 - 4.5% alcohol content by volume.

At 100%, capacity utilisation the plant would require 200 tonnes of maize grits; allowing for about 15% mechanical waste (spillage) and other losses.

4.1.3 Finger Millet/malt

The traditional technology of busaa production have always incorporated finger millet malt. There are two-fold reasons for this:

a) Finger millet malt is known to have extremely high enzymatic power. The A-amylase and B-amylase from finger millet have high ability to convert starch, dextrine and disaccharides into simple sugars (mono-saccharide)

(b) to produce finger millet malt, is an easier undertaking compared to sorghum malt since finger millet malts easily. The project will thus capitalise on these two desirable characteristics of finger millet malt.

However, due to the fact that finger millet is a small grain, it will be difficult to handle large quantities of this grain as would be required in the production at commercial levels. As a result finger millet malt forms only a small proportion in the recipe. On the other hand from the marketing point of view, that is the production of a sorghum cloudy beer suited to the local taste, it will be unavoidable to use some amount of finger millet malt since this will give the beer the traditional flavour of cloudy beer. After balancing the technological and marketing objectives, the project will require 150 tonnes of finger millet malt per annum.

4.1.4 Yeast

This is the agent involved in the production of alcohol from the sugars gained from the sorghum malt grits, maize grits and finger millet malt. In conventional brewing for production of lager beer, a clear distinction has to be kept between a bottom type and a top type fermenting yeast. For the project, this matter is not important as the yeast is not separated from the product, in fact it forms part of the product as the product is sold 'live'. The fermentation of the product continues even when the beer has been packed.

It is however, important that a yeast strain of desirable characteristics be identified that will produce a product of optimum quality. If a low quality yeast such as bakers yeast is used, the required alcohol contents will not be high and there is a risk of production of off-flavours.

Initially, a high quality brewers yeast will be identified and this will be propagated in the laboratory at the brewery. It may be essential to keep the original stock that can be used to revitalise what culture has been propagated at the laboratory. On an annual basis, about 11 tonnes of yeast would be required for the production of 180,000 hectolitres of sorghum cloudy beer.

4.1.5 Enzymes

For full conversion of the starches and other polysaccharides in sorghum and maize, there is need to use external enzymes. Two types of enzymes are used namely:

(a) Termamyl.

(b) Amyloglucosides (AMG).

These two enzymes have two different optimum activity temperatures and are applied at the end of the cooking process. The use of sorghum malt in the recipe reduces the

amount of enzymes required as during the germination process some amylases are synthesized. The level of enzyme required on annual basis will be 600 litres, for both. It is also possible to use only AMG to achieve the desired results.

4.2. UTILITIES

4.2.1 Water

A supply of good quality water (potable) is essential for successful operation of the factory. Water is an ingredient in the manufacture of sour, production of wort and is part of the cooking conversion process. For every 15,000 litres of wort, water forms about 12,000 litres. Water is also needed for general factory cleaning of floor, vessels and other equipment.

The water used for processing must be free of E. coli otherwise it will have to be used for general cleaning. It is also desirable that the water be free from excessive chlorides as this corrode process equipment. Hard water is not good for brewing though its desirable to a calcium content of 60 ppm to stabilise the "head" or form in beer. It is known that foam stabilisers that are used in lager beer are not effective in sorghum beer.

4.2.2 Electricity

Electricity is another important utility for the plant. About 3.6 million Kwh per year would be consumed. This power will be supplied to the plant by a 11000 KV power supply from the national grid which will be stepped down to 415 KVA. A stand-by generator will also be installed to supply the required energy incase of any power cut from the national power supply system.

4.2.3 Steam

Steam will be used in cooking/convertion, general heating and fermentation of sour production. For the production of 1 hectolitre of beer about 120 kg of steam are required. This translates to 21.6 million Kgs of steam per year. This steam will be generated by a boiler which runs on the industrial fuel and is installed within the brewery in a boiler house. However possibilities of firing the boiler with fuel-wood can also be exploited.

4.3 FACTORY SUPPLIES

For other auxiliary activities, the following factory supplies will be needed:-

(i) packaging material.

(ii) chemicals (detergents).

(iii) maintenance materials e.g. grease, oil, paints.

(iv) stationery, charts, and other office supplies.

4.3.1 Packaging Material

Two types of packaging would be required namely:

(a) one litre carton using Metal Box packaging equipment (Nimco 880). A supply of good quality paper board is desirable.

(b) for bulk packaging, 2 litre and 20 litres plastic package would be required.

It is estimated that 70% of the product will be packaged in the 1 litre packs and therefore about 15 million packs will be required annually. Twenty (20) per cent of the product will be packaged in bulk and this would need 200,000 twenty litre

plastic packages annually. The rest of the product will be in 2 litre packages and this will require 900,000 packs p.a.

The 1 litre and 2 litre packs will then be packaged in returnable crates. About 200,000 crates will be needed.

4.3.2 Chemical and detergents

An assortment of chemicals will be needed for basic laboratory. analysis e.g. acidity measurements, for washing the general equipment and brewery. Various types of soaps and detergents will be consumed.

4.4 RAW MATERIAL SUPPLIES PROGRAMME

4.4.1 Sorghum grit and Malt

Sorghum grits and malt will be obtained from the sorghum malt plant that shall be established as part of this project (see details on Malt Plant). Sorghum is a traditional crop in country and adequate supplies are available for use for the sorghum malting plant and hence the brewery. Western Kenya produces about 70% of the total Sorghum output in the country as shown in tables VIII and IX below.

TABLE VIII: SORGHUM PRODUCTION BY PROVINCE 1989 - 1991

PROVINCE	1989	1990	1991
		(Metric Tones)	
Nyanza	57,520	46,792	49,751
Western	16,980	18,445	22,360
Eastern	39,084	37,311	30,196
Coast	1,001	1,411	285
N/Eastern	340	874	890
R/Valley	6,490	5,242	4,353
Central	85	78	56
TOTAL	121,500	110,153	107,891

Source: Ministry of Agriculture - Provincial Annual Reports.

TABLE IX - SORGHUM PRODUCTION IN WESTERN KENYA 1989 - 1993

DISTRICT	1989	1990	1991	1992	1993
	(Metric Tonnes)				
Busia	2,920	13,136	7,861	7,112	10,556
Bungoma	620	1,070	978	894	772
Kakamega	3,440	4,240	2,119	3,095	2.739
Siaya	24,360	19,562	17,550	16,000	14,740
Kisumu	9,872	9,082	9,899	7,533	4,075
S/Nyanza	22,789	17,312	18,086	23,477	18,862
Kisii	499	836	674	620	473
TOTAL	74,500	65,238	57,167	58,731	52,217

Source: Ministry of Agriculture - District Annual Reports

Until recently the marketing of sorghum grain was been controlled by the National Cereals and produce Board (NCPB) a government corporation but as result of the liberalisation of the economy the purchase of sorghum is in the open free market. There will be therefore no restrictions by government impediments in sourcing the raw material.

4.4.2 Maize grits

Maize grits will be purchased from local maize millers e.g. United Millers. The price of the maize grit is about KSh.13,000.00 (US$ 325.0) per ton.

4.4.3 Yeast and Enzymes

These processed industrial materials will be sourced locally from a representative of an international manufacturer e.g. Ron Poulec who represents Nova Chemicals of Denmark.

4.4.4 Packaging Material

The carton boards will be obtained from local based paper converter e.g. Tetra Laval. The crates and the plastic bulk packages will also be locally obtained from local plastic container manufacturers.

4.4.5 Delivery Schedule for raw materials

The material inputs such as sorghum grits, malt, maize grits, yeast and enzymes will be delivered on a periodic basis. The most suitable period is adequate supplies to cover at least one month's production. Storage of these raw materials for excessively long period should be avoided as this may lead to deterioration of the same. For example, enzyme activity and yeast performance are known to be affected with prolonged storage periods under ambient conditions.

A small store to keep up to a months supply of these major inputs will be built as part of the brewery complex.

4.5 RAW MATERIAL AND SUPPLIES COSTS

The table below gives a summary of the cost of the necessary raw materials using 100% production capacity of the plant.

TABLE X : RAW MATERIALS AND SUPPLIES REQUIREMENT

Raw material	Unit cost (US $per Unit)	Quantity (Tonnes p.a)	Total Cost (US$ '000)
A.Semi-processed			
(i) Sorghum			
- Malt	450/ton	1100	357.5
- Grits	280/Ton	480	134.4
(ii) Maize grit	330/Ton	960	316.8
(iii) Finger millet Malt	400/Ton	120	48.0
(iv) Yeast	5300/Ton	10.8	56.7
(v) Enzymes	10.50/litre	6000	63.0
B.Utilities			
(i) Water	0.25/Cu.m	60,000 Cu.m	15.0
(ii) Electricity	0.09/Kwh	2 M Kwh	180.0
(iii)Fuel oil	0.45/litres	24,960 l	11.2
C.Factory Supplies			
(i) Packaging			
- 1 litre pkts	0.09/Pkt	15 million	1350.0
- 2 litre pkts	0.13/Pkt	900,000	117.0
- Crates	2.50/crat	50,000	125.0
- 20 lt Drums	1.25/Drum	200,000	250.0
TOTAL			3024.6

CHAPTER V

5.0 LOCATION AND SITE

5.1 LOCATION

For successful establishment and operation of the brewery, the location has to fulfil the following requirements:

(i) availability of reasonable space, at least 2 ha.

(ii) good terrain for easy drainage.

(iii) access to markets near towns or densely populated region.

(iv) good communication network.

(v) access to cheap labour.

(vi) good infrastructure (telephone, road, rail).

(vii) produce or be near the source of major raw materials.

(viii) availability of utilities (water, electricity).

Three possible locations for the project namely Busia town, Kakamega town and Kisumu town were evaluated.

5.1.1 Selection of location

The project will be located in Busia town, in Busia District of Western Province of Kenya. Busia District is one among the districts that form the Western region which is composed of Nyanza and Western Provinces.

Busia town has been selected as the location for the project for the following reasons:-

(a) there is good transport facilities (its on a major transnational road). The district has a total road network of 790 Km which is all-weather. This network connects the district with all the neighbouring districts which will be the market of the final product and source of raw material.

(b) the town has adequate (potable) water which serves about 90% of the population. Busia town is connected to the major water reticulation system which also can be used for the project. In addition the water table is very high and therefore makes it easier to drill a bore-hole incase of need. There are several permanent rivers and streams in the location of the project.

(c) Land is still plenty in the entire district and even in Busia town for both agricultural and industrial purposes. Unlike the other location, land in Busia is relatively cheap at about KSh.50,000.00 (US$ 1250.0) per acre. In addition, the entrepreneur already has about two hectare of land 8 Km south of the centre of Busia town which can be used for putting up the plant.

(d) Busia district has plenty of both skilled and unskilled labour force. Of the total labour force of 200,110,of which 70% are in wage employment. It therefore follows that the project will have no problems in respect to labour.

(e) Busia town is fairly well served with all the basic social amenities such as hospitals, banks, schools, hotels and restaurants and sports centres. There is ample housing facilities for the work-force of the proposed project.

(f) the town being a rural one, is favoured by government industrialisation policies such as rebate on taxes, import duty on machinery and other investment incentives. The local authority too has favourable investment packages to attract industrial investment projects such as this brewery.

(g) the location of the project has good infrastructural facilities necessary for industrial development. These include means of waste disposal, telephone and electricity.

5.2 SITE

Two potential sites were considered for the project:

- The Kenya Industrial Estates site; and

- Mundika Trading Centre

The site at Mundika has been selected due to:

(i) The plot with ample space - (8 acres) is readily available as it is owned by the investor.

(ii) located at about 10 Km from the Kenya-Uganda border which is desirable for security reasons.

(iii) the terrain at Mundika is good for drainage purposes.

The K.I.E. site suffers from congestion, unavailability of reasonable size of land and poor drainage terrain.

5.3 LAND COSTS

The following site costs will be incurred by the project.

(i) purchase of land from the investor - estimated at KSh.400,000/= (US $ 10,000) this is Ksh. 50,000 (US $ 1250) per acre.

(ii) legal expenses, stamp duty and transfer fees about KSh.30,000/= (US $ 750).

(iii) land rent and service charge estimated at KSh.5,000/= (US $ 125) annually.

5.4 ENVIRONMENTAL IMPACT ASSESSMENT

The project will have very little negative environmental impact. All the solid waste produced as Machicha will be used by the neighbouring community to feed pigs and dairy cows.

There will be some minimal solid wastes which will be recovered by a simple screen and the same can be mixed with some dry solid waste and incinerated.

The only point that may be of concern is the pH of the effluent but this can be controlled by dosing limeinto the effluent and then released to oxidation ponds before it is discarged into the river. This would bring the pH of the effluent water to acceptable levels.

However it may be desirable to have a small effluent treatment plant which together with the oxidation pond is estimated to cost about KSh.250,000/= (US $ 6250).

CHAPTER VI

6.0 ENGINEERING AND TECHNOLOGY

6.1 INTRODUCTION

The production programme of the project is based on the following data:-

(i) anticipated sales of the final product.

(ii) installed capacity of the plant.

(iii) marketing strategy.

(iv) increased demand of the final product in specific periods (weekend or month-end).

(v) optimising on the quality product characteristics through the sales channel.

(vi) expected loss through spillage on spoilage claims.

6.1.1 Production data

The envisaged plant production levels is as shown in Table IX.

TABLE XI: QUANTITY PRODUCED AND INSTALLED CAPACITY UTILISATION

Year	% capacity utilisation	Quantity produced
2	60%	108,000 Hl
3	75%	135,000 Hl
4+	90%	162,000 Hl

6.1.2 Production programme

Its noted that the plant will attain 90% capacity utilisation after fourth year. This is due to:

(i) the market penetration. The products of the proposed project will need aggressive marketing campaign to build good-will and challenge the competitors.

(ii) the plant will be operating at 312 days in a year. Time will be needed for maintenance and repair of equipment, machinery & buildings. There will also be down-time due to breakdown of plant. It will be expected that the plant will be closed for a total of at least two months for repair and maintenance, not necessarily on a continuous basis.

The plant is expected to start production in May 1996 and have a two (2) months trial run. The initial production will start in July 1996 at 50% capacity production and increase as shown in Section 6.1.1 (Table XI).

6.2 PLANT CAPACITY

The determination of the plant capacity is based on the anticipated market demand and the minimal economical viable capacity.

For a sorghum based brewery to break-even, a minimum capacity of 1 million litres per month is required. For such a plant to make good profits, a production capacity of 1.5 million litres per month is desirable and thereafter profit margins increase with output.

Given the market size and the market threshold for efficient distribution of the product, a production capacity of 180,000 Hl/year has been selected at 100% capacity assuming two ten-hour shifts per day for 312 days in a year.

6.3 TECHNOLOGY

6.3.1 Technology selection and acquisition

The technology for sorghum cloudy beer brewing is unique and developed to suit sorghum as the basic raw material. Some of the unit operations such as filtration are dispensed of unlike in the conventional barley lager beer production. The technology selected for this project is based on several parameters as under:-

(i) an intermediate technology which is neither too capital nor labour intensive has been adopted. This gives a balanced investment portfolio in terms of fixed and variable costs. The technology being intermediate is more adaptable, and absorbable to the Kenya situation which has both high trained manpower and a large labour force that is unskilled.

(ii) the technology for the project is indigenous in the East and South African region, although in Kenya it is at its rudimentary stage. For this, refinements of the technology will be sourced from South Africa through a joint venture arrangements. The efficacy of the selected technology has already been demonstrated in the most of the Southern African countries namely, South Africa, Botswana and Zimbabwe and the CSIR of South Africa has contributed immensely in the development of the technology.

(iii) the technology selected will produce a product with the following characteristics:-

- an alcohol content of between 3.5 and 4% by volume.
- an acidity of 18 Brewers degree (equivalent to 1% lactic acid).
- a mouth feel that is neither gritty nor too smooth.

- a viscosity of 30-40 cp.

- solids content of 4.5% m/m.

- the solid particles will be suspended in the body of the product during the entire life of the product.

- the product will have a 'head' (foam) that is characteristic of beer.

These characteristics satisfy the market requirements of the product.

(iv) the technology selected fits the use of sorghum as the basic ingredient in the recipe.

The sorghum to be used in the project has:-

- good malting characteristics.

- high diastatic power.

- low mould infection.

- high free amino nitrogen (FAN).

- low polyphenols (tannin) content.

- good colour and aroma.

Sorghum with this quality characteristics is locally available.

6.4 TECHNOLOGY TYPE AND PRODUCTION PROCESS

The technology for the project has two sub-components: the machinery plant and equipment; the manufacturing process.

6.4.1 Machinery, Plant and Equipment and Cost

The equipment for the project are classified into production, auxiliary and service equipment.

(a) Production equipment

Name	Capacity	No.	Cost (US$ 000)
Souring tanks	15000 l	2	64.7
Cooker/convertor with agitator	15000 l	3	92.6
Centrifuge/S ainer	3000 l	1	140.0
Screen separator		1	13.0
Plate heat ex-changer		1	14.7
Fermenters	15000 l	4	76.5
Holding tanks	15000 l	2	61.6
Stainless pumps	16000 l/h	8	37.6
Packaging machine (CIF Mombasa)	2400 packs/h	1	600.0
SUB-TOTAL			**1111.9**

* With the exception of the Packaging equipment most of the equipment will be fabricated locally.

(b) Auxiliary equipment

Name	Capacity	No.	Cost (US$ 000)
Boiler	4 tonne	1	187.7
Cooling towers		2	20.6
Steam, condensate & cooling water piping + valves		several	117.6
Crate washer			88.2
Packaging heater tank			22.1
Chilling Plant			47.1
Electrical control panel			88.2
Electrical installation from mains supply			103.0
Effluent screen	10000 l/h		6.3
SUB-TOTAL			680.6

(c) Service equipment

Name	Capacity	No.	Cost $'000)
Lab. equipment & misc. equip.		several	25.0
Generator	400 KVA	1	81.6
Catwalks & Stairs		several	20.6
SUB-TOTAL			127.2
TOTAL			1,919.7

(d) Transport equipment

Name	Capacity	No	Cost $ '000)
Delivery Trucks	8 tons	3	321.3
Saloons	4 seater	1	100.6
Pick Up	1 ton	3	396.1
SUB-TOTAL			518.0

(e) Office equipment

Various Equipment e.g typewriters,etc	38.0

TOTAL PLANT MACHINERY & EQUIPMENT COST US$ 2,475.7

6.4.2 Manufacturing Process

The production technology can briefly be described as follows:-

- lactic acid 'sour' is produced by inoculating a slurry of sorghum and finger millet malt with an appropriate lactic acid bacteria. The slurry is fermented at 48 degrees Centigrade (equivalent to 18 Brewers degree) until lactic acid content reaches a concentration of 1%.

- in a separate mixing tank, sorghum malt, sorghum grit and maize grit are mixed to form a slurry of 11000 litre.

- The slurry so produced is then turned into a sour by introducing a culture of lactobacillaceae Spp. such as lactobacillus Leichmimni. A homofermentative species must be used in order to produce lactic acid only as production of other metabolites will introduce other undesirable flavour. The lactic acid fermentation is continued until a concentration of 18 Brewers degree is reached. The fermentation is carried out at 48 C.

- the sour of about 4000 litre is mixed with the 11000 litre slurry and fed into a cooker converter.

- the 15000 litre mixture is heated from room temperature to 100 degrees centigrade, held at boiling point,cooled to 65 degrees centigrade and held at this temperature for conversion to take place until wort develops.

- the wort is screened and centrifuged following which it is cooled and pumped into the fermenters.

- the wort in the fermenters is inoculated with an appropriate yeast and allowed to ferment to the required degree of alcohol content.

- the sorghum beverage is pumped into holding tanks and quickly disposed of to the packaging room to be dispensed into one litre, two litre and twenty litre packages.

- the packaged product is loaded into crates and ready for distribution.

The entire production cycle will take about 20 hours. The detailed time frame for each activity is appendix I.

6.5 PROJECT LAY OUT

The project will be sited in an area of 25000 m.sq. (2.5 Ha) This will accommodate all the project equipment, plant and related auxiliary services. The sorghum Brewery factory lay-out is shown in Appendix I. The plant and machinery will be installed in an area of 3500 m.sq. and comprise of:-

- souring tanks.
- raw material store.
- mixing room.
- cooking/conversion station.
- screening, centrifugation and plate heat exchanger.
- fermentation house.
- holding section.
- packaging section.
- final product store.
- laboratory

The lay out of the machinery and equipment (Appendix II) is such that there is a logical sequence to allow continuous flow of the production process. Within the process building and site lay out, provision has been made to ensure that operational requirement of the plant and flow of traffic, loading of final products and unloading of raw materials is sited at a distance to each other to avoid obstruction.

The siting of the offices and at the main gate is to ensure strict control of traffic and personnel movements within the brewery complex.

6.6 PROJECTS CIVIL ENGINEERING WORKS

6.6.1 Site Preparation and Development

Before the project structures are put-up, the first civil engineering works to be undertaken will be the site preparation which basically involves site cleaning, fencing and levelling.

6.6.2 Building and Special Civil Works

In carrying out the design and the actual construction and civil works for the project the following requirements should be taken care of:-

- the siting of the building on the site should allow easy flow of traffic and future extension.

- as far as is practically possible, areas where dirt can collect i.e. horizontally level window sills, 90 degrees angles between wall and floor and gullies should be avoided.

- floor in the brewery hall and the packaging area must be acid proof; either acid resistant tiles or epoxy screen and should be extended to walls (interior) to at least 1 meter high.

- all floor in wet areas must permit complete draining into either sewer gullies and/or drain which are connected to the effluent disposal system.

- facilities in administrative block and the size thereof should be adequate for all work required.

- a bore-hole should be provided for to supply water incase of breakage in supply from the main water system.

The details for the building/civil works is as given below.

(i) Structure
The main structural elements of the building will be structural steel. The use of structural still will enable quick completion of the construction.

(ii) Foundations and floor slabs
Reinforced concrete.

(iii) Roof
Double spelter, fluted corrugated iron acrylic coloured.

(iv) Cladd ·ıg
Double spelter fluted corrugated iron acrylic coloured.

(v) Ceiling (where applicable)
Asbestos and fibre glass blanket.

(vi) Partitions
Double spelter fluted corrugated iron acrylic coloured.

(vii) Walls
Brick work plastered and finished with epoxy paint.

(viii) Floor finish
Tiles with epoxy in the process areas, raw material and final product store.

(ix) Doors

Tongue and grooved timber internal and external personnel doors.

(x) Doors - External
Galvanised and painted roller shutter doors.

(xi) Windows/Glazing
PVA or fibre glass sheets to same profile as side cladding.

(xii) Floor drains
Open gullies.

(xiii) Lighting

Lighting levels for the various process areas are as follows:

- Raw materials store - 250 Watt
- Mixing area - 500 Watt
- Brewing area - 800 Watt
- Fermentation - 500 Watt
- Packing - 800 Watt
- Despatch store - 500 Watt
- Carton and Crate Store - 250 Watt

Lights will be switched individually in each area at the door way entrances.

Security lights will be provided outside by means of four lighting masts. Three phase and single phase power outlets will be provided in each of the process areas to serve mobile equipment.

(xiv) Ventilation

Mechanical ventilation to the Factories Act requirements will be provided.

(xv) **Roads**

All road works within the Brewery site are to be of a standard offering satisfactory performance when subjected to heavy duty traffic. Storm water discharge will be by crossfall and surface run off. A final choice between concrete and mixed bitumen surfacing will be made in the light of material availability and costs at the time of construction.

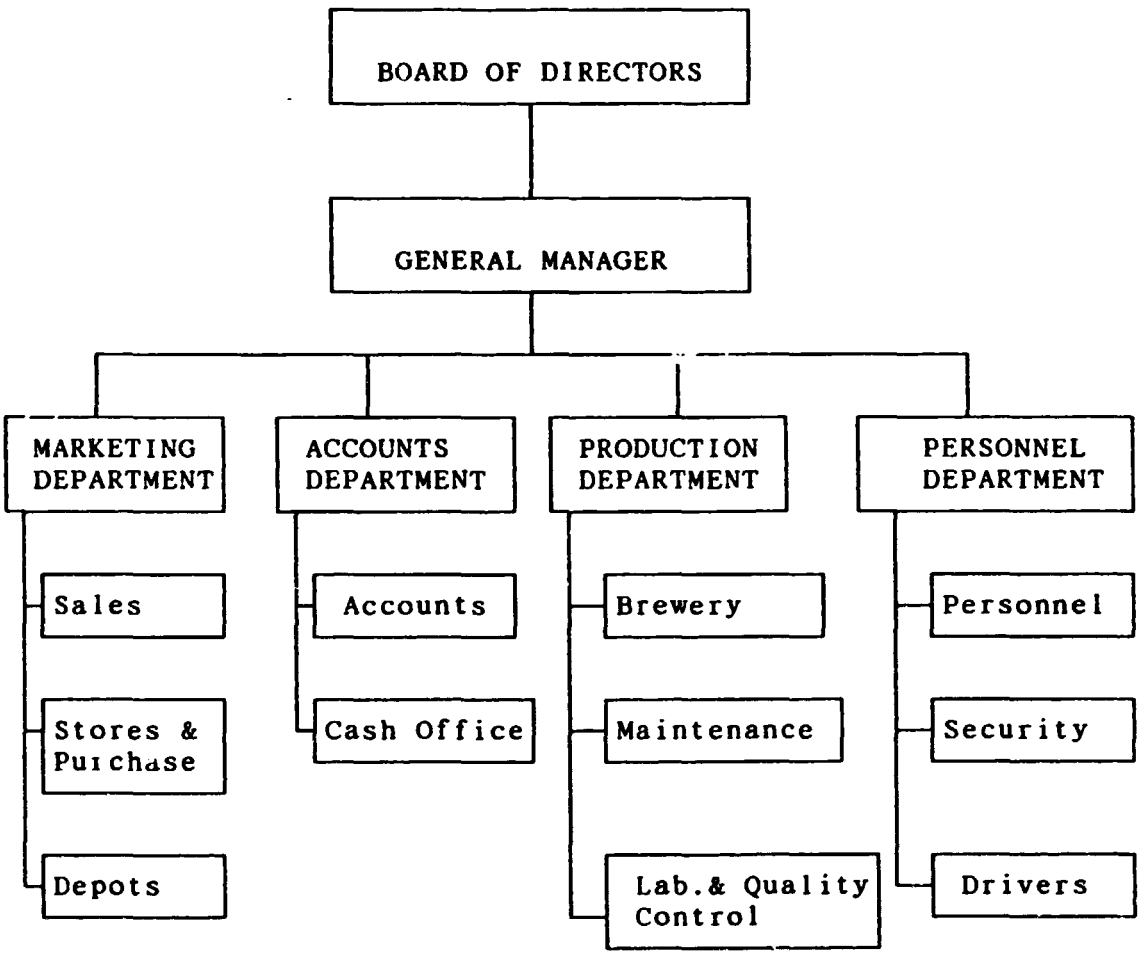
CHAPTER VII

7.0 ORGANIZATION AND OVERHEAD COSTS

7.1 ORGANIZATIONAL STRUCTURE

The following organization structure is proposed

CHART I: ORGANISATIONAL STRUCTURE



7.1.1 Board of Directors

The Board of Directors (BOD) will be the supreme policy making organ of the Company and it will consist of the company directors who are the sponsors and investors in the project.

The BOD will be meeting at least three times a year to deliberate on important issues concerning the operations of the company.

7.1.2 General Manager

Directly under the BOD will be a General Manager who will oversee the overall functioning of the Company especially ensuring that production and sales schedules are met within the planned period.

7.1.3 Departments

The plant shall have four (4) distinct departments namely the Production, Marketing, Accounts, and Personnel.

(a) Production Department

The production Dept. will be headed by a Head Brewer and will be responsible for the Brewing, Repair and Maintenance, and ensuring product quality.

(b) Marketing Department

This department will be headed by a Marketing/Sales exccutive who will be responsible for the sales and marketing of the final product, purchase of raw materials as per requirements given by the production department, and the management of the operations of the distribution Depots and distribution network as a whole.

(c) Accounts Department

The Accounts Department headed by a Chief Accountant will be in-charge of all the financial matters of the project. All receipts and expenditure made by the Company will be handled by this department.

(d) Personnel Department

The Personnel Department is a support dept. which will be responsible for the recruitment, personnel administration, security and all other related personnel issues of the plant.

7.2 ORGANIZATION OVERHEAD COSTS

The anticipated overhead costs on organisation are detailed below:

7.2 ORGANIZATION OVERHEAD COSTS

The following overhead costs are anticipated:

Cost Item	GA	BOD	PD	MD	AC	PrD	TOTAL
Allowances	-	45,000	-	-	-	-	45,000
Maintenance	-	-	55,550	-	-	-	55,550
Communication	15,000	-	-	-	-	-	15,000
Insurance	-	-	-	-	45,450	-	45,450
Travel	-	-	-	6,000	-	12,000	18,000
Transport	-	-	-	30,000	-	-	30,000
Rents	-	-	-	5,000	-	-	5,000
Licenses & fees	1,000	-	-	-	-	-	1,000
Effluent	-	-	5,250	-	-	-	5,250
Sub-total	16,000	45,000	60,800	41,000	45,450	12,000	220,250
Depreciation	-	-	-	650,000	-	-	650,000
TOTAL	16,000	45,000	60,000	691,000	45,4500	12,000	870,250

GA = General Administration; BOD = Board of Directors; PD = Production Department;
MD = Marketing Department; AC = Accounts Department; PrD = Personnel Department.

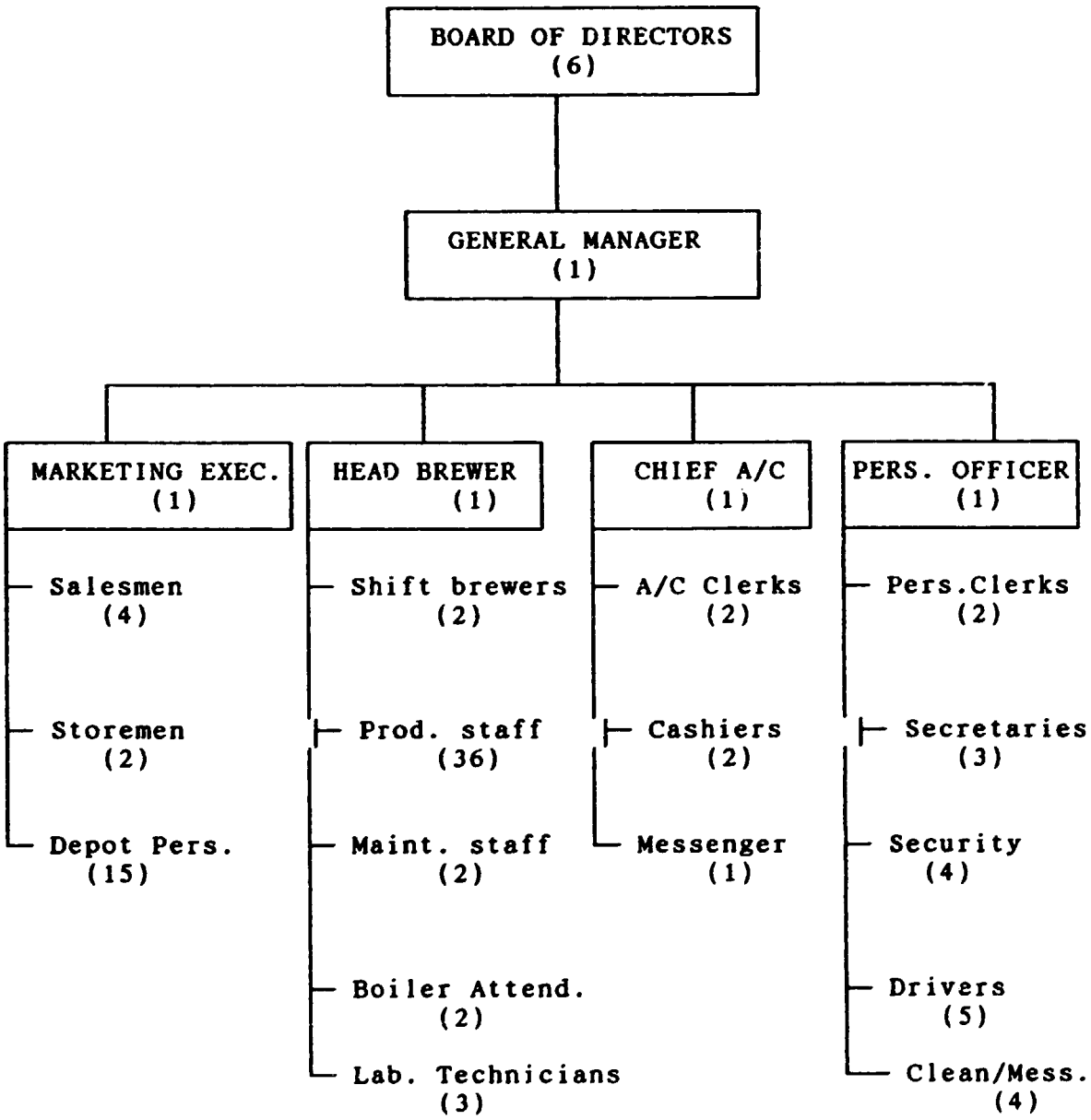
CHAPTER VIII

8.0 HUMAN RESOURCES

8.1 LABOUR REQUIREMENTS

The personnel and labour requirements for the effective operation of the project is as shown in the chart below:

CHART II: LABOUR REQUIREMENTS



8.1.1 Labour skill requirements

(a) General Manager

A degree in Brewing Science or related field with a post-graduate qualification in Management preferably MBA. Three (3) year work experience in a brewery preferable.

(b) Production Department

Category	Qualification	Experience
1.Head Brewer	Degree in Food technology or Brewing science	Not less than 3 years in a similar position.
2.Shift Brewer	Degree or HND in Food Technology or Brewing Science	Three years working experience in a food industry. Working in a brewery will be an added advantage.
3.Plant Operator	Secondary Education	1-2 year working experience in a food processing industry.
4.Technicians	Diploma in Electrical or Mech. Engineering.	1-3 years working experience.
5.Laboratory Technicians	Diploma in Laboratory Technology	3 years working experience in a busy food Processing Industrial laboratory.

(c) Marketing Department

Category	Qualification	Experience
1.Marketing Executive	A degree in B.Com. (Mktg. Option)	3-5 year experience in a similar position.
2.Sales Manager	Diploma in Marketing.	At least two years working experience
3.Store Clerks	Certificate in Store, purchasing & Book keeping	1-2 year experience
4.Depot Manager	Diploma in Business Administration	2 years experience
5.Depot Attendants	Secondary Education	-

(d) Accounts Department

Category	Qualification	Experience
1.Chief Accountant	B.Com. with at least a CPA II or an Accountant with CPA III	3 year working experience in a similar position
2.Accounts Clerks	Certificate in Accounting	2 years working experience
3.Cashiers	High School Certificate with accounting know-ledge	2 years working experience

(e) Personnel Department

Category	Qualification	Experience
1.Personnel Off.	Graduate in Social science with at least post graduate diploma in Personnel Mgt.	3 years working experience
2.Personnel Clerks	High School graduates with certificates in Personnel Administration	at least 1 year working experience
3.Secretary	Certificates	
4.Security	High School Education	Ex-armedforces or Police
5.Drivers	Competence in driving	4 years experience
6.Messengers	High School Education	-
7.Cleaner	High School Education	-

8.1.2 Labour Manning Schedule and Labour Costs

The manning of the plant will be as shown in the manning table below:

(a) Labour Manning Table

Production Dept.	Shift	No.	Amount per month (US $)	Total P.A
Shift brewer	I	1	625	7,500
	II	1	625	7,500
Mixing Machine Op.	I	2	120	2,880
	II	2	120	2,880
Cooling Machine Op.	I	2	120	2,880
	II	2	120	2,880
Fermentor	I	2	120	2,880
	II	2	120	2,880
Decanters	I	2	120	2,880
	II	2	120	2,880
Packagers	I	4	120	5,760
	II	4	120	5,760
Raw material handling	I	2	75	1,800
	II	2	75	1,800
Labourers	I	3	62.5	2,250
	II	3	62.5	2,250
Total per annum		**36**		**57,660**

(b) **Staff Manning Table**

Department/function	No.	Salary per month (US $)	Total
General Manager	1	1,300	15,600
Production Department			
- Head Brewer	1	875	10,500
- Maintenance techn.	2	375	9,000
- Boiler atten.	2	300	7,200
- Laboratory Tech.	4	300	7,200
Marketing Department			
- Marketing Executive	1	700	8,400
- Salesmen	4	375	18,000
- Stores Clerks	2	375	9,000
- Depot Managers	5	375	22,500
- Depot atten.	10	120	14,400
Finance Department			
- Chief Accountant	1	750	9,000
- Accounts Clerks	2	375	9,000
- Cashiers	2	375	9,000

Personnel Department

- Personnel Officer	1	625	7,500
- Personnel Clerks	4	375	18,000
- Secretary	3	375	13,500
- Security	4	75	3,600
- Drivers	5	100	6,000
- Messengers	4	75	3,600
- Cleaners	2	62.5	1,500
Expatriates			
Technical Manager	1	6,250	75,000
Technical Advisor	1	5,000	60,000
Total per annum	**61**		**337,100.00**

8.2 MANPOWER TRAINING

All the personnel associated with the project will receive some orientation training related to their disciplines. Its only the production staff, particularly those in the brewing activity that will receive training overseas. The rest of the staff will be trained in local institutions, since Kenya has capacity in most of this disciplines (personnel management, accounts and laboratory/Quality Control.

8.2.1 Overseas Training

(a) Chief Brewer

One week orientation in Sorghum Cloudy Beer Brewery in South Africa.

(b) Shift Brewers: (2).

Two weeks each orientation training in sorghum cloudy beer brewing in South Africa (TBI and CSIR).

(c) Packaging machine operator - to be trained at Metal Box (SA) for two weeks.

8.2.2 Local training

(a) Lab. Technicians - to send to Kenya Polytechnic and attachment at KIRDI and KeBS for three weeks.

(b) production staff - one week job training during the trial run.

8.2.3 Training costs

Category	No	Period	Overseas	Local	Total
1.Chief Brewer	1	1 wks	3,000	-	3,000
2.Shift Brewer	4	4 wks each	15,500	-	15,500
3.Packaging Technician	1	1 month	4,000	-	4,000
4.Lab. Tech.	1	3 wks	-	1,000	1,000
5.Production Staff	Several	1 week	-	750	750
TOTAL			**22,500**	**1,750**	**24,250**

CHAPTER IX

9.0 THE PROJECT IMPLEMENTATION AND BUDGETING

9.1 IMPLEMENTATION

The Sorghum Brewery Project will be implemented by the interested parties who fall broadly under the following categories.

(a) Project Promoter - M/S Stellascope Food Co. Ltd.

(b) Other local investors - Busia professional group (BUPA) and others.

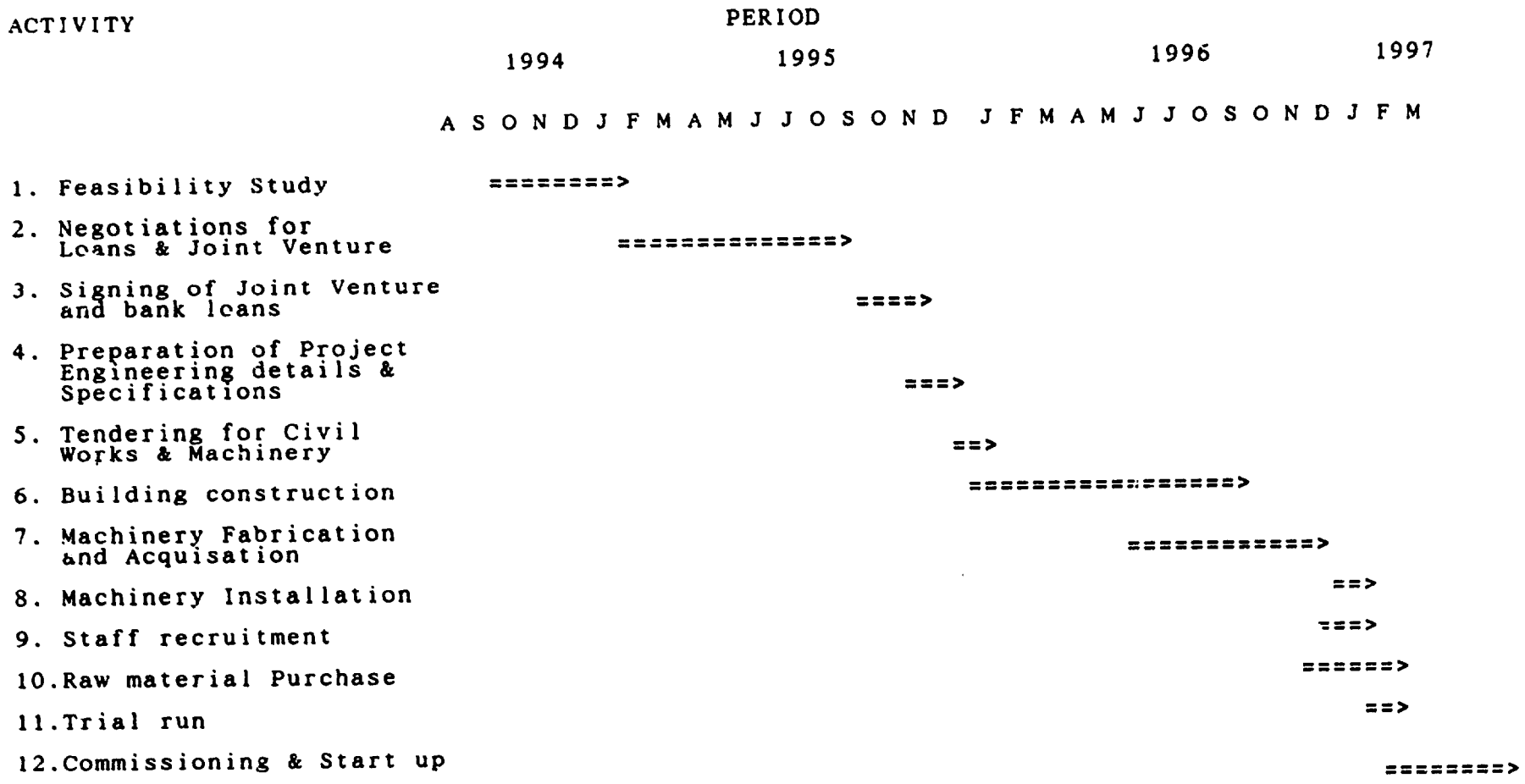
(c) Joint venture (foreign) investors (TBI,SAB).

(d) Technical consultants (KIRDI, CSIR,).

9.1.1 Implementation Schedule

The implementation is anticipated to take a maximum of one and a half years from the time the feasibility study report is handed over to the project promoter to the start of commercial production. Several of the activities in the implementation will run concurrently.

The major implementation activities to be undertaken and their time duration are given in the per-chart below.


ACTIVITY
PERIOD
1994
1995
1996
1997
A S O N D J F M A M J J O S O N D J F M A M J J O S O N D J F M
1. Feasibility Study
2. Negotiations for Loans & Joint Venture
3. Signing of Joint Venture and bank loans
4. Preparation of Project Engineering details & Specifications
5. Tendering for Civil Works & Machinery
6. Building construction
7. Machinery Fabrication and Acquisation
8. Machinery Installation
9. Staff recruitment
10. Raw material Purchase
11. Trial run
12. Commissioning & Start up

9.2 COST ESTIMATE OF PROJECT IMPLEMENTATION

Activity	Local Cost (US $)	Foreign Cost (US $)	Total Cost US $)
1. Legal expenses	3,000		3,000
2. Design and Eng. consultancy	3,200	132,000	164,000
3. Tendering documents	500		500
4. Costs during construction (Building and civil works)	240,000	-	240,000
5. Architectural fees	1,440		1,440
6. Administration and Recruitment	5,000	-	5,000
7. Training	1,750	32,000	33,750
TOTAL	37,850	164,000	201,850

CHAPTER X

10.0 FINANCE APPRAISAL

10.1 FINANCIAL ANALYSIS

10.1.1 Total Investment

The total investment costs amount to US$ 4,550,000 as detailed in the schedule below:

	($'000)		
	Local	Foreign	Total
Land	10	-	10
Infrastructur	192	-	192
Design and engineering	32	132	164
Buildings	240	0	240
Service equipment	102	25	127
Transport equipment	518	-	518
Plant machinery equipment	318	1,324	1.642
Office furniture and other	414	-	414
Sub-Total	1,826	1,481	3,307
Pre-Prod.exp.	212	73	285
Contingencies (5%)	92	70	162
Total initial fixed investment	2,130	1,624	3,754
Working capital	423	373	796
Total Investment	**2,553**	**1,997**	**4,550**

10.1.2 Project Financing

It is proposed that the project be financed as follows:

	SOURCE OF FINANCE		
	Local	Foreign	Total
Long term loan	1,183	1,088	2,771
Short term loan	463	128	591
Equity	907	781	1,688
Total	2,553	1,997	4,550

A long/medium term foreign loan of US$ 1,088,000 will be secured either from South Africa or from long term lenders such as PTA Bank, IDB or EADB. This dollar loan, carrying a maximum interest rate of 12% p.a. will be used to finance a substantial part of plant machinery and equipment cost. The interest rates obtained in South Africa at the time of carrying out a survey were 12% p.a. and no increases are anticipated at least in the short term. PTA and EADB banks also prefer financing imported plant and machinery through their foreign lines of credit and so in the event of the South African credit not forthcoming, this avenue will be explored. It is also possible for joint financing between South African banks on one hand and PTA and EADB banks.

A long term loan of an equivalent of US$ 1,183,000 in local currency will be sought from local banks and financial institutions to finance the local component of machinery and equipment purchase. The local financial institutions expected to provide this loan are DFCK, and ICDC. These loans will be at an interest rate of 21% per annum. The long/medium term loan can readily be repaid over a period of 6 years including 2 years grace period These conditions are in conformity with local banks lending terms.

A short term loan equivalent to US$ 591,000 will be sought from local commercial banks to finance part of the working capital and can be secured against the project's fixed assets such as land and buildings. The loan is assumed to carry the prevailing interest rate of 21% p.a. There is a local and foreign component of this loan to finance local inputs and imported inputs, respectively.

The short term loan will be repaid within a 3 year period and has no grace period in conformity with typical local commercial bank conditions.

A summary of the loans and their conditions is given below:

	Interest rate %		Repayment period	Grace period (years)	Year of reception (years)
	Local	Foreign			
Medium term loan	21	12	8	1	Yr. 1
Short term loan	21	12	3	0	Yr. 2

The equity capital requirement of US$ 1,688,000 will be split between local and foreign investors at a ratio of 52:48. This share-holding ratio is acceptable to both parties of investors and conforms well to the foreign investment wishes of the country.

The debt/equity ratios of the project financing is as depicted here below:

	($'000)	%	Ratio
Equity	1,688	37	1
Loans	2,862	63	1.7
TOTAL	**4,550**	**100**	**2.7**

The debt to equity ratio is about 1:1.7. that is about 37% of the total investment shall be financed through equity and only 63% through loan. This low debt/equity ratio is important because it minimises the debt burden of the project, hence improving its cash flow and is acceptable by banks.

The debt/equity ratio could be increased to a maximum of 70/30 should the investors indicate they are unable to raise the proposed equity.

10.2 UNIT COST OF PRODUCTION

The per unit cost of production decrease from US$ 0.35 during the second year to 0.25 per litre in the fifth as the capacity utilisation increases from 60% to 90%. as shown in the table below.

TABLE XIII: PER UNIT PRODUCTION COST

	Units	Period			
		2	3	4	5
Cap.Utilisation	%	60	75	90	90
Direct materials	$ '000	1,547	1,934	2,321	2,321
Direct Labour	$ '000	31	39	47	47
Utilities	$ '000	123	154	184	184
Administrative and Marketing	$ '000	50	50	50	50
Management and Technology	$ '000	337	337	337	337
Other Overheads	$ '000	682	495	495	495
Financial costs	$ '000	492	400	308	217
Depreciation	$ '000	523	523	506	506
Total Production costs	$ '000	3,785	3,932	4,248	4,157
Total units produced	$ '000	10,800	13,500	16,200	16,200
Unit cost	US $	0.35	0.29	0.26	0.25

10.3 FINANCIAL STATEMENTS

10.3.1 Net Income Statement

The projected Net Income Statement is depicted in Annex II. The sales revenue increase from US $ 4,589,000 during the second year when the plant is operating at 60% to US $ 6,884,000 when operating at 90%. The production costs however increases marginally compared to the revenue from US$ 3,785,000 in year two to US$ 4,517,000 in year eight and thereafter. In the first year of operation the project registers an operating loss of $ 454,000, but registers a Net Profit of $ 682,000. Thereafter the project makes appreciable profit yearly. From the third year the project will be able to pay dividends of US $ 240,000 that will increase steadily to a maximum of US $ $ 400,000 from the eighth year.

10.3.2 Payback Period

The payback period of the project is 5 years as depicted here below:

($'000)

Period >	1	2	3	4	5
Annual Net Cash flow	(3,577)	1,106	1,994	2,412	2,499
'Profit'	(75)	1,697	2,097	2,528	2,496
Cumulative profit	(75)	1,622	3,718	6,247	8,743

The payback period of 4 years is equal to the Kenyan preferred commercial payback period. The project's payback period of 4 years should make the project more acceptable to the investors and financiers.

10.3.3 Cash flow

Projected cash flow for a period of 15 years is depicted in annex III. The project registers excess net cash flow throughout except for the 10th year when assumed replacement of fixed investment takes place. The most important parameter of cash flow i.e. the cumulated cash balance is however, impressively positive throughout the 15 year period.

10.3.4 Working Capital

The project will require a net working capital of US $ 590,000 during the second year of the project that increases to a maximum of US $ 809,000 during the 4th year and progressively decreases to stabilise at $ 796,000 from the nineth year. Details on the working capital calculation are given in annex IV.

10.3.4 Balance Sheet

Projected balance sheet is depicted in annex V. The total assets of the project increase from US $ 3,505,000 in year one to US $ 21,576,000 in the fifteenth year. The project liabilities during the entire 15 years are balancing with the project's assets.

10.3.5 Simple rate of return

The project's simple rates of return on some slected years are depicted below and detailed in Annex VI.

	1	2	3	4	5	6	7
ROI	(10.0)	15.0	25.8	37.7	39.0	39.7	41.6
ROE	(26.9)	40.4	69.6	101.5	105.0	107.1	112.1
ROS	0.0	14.9	20.5	24.9	25.8	26.3	27.5

Apart from the second year, all the returns are positive and at acceptable levels.

ROI = Return on total Investment, ROE = Return on Equity, ROS = Return on sales.

10.3.6 Net Present Value

Discounted at 21% the net present value of project is US$ 4,111,000

10.3.7 Internal Rate of Return

The internal rate of return of the project is 50.3% This is higher than the basic local lending rates of 21% on short term loans or savings interest rates of 19% p.a. The IRR is also much higher than the lending rates in South Africa of 12% p.a.

10.3.8 Break-even Analysis

Year >>	2	4	6	8
Sales revenue (SR)	4,589	6,884	6,884	6,884
Variable costs (VC)	1,701	2,552	2,552	2,552
- materials	1,457	2,321	2,321	2,321
- direct labour	31	47	47	47
- utilities	123	184	184	184
fixed costs (FC)	2.084	1,695	1,549	1,441
- overheads	1,069	881	881	881
- depreciation	523	506	506	506
- interest	492	308	162	54
BEP%	72	38	32	30

$$\left(\frac{FC \times 100}{SR - VC} \right)$$

Year 2 shows an a high break even point 72%. Year 4 shows a break even capacity of 38% which is about half the planned production capacity of 90%. In year 8, the break even capacity of 30% is favourable as it is lower than the planned capacity utilization of 90%.

From the above financial analysis the project has been found to be financially viable since it has passed all the financial viability tests.

CHAPTER XI

11.0 ECONOMIC EVALUATION

On completion, the project will impact the economy and society in both positive and negative sense. The negative impact will be risk element of the project.

11.1 ECONOMIC BENEFITS

11.1.1 Employment generation:

The project will directly employ 104 persons when operating at full capacity (Annex VII). However, it's the people who will be employed indirectly by the project that substantive impact will be felt.

Breweries by their nature are known to have strong backward and forward linkages. As the brewery will source raw materials locally, the number of people involved in farming, distribution of farm inputs and implements, grain dealers, warehousing and transportation of material and inputs will be large. On the marketing aspect, there will be stockists, transporters, bar and beer-hall owners. In all the project will generate substantial employment opportunities both directly and indirectly. As an estimate 2000 jobs will be created.

11.1.2 Income distribution:

At the moment, sorghum is traded but mainly as a subsistence crop. The project will create a major marketing outlet for sorghum farmers who will take to commercial farming of sorghum. The product from the project will also attract a clientele from the middle income group who will spend their disposable income in consumption of this product. In this way, the project will be beneficial in the distribution of incomes and thereby bridging the gap differences in various income groups. In addition to this, the project will be a

source of income in terms of the wages and salaries paid to the employees. The project is expected to disburse a total of US $ 306,000 annually through wages and salaries.

11.1.3 Excise duty and VAT:

The product of the project attract excise duty and Vat. A total of US$ 1.06 million will be generated annually as tax revenue to the exchequer who will in turn use this to provide social services such as hospitals, schools, roads and other infrastructure. In all this will go to improve the standard of living and, therefore promote social development.

11.1.4 Value Added

The project would also have a substantial economic benefit in terms of the Value Added on the local raw materials and other inputs. In a period of 15 years, the total Net National Value Added will be US $ 10,047,000 a detailed in annex IX.

11.1.5 Nutrition

The product from the project as seen before will not only be a source of alcohol but also nutrients. Alcohol itself is nutrient of high energy value. The project will therefore contribute substantially to community nutrition in that the product will be a conduit for intake of minerals, water soluble vitamins and some enzymes particularly from the yeast intake. The raw materials particularly sorghum and millet which may not be consumed in large quantities when presented in other forms, will now be consumed in large quantities by way of the product.

11.1.6 Animal Production:

The by-product from the project will promote the livestock development particularly dairy and piggery. This will lead to enhanced economic activity and better nutrition due to

increased intake of dairy products and animal protein (pork, sausages etc.).

11.2 SOCIO-ECONOMIC COSTS

The project will be subject some costs such as:

(a) environmental costs,

(b) social cost, and

(e) foreign exchange cost

11.2.1 Environment:

Most of the areas where sorghum, the major raw material will be grown are fragile ecosystems. Extensive cultivation of land especially when mechanised methods are used may expose the soil to soil erosion agents such as floods and wind that may take away the top soil.

If the farmers use agricultural inputs such as fertilizer and herbicides, this will find their way into the rivers and ground water leading to water pollution.

11.2.2Foreign Exchange

The project will have same negative foreign exchange impact on the Kenyan economy. Over a period of 15 years, a net foreign exchange outflow of US $ 2,093,000 is expected against an inflow of only US $ 1,216,000. The outflow of foreign exchange will mainly be due to importation of equipment, repayment of foreign loans, repatriated wages and dividends and interest on the foreign loans (Annex IX)

11.2.3 Social Habits:

The traditional liquor act of 1971 was passed to suppress the mushrooming of beer halls and bars which were found to waste a lot of the productive man-hours of the labour force. Traditional brew had been found to be cheap and therefore easily accessible by the poor. The product of brewery may encourage excess consumption of alcohol leading to alcoholism and other social ills associated with excessive drinking of alcohol in the community. This problem may, however, be overcome if the hours of beer halls and bars are strictly regulated as required by the law.

11.3 CONCLUSION

After careful analyzing the financial and technological inputs, the results of the analyses has shown that the project is a worth while investment.

The project is quite profitable commercially and is thus capable of meeting all its financial obligations. The financial evaluation of the project through indicators such as pay back period, internal rate of return and Net Present value are all positive and within acceptable margins.

In addition to the above, the project has also been found to be economically viable technically feasible and socially acceptable with benefits which far outweigh costs.

ANNEX I - PROJECT SUMMARY

1. Project Tittle;	SORGHUM CLOUDY BEER BREWERY	2. Sponso	STELLASCOPE FOOD LTD.
3. Location	BUSIA	4. Const period	12 MOTHS
5. Total inveatment	US $ 4,550,000	6. Net Present Value	4,111,000 at Discount rate of 21%
7. 'nternal Rate of Return	50%	8. Payback Period	4 YEARS
9. Debt /Equity Ratio (Initial)	63	'0. Retun on Equity	105% at full operation

ANNEX II - NET INCOME STATEMENT

Item Period >>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
TOTAL SALES	0	4,589	5,737	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884
DIRECT COST	0	1,701	2,127	2,552	2,552	2,552	2,552	2,552	2,552	2,552	2,552	2,552	2,552	2,552	2,552
Materials	0	1,547	1,934	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321
Direct Labour	0	31	39	47	47	47	47	47	47	47	47	47	47	47	47
Utilities	0	123	154	184	184	184	184	184	184	184	184	184	184	184	184
GROSS MARGIN ON SALES	0	2,888	3,610	4,332	4,332	4,332	4,332	4,332	4,332	4,332	4,332	4,332	4,332	4,332	4,332
INDIRECT COSTS	75	1,069	881	881	881	881	881	881	881	881	881	881	881	881	881
Adm. & Marketing	0	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Mnagement & Techn.	75	337	337	337	337	337	262	262	262	262	262	262	262	262	262
Other Overheads	0	682	495	495	495	495	495	495	495	495	495	495	495	495	495
DEPRECIATION	0	523	523	506	506	506	506	506	506	506	490	490	490	490	490
OPERATING PROFIT	(75)	1,297	2,206	2,945	2,945	2,945	3,020	3,020	3,020	3,020	3,020	3,036	3,036	3,036	3,036
INTEREST EXPENSES	379	492	400	308	217	162	108	54	0	0	0	0	0	0	0
GROSS PROFIT	(454)	805	1,806	2,636	2,728	2,782	2,911	2,965	3,020	3,020	3,020	3,036	3036	3,036	3,036
INCOME TAX	0	123	632	923	955	974	1,019	1,038	1,057	1,057	1,057	1,063	1,063	1,063	1,063
NET PROFIT	(454	682	1174	1174	177	1,808	1,892	1,928	1,963	1,963	1,963	1,973	1,973	1,973	1,973
DIVEDENDS	0	0	240	240	300	300	300	300	400	400	400	400	400	400	400
UNDISTRIBUTEL ITS	(454)	682	934	1,474	1,473	1,508	1,592	1,628	1,563	1,563	1,563	1,573	1,573	1,573	1,573
ACCU. UND. PROFIT	(454)	228	1,162	2,636	4,109	5,617	7,210	8,837	10,400	11,963	13,526	15,099	16,672	18,246	19,819

ANNEX III - CASH FLOW

Item Period >>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SOURCE OF CASH	3,884	2,410	2,729	3,451	3,451	3,451	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526
EQUITY	1,628	0	0	0	0										
LOANS	2,271	591	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATING PROFIT	(75)	1,297	2,206	2,945	2,945	2,945	3,020	3,020	3,020	3,020	3,020	3,036	3,036	3,036	3,036
DEPRECIATION	0	523	523	506	506	506	506	506	506	506	506	490	490	490	490
USES OF CASH	3,881	1,205	1,897	2,108	1,990	2,691	1,745	1,715	1,780	4,158	1,457	1,627	1,463	2,395	1,463
INVESTMENT & REPL.	3,502	0	0	0	0	932	0	0	0	2,701	0	164	0	932	0
VAR. IN WORKING CAPITAL	0	590	103	116	(3)	(2)	(7)	(2)	(2)	0	0	0	0	0	0
DEBT SERVICE															
Interest	379	492	400	308	217	162	108	54	0	0	0	0	0	0	0
Repayment	0	0	521	521	521	324	324	324	324	0	0	0	0	0	0
TAXES	0	123	632	923	955	974	1,019	1,038	1,057	1,057	1,057	1,063	1,063	1,063	1,063
DIVIDENDS	0	0	240	240	300	300	300	300	400	400	400	400	400	400	400
EXCESS/DEFICIT	3	1,206	832	1,343	1,461	760	1,781	1,811	1,746	(632)	2,069	1,899	2,063	1,131	2,063
CUMULATED CASH BALANCE	3	1,209	2,041	3,384	4,844	5,604	7,385	9,196	10,943	10,311	12,384	14,280	16,343	17,474	19,538

ANNEX IV - WORKING CAPITAL ANALYSIS

Item	Work cap. (Days)	<< Period >> 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. CURRENT ASSETS																
1.1. ACCOUNT RECEIVABLE	15	0	191	239	287	287	287	287	287	287	287	287	287	287	287	287
1.2. INVENTORIES																
* Raw materials	60	0	258	322	387	387	387	387	387	387	387	387	387	387	387	387
* Work in Progress	5	0	38	41	47	47	47	46	46	46	46	46	46	46	46	46
* Finished Products	10	0	77	84	95	95	95	93	93	93	93	93	93	93	93	93
* Spares	120	0	29	29	29	29	29	29	29	29	29	29	29	29	29	29
1.3. CASH IN HAND	10	0	44	37	34	32	30	27	25	24	24	24	24	24	24	24
TOTAL CURRENT ASSETS		0	637	751	879	877	875	868	867	865	865	865	865	865	865	865
2. ACCOUNTS PAYABLE	10	0	46	58	70	70	70	70	70	70	70	70	70	70	70	70
3. NET WORKING CAPITAL		0	590	693	809	807	805	799	797	796	796	796	796	796	796	796
4. INCREASE/DECR.IN WORK.CAP.		0	590	103	116	(3)	(2)	(7)	(2)	(2)	0	0	0	0	0	0

ANNEX V - BALANCE SHEET

Item	Work cap. (Days)	<< Period >> 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. ASSETS																
1.1 CURRENT ASSETS																
Cash Balance		3	1,253	2,078	3,418	4,876	5,635	7,412	9,222	10,966	10,335	12,404	14,303	16,367	17,498	19,562
Account receivable	15	0	191	239	287	287	287	287	287	287	287	287	287	287	287	287
Inventory																
Raw material	60	0	258	322	387	387	387	387	387	387	387	387	387	387	387	387
Work in progress	5	0	38	41	47	47	47	46	46	46	46	46	46	46	46	46
Finished Goods	10	0	77	84	95	95	95	93	93	93	93	93	93	93	93	93
Spares	120	0	29	29	29	29	29	29	29	29	29	29	29	29	29	29
1.2. FIXED ASSETS																
Cum. investment		3,502	3,502	3,502	3,502	3,502	4,434	4,434	4,434	4,434	7,135	7,135	7,299	7,299	8,231	8,231
Cum. depreciation		0	523	1,046	1,552	2,059	2,565	3,071	3,578	4,084	4,591	5,097	5,587	6,077	6,568	7,058
Net fixed assets		3,502	2,979	2,456	1,950	1,443	1,869	1,363	856	350	2,544	2,038	1,712	1,222	1,663	1,173
TOTAL ASSETS		3,505	4,825	5,249	6,213	7,164	8,348	9,616	10,919	12,158	13,721	15,283	16,857	18,430	20,003	21,576
2. LIABILITIES																
2.1. CURRENT LIABILITIES																
Account payable	10	0	46	58	70	70	70	70	70	70	70	70	70	70	70	70
Short term loans		0	591	394	197	0	0	0	0	0	0	0	0	0	0	0
2.2. MEDIUM/LONG TERM LOANS		2,271	2,271	1,947	1,622	1,298	973	649	324	0	0	0	0	0	0	0
2.3. EQUITY		1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688	1,688
2.4. ACCUM. UND. PROFIT		0	(454)	228	1,162	2,636	4,109	5,617	7,210	8,837	10,400	11,963	13,526	15,099	16,672	18,246
2.5. UNDISTRIBUTED PROFIT		(454)	682	934	1,474	1,473	1,508	1,592	1,628	1,563	1,563	1,563	1,573	1,573	1,573	1,573
TOTAL LIABILITIES		3,505	4,825	5,249	6,213	7,164	8,348	9,616	10,919	12,158	13,721	15,283	16,857	18,430	20,003	21,576

ANNEX VI - RATIO ANALYSIS

Item Period >>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Return on total investment	(10.0)	15.0	25.8	37.7	39	39.7	41.6	42.4	43.1	43.1	43.1	43.4	43.4	43.4	43.4
Return on Sales (%)	0	14.9	20.5	24.9	25.8	26.3	27.5	28	28.5	28.5	28.5	28.7	28.7	28.7	28.7
Return on Equity (%)	(26.9)	40.4	69.6	101.5	105	107.1	112.1	114.2	116.3	116.3	116.3	116.9	116.9	116.9	116.9
Debt Service Coverage	(9.4)	2.3	2.2	2.9	3.4	3.2	5.8	6.6	7.6	0	0	0	0	0	0
Investment turnover	0	1.5	2.3	3.5	4.8	3.7	5.1	8	19.7	2.7	3.4	4	5.6	4.1	5.9
Debt/Equity ratio	1.3	1.3	1.2	1	0.8	0.6	0.4	0.2	0	0	0	0	0	0	0

Investment per Employee US $ 48,000

ANNEX VII - OPERATIONS ANALYSIS

Item Period >>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. SALES ANALYSIS															
1.1. SORGHUM BEER															
Capacity utilisation (%	0	60	75	90	90	90	90	90	90	90	90	90	90	90	90
Units Produced	0	10,800	13,500	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200
Unit price	424	424	424	424	424	424	424	424	424	424	424	424	424	424	424
Total value of Sales	0	4,579	5,724	6,869	6,869	6,869	6,869	6,869	6,869	6,869	6,869	6,869	6,869	6,869	6,869
1.2. MACHICHA															
Capacity utilisation (%	0	60	75	90	90	90	90	90	90	90	90	90	90	90	90
Units Produced	0	600	750	900	900	900	900	900	900	900	900	900	900	900	900
Unit price	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Total value of Sales	0	10	13	15	15	15	15	15	15	15	15	15	15	15	15
TOTAL SALES	0	4,589	5,737	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884
2. MATERIALS															
2.1 SORGHUM MALT															
Amount used per year	0	648	810	972	972	972	972	972	972	972	972	972	972	972	972
Unit cost	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
Total item Cost	0	292	365	437	437	437	437	437	437	437	437	437	437	437	437
2.2 SORGHUM GRITS															
Amount used per year	0	324	405	486	486	486	486	486	486	486	486	486	486	486	486
Unit cost	280	280	280	280	280	280	280	280	280	280	280	280	280	280	280
Total item Cost	0	91	113	136	136	136	136	136	136	136	136	136	136	136	136
2.3. MAIZE GRITS															
Amount used per year	0	540	675	810	810	810	810	810	810	810	810	810	810	810	810
Unit cost	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330
Total item Cost	0	178	223	267	267	267	267	267	267	267	267	267	267	267	267
2.4 FINGER MILLET															
Amount used per year	0	76	95	113	113	113	113	113	113	113	113	113	113	113	113
Unit cost	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Total item Cost	0	30	38	45	45	45	45	45	45	45	45	45	45	45	45
2.5. YEAST & ENZYMES															
Amount used per year	0	10,044	12,555	15,066	15,066	15,066	15,066	15,066	15,066	15,066	15,066	15,066	15,066	15,066	15,066
Unit cost	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
Total item Cost	0	79	99	119	119	119	119	119	119	119	119	119	119	119	119
2.6 PACKAGING															
Amount used per year	0	9,504	11,880	14,256	14,256	14,256	14,256	14,256	14,256	14,256	14,256	14,256	14,256	14,256	14,256
Unit cost	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3
Total item Cost	0	877	1,097	1,316	1,316	1,316	1,316	1,316	1,316	1,316	1,316	1,316	1,316	1,316	1,316
TOTAL MATERIAL COST	0	1,547	1,934	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321

Operation Analysis (Cont'd)

3. LABOUR															
3.1. DIRECT LABOUR															
3.1.1 Unskilled Labour (no.	0	6	8	9	9	9	9	9	9	9	9	9	9	9	9
Payrate per year	789	789	789	789	789	789	789	789	789	789	789	789	789	789	789
Unskd. Lab.costs/year	0	5	6	7	7	7	7	7	7	7	7	7	7	7	7
3.1.2 Semi skilled (No.)	0	14	18	22	22	22	22	22	22	22	22	22	22	22	22
Payrate/year	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201
Semi skd. Lab. Cost	0	17	22	26	26	26	26	26	26	26	26	26	26	26	26
3.1.3. Skilled & tech. (no.	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2
Payrate per year	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488	7,488
Skilled la.costs/ye	0	9	11	13	13	13	13	13	13	13	13	13	13	13	13
TOTAL DIRECT LABOUR COSTS	0	31	39	47	47	47	47	47	47	47	47	47	47	47	47
3.2 INDIRECT LABOUR															
3.2.1. Clerical/Admin. (no.	0	56	56	56	56	56	56	56	56	56	56	56	56	56	56
Payrate/year	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688	2,688
Cler./Adm.Costs/yr.	0	151	151	151	151	151	151	151	151	151	151	151	151	151	151
3.2.2 Management (no.)	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Payrate/year	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200
Mgt. Staff Costs/yr	0	51	51	51	51	51	51	51	51	51	51	51	51	51	51
3.2.3. Expatriates Temp.(no	1	1	1	1	1	1									
Payrate/year	75,000	75,000	75,000	75,000	75,000	75,000									
Exp. temp. cost/yr	75	75	75	75	75	75									
3.2.4 Expatriate perm.(No.)	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Payrate/year	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Exp. perm.cost/year	0	60	60	60	60	60	60	60	60	60	60	60	60	60	60
TOTAL INDIRECT LAB. COSTS	75	337	337	337	337	337	262	262	262	262	262	262	262	262	262
TOTAL PAYROLL	75	368	375	383	383	383	308	308	308	308	308	308	308	308	308
TOTAL NO. OF EMPLOYEES	1	85	90	95	95	95	94	94	94	94	94	94	94	94	94

Operation Analysis (Cont'd)

4. UTILITIES														
4.1. ELECTRICITY ('000 kwh	0	1,200	1,500	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
Unit Cost /'000	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Electric. cost/year	0	108	135	162	162	162	162	162	162	162	162	162	162	162
4.2. LIQUID FUEL (Ltr)	0	15,012	18,765	22,518	22,518	22,518	22,518	22,518	22,518	22,518	22,518	22,518	22,518	22,518
Unit cost /'000	450	450	450	450	450	450	450	450	450	450	450	450	450	450
Fuel cost/yr('000)	0	7	8	10	10	10	10	10	10	10	10	10	10	10
4.3. WATER ('000 Lt.)	0	32,400	40,500	48,600	48,600	48,600	48,600	48,600	48,600	48,600	48,600	48,600	48,600	48,600
Unit cost /'000 Ltr	250	250	250	250	250	250	250	250	250	250	250	250	250	250
Water cost/yr('000)	0	8	10	12	12	12	12	12	12	12	12	12	12	12
TOTAL UTILITIES	0	123	154	184	184	184	184	184	184	184	184	184	184	184
5. OTHER OVERHEADS														
Depreciation	0	523	523	506	506	506	506	506	506	506	490	490	490	490
Maintenance & Insur	0	172	172	172	172	172	172	172	172	172	172	172	172	172
Transport	0	300	300	300	300	300	300	300	300	300	300	300	300	300
Building rent	0	5	5	5	5	5	5	5	5	5	5	5	5	5
Misc. & special exp	0	206	18	18	18	18	18	18	18	18	18	18	18	18
Admin & Mkting exp.	0	50	50	50	50	50	50	50	50	50	50	50	50	50
TOTAL OVERHEADS COST	0	1,255	1,068	1,051	1,051	1,051	1,051	1,051	1,051	1,051	1,035	1,035	1,035	1,035
TOTAL COST OF OPERATIONS	75	3,293	3,531	3,939	3,939	3,939	3,864	3,864	3,864	3,864	3,864	3,848	3,848	3,848

ANNEX VIII - DEBT SERVICE

Item Period >>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. LOCAL LOANS															
1.1. LONG TERM LOANS															
Repayment	0	0	169	169	169	169	169	169	169	0	0	0	0	0	0
Balance	1,183	1,183	1,014	845	676	507	338	169	0	0	0	0	0	0	0
Interest	248	248	213	177	142	106	71	35	0	0	0	0	0	0	0
1.2. SHORT TERM LOANS															
Repayment	0	0	154	154	154	0	0	0	0	0	0	0	0	0	0
Balance	0	463	309	154	0	0	0	0	0	0	0	0	0	0	0
Interest	0	97	65	32	0	0	0	0	0	0	0	0	0	0	0
LOCAL REPAYMENT	0	0	323	323	323	169	169	169	169	0	0	0	0	0	0
LOCAL BALANCE	1,183	1,646	1,323	999	676	507	338	169	0	0	0	0	0	0	0
LOCAL INTEREST	248	346	278	210	142	106	71	35	0	0	0	0	0	0	0
2. FOREIGN LOANS															
2.1. LONG TERM LOANS															
Repayment	0	0	155	155	155	155	155	155	155	0	0	0	0	0	0
Balance	1,088	1,088	933	777	622	466	311	155	0	0	0	0	0	0	0
Interest	131	131	112	93	75	56	37	19	0	0	0	0	0	0	0
2.2. SHORT TERM LOANS															
Repayment	0	0	43	43	43	0	0	0	0	0	0	0	0	0	0
Balance	0	128	85	43	0	0	0	0	0	0	0	0	0	0	0
Interest	0	15	10	5	0	0	0	0	0	0	0	0	0	0	0
FOREIGN REPAYMENT	0	0	198	198	198	155	155	155	155	0	0	0	0	0	0
FOREIGN BALANCE	1,088	1,216	1,018	820	622	466	311	155	0	0	0	0	0	0	0
FOREIGN INTEREST	131	146	122	98	75	56	37	19	0	0	0	0	0	0	0
TOTAL REPAYMENT	0	0	521	521	521	324	324	324	324	0	0	0	0	0	0
TOTAL BALANCE	2,271	2,862	2,341	1,819	1,298	973	649	324	0	0	0	0	0	0	0
TOTAL INTEREST	379	492	400	308	217	162	108	54	0	0	0	0	0	0	0

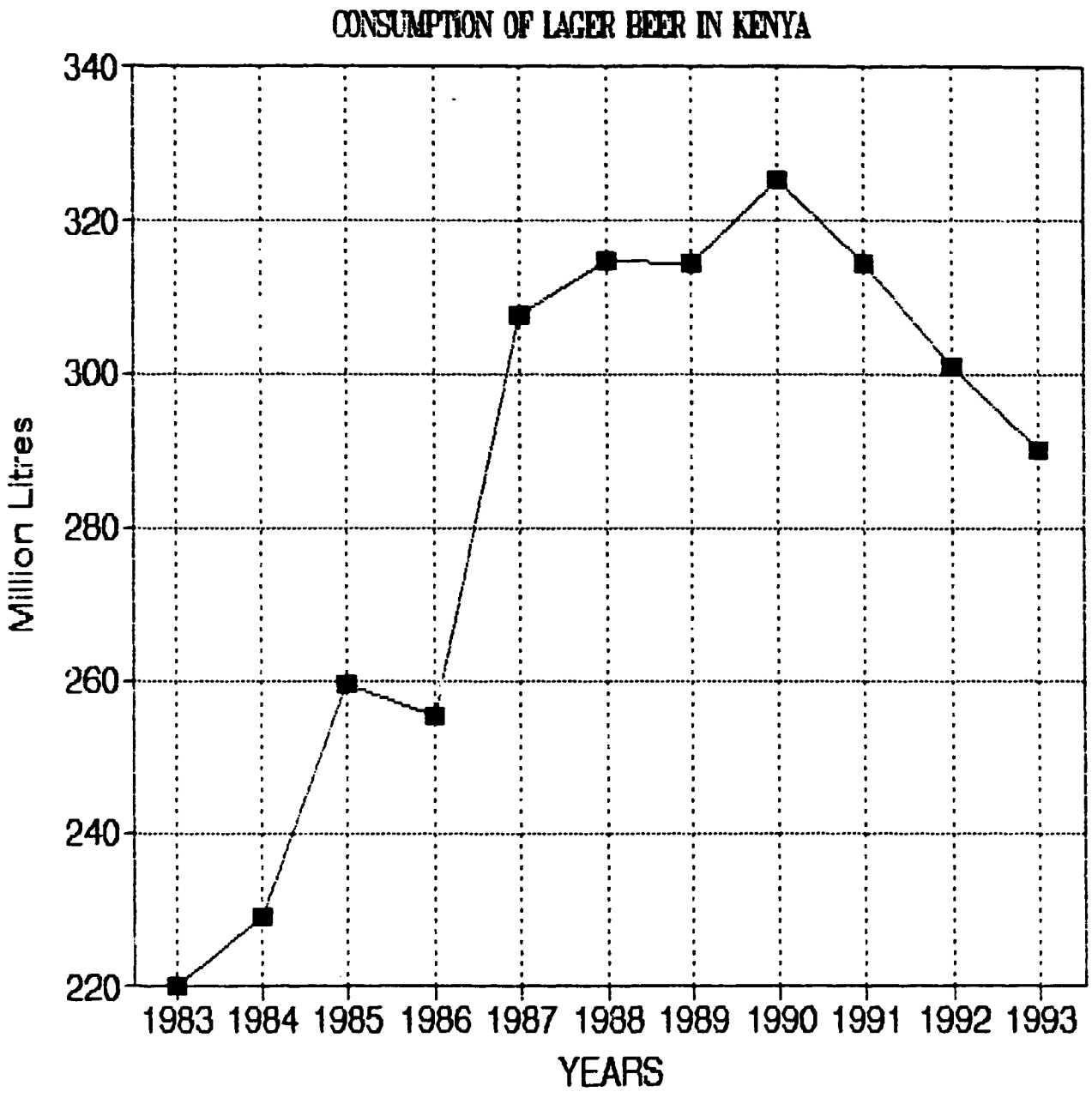
ANNEX IX - VALUE ADDED

Item Period >>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VALUE OF OUTPUT	0	4,589	5,737	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	6,884	9,105
VALUE OF MATERIAL INPUT	3,502	1,670	2,088	2,505	2,505	3,437	2,505	2,505	2,505	5,206	2,505	2,669	2,505	3,437	3,505
Investments	3,502	0	0	0	0	932	0	0	0	2,701	0	164	0	932	0
Imported	1,481	0	0	0	0	0	0	0	0	1,349	0	132	0	0	0
Domestic	2,021	0	0	0	0	932	0	0	0	1,352	0	32	0	932	0
Current Material Input	0	1,670	2,088	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505	2,505
Imported	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Domestic	0	1,547	1,934	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321	2,321
Utilities	0	123	154	184	184	184	184	184	184	184	184	184	184	184	184
NET DOMESTIC VALUE ADDED	(3,502)	2,919	3,649	4,379	4,379	3,447	4,379	4,379	4,379	1,678	4,379	4,215	4,379	3,447	6,600
REPATRIATED PAYMENTS	168	213	301	277	281	262	206	187	215	215	215	215	215	215	215
Wages	38	68	68	68	68	68	30	30	30	30	30	30	30	30	30
Profits (dividends)	0	0	111	111	139	139	139	139	185	185	185	185	185	185	185
Interest	131	146	122	98	75	56	37	19	0	0	0	0	0	0	0
NET NATIONAL VALUE ADDED	(3,670)	2,706	3,348	4,102	4,098	3,185	4,173	4,191	4,164	1,463	4,164	4,000	4,164	3,232	6,385
Wages	38	300	308	316	316	316	278	278	278	278	278	278	278	278	278
Social Surplus	(3,708)	2,406	3,041	3,786	3,782	2,869	3,895	3,913	3,886	1,185	3,886	3,722	3,886	2,954	2,107
DISCOUNTED AT 21 %															
NET NAT. VALUE ADDED	(3,033)	1,848	1,890	1,914	1,580	1,015	1,099	912	749	217	512	406	349	224	366
Discounted Wages	31	205	174	147	122	101	73	61	50	41	34	28	23	19	16
Discounted Social Surpl	(3,064)	1,643	1,716	1,766	1,458	914	1,026	852	699	176	477	378	326	205	350

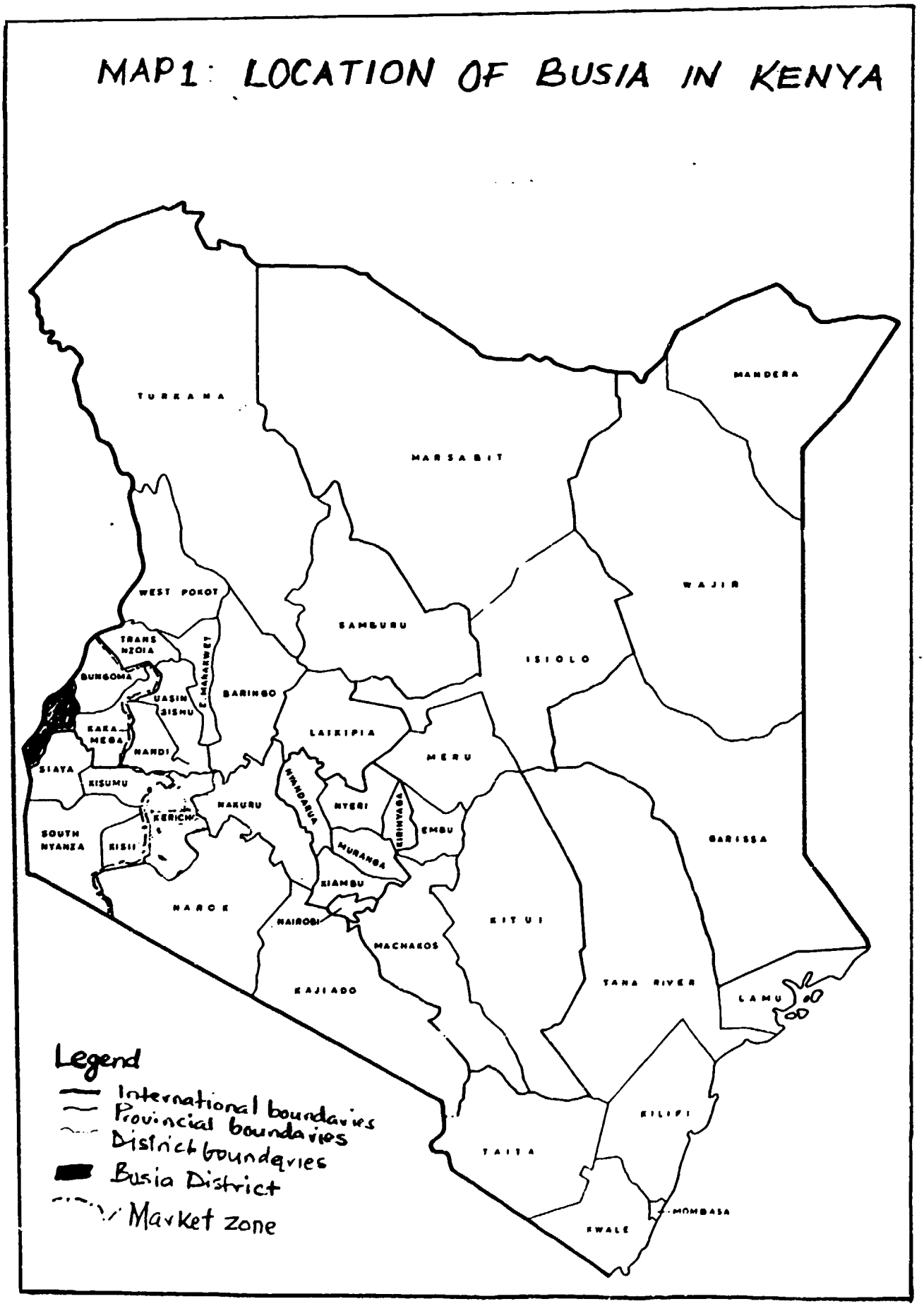
ABSOLUTE EFFICIENCY TEST	PV (NNVA)		PV (Wages)
	10,047	>	1,125

ANNEX X - FOREIGN EXCHANGE EFFECT

Item Period >>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FOREIGN EXCHANGE INFLOW	1,869	128	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign Equity	781	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Foreign Loan	1,088	128	0	0	0	0	0	0	0	0	0	0	0	0	0
FOREIGN EXCH. OUTFLOW	1,649	248	542	527	531	470	414	395	423	1,616	267	399	267	267	267
Imported Equipment	1,481	0	0	0	0	0	0	0	0	1,349	0	132	0	0	0
Imp. Materials, Utiliti	0	35	44	52	52	52	52	52	52	52	52	52	52	52	52
Repayment of Loans	0	0	198	198	198	155	155	155	155	0	0	0	0	0	0
Repatriated wages	38	68	68	68	68	68	30	30	30	30	30	30	30	30	30
Devided repatriated	0	0	111	111	139	139	139	139	185	185	185	185	185	185	185
Interest on Loans	131	146	122	98	75	56	37	19	0	0	0	0	0	0	0
NET FOREIGN EXHANGE FLOW	(561)	(120)	(542)	(527)	(531)	(470)	(414)	(395)	(423)	(1616)	(267)	(399)	(267)	(267)	(267)
NET FOREIGN EXCH. EFFECT	(561)	(120)	(542)	(527)	(531)	(470)	(414)	(395)	(423)	(1616)	(267)	(399)	(267)	(267)	(267)
DISCOUNTED NET FOREIGN EXCHANGE FLOW	(464)	(82)	(306)	(246)	(205)	(150)	(109)	(86)	(76)	(240)	(33)	(41)	(22)	(19)	(15)
DISCOUNTED NET FOREIGN EXCHANGE EFFECT	(464)	(82)	(306)	(246)	(205)	(150)	(109)	(86)	(76)	(240)	(33)	(41)	(22)	(19)	(15)

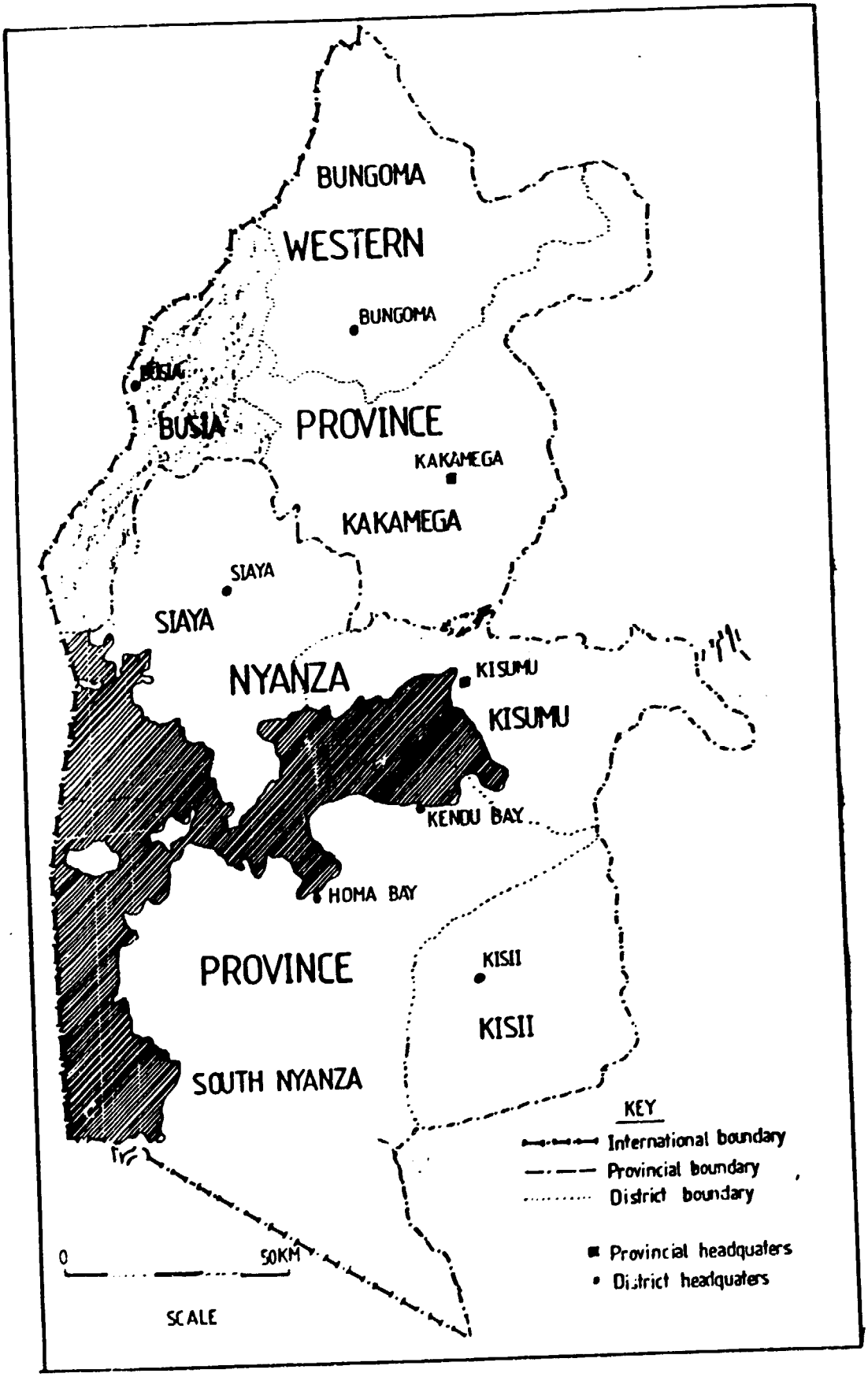

CONSUMPTION OF LAGER BEER IN KENYA
340
320
300
280
260
240
220
Million Litres
1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993
YEARS

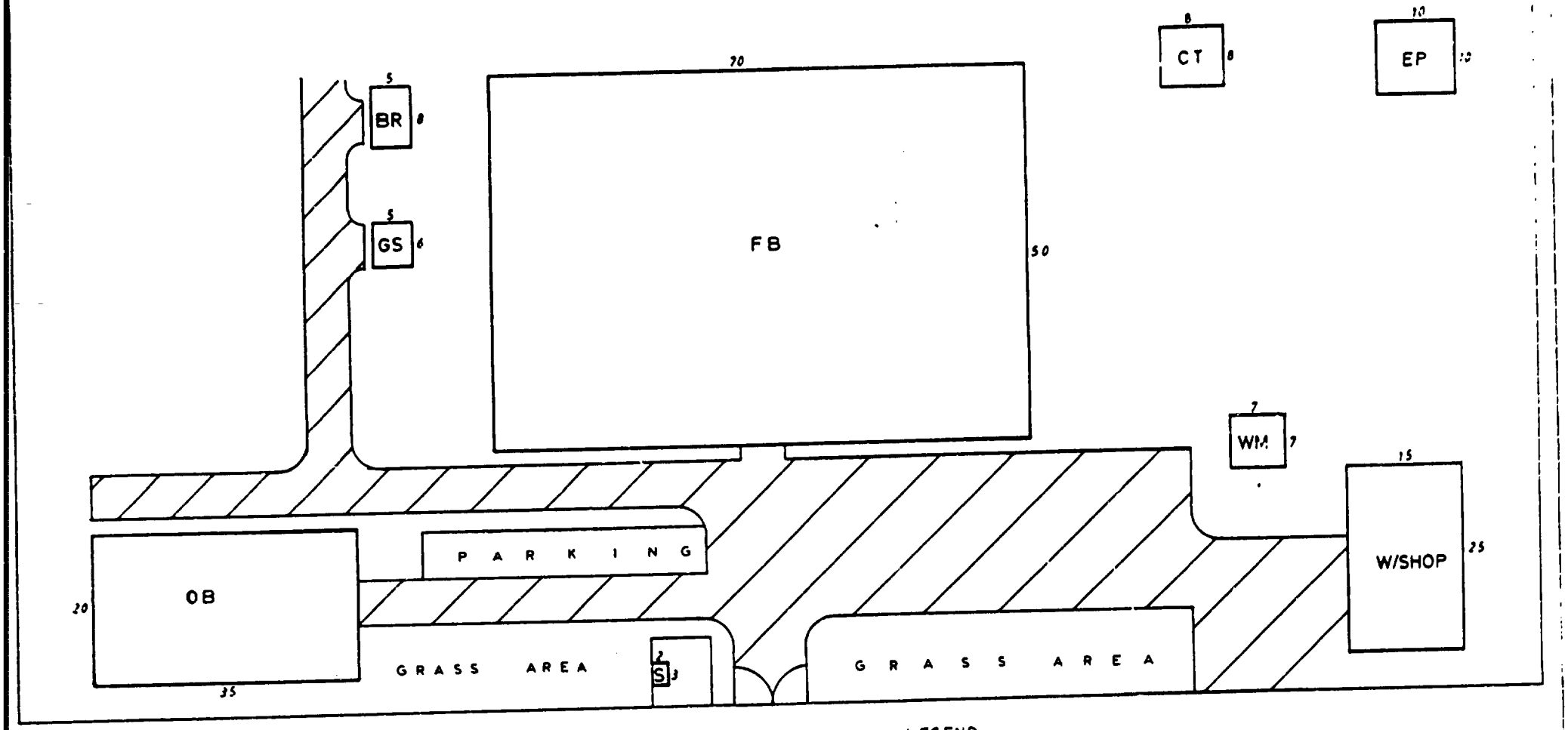
MAP 1: LOCATION OF BUSIA IN KENYA



MAP II

WESTERN KENYA



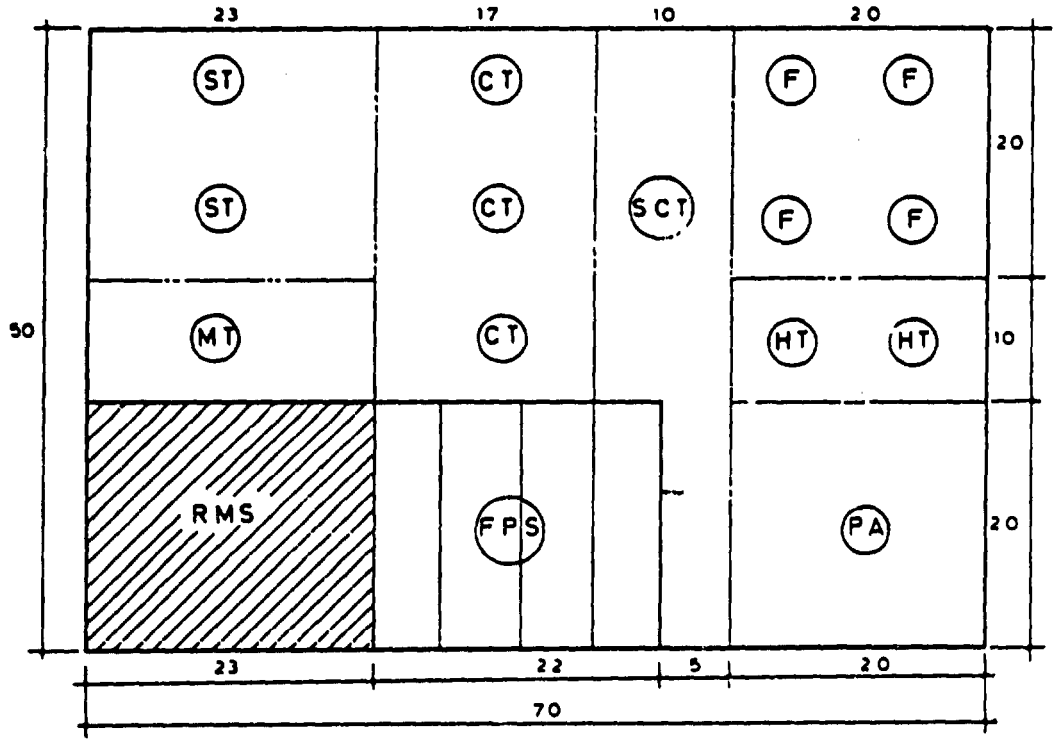


LEGEND

BR	BOILER ROOM
EP	EFFICIENT PLANT
GS	GENERATOR
FB	FACTORY BLOCK
CT	COOLING BLOCK
OB	OFFICE BLOCK
W/SHOP	WORKSHOP
S	CENTRY/GUARDROOM
▨	ROADS/PARKING AREA
note	DIMENSIONS ARE IN METRES

SCALE
1:500

APPENDIX I
FACTORY LAYOUT



KEY

RMS	RAW MATERIAL STORE
MT	MIXING TANK
ST	SOURING TANK
CT	COOLING TANK
SCT	SNEERING TANK
F	FERMENTOR
HT	HOLDING TANK
PA	PACKAGING AREA
FPA	FINAL PRODUCT AREA

note DIMENSIONS ARE IN METRES

	DATE	NAME	SIGN
DESIGNED			
DRAWN	28-10-96	S. O omweri	
SCALE 1 400			

APPENDIX II
PLANT EQUIPMENT LAYOUT