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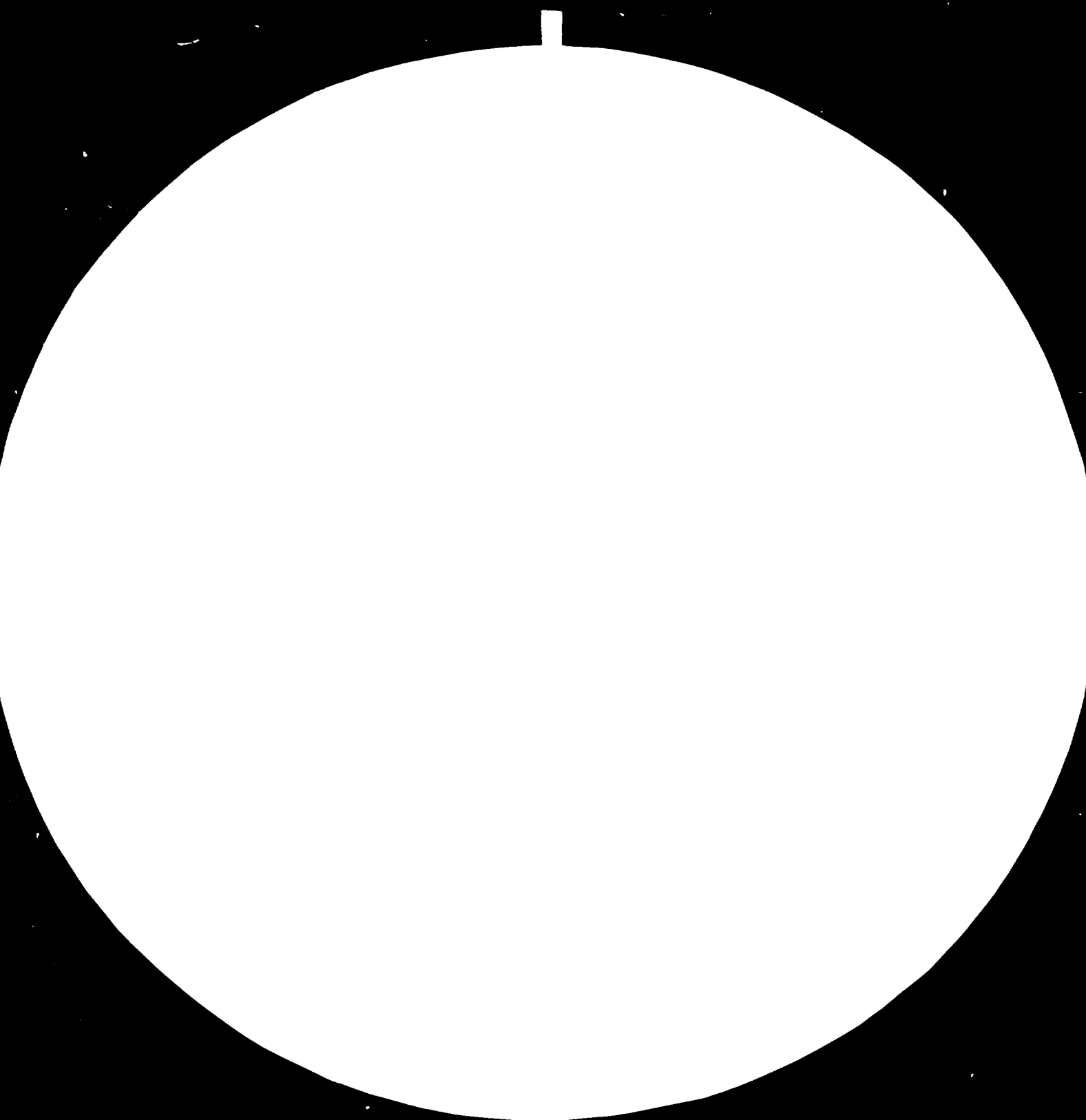

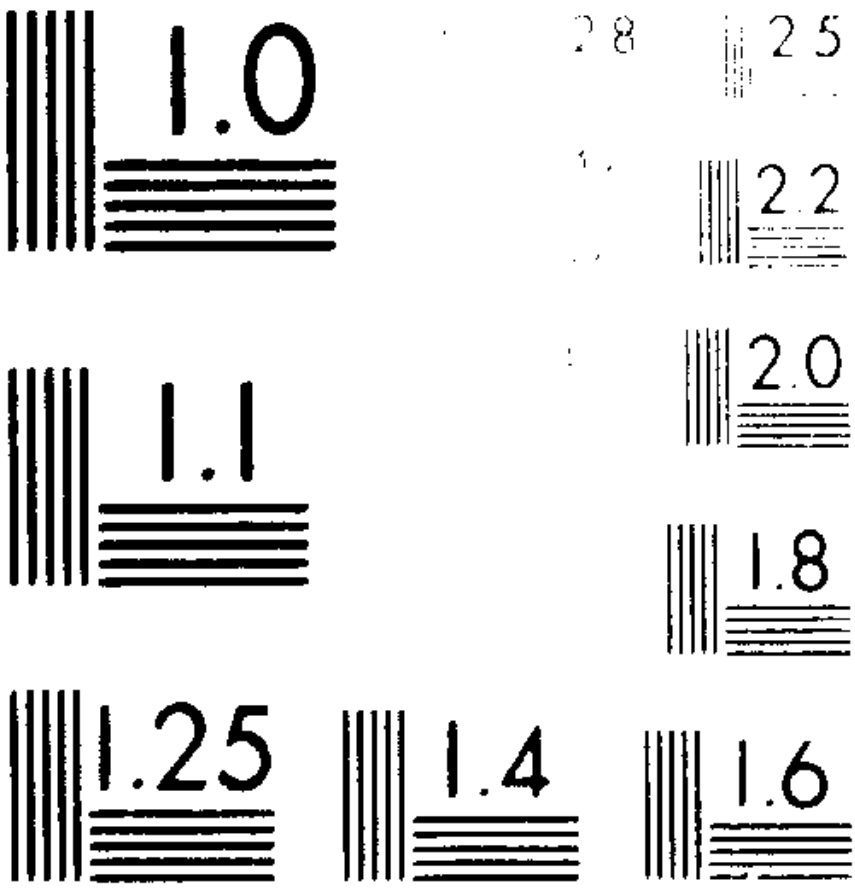
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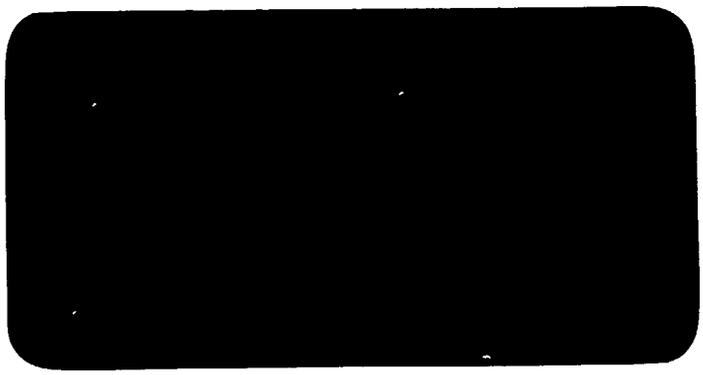

SOFRECO

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FINAL REPORT

Feasibility study on Sorghum Milling Industry in BOTSWANA

(Volume I)

SOFRECO

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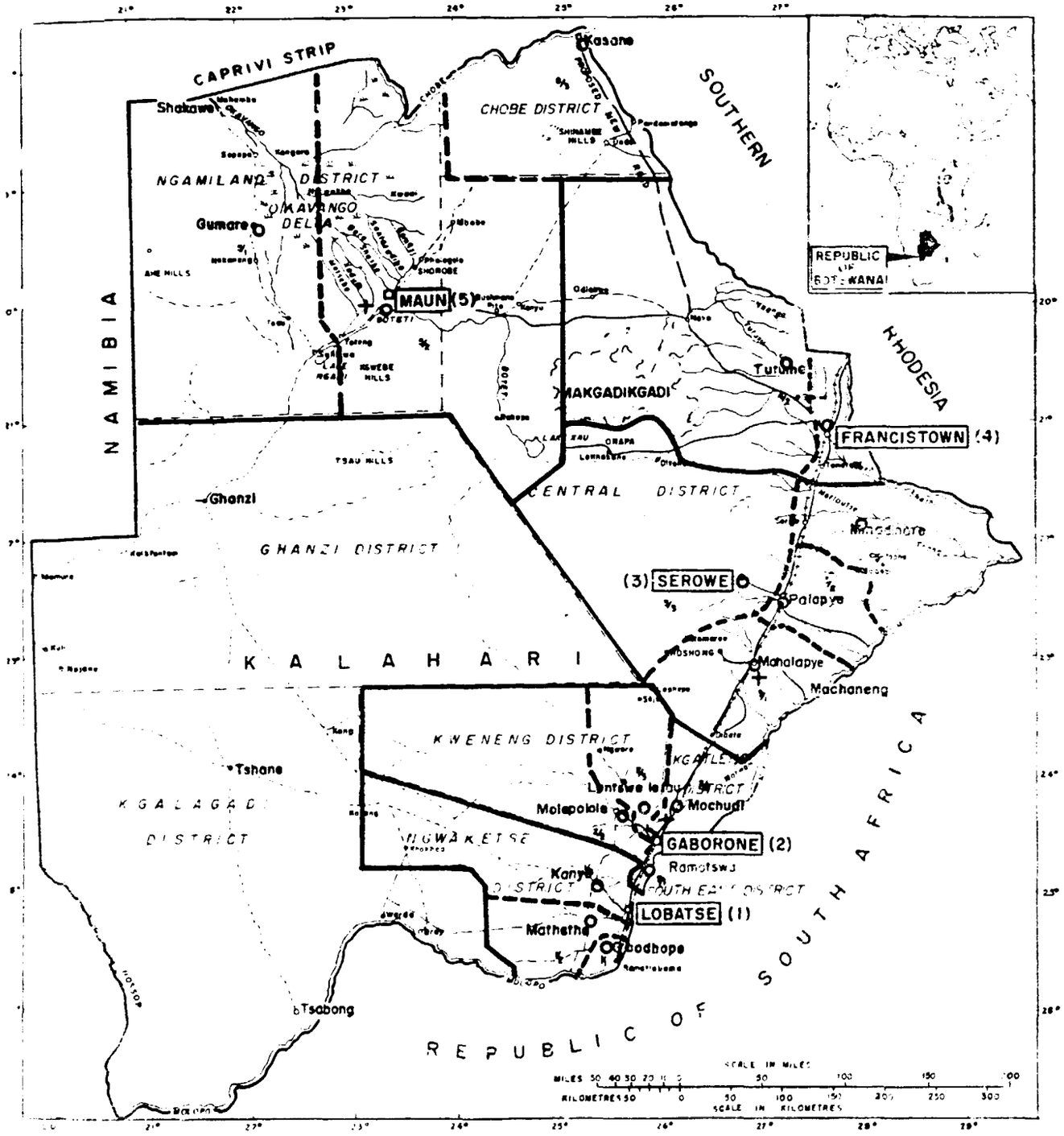

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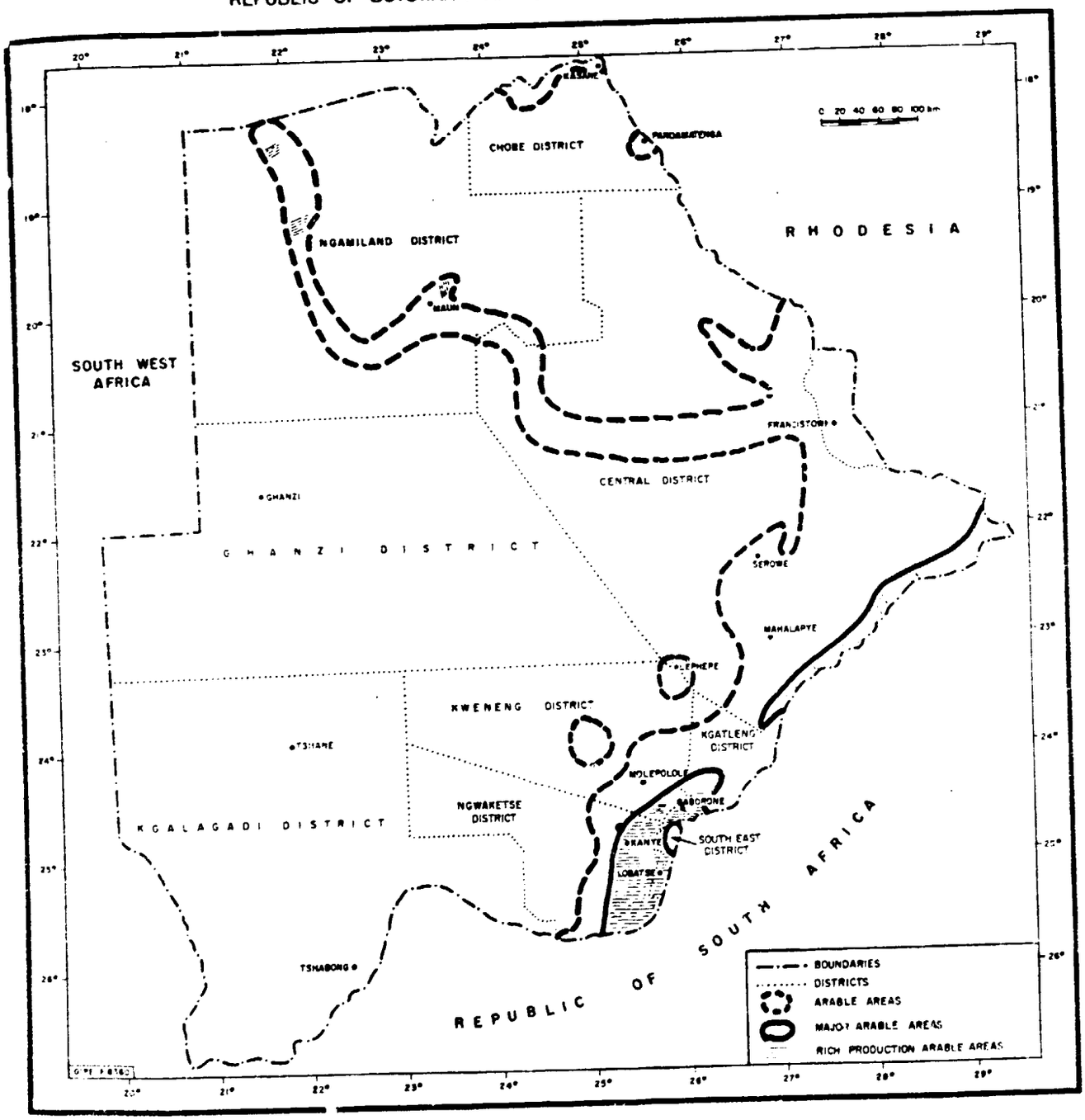

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FOREWORD

1. On August 4th, 1980 the UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION in Vienna, AUSTRIA commissioned Societe Française de Réalisation, d'Etudes et de Conseil (S.O.F.R.E.C.O.) from FRANCE for carrying out a feasibility study on sorghum milling industry in BOTSWANA.

2. The feasibility study included two phases :

   - the field investigations in BOTSWANA were conducted during September 1980 by two consultants :
     Mr P.H. BOTHIER , Economist and Market Researcher
     and Mr J.P. POSTEL, Milling Technologist

   - the writing of final draft report done in FRANCE by the team of experts.

3. The study team wishes to thank all who participate in this study by providing useful information, comments or remarks on the subject matter.

CHAPTER 1

EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

1.1. PROJECT BACKGROUND AND HISTORY

At present BOTSWANA is a net importer of processed cereal from neigrbouring countries. Sorghum being preferred to other cereals by consumers and being also the most widely grown cereal throughout BOTSWANA, the aim of the Government of BOTSWANA is to develop a cereal processing industry that will substitute imported products by locally processed cereals.

The following objectives of governmental policies have been set forth in the sixth National Development Plan :

- to raise National income by increasing the value of agricultural production
- to reduce BOTSWANA's dependence on imports of agricultural produce
- to increase the number of employment opportunities particularly in the rural areas.

The aim of this study is to prepare a feasibility report giving recommendations for establishing a milling industry in BOTSWANA in conformity with the hereabove mentioned objectives.

This project was sponsored by the following Government Ministries :

1. Ministry of Agriculture
   Private bag 003 - Phone 5428
   GABORONE - BOTSWANA

2. Ministry of Finance and Development Planning
   Private bag 008 - Phone 5527
   GABORONE - BOTSWANA

3. Ministry of Commerce and Industry
   Private bag 004 - Phone 5388
   GABORONE - BOTSWANA

The study has identified other private and public institutions showing interests for the project .

Two potential investors :

1. The COOPERATIVE MOVEMENT
   Department of cooperative development
   PO BOX 86 - GABORONE

2. The BOTSWANA AGRICULTURAL MARKETING BOARD
   Private bag 0053 - GABORONE - Phone 4396

Two financial institutions :

1. The NATIONAL DEVELOPMENT BANK - N.D.C.
   PO BOX 225 - GABORONE

2. The BOTSWANA DEVELOPMENT CORPORATION - B.D.C.
   PO BOX 438 - GABORONE

1.2. MARKET AND PLANT CAPACITY

The determination of the milling requirements have been based on a total demand for sorghum food estimated at 60 000 tons of grain per year.

Two segments of the demand have been differentiated :

- Firstly, the demand for a commercial product which has been estimated at 24 000 tons, corresponds to a large extent to the demand expressed by the urbanized segment of the population

- Secondly, the demand for a milling service which corresponds to the needs of the rural population of BOTSWANA.

The mills considered in this study have been designed with the following capacities :

- Industrial mill : 42 tons per day at an extraction rate of 85 %

- Semi-industrial mill : 11 tons per day at an extraction rate of 82 %

- Service mill : 3 tons per day at an extraction rate of 82 %

The production programme for each mill is as follows :

YEAR / MILL	1	2	3	4	5	6
Industrial mill	50 %	70 %	80 %	90 %	100 %	100
Semi-industrial mill	50 %	75 %	100 %	100 %	100 %	100
Service mill	30 %	50 %	65 %	80 %	90 %	100

1.3. MATERIAL AND INPUT

Apart from a very narrow commercial sector, sorghum in BOTSWANA is predominantly grown for the subsistence needs of the farming population, hence the very low level of marketable surplus which enter trade networks. This factor constitutes the main obstacle to the development of a milling industry based exclusively on commercial operations. At present, marketable surplus from the locally produced sorghum does not permit to envisage a viable commercial milling industry, thus restricting to service milling only any future possible development in this sector of activity.

The attempt of the present study has also been to appraise the economic viability of a commercial milling industry depending on imported raw material. It is expected that BOTSWANA would nevertheless benefit from such development since it is preferable to import raw grain and process it in BOTSWANA rather than importing directly finished products having higher added value content. Two competing project alternatives have thus been compared in this study :

- the industrial option making exclusive use of industrial technology
- the semi-industrial option using both industrial technology and appropriate technology developed in fonction of developing countries' needs.

Other inputs necessary for the running of the mills consist of the utilities. Diesel for engine is supplied by private companies which distribute oil and petroleum products throughout BOTSWANA.

1.4. PLANT ORGANIZATION AND OVERHEAD COSTS

Overheads costs concern principally factory overheads, administrative overheads and depreciation.

Factory overheads consist of costs incurred for repair and maintenance of plant equipment and machinery. They are calculated as a percentage of the value of the original investment.

Administrative overheads consist of Insurance premium and land fees.

The annual depreciation rate is 10 per cent for civil works and machinery but 20 per cent for transport vehicules.

1.5. LOCATION AND SITE

The following locations have been selected for each alternative :

- SEMI-INDUSTRIAL ALTERNATIVE

  . GABORONE Region : - Gaborone (2 mills)
  - Mochudi

  . CENTRAL Region : - Mahalapye
  - Palapye
  - Selebi pick e
  - Serowe

  . FRANCISTOWN Region : - Francistown

- SERVICE MILL

  . GABORONE Region : - Molepolole
  - Mochudi

  . CENTRAL Region : - Mahalapye
  - Palapye
  - Serowe
  - Maope
  - Bobowong

  . FRANCISTOWN Region : - Tsamaya
  - Tutume

  . MAUN Region : - Maun

1.6. PROJECT ENGINEERING

The type of milling technology which has been developed in BOTSWANA with the assistance of the Canadian based International Research Development Center is recommended for both Semi-Industrial Mills and Service Mills. The two critical operations in the process of flour making is the dehulling and the grinding. As to dehulling, the abrasive disks mounted in a metal casings is the recommended technology.

As regards the grinding, the hammermill with a set of different screens should provide the best results.

Auxiliary equipment consisting principally of bucket conveyors and cyclones are recommended for the Semi-Industrial Mills working on a continuous flour milling system. Machinery for grain and flour conveying is not justified in the case of the Service Mill which is operated on a batch system whereby small quantities of grain are processed separately. The Service Mill design should be simplified where possible to minimize operating costs and thus the service fee to the farmers.

Equipments of the Semi-Industrial Mills and Service Mills are driven by diesel engines.

Civil engineering works consist of one level building which accomodates grain storage, milling equipment and flour storage facilities.

1.7. MANPOWER

a/ Semi-Industrial Mill

12 employees will constitute the total labor force of the Semi-Industrial Mill. Skilled labor for the Semi-Industrial Mill will work on two shifts with the following personnel :

- a mill foreman
- a dehuller operator
- a hammermill operator

The unskilled labor will comprise the following personnel working on one eight hour shift :

- one (1) truck driver
- five (5) unskilled workers

The staff comprises the following personnel :

- one (1) mill manager
- one (1) qualified accountant
- one (1) secretary

b/ The Service Mill

The personnel required from the running of the Service Mill includes :

- a mill manager
- a mill foreman
- three unskilled workers

1.8. IMPLEMENTATION SCHEDULING

The Semi-Industrial Mill project will be implemented within a period of one year. The manufacturing of equipment and construction of the building will be undertaken simultaneously so as to shorten the total duration of the project implementation.

The Service Mill project will be executed within the same time period.

1.9. FINANCIAL AND ECONOMIC ANALYSIS

Two competing types of mill have been considered for meeting the first segment of the demand for sorghum meal. The first one referred to in this study as "The Industrial Mill" and the second one referred to as the "Semi-industrial Mill". The first alternative has been discarded as it does not correspond to governmental policies tending to favor rural industrialization.

a/ Industrial mill

The Industrial mill represents a total investment outlay of 1 001 741 pulas.

The internal rate of return over a period of ten years is 50,77 per cent.

b/ Semi-Industrial mill

- The Semi-Industrial mill represents a total investment outlay of 194 706 pulas broken down into the following cost components

Land and site preparation	5 000
Civil engineering works	30 000
Equipment and machinery	82 200
Preproduction capital costs	4 920
Working capital	72 586
TOTAL INVESTMENT COSTS	194 706

- Project financing

The project is financed with equity for 33 120 pulas and with a bank loan of 130 000 pulas payable in two installments

- Manufacturing costs

Factory costs	458 494
Administrative overheads	11 230
Sales and distribution costs	34 500
Operating costs	504 224
Depreciation	20 924
TOTAL PRODUCTION COSTS	525 148

- Financial analysis

Simple rate of return	40.85 %
Milling margin	12.27 %
Turnover ratio	3.33
Pay-back period	4.2 years
Breakeven point	21 % of full capacity
Internal rate of return	62.41 %

The financial analysis reveals that the two projects, the Industrial Mill and the Semi-Industrial mill, are very profitable investments.

Such high profitability results from the assumptions made in this study.

Firstly , the engineering design selected for the two mills was aimed at minimizing the total investment value. For instance the Industrial Mill does not incorporate any outside protected storage facilities for finished products as the dry climate in BOTSWANA allows for outdoors storage.

Furthermore, the present study has not retained the possibility of having this project executed by a European Contractor, such hypothesis leading to increase the total investment cost by 40 per cent.

Secondly, the selling price for Sorghum flour considered in this study corresponds to the highest selling price of maïze flour. The sensitivity analysis demonstrates that the internal rates for the Industrial Mill and the Semi-Industrial Mill are respectively brought down to 34 per cent and 34.6 per cent by a price reduction of 10 per cent in the selling price of Sorghum flour

Thirdly, it is also worth mentionning that revenues from sales of bran are quite hypothetical since industrial milling will produce quantities of bran in excess of potential demand. The internal rate of return of the two projects are further reduced down to 25.65 per cent and 18 per cent.

c/ Service Mill

- The Service Mill represents a total investment outlay broken down into the following cost components.

Land and site preparation	300
Civil engineering works	9 600
Equipment and machinery	10 600
Preproduction capital costs	1 000
Working capital	940
TOTAL INVESTMENT COSTS	22 240

- Project financing

The project is financed with equity for 23 800 pulas and with a bank loan of 10 000 pulas.

- Manufacturing costs

Factory costs	11 209
Administrative overheads	2 430
Operating costs	13 639
Depreciation	3 310
TOTAL PRODUCTION COSTS	16 949

- Financial analysis

Simple rate of return	17.12	%
Milling margin	16.80	%
Turnover ratio	1.02	%
Pay-back period	6	years
Break-even point	380	Tons
International rate of return	17.35	%

The poor financial performance of the Service Mill is explained by the moderate fee at which the milling service is sold to farmers. The profitability of the Service Mill would therefore be greatly increased by a service fee fixed at 4 thebe per kilogramme.

CONCLUSION

Two segments of the total demand for processed sorghum have been differentiated, namely, the demand for a commercial product and the demand for a milling service. The satisfaction of these two demand components calls for two different types of industrial organization in the process of flour making.

As regards the commercial demand, the Semi-Industrial option appears as the most suitable form of production since it presents the following advantages over the industrial alternative.

- the technology selected for equipment has been satisfactorily tested in BOTSWANA and does not necessitate foreign assistance for project implementation

- the creation of eight Semi-Industrial mills conforms to the decentralized industrialization schemes advocated by governmental policies in BOTSWANA

- More employment opportunities are created in rural areas of BOTSWANA.

As regards the second component of the demand for processed sorghum, the service mill system should be extended for satisfying the needs of the rural population of BOTSWANA.

Two types of potential investors are more likely to derive benefits from the development of Milling Industry. Firstly the Cooperative Movement which, through its form of association, would allow for the redistribution of profits to grain producers thus creating direct incentives to farmers for increasing their crop production.

Secondly, the Botswana Agricultural Marketing Board which would thus avoid grain stockpiling in excess of the Country's requirements, in years of good production.

CHAPTER 2

PROJECT BACKGROUND AND HISTORY

2. PROJECT BACKGROUND AND HISTORY

2.1. GEOGRAPHY

The Republic of BOTSWANA covers a total surface area of approximately 580,000 square kilometres and is, on average, 1,000 metres above sea level. It has no coastline and lies to the North-West of South AFRICA, to the South-West of ZIMBAWE , to the South of ZAMBIA and the CAPRIVI Strip and to the East of NAMIBIA.

The Eastern half of the country is the most fertile part, hence the most densely populated, the population being mainly concentrated, near the railroad, which cuts straight through the country from South Africa to ZIMBAWE . The KALAHARI Desert, where vegetation is virtually non-existent, covers the great part of the Western half of the country with the exception of its North-Western trip.

2.2. CLIMATE

BOTSWANA has a subtropical climate which is characterized by uneven, scarce and unpredictable rainfall.

Severe drought occurs approximately once in every three years, this having a devastating effect on subsistence crops. Statistics show that average rainfall ranges from 250 mm per annum in the South-West to more than 650 mm per annum in the North-East. Climatic conditions also vary according to altitude and latitude.

2.3. POPULATION

A census carried out in 1971 revealed a total population of approximately 630,000. Taking an average demographic growth rate of three per cent per annum, the estimate for 1980 is 822,000. Migration patterns are now changing, people mainly heading towards the large cities and economic growth areas and it should be pointed out that 80 % of the Botswanan population live in the Eastern half of the country, where the best prospects for making a livelihood are offered.

2.4. THE ECONOMY

The economy of BOTSWANA has seen rapid growth since its independence. The GDP in current prices increased from P 37 million in 1966 to P 490 million in 1978, thus an average growth rate exceeding 20 %. However, it should be noted that, as the inflation rate recorded over the last 10 years was about 10 per cent, the yearly GNP growth in real term is only 10 per cent. Mining and agriculture are the two major economic sectors. Coppernickel ore, diamonds and coal and soda ash constitute the country's principal deposits.

Cattle accounts for 80 per cent of the country's agricultural output. The importance of cattle raising in BOTSWANA stems principally from a strong comparative advantage derived from the savanna type vegetation covering more than half of the total surface area of BOTSWANA.

2.5. CROP PRODUCTION

The vulnerability of crop production stems from the country's proneness to draught, uncontrolled soil depletion, lack of implements, smallholders lacking draught power, unequal distribution of resources , pests and diseases affecting crops. These factors account for the decline of agriculture over the past decade. Agriculture accounted for only 20 percent of the 1978 gross domestic product as against 37 percent in 1974. Agriculture is mainly practised for subsistence reasons and cannot provide, except in particularly good production year, adequate marketable surplus to the urban population.

With the ultimate aim of modernizing the agricultural sector the Government of BOTSWANA initiated and developed several promotional schemes and institutions among which are the Botswana Agricultural Marketing Board (BAMB), the Arable Lands Development Programme (ALDEP), the Cocperative Development Center (CODEC).

The Botswana Agricultural Marketing Board was created to stabilize market prices and guarantee minimum prices to crop producers. Before BAMB's existence a large part of the grain crop was sold as soon as harvested, usually to South Africa. When the available stocks on hand were depleted, higher priced grain was imported until the next harvest. The Board was asked by the Government to fix producer prices for Maïze and Sorghum at a higher level than those prevailing in the Republic of South Africa. The primary objective was to maintain and encourage domestic cereal production so as to obtain self sufficiency and secondly to prevent producers from selling their cereal crops to South Africa, thus retaining within BOTSWANA sufficient cereals to meet domestic demand.

The Botswana Agricultural Marketing Board has therefore raised producer prices for Sorghum by more than 175 per cent in the last five years.

More recently and with the aim of reverting the trend towards diminishing agricultural output, the Government of BOTSWANA decided to promote the "Arable Lands Development Programme " oriented towards the development of smallholder production. The aims of ALDEP are summarized hereunder :

- to increase agricultural output by 4 - 6 % per year with a view to reducing the food grain deficit and ultimately achieving self sufficiency.

- to encourage rural development by both raising the general level of rural income further to the introduction of more productive agricultural technology and also by creating new employment opportunities.

The Cooperative Movement in BOTSWANA started as early as 1964 when the first Cooperative Society was set up. Since then the movement has gained such momentum that today one in every three Bastwana belongs to the cooperative movement.

The cooperatives were created to :

- raise the standart of living for the poorer strata of the rural and urban population

- supply the input required to produce sufficient food for an increasing population

- provide commodities for export and import substitution

- facilitate education, acquire self sufficiency and new skills

- provide the basis for new Botswana-owned industries.

The cooperative movement has been able to diversify its activities into many fields so that there are now various types of cooperatives.

- the Agricultural Marketing Societies who mainly market the cattle on behalf of their members

- the Consumer Societies which are running shops of different sizes at the retail level

- the Thrift and Loan Societies which are granting loans to members

- the BOTSWANA Cooperative Union which is the apex organization of the Cooperative movement and act as wholesale supplier of goods to the consumer co-operatives.

The cooperative movement has been so successful that it now represents one of the largest business enterprises in BOTSWANA with an annual turnover of 20 million of pulas . Consumer Societies now account for approximately 20 per cent of the national retail grocery sales.

With the assistance of the Cooperative Development Center (CODEC) the Government of BOTSWANA is supporting the entire Cooperative Movement. The objectives of the CODEC organization is to promote cooperative growth and development, give technical support to the cooperatives and also train and educate staff members.

2.6. PROJECT BACKGROUND

Due to the inability of subsistence farmers to produce grains in excess of their own consumption requirements, BOTSWANA is a deficit country in raw cereal. Raw grains and processed cereals have to be imported in increasing quantities and the ultimate objective of the Government of BOTSWANA is to create conditions that will permit to the country to become self-sufficient in food production.

The immediate aims of this agricultural development are as follows :

- to improve the living standarts of the rural population by ensuring more stable and higher income to its farmers

- to create new employment opportunities in rural areas

- to raise national income by increasing the value of agricultural production

Among crop cereal, sorghum, being drought and heat resistant appears to be the most suitable cereal for BOTSWANA severe climatic conditions and is traditionally grown by a vast majority of Batswana farmers.

Sorghum is one of the most preferred staple food and is used as a basic ingredient for traditional porridge.

Despite all these favorable factors sorghum production has lost ground to other cereal crops in the last few years.

The reasons for this downward trend in Sorghum production is mostly the decreasing return obtained by farmers compared to other cash crops which are more lucrative. More comprehensive analysis of the factors for this decline is provided in chapter 4.1.4. of this study.

2.7. PROJECT HISTORY

In 1975 the Governement of BOTSWANA decided to set up a pilot sorghum mill at PITSANE with the technological assistance of the Canadian based International Development Research Center. The main objective of the project was "to develop a suitable village level milling system for processing sorghum into a Sorghum meal which is as acceptable both in quality and in price as imported maïze meal.

The mill at PITSANE started commercial operations in late 1977 under the management of the Botswana Agricultural Marketing Board. Sorghum grain is supplied through the BAMB depots and the processed products are marketed through BAMB distribution channels.

In spite of a sales price 20 % higher than its direct substitute maïze, the total production of the mill (1 840 tons per year) could be sold easily.

As an overwhelming part of grain production is consumed by the farmers themselves it was decided to allow the rural population to benefit from this type of technology.

The pilot mill was built on a smaller scale in order to subsitute the continous flow milling system by the batch system, by which the customer brings his grain to the mill, pays a service charge for milling and collects the meal and bran corresponding to the exact amount of grain he originally brought. Two village level types of mills were set up with IDRC Assistance : one at KANYE with the Rural Industries Innovation Center under the sponsorship of the German based FRIEDRICH EBERT FOUNDATION and the other at GABANE under the sponsorship of the Pelegano Village Industries Development Association. The first mill operates exclusively on a batch basis, the second combining both commercial and service milling.

2.8. PURPOSE OF THE STUDY

The purpose of the study is to give recommendation in order to expand further the production capacities of the existing milling industry.

2.9. PROJECT INITIATORS AND POTENTIAL PROMOTERS

This feasibility study on Sorghum milling in BOTSWANA has obtained strong governmental support from the following ministries which express deep concern for the economic, financial and social benefits that can be derived from this project.

1. Ministry of Agriculture
   Private bag 003 - Phone 5428
   GABORONE - BOTSWANA

2. Ministry of Finance and Development Planning
   Private bag 008 - Phone 5527
   GABORONE - BOTSWANA

3. Ministry of Commerce and Industry GABORONE
   Private bag 004 - Phone 5388
   GABORONE - BOTSWANA

Apart from private investors in service milling industry, two potential investors appeared mostly interested for future project development in Industrial and Semi-industrial milling industry :

1. The COOPERATIVE MOVEMENT
   Department of Cooperative Development
   PO BOX 86 GABORONE - Phone 5343

2. The BOTSWANA AGRICULTURAL MARKETING BOARD
   Private Bag 0053 - GABORONE - Phone 4396

Financial institutions which may wish to participate through credit allocation or equity participation are the following :

1. The NATIONAL DEVELOPMENT BANK which offers lower interest rates than those of commercial banks since the Bank's funds are made available by Government on favourable terms.

2. The BOTSWANA DEVELOPMENT CORPORATION which is a Government owned public company set up in 1970 to stimulate large scale economic development by identifying viable investment opportunities and developing them either on its own or in partnership with other local or foreign investors.

CHAPTER 3

MARKET AND PLANT CAPACITY

3. MARKET AND PLANT CAPACITY

3. 1. TOTAL DEMAND FOR SORGHUM GRAIN

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3.3.2. The geographical distribution

3.3.3. Service milling requirements

3.1. TOTAL DEMAND FOR SORGHUM GRAIN

3.1.1. FIRST APPROACH : ESTIMATING THE DEMAND FOR SORGHUM FROM PRODUCTION IMPORTS AND EXPORTS FIGURES

This method starts with the components of the consumption of sorghum which are estimated separately.

The total potential demand for sorghum is obtained by aggregating the two distinct components of the demand, namely :

- the effective consumption of unprocessed sorghum
- the potential demand of processed sorghum food.

The study has tried to distinguish to distinct segments of the demand for the sorghum : the effective demand which concerns raw grains only and the potential demand which concerns a processed product, which is not yet readily available in retail outlets.

The demand for a commercial product is mostly expressed by urban dwellers who do not find enough time to devote to laborious nand pounding.

On the contrary, the rural population, defined as the stratum of the population made up of subsistence farmers, grows, harvests and consumes its own production for its own needs without building up appreciable marketable surplus. Most of the time, this segment of the population is self sufficient in food supply and is not a regular customer of commercial product except in years of severe draught. During those periods , sorghum is bought mostly in the form of raw grain instead of flour which is twice more expensive.

3. 1.1.1. Estimating the consumption of unprocessed sorghum

Methodology : The consumption of sorghum grain for a given year is arrived at by aggregating official figures on domestic production, imports and exports of raw grain corresponding to that year.

The risk of error in estimating consumption from a particular year considered as a "representative or normal year" in terms of consumption and production level is eliminated by calculating average consumption figure. A five year period is deemed to be long enough to even out fluctuations affecting crop production as farmers are used to the practice of stocking and destocking.

The average consumption figure is based on the following years :

- 1975 Average crop production year
- 1976 Fairly good production year
- 1977 Less than average production year
- 1978 Poor production year
- 1979 Extremely poor production year

The period from 1975 to 1979 presents the following characteristics :

- Statistical information concerning imports and exports is only considered reliable from 1975 onwards

- The period of reference corresponds to a recent past which has not seen profound modifications or structural changes generating new production and consumption patterns thus minimizing the risk of error.

Besides this, it is expected that the general level of cereal consumption is not dramatically affected by fluctuations in crop production, this being due to the following :

- The free movement of low cost imports permit to alleviate deficits in bad production years

- Grain supplied at no cost under the world food programme ensures a minimum consumption level to the most underprivileged part of the population.

- Farmers being accustomed to the practice of building up inventories, crop surplus in good production years are carried over to low production years.

- The fact that high yields in one year lessen production incentives in the following year, tends to demonstrate that minimum subsistence requirements are,on the average, more or less satisfied.

Table I gives the following consumption of sorghum over the period considered

	Cumulated in Tons	Average
1975 - 1979 Sorghum production	144 140	28 828
1975 - 1979 Sorghum imports	38 182	7 636
Less sorghum exports		
- unprocessed.....	5 082	1 016
- processed (in grain equivalent).	2 000	400
	175 240	35 048

1978 and 1979 were two consecutive years of low production.

They tend to lower the average production figure for sorghum over the period considered (1975-1979). An arithmetic mean calculated over the last ten years (1970-1979) gives a figure of 37 720 tons (source : Ministry of Agriculture) which appears more accurate than the average production figure obtained over the last five years.

3.1.1.2. Estimating the potential demand for processed sorghum

The demand for processed sorghum food is obtained by estimating the potential quantities of other processed cereals which could be substituted by sorghum if available for consumers. An attempt to determine the acceptability of sorghum processed food by consumers was made by carrying out surveys at the retail level, the relative importance of the sales of this particular locally produced cereal being noted.

The purchases of various processed cereal foods were recorded during one hour surveys conducted at different times in two supermarkets at GABORONE. Results obtained show that sales of sorghum processed food represented an average of 41 per cent of the total sales registered during the tests.(see table ?)

The following processed cereal were marketed during the purchase surveys:

- Maïze meal
- Maïze stamps and Maïze rice
- Cake wheat flour
- Wheat bread flour
- Sorghum meal

The effective demand of processed cereal food over the period from 1975 to 1979 is given hereunder :

	Total over 5 years 1975 - 1979	Average
Imported processed cereals		
Wheat flour	88 729	17 746
Maïze flour	150 179	30 036
Other cereal flour	1 269	254
Locally produced cereals		
Lobatse Mill (maïze meal)	66 377	13 275
Pitsane Mill (sorghum meal)	2 000	400
TOTAL	308 554	61 711

Given the hypothesis that 41 percent of the demand for processed cereals estimated above at 61 711 tons can be substituted by sorghum food, the potential demand for processed sorghum amounts to 25 301 tons equivalling 31 626 tons of raw grains.

3.1.1.3. Totalling the two components of the demand

- Effective demand for sorghum grain	35 048
Less the part of demand processed into flour	(400)
- Potential demand for processed sorghum (in grain equivalent)	31 626
TOTAL DEMAND OF SORGHUM GRAIN	66 274
Less grain quantities used for beer & seeds (28 828 x 1/3)	9 513
TOTAL SORGHUM FOOD CONSUMPTION	56 761

3.1.2. SECOND APPROACH : DERIVATING DEMAND FOR SORGHUM FROM GENERAL CONSUMPTION FIGURES

The second approach starts by aggregating consumption data for all cereals, evaluating the crop deficits resulting from insufficient domestic production and assessing the relative importance of sorghum in crop cereal consumption.

3.1.2.1. Total consumption of cereal in BOTSWANA

The estimate of the total consumption of basic local cereal (Maïze - sorghum - millet) is based on the two following concurrent methods :

a/ Making reference to studies made previously by International Development Organization on cereal consumption patterns in AFRICA

- Such studies show that the average quantity of cereal food consumed daily per capita is about 410 grammes representing and annual consumption of 150 kgs.

- Andrew Hamilton in his review of post harvest technologies gives different estimates made by some researchers.

  AMARAL (1965) 133 kg/capita/year
  CALKIN (1972) 130 kg/capita/year
  HAMILTON (1975) 135 kg/capita/year

- Andrew Hamilton himself estimated the total daily consumption of cereals at 137 kg per capita according to a market survey he conducted in a selected area of BOTSWANA.

- An average figure of 140 kgs/capita/annum applied to a total population roughly estimated at 800,000 gives an annual consumption of 112,000 tons of cereal food

b/ Official statistics in production and Trade balance for cereals in BOTSWANA (sorghum - maïze - millet)

The total consumption of cereal products is obtained by aggregating domestic production figures with imports and deducting exports (see table I).

Average consumption for both unprocessed and processed cereals thus amounts to 139, 163 tons per year. Average consumptions of wheat, rice and miscellaneous products are also calculated and deducted from total cereal consumption figure.

	GRAIN IMPORTS	+ PROCESSED PRODUCT-IMPORTS	GRAIN EXPORTS	TOTAL
Wheat	14	17 746	288	17 472
Rice	715		1	714
All other cereals (except maïze, sorghum)	48	159		207
	777	17 905	289	18 393

Average consumption over a five year period for the locally produced basic cereal food is then as follows :

TOTAL CONSUMPTION ALL CEREAL	139 163
Less consumption for beer-seeds & losses	8 648
Less total non locally produced food	18 393
TOTAL CONSUMPTION OF BASIC CEREAL FOOD	112 122

3.1.2.2. Crop production in BOTSWANA

Taking average production figures for sorghum, maïze and millet over a 10 year period from 1970 to 1979. (see table 3)

Sorghum production	37 720
Maïze production	23 693
Average crop production	61 412

3.1.2.3. Cereal deficit in BOTSWANA

If one estimate the required tonnage of basic cereal at 112,000 tons then the crop deficit would approximately amount to 50 588 tons of cereals. These quantities would need to be imported to satisfy the potential demand for basic food cereal.

3.1.2.4. The relative importance of sorghum production

Assuming that 50 % of this crop deficit could be supplied by importing sorghum, the potential demand for sorghum imports would represent 25 294 tons. The total consumption of sorghum is obtained by averaging the local domestic production and the demand for sorghum imports :

- domestic production	37 720 tons
- import requirements	25 294 tons
TOTAL DEMAND OF SORGHUM FOOD	63 014 tons

3.1.3. COMPARING THE RESULTS OF THE TWO APPROACHES

The demand for sorghum by appraising the two components separately is estimated at 56 761 tons whereas estimates derived from general consumption level gives a figure of 63.014 tons. In the second method it was assumed that sorghum could satisfy as much as 50 per cent of the cereal deficit in BOTSWANA. In the first method the substitution rate of imported processed cereal by sorghum was only 41 percent. Such discrepancy between the two percentages accounts for the two different estimates obtained for the demand of sorghum.

3.1.4. SORGHUM MILLING CAPACITY REQUIREMENTS

If all sorghum consumed in BOTSWANA were to be mechanically processed into flour the milling capacities which would need to be created would range from 57 000 to 63 000 tons according to our two estimates. As the demand for a mechanically processed product is not unelastic to price variations, it is difficult to envisage a sudden and complete elimination of traditionnal pounding further to the introduction of mechanical milling.

In order to determine the part of sorghum production which will be processed mechanically into flour, two segments of the total demand have been differentiated , namely :

- the demand for a commercial product available in retail outlets
- the demand for a milling service available near the crop production areas.

As regards the demand for a commercial product, this segment of the demand for sorghum will be met with the Industrial or Semi-industrial mills which can process both sorghum and maïze into flour according to the demand.

3.2. THE DEMAND FOR A COMMERCIAL PRODUCT

Two concurrent methods have been used to estimate the demand for a commercial sorghum product in order to minimize the risk of errors.

3.2.1. THE FIRST APPROACH

The first approach consisted in conducting a consumer survey on cereal purchases made by consumers at the retail level. The relative share which commercial sorghum products hold in the total demand for cereal processed products is 41 per cent. Before extrapolating this result to the entire population one has to take the precaution to identify factors which may lead to underestimating or to overestimating the demand for a commercially marketed sorghum product.

a/ The underestimating factors

- The consumer clientele in GABORONE Supermarket is not representative of the overall population of the country. Social and economic factors such as better education and a higher level of income set this group apart from the rest of the population and it is assumed that this higher income group is less sensitive as far as prices are concerned than the rest of BOTSWANA people.
- The relatively small quantities of sorghum flour made available in GABORONE supermarkets may well cause a rush by the consumers which is not representative of normal purchasing consumption pattern.

- The General Manager of the Camp hyperstore supermarket at GABORONE estimated commercial sorghum flour sales to be 20 per cent of the total sales of processed cereals.

- Sales records at GABORONE consumers cooperative society showed that only 30 per cent of the sales of all processed cereals are sorghum related. This figure does not however take into account periods when the retail shop was running short of sorghum meal.

b/ The underestimating factors

Sorghum food has only been available to GABORONE consumers for the past two years so that urban dwellers may well have developed other consumption patterns away from sorghum.

Considering the importance of food expenditure in the total budget of BOTSWANA households, one may reasonably suppose that a sorghum price equal to that of maïze which corresponds to a 20 per cent decrease in the selling price of sorghum flour may well boost the sales of commercial processed flour.

3.2.2. THE SECOND APPROACH

The second approach for estimating the potential demand for processed sorghum is first to appraise the acceptability of the product by households and then, from this, to derive an estimated substitution rate of Maïze products by sorghum products. This method starts by investigating consumer culinary habits and preferences.

Sorghum and Maïze flour are mainly used for the preparation of porridges which differ in consistence.

Thin porridge is frequently served for breakfast, to new mothers or young children, whereas a stiff porridge is usually preferred for lunch and dinner where it accompanies meat and gravies.

For the preparation of fermented porridge, sorghum meal is usually mixed with water in a covered clay pot and left to ferment in a warm place for a period ranging from 6 to 24 hours. One fermentation has taken place, the liquid mixture is transferred to a pot containing boiling water and cooked for 20 mn to one hour according to the consistency desired by the housewife.

For the preparation of unfermented porridge sorghum flour is added to boiling water and cook for 20 mn to one hour according to the desired consistency.

In some parts of BOTSWANA a finely milled flour is used whereas in others a coarsely milled flour or a combination of coarse and fine flour is preferred . A consumer preference survey was made on sorghum by two Canadian researchers from IDRC. Their study shows that from the group of people taking part in the survey 53 per cent preferred a coarse texture as against 33 % for an average texture and only 12 % for a fine texture. Data collected for the survey also indicated that most people prefer white sorghum.

Assuming that sorghum and maïze products are , as perfect substitutes, equally appreciated by consumers, one may reason that at similar prices sorghum and maïze products would share the total demand for basic cereal foods on an equal basis.

The demand for Maïze processed products is estimated below.

	Total over 5 years	Average
Imported processed maïze (Maïze meal and Maïze samps)	162 206	32 441
Locally processed Maïze	66 377	12 275
TOTAL DEMAND FOR PROCESSED MAIZE	228 583	44 716

With a 50 percent substitution rate, potential demand for sorghum processed food would be 22 858 tons or 28 572 tons in grain equivalent.

3.2.3. INTERPRETING THE RESULTS OF THE TWO METHODS

One should be careful not to rely exclusively on one method and should assess the possible biases and risks of errors inherent to the two methods.

The consumer test only measured sorghum sales of a given product sold at a given price in given markets.

The random variable namely, the share of the cereal market for sorghum processed food, is distributed according to the student probability distribution.Considering the small size of the sample the standart error of the mean is greatly increased.

Comparing the results of the two methods

Obtaining the sorghum demand from the results of the survey which indicated that 41 percent of processed cereal sales are sorghum related, the total present demand can be estimated at 25 301 tons of finished product or 31 626 tons of raw grains.

By assuming that processed sorghum could have replaced processed maïze over the last five years by up to 50 per cent of the known demand the present potential demand for processed sorghum would correspond to 22 858 tons or 28 572 tons in grain equivalent.

The results obtained from the two methods are quite compatible.One may reason that they are pessimistic estimates but since processing costs for transforming grain into flour being higher for maïze than for sorghum, processed sorghum is more likely to be offered to consumers at a lower price than maïze products.

A middle of the road demand estimate of 24 000 tons of processed sorghum or an equivalent of 30 000 tons in raw grain will be used for the purpose of our study.

3.2.4. THE GEOGRAPHICAL DISTRIBUTION OF THE DEMAND FOR A COMMERCIAL PRODUCT

With a demand for a sorghum commercial product estimated at 30 000 tons the geographical distribution of the demand for sorghum flour is presented hereunder :

REGION	POPULATION	URBAN POPULATION EXPRESSED IN PERCENTAGE OF THE TOTAL	URBAN SORGHUM CONSUMPTION
1/ SOUTH REGION			
KANYE	35 000		
LOBATSE	17 000		
TOTAL SOUTH REGION	52 000	19 %	5 696
2/ GABORONE REGION			
GABORONE	51 500		
MOLEPOLOLE	31 000		
MOCHUDI	20 000		
TOTAL GABORONE REGION	102 500	37,40 %	11 226
3/ CENTRAL REGION			
SEROWE	35 000		
SELEBI-PIKWE	25 100		
MAHALAPYE	15 000		
PALAPYE	12 000		
TOTAL CENTRAL REGION	87 100	31,80 %	9 539
4/ FRANCISTOWN REGION			
FRANCISTOWN	32 300	11,80 %	3 539
T O T A L	273 900	100 %	30 000

3.2.5. DEMAND PROJECTION FOR THE NEXT 10 YEARS

Future demand for a commercially processed sorghum product is much dependent upon the demographic growth rate, its urbanization rate, the increase in the general standart of living and income per capita as well as distribution of wealth and reduction of social imbalances.

In our forecast method we started by examining the sales of imported maïze flour from 1975 to 1978 to determine the trend over the period. Calculations give an average rate of growth of 16 per cent over the period. (Taking the period from 1975 to 1979 the average growth rate is about 19 per cent per annum but this figure may well overestimate the actual rate of growth of the maïze sales as 1978 and 1979 were two years of very low domestic production). The major underlying factors for such rapid growth over this period were as follows:

a/ A gross domestic product increasing at a rate of 10 per cent per annum

b/ A 12 per cent per annum growth rate of urban population

c/ A 3 per cent demographic growth rate

d/ A stagnant domestic crop production.

In order to compile sales forecasts for the next ten years, one has first to appraise each factor separately, anticipate future growth in each parameter and from this derive a projected growth rate for the demand of a sorghum processed product and apply it to the estimate of present consumption of sorghum processed food.

- Given the relative importance of mining in the BOTSWANA economy, the G.D.P growth rate is dependent to a great extent on an unpredictable discovery rate of new deposits. Considering present agricultural and development policies which are more or less the continuation of past policies, it is assumed that average annual GDP growth will continue at the same rate, i.e. 10 % per annum in real terms.

- Deriving the growth rate in income per capita from the GDP growth may however lead to considerable overestimation of the average wealth of the BOTSWANA people since benefits from economic growth accrue to both labor and capital,to a large extent in the hands of foreigners. There is firstly a net outflow of interests and dividends to foreign capital and secondly a large proportion of new incomes is distributed to foreigners living in BOTSWANA. However a large inflow of income from BOTSWANA workers living outside the country courterbalances the part of national wealth accruing to non-Batswana. The distribution of income in urban areas is highly skewed as towns and large village in BOTSWANA attract many poor people from outlying villages who are mostly unemployed . According to recent estimates up to 60 to 70 percent of households in some major towns have income below an urban proverty levels. For the sake of this study it is presumed that the average income per capita is increasing at a rate of 5 per cent per annum in real terms.

- Urban population growth which has averaged almost 12 per cent a year during the period from 1971 to 1975 is not expected to continue to grow at the same rapid rate as the pattern of distribution between rural and urban population is most likely to stabilize in the future due to government policies aiming at reducing migrations and also to the inability of urban areas to generate employment opportunities in sufficient quantity. For the sake of this study, it is assumed that the rate of urban growth will only be half that of the past decade, i.e. 6 per cent per annum.

- It is assumed that the rural population will grow at a rate of 3 per cent per annum and that growth in real income per capita will also be 5 per cent.

- No studies have been made in BOTSWANA as to income elastricities of demand for food. International figures prepared by F.A.O. indicate that income elasticity of demand for cereal in Africa is 0.4 i.e. a 1% increase in income is associated with a 0.4 % increase in the demand for cereals.

Using the above assumption, we obtain the following growth rate for the demand of processed sorghum.

$$\left(\left[1 + \left(5/100 \times \frac{40}{100}\right)\right] \times 1.06\right) - 1 = 8.12\%$$

Assuming now a 9 per cent instead of 6 per cent growth rate of urban population, we arrive at the following figure :

$$\left(\left[1 + \left(5/100 \times \frac{40}{100}\right)\right] \times 1.09\right) - 1 = 11.18\ \%$$

A middle of the road figure of 10 per cent as the growth rate of the demand for commercial sorghum will be considered for estimating future demand.

As for the rural demand for service milling, the growth rate is as follows :

$$\left(\left[1 + \left(5/100 \times \frac{40}{100}\right)\right] \times 1.03\right) - 1 = 5.06\ \%$$

3.2.6. LOCALIZING THE DEMAND FOR A COMMERCIAL PRODUCT

Two approches were used to determine the geographical division of the demand. In the first approach, estimates from experienced professionals working in the cereal market sector were obtained to determine demand per geographical area sector.

Those interviewed were managers of the various SEFALANA Company wholesale outlets throughout BOTSWANA . They were questionned as to their cereal turnover, especially for Maïze products and were asked to give an estimate of their share in the market for each type of cereal.

In the second approach we assume that demand can be geographically divided according to the relative importance of the population of the ten major cities in BOTSWANA.

Results of the two approaches are shown on the table below.

	Relative importance of market share per geographical area for processed maïze (estimate given by experienced professionnals)	Relative importance of market segment per geographical area determined from urban demand estimates.
1/ SOUTH REGION	19.7 %	18.97 %
2/ GABORONE REGION	37.7 %	37.40 %
3/ CENTRAL REGION	30 %	31.78 %
4/ FRANCISTOWN & MAUN	11.8 %	11.78 %

3.2.7. DETERMINATION OF PLANT CAPACITY FOR COMMERCIAL MILLING

The present demand for commercial sorghum products in grain equivalent has been estimated at 30 000 tons per year increasing at a rate of 10 percent annually.

Taking into account the type of industrial milling equipment required (total life of 20 years), it is desirable to fix the plant capacity in accordance with the predictable demand for the next five years. Future growth in processed cereal demand will be related to subsequent plant expansions.

The demand in five years ahead can be estimated at 44 000 tons when applying a 10 % growth rate (see chapter 3.2.5.)

The milling capacities existing at present in BOTSWANA are as follows :

- PITSANE MILL	(8 tons/day/230)	1 840 tons
- GABANE MILL	(3,5 tons/day /250)	875 tons
- LOBATSE MILL	(24 tons/day/330)	7 920 tons
TOTAL EXISTING MILLING CAPACITIES		10 635 tons
or(total corresponding flour production)		8 508 tons

The table below gives the milling capacities and desirable locations for the creation of new such capacities.

	Geographical importance of Sorghum demand		Existing milling capacities	Milling capacity requirements
SOUTH REGION	20 %	8 800	9 760	-
GABORONE REGION (a)	37 %	16 280	875	14 445
MAHALAPYE	5 %	2 200	-	2 200
SEROWE + PALAPYE	17 %	7 480	-	7 480
SELEBI-PICKWE	10 %	4 400	-	4 400
TOTAL CENTRAL REGION	32 %	14 080	-	14 080
FRANCISTOWN REGION	11 %	4 840	-	4 840
TOTAL REGION		44 000	10 635	33 365

(a) Capacity in excess in South region is transferred to Gaborone region.

The present feasibility study will evaluate comparatively two production alternatives.

1/ two industrial mills working 306 days per year with a capacity fixed at 42 tons per day each

2/ eight Semi-industrial mills working 254 days per year with a capacity fixed at 11 tons per day each.

3.2.8. Retail price structure

Average prices for processed cereals available in GABORONE Supermarkets and retail outlets in BOTSWANA were as follows :

	Price range in thebe per kg
- Sorghum flour	30 - 31
- Maïze processed products	
. Coarse meal ("special")	27 - 28
. Fine meal ("super")	30 - 31
. Maïze stamps	29 - 31
- Wheat flour	
. Bread flour	40 - 43
. Cake flour	47 - 49

- Sorghum flour was sold in supermarket and most retail shop at an average price of 30 thebe per Kg which is 20 % higher than the price for coarse maïze meal

- The margin to the retailer is fixed by governmental decree at 10 % of the selling price to consumers

- The price differential prevailing between coarse flour and fine flour for Maïze processed product is about 10 % . We make the assumption that consumers will accept for sorghum price differential of 10 % between coarse and fine flour.

- As we estimated that , at equivalent price with Maïze, sorghum consumption could represent as much as fifty per cent of basic cereal food consumption in BOTSWANA we based our sale revenues on the following selling prices to retail outlets.

. coarse sorghum flour and semolina	270	pulas per ton
. fine sorghum flour	300	pulas per ton
. bran and folle flour	70	pulas per ton

3.2.9. PRODUCTION PROGRAMME AND SALES REVENUES

The present demand for sorghum processed food is estimated at 24 000 tons. The present milling industry supplying only 8 500 tons per year, the part of the demand which remains unsatisfied amounts at 15 500 tons per year.

In view of this, a sales target of 50 per cent of the overall milling capacity for the first year of operation will be considered as reasonable.

During the first five years of operations sales will gradually grow so that full production would be achieved in the fifth year of operations for the Industrial Mill and in the third year for the Semi-Industrial Mill. According to consumer preference surveys coarse flour appear to be the most preferred form of processed cereals. It is recommended that this type of product accounts for most of processed sorghum production.

Homogeneous fine flour as well as sorghum semolina will however be produced to test the consumer acceptability for these products and eventually turn up future production programmes to consumer preference. The table presented hereunder gives the production programmes for the Industrial and Semi-Industrial Mills.

Year		1	2	3	4	5
Unsatisfied demand		15 500	17 300	19 235	21 315	23 551
Industrial Mill	Capacity utilization	50 %	70 %	80 %	90 %	100 %
	Production	10 924	15 294	17 473	19 663	21 848
Semi-Industrial Mill	Capacity utilization	50 %	75 %	100 %	100 %	100 %
	Production	9 164	13 746	18 320	18 320	18 320

It is recommended that the total demand for processed sorghum be not entirely satisfied so that service milling could have the possibility to enter into commercial operations.

3.3. THE DEMAND FOR MILLING SERVICE

3.3.1. POTENTIAL DEMAND

As a major part of crop production in BOTSWANA is for the direct consumption of farmers, the demand for a service milling is expected to correspond, more or less, to the domestic production of sorghum. Over the last ten years, the average sorghum production amounted to 37 320 tons per year.

Over the last ten years, the average sorghum production amounted to 37 320 tons per year which is above the average of 28 828 tons calculated over a five year period. We have nevertheless considered in this study the 10 year average which would reflect more accurately the future agricultural development resulting from governmental incentives offered to remedy the present defavourable situation.

3.3.2. GEOGRAPHICAL DISTRIBUTION OF THE DEMAND

Geographical distribution of demand is obtained by identifying the principal regions of agricultural production.

Statistical data on sorghum crop production is available for the years 1974 , 1975 and 1976.

1976, which was a year of good rainfall is used as reference year to show geographical distribution of sorghum production in BOTSWANA. A potential annual demand fixed at 40 000 tons is given per geographical areas on the following table.

	Production in 1976	Geographical distribution in percentage	Geographical distribution of a production based on 40 000 tons
1. BAROLONG DISTRICT	578	1.04	416
2. NGWAKETSE S.DISTRICT	1 921	3.46	1 384
3. NGWAKETSE N.DISTRICT	4 694	8.45	3 380
SOUTH REGION	7 193	12.95	5 180
1. BAMALETE DISTRICT	639	1.15	460
2. KWENENG S. DISTRICT	7 613	13.71	5 484
3. KWENENG N. DISTRICT	3 548	6.39	2 556
4. KGATLENG	5 079	9.14	3 656
GABORONE REGION	16 879	30.39	12 156
1. MAHALAPYE	2 235	4.02	1 608
2. PALAPYE	1 979	3.56	1 424
3. SEROWE	3 333	6.00	2 400
4. MMADINARE	4 855	8.74	3 496
CENTRAL REGION	12 402	22.32	8 928
1. TATI	8 561	15.42	6 168
2. TUTUME	8 009	14.42	5 768
FRANCISTOWN REGION	16 570	29.84	11 936
1. NGAMILAND W	882	1.59	636
2. NGAMILAND E	1 169	2.10	840
3. CHOHE	445	0.80	320
MAUN REGION	2 496	4.49	1 796
TOTAL	55 540	100.00	

3.3.3. SERVICE MILLING CAPACITY REQUIREMENTS

To determine precisely the production capacities needed for service milling the following factors have to be appraised and their impact on demand measured :

- the time required for farmers to accept village level milling technology
- the concentration of population in rural areas and main villages
- the rural income distribution
- price and income elasticities of demand for service milling
- transportation facilities available to the farmers
- road and track communication networks

Information readily available on these subjects is not sufficient to enable us to determine without any risk of error the production capacities needed for service milling. Nevertheless, we recommend as a first step, to set up total milling capacities for 10 000 tons of sorghum per annum as further expansion of village level milling capacities can be speedly introduced and implemented.

The following production programme is applicable for the Service Mill

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
30 %	50 %	65 %	80 %	90 %	100%

Schedule 5.1 : Estimate of sales revenues

Products/By-products		Year 1 & Year 2		Year 3		Year 4		Year 5		Year 6		Year 7		Year 8		Year 9		Year 10		Year 11		Year ...	
DESCRIPTION	UNIT PRICE	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes
Sorghum flour	270			5 462	1360358	7 646	3012524	8 739	3311465	9 832	4099596	10 924	4746024	10 924	6324996	10 924	6936740	10 924	7635876	10 924	8400556	10 924	9240612
Sorghum Bran	70			771	71703	1 079	110058	1 234	139442	1 388	172112	1 542	209712	1 542	231300	1 542	254430	1 542	279102	1 542	306858	1 542	339044
Sales revenues					2032561		3122582		3940907		4871308		5955736		6556296		7191170		7914978		8707414		9600279

Inflation Rate : 10 percent per year

INDUSTRIAL MILL

Schedule 3.2. : Estimate of production cost : sales and distribution costs

ESTIMATE OF PRODUCTION COST

Sales and distribution costs

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1	1 638 600		Containers and packaging			0.10	163 860		163 860
2	36 720	liter	Petrol for transport vehicule			0.55	20 196		20 196
			TOTAL				184 056		184 056

INDUSTRIAL MILL

Schedule 3.3. : Production programme

Products, By-products, Wastes	Unit at 100 % capacity	Year 1		Year 2		Year 3		Year 4		Year 5		Year N	
		Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units
		50 %		70 %		80 %		90 %		100 %			
Sorghum Flour	10 924	50 %	5 462	70 %	7 647	80 %	8 739	90 %	9 832	100 %	190 924		
Sorghum Bran	1 542	50 %	771	70 %	1 079	80 %	1 234	90 %	1 388	100 %	1 542		

SEMI-INDUSTRIAL MILL

Schedule 3.1. : Estimate of sales revenues

Products/By-products		Year 1		Year 2 1982		Year 3 1983		Year 4 1984		Year 5 1985		Year 6 1986		Year 7 1987		Year 8 1988		Year 9 1989		Year 10 1990		Year 11 1991	
DESCRIPTION	UNIT PRICE	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes
SORGHUM FLOUR	270			1 145	374 415	1 718	616 762	2 291	902 654	2 291	996 585	2 291	1095 098	2 291	1205 066	2 291	1326 489	2 291	1454 785	2 291	1601 409	2 291	1761 7
SORGHUM BRAN	70			209	17 765	314	29 202	419	42 738	419	47 347	419	51 956	419	56 984	419	62 850	419	69 135	419	75 d39	419	d3 3
TOTAL				392 180		645 964		945 392		1 043 932		1 147 054		1 262 050		1 389 339		1 523 920		1 677 248		1 845 160	

Inflation rate : 10 per cent per year

Schedule 3.2. : Estimate of production cost : sales and distribution costs

ESTIMATE OF PRODUCTION COST

Distribution cost

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1	345 000		Packaging			0.10	34 500		34 500
2	10 160	Liter	Petrol for transport vehicule			0.55	5 588		5 588
			TOTAL				40 088		40 088

SEMI INDUSTRIAL MILL

Schedule 3.3.

Products, By-products, Wastes	Unit at 100 % capacity	Year 1		Year 2	
		Capacity (%)	Units	Capacity (%)	Units
Sorghum flour	2 291			50 %	1 145
Sorghum bran	419			50 %	209

: Production programme

Year 3		Year 4		Year 5		Year N	
Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units
75 %	1 718					100 %	2 291
75 %	314					100 %	419

SERVICE MILL

Schedule 3 - 1: Estimate of sales revenues

Products/By-products		Year 1 1981		Year 2 1982		Year 3 1983		Year 4 1984		Year 5 1985		Year 6 1986		Year 7 1987		Year 8 1988		Year 9 1989		Year 10 1990		Year ... 1991	
DESCRIPTION	UNIT PRICE	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes	Quantities to be sold	Sales revenues including sales taxes
Sorghum flour	30			283	8 298	381	15 202	495	21 694	609	29 444	686	36 416	762	44 577	762	48 920	762	53 721	762	59 207	762	65 141

Inflation rate: 10 percent per year

SERVICE MILL

Schedule 3.3.

Products, By-products, Wastes	Unit at 100 % capacity	Year 1		Year 2	
		Capacity (%)	Units	Capacity (%)	Units
GRAIN	762	30	228.60	50	381

: Production programme

Year 3		Year 4		Year 5		Year N	
Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units	Capacity (%)	Units
65	495.30	80	609.6	90	685.8	100	762

CHAPTER 3

MATERIALS AND INPUTS

4. MATERIAL AND INPUTS

4.1. ANALYSIS OF THE GENERAL CONDITIONS IN THE AGRICULTURAL SECTOR

In order to estimate future agriculture development in BOTSWANA, the action taken by the Government has to be appraised simultaneously with the factors detrimental to agricultural production, namely :

4.1.1. Physical factors

Climatic conditions characterized by uncertain rainfall and severe drought is the major natural factor affecting crop production. Official records show that rainfall is not adequate in one out of every four years.

Soil depletion in BOTSWANA results from constant cultivation and inadequate growing control.

4.1.2. Sociological factors

With increasing migration towards large cities, the farming community tends to diminish in relative importance, thus further growth in agriculture output is hampered. The male population of villages finds better incentives in the mining sector and leaves the rural areas which are now mostly cultivated by women.

Inequality in income distribution also has a detrimental effect on agricultural output.

The major underlying factor in the pattern of income distribution in rural areas is the skewed ownership of cattle . The concentration of ownership (i.e. fewer and larger herds) has reduced the availability of draught animals to smaller farmers. Only 50 percent of the rural population possess draught power. This scarcity in draught animals leads most often to delay or missing timely ploughing by poorest farmers.

Most smallholders lack the necessary means to purchase implements,good quality seeds, fertilizers or to hire labor and draught power. Smallholders in certain areas do not find sufficient land to cultivate.

4.1.3. Agricultural practices

A part from a commercial sector in the form of freehold farming in the South East part of the country, Agriculture in BOTSWANA is mainly pursued for subsistence. More than half of the total arable farmers produce less than 10 bags of major cereal crops and they account for less than 16 % of total production.

An even more discouraging fact is that BOTSWANA farmers tend to neglect crop production during the years following an extremely good harvest.

4.1.4. Economic factors

Free importing of raw grain from South Africa at low prices has lowered the general level of prices in BOTSWANA, thus reducing incentives for farmers to increase their crop production for commercial purposes.

All these factors have led to stagnant agricultural output over the last ten years, and, more important with regard to the purpose of this study, in profound modification in the crop distribution pattern adopted by farmers.Sorghum production which greatly predominated in the 1960's is now loosing ground in favor of Maïze production.

In their publication "Agricultural change in BOTSWANA", Mr B.A. PURCELL & J.P.G. WEBSTER note also that arable farming in BOTSWANA has seen significant changes in the past few years. A considerable reduction in the dependence on sorghum is noted. Sorghum crops now only occupy 20 % of cultivated land as against 70 % a few years ago. Maïze crops on the other hand now occupy 40 % of cultivated land as against 20 % in years past. The following findings are given in their publication.

Percentage of total land cultivated with maïze + sorghum

	71	72	73	74	75	76
SORGHUM	67.0	55.3	46.5	48.6	21.7	21.5
MAIZE	19.1	20.9	22.0	26.0	47.1	40.5

Such pessimistic figures should however be compared with the results of the 1978 and 1979 crop surveys made by the agricultural statistic units.

The 1978 farm management survey shows that sorghum occupied 42.6 % of the total planted area as against 26.7 % for maïze during that particular year.

The 1979 livestock and crop survey indicates that 37.9 % of the total cultivated area was planted with sorghum as opposed 29.1 % with maïze.

The principal underlying factors in the downward trend in sorghum production are as follows:

- firstly, income incentives from crop cultivation are declining. Livestock raising gives a higher return to labor than crop farming. In 1975/1976 the return to labor was twice as high for livestock raising as for crop farming

- secondly, among the other crops offered, cultivation of sorghum is the less lucrative. Gross margins per hectare for various crops were calculated for the period extending from 1973 to 1976. Messrs B.A. PURCELL and J.P.G. WEBSTER arrived at the following returns per cultivated hectare.

Mean Gross Margins per Hectare
for Various Crops (P/ha)

	73	74	75	76	4 year mean
SORGHUM	11	25	7	18	15.3
MAIZE	11	27	24	19	20.3
BEANS	19	21	17	14	17.8
GROUNDNUTS	15	193	12	27	61.3
SUNFLOWER	9	6	20	34	17.8

When the gross margins are recalculated in terms of return per man day sorghum has a distinct disadvantage over maize. Sorghum necessitates labor to scare birds away which accounts for its lower margin. The results obtained in the survey are shown below.

Mean Gross Margins per Manday for
Various Crops (P/Manday)

	72/3	73/4	74/5	75/6	4 Year Mean
SORGHUM	0.7	1.1	2.6	1.2	0.9
MAIZE	1.1	1.6	2.9	2.2	2.0
BEANS	0.9	0.7	0.7	0.7	0.8
GROUNDNUTS	0.8	8.4	0.9	2.8	3.2
SUNFLOWER	0.4	0.5	1.5	6.5	2.2

4.2. SORGHUM PRODUCTION

An extract from table I gives the following production figures for major cereal crops over a five year period from 1975 to 1979.

SORGHUM production	28 828	tons
MAIZE production	29 317	tons
MILLET production	1 680	tons
Average crop production	60 425	tons

Sorghum represented only 47 per cent of crop production for the period from 1975 to 1979.

Major cereal production averages calculated over various periods are shown on table 3.

	Sorghum	Maïze	TOTAL
Period 1970 - 1979	37 320	23 692	61 012
Period 1960 - 1969	30 028	6 495	36 523
Period 1950 - 1959	51 710	6 259	61 411

The averages calculated over the periods illustrate the declining trend in sorghum production. In 1976 maïze output reached a similar production level to that of sorghum whereas during the period from 1960 to 1969 maïze represented only one fifth of sorghum production. During the period 1970 to 1975 an average of 54 000 tons of grain was produced in BOTSWANA of which 85 % was sorghum.

The BAMB policy of fixing higher prices for crop production in BOTSWANA than those in South Africa has enable them to acquire the entire crop production in excess of farmers' own requirements. The analysis of marketable surplus delivered over the last three years to the BAMB then shows the downward trend for sorghum production.

DOMESTIC CROP PURCHASES BY BAMB (Tonnes)

	1976	1977	1978	1979	1980
MAIZE	540	2 379	8 311	6 899	663
SORGHUM	150	138	5	438	186
PULSES	-	618	1 378	2 720	80
GROUNDNUTS	-	22	481	714	39
SUNFLOWER	-	406	2 000	2 671	639
WHEAT	-	-	44	204	-
	690	3 463	12 519	13 646	1 607

Considering the low level of marketable surplus made available in BOTSWANA by subsistence farmers one may reason that only service mill for the exclusive use of farmers is a viable venture. It is very doubtful that commercial milling working exclusively with locally available grain would be operated profitably on the long run.

4.3. LOCATION OF GRAIN DEPOTS IN BOTSWANA

In order to implement its pricing policies, BAMB has built up grain storage facilities throughout BOTSWANA. The table below shows the different locations and corresponding capacities of the BAMB depots.

	CAPACITY (tonnes)	
SOUTHERN REGION		
- Pitsane	29 000	
- Kanye	1 000	
- Moshupa	1 000	
- Mmathethe (co-operative agent)	500	
- Kanye (co-operative agent)	500	
.....		32 000
GABORONE REGION		
- Gaborone	2 000	
- Gaborone (trader agent)	500	
- Mokolodi (trader agent)	500	
- Kumakwane (trader agent)	500	
- Molepolole (co-operative agent)	500	
- Lentsweletan (co-operative agent)	500	
- Mochudi (co-operative agent)	500	
.....		5 000
CENTRAL REGION		
- Mahalapye	2 000	
- Palapye	2 000	
- Selebi-Pikwe	1 000	
- Letlhakane	1 000	
- Serowe	1 000	
- Tsetsejwe	1 000	
.....		8 000
FRANCISTOWN REGION		
- Francistown	2 000	
- Tutume	1 000	
- Nata	1 000	
- Marapong (co-operative agent)	500	
- Tonota (co-operative agent)	500	
.....		5 000
NGAMILAND REGION		
- Maun	2 000	
- Kasane	1 000	
.....		3 000
GHANZI/KGAPAGADI REGION		
- Ghanzi	1 000	
- Tshane	1 000	
- Hukuntsi	1 000	
.....		3 000
TOTAL BAMB STORAGE CAPACITY		56 000

4. 4. GEOGRAPHICAL DISTRIBUTION OF PRODUCTION

An extract from table 4 shows expressed (in percentages) the relative contribution of each region in the total sorghum production.

	1974	1975	1976	1979	Average
South region	25.3	21.0	13.0	20.5	19.95
Gaborone region	45.8	35.5	30.4	16.3	32.00
Central region	18.0	18.6	22.3	26.7	21.40
Francistown region	9.1	23.4	29.8	32.5	23.70
Maun region	1.8	1.5	4.5	4.0	2.95
TOTAL	100.0	100.0	100.0	100.0	100.00

The Gaborone and South regions account for more than fifty per cent of total sorghum production. The Central and Francistown regions produce equivalent quantities of Sorghum grain.

4. 5. TYPES AND VARIETIES OF SORGHUM IN BOTSWANA

The characteristics of the different varieties of sorghum seeds which are distributed by the Agricultural Research Station are given on table 5 of the present study. Sorghum varieties can be broken down into two categories : The open-pollinated variety and the hybrid variety which has only recently been introduced into BOTSWANA. The open-pollinated variety is lighter in color and is preferred by farmers, this due to the quality of food obtained from this variety although the hybrid variety gives a higher yield.

4.6.PRODUCER PRICES FOR SORGHUM

With the BAMB pricing policies of setting producer prices at higher level than those fixed by the South African Marketing Board, prices in BOTSWANA have more than doubled over the last five years as evidenced by the table below.

	77	78	79	80	81 (price in Pulas/ton)
MAIZE	55	73.60	76.50	105.70	130
SORGHUM	65.55	81.00	84.00	118.6	135

Cereal prices in South Africa, are fixed by the South African Maize Board. Table below gives South African prices in Pula per ton

	SAMB purchase price to farmers	SAMB release price	S.A grains delivered in GABORONE by railways.
MAIZE	120	124	144
SORGHUM	92	129	149

Railways fare is 3.8 thebe/ton/km. With an average distance of 500 km from the source of supply in South Africa rail transportation will increase by approximately 20 pulas the price of one ton of grain .

4.7. OTHER INPUTS

Electricity for Industrial mills - Semi-industrial mills and Service mills are supply by the diesel generators. The diesel for the engine will be delivered to the storage tank of the mill by tank-lorries every 10 days.

As for water, the Industrial and Semi-industrial mills are constructed in the Industrial areas of the cities mentionned on Chapter 5.12 and 5.13. which are connected to public services.

For Service mill, diesel is bought in the nearest gas stations. Electricity is supplied also by diesel generator. No water is necessary for the running of the Industrial, Semi-industrial and Service mill.

INDUSTRIAL MILL

Schedule 4-1 : Estimate of production cost : materials and inputs

ESTIMATE OF PRODUCTION COST

Materials and inputs

Project component No _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1			Raw material						
	12 852		Grain			149	1 914 948		1 914 948
2.			Utilities						
	146 880		Fuel			.53	77 846		77 846
3.			Spare parts			4 000	4 000		4 000
			TOTAL				1 996 794		1 996 794

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INDUSTRIAL MILL

Schedule 4.2. :

SUMMARY SHEET - PRODUCTION COST

Materials and inputs

PROJECT COMPONENT	
NO.	DESCRIPTION
1.	Raw material
2.	Utilities - Fuel
3.	Spare parts
	TOTAL

mary sheet - production cost : materials and inputs

	PRODUCTION COST CARRIED OVER		
	REIGN	LOCAL	TOTAL
1	4 948		1 914 948
	7 846		77 846
	4 000		4 000
	1 996 794		1 996 794

SEMI INDUSTRIAL MILL

Schedule 4-1 : Estimate of production cost : materials and inputs

ESTIMATE OF PRODUCTION COST

Materials and inputs

Project componen. No ____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1.	2 794	tonne	Raw material grain			149	416 306		416 306
2.	40 640	liter	Utilities fuel			0.53	21 539		21 539
3.			Spare parts				1 000		1 000
TOTAL							438 845		438 845

SEMI INDUSTRIAL MILL

Schedule 4.2. : Summary sheet - production cost : materials and inputs

SUMMARY SHEET - PRODUCTION COST

Materials and inputs

PROJECT COMPONENT		PRODUCTION COST CARRIED OVER		
NO.	DESCRIPTION	FOREIGN	LOCAL	TOTAL
1	Raw grain	416 306		416 306
2	Diesel fuel	21 539		21 539
3	Factory supply	1 000		1 000
	TOTAL	438 845		438 845

SERVICE MILL

Schedule 4-1 : Estimate of production cost : materials and inputs

ESTIMATE OF PRODUCTION COST

Materials and inputs

Project component No ____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1	10 160		Utilities fuel			.53	5 385		5 385
2			Spare parts			1000	1 000		1 000
TOTAL							1 000	6 385	6 385

SERVICE MILL

Schedule 4.2. :

SUMMARY SHEET - PRODUCTION COST

Materials and inputs

PROJECT COMPONENT	
NO.	DESCRIPTION
1	Utilities fuel
2	Spare parts
	TOTAL

Summary sheet - production cost : materials and inputs

PRODUCTION COST CARRIED OVER		
FOREIGN	LOCAL	TOTAL
5 385		5 385
1 000		1 000
6 385		6 385

CHAPTER 3

LOCATION AND SITE

5. LOCATIONS AND SITES

5.1. COMMERCIAL MILLING

5.1.1. Selection of location

Four decisions criteria were taken into account for the selection of the most appropriate locations for the construction of the commercial mills.

- the immediate proximity to the road and railways communication networks
- Nearness to sources of raw material
- Concentration of population in the immediate vicinity
- Governmental policies which tend to favor decentralized development schemes rather than centralized ones

5.1.2. Industrial mill (42 tons capacity)

The two following locations have been selected for the setting up of the two industrial mills.

- GABORONE Region : Gaborone
- CENTRAL Region : Mahalapye

5.1.3. Semi-Industrial mill

The sites selected for the Semi-Industrial Mills are the following :

- GABORONE Region : - Gaborone (Two mills)
  - Mochudi
- CENTRAL Region : - Mahalapye
  - Palapye
  - Selebi pickwe
  - Serowe
- FRANCISTOWN Region : - Francistown

5.1.4. The cities of GABORONE and MAHALAPYE have industrial areas which offer the necessary space and facilities needed for the setting up of the commercial mills.

Except for fencing, no special land preparation, such as vegetation removal works, land levelling or the installation of drainage system is necessary.

Land in the industrial areas of these cities is made available through state lease agreements which are valid for a period of fifty years. Site preparation costs including drainage works, water and electricity supplies are incorporated in the price.

Renting prices for industrial land are as follows :

GABORONE	:	4,5 pulas per square meter per annum
FRANCISTOWN	:	2,5 / 3 pulas per square meter per annum
SELEBI-PIKWE	:	2,5 pulas per square meter per annum.

For the towns of PALAPYE and MAHALAPYE, the system of Tribal land prevails. Tribal land in BOTSWANA is controled by Land Boards which follow a standard allocation procedure.

5.2. SERVICE MILLING

Two criteria have been used in the selection of the villages for setting service mills.

- the proximity of sorghum production areas
- the village population concentration. Each mill location has been selected so as to serve a population of 20 000 habitants living within a radius of 50 km from the mill.

The following villages have been selected :

GABORONE Region	:	Molepolole
		Mochudi
CENTRAL Region	:	Serowe
		Maope
		Bobowong
		Mahalapye
		Palapye
FRANCISTOWN Region	:	Tsamaya
		Tutume
MAUN Region	:	Maun

INDUSTRIAL MILL

Schedule 5.2. : Estimate of production cost : Land

ESTIMATE OF PRODUCTION COST									
Land									
NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
	3 150	m^2	Land Lease			0.3		95	95
TOTAL								95	95

SEMI INDUSTRIAL MILL

Schedule 5.2. : Estimate of production cost : Land

ESTIMATE OF PRODUCTION COST									
Land									
NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
			ANNUAL PAYMENTS FOR :						
1	1 000	Square meter	- Land lease	X		0.03		30	30
TOTAL								30	30

CHAPTER 5

PROJECT ENGINEERING

6. PROJECT ENGINEERING

6.1. INDUSTRIAL MILL

The industrial mill has been dimensioned for a milling capacity of 1,5 to 2 tons per hour, i.e. 36 to 48 tons per day or an average of 42 tons. The industrial mill is working twenty four hours per day on three eight hour shifts, this for 306 days a year.

6.1.1. Raw material storage

Storage facilities will be provided for by four (4) moisture proof metallic silos, each cell having a total capacity of 250 tons representing a 20 days security stock of raw material. Each silo will lie on metallic support frames 3,5 meters above ground level. The silos have the following dimensions :

- diameter : 6 meters
- height : 11 meters

Silo feeding will be made from a bucket elevator conveying raw grains up to a four direction revolving distributor directly connected to silo feeding hoppers.

A helicoïdal screw system collecting grains from the adjustable flow outlets located at the bottom part of each cell will allow for the mixing of several sorghum varieties to be poured into the first bucket elevator.

Grains will be supplied every two weeks by trains in bulk of 500 tons.

6.1.2. Grain cleaning

The first bucket elevator conveys raw grain to the cleaner separator. The cleaner is made of three superposed screens with one incorporated suction fan having double air intake opened at grain entrance and at grain outlets . The following foreign matters or cereal fragments will thus be separated :

a/ large sized foreign particules such as particles, stones, insects, bag pieces

b/ other cereals like pulses (peas - beans - maïze)

c/ sand, straw, broken kernels

d/ dust, empty kernels, straw pieces

(a), (b) and (c) products will be separately conveyed to a bag filling machine

(d) products are channelled through a metallic cyclone and bagged with a separate bagging machine. The cyclone chimney communicate with outdoors.

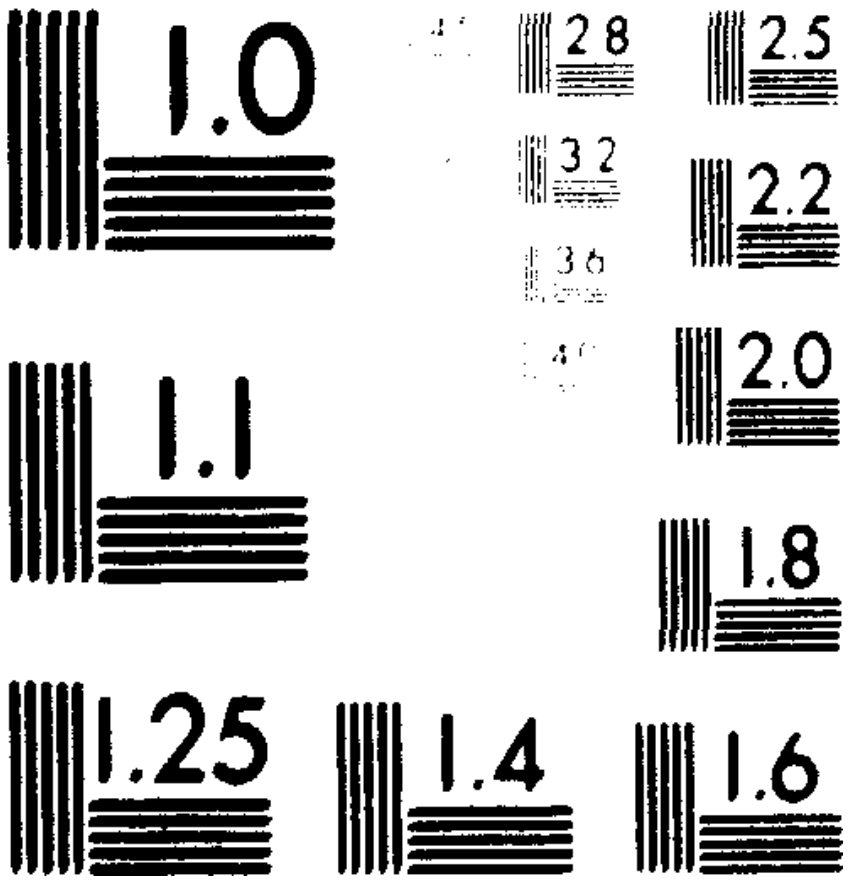
(b), (c) and (d) products will be mixed with bran from dehullers.

A magnetic apparatus will be set up at the discharge outlet of the cleaner so as to extract metallic particules or objects. Sorghum grain will be weighed with an automatic scale having a weigh meter incorporated to allow a regular and continuous feeding flow into the two dehullers.

6.1.3. Grain dehulling

A bucket elevator conveys raw grains to grain feeders placed above the dehullers.

The grain enters the dehullers through feeding hoppers.



The recommended dehuller type is powered by vertical shaft. Dehulling is adjustable during motion. Such dehuller are similar to the whitening cone used for husked rice pearling. A iron cone with abrasive surface is supported by a rotating vertical shaft. This rotor is mounted in a multi screen casing with rubber brakes framed segments. Regulation handwheels fixed on the outer surface of casing permit to adjust the clearance between the abrasive cone and the screen casing and thus augment or diminish the dehulling power. Such adjustment is made in function of the different varieties of sorghum so as to remove entirely the germ as well as the outer layer such as pericarp and mesocarp constituting the bran. Extraction rate will be 85 per cent.

The sorghum grain is moving down in a circular movement between the iron cone and the screens through the combined effects of gravity and rotation forces. The bran goes through the screens and is directed by suction fan into metallic cyclones where it is separated from the air. A scraper system for bran is incorporated in each dehuller. Bran is conveyed to the feeding bushels or to vertical screw type mixing machines for direct bagging.

In order to facilitate the working of the hammermill , a winnower with 4 to 6 screens fixed in series and a suction fan, will separate dehulled grains from broken grains, empty husks and other foreign particles.

6.1.4. Grain milling

A bucket elevator will feed a classic type hammermill. The hammermill comprised a rotor constituted of oscillating hammers especially designed for sorghum and strator constituted by round holes perforated screens forming a 180° to 270° angle varying with existing types of manufacturer brands. Screens with different hole diameters are utilized to obtain different meal texture corresponding to the desired particule size.

An incorporated suction fan located at one extremity of the hammermill shaft conveys pneumatically the flour to another cyclone which separates large sized particules from small particules. At the lower part of the cyclone a three direction discharge outlet distributes the milled product either to direct bulk bagging, to flour storage silos, or to rotary sieve classifiers for flour sieving.

The upper outlet of the hammermill cyclone is connected with a suction filter comprising a set of filtration sleeves. Such device allows for the recuperation of the finest milling products.

The third cyclone outlet is connected to a bucket elevator feeding the storage silos for flours.

6.1.5. Flour sieving

The rotary sieve classifier more commonly called planchister is made up of 5 superposed sieves with metallic or synthetic fiber fittings. This apparatus rotates in a circular movement through the action of a counter balanced wheel. This apparatus hangs with suspension rods from a metallic frame.

6.1.6. Finished product storage

The storage unit for finished product include 4 metallic silos incorporated in the building structure frame. Each storage cell has a total capacity of 80 tons representing a total storage capacities of 320 tons or, at a 85 per cent extraction rate, a 8 to 10 day security stock.

The lower part of each cell is equiped with a rotary extractor with adjustable outflow so as to permit either the mixing of several varieties stored in the four cells or direct bagging with two automatic weighing bagging machines.

A surface covered with concrete outside the main building will be used for bag storage before onloading on trucks.

Another bucket elevator will serve to transfer flours between the different cells so as to avoid flour souring or hardening.

Two weighing bagging machines will be used in bagging operations. The first machine will serve for the filling of 10 to 60 kilogramm bags whereas the second machine will be used in the filling and sealing of plastic bags with a 2,5 to 10 Kg content capacity.

6.1.7. Energy

Energy will be supplied by a watercooled 100 horse-power diesel generator.The fuel tank will have a 5 cubic meter capacity.

6.1.8. Spare parts

Spare parts necessary for a smooth running of the mill will consist of metal screens for hammermill, filtering sleeves, sieves, hammers, iron cones, rubber brakes, electrical parts.

6.1.9. Transportation vehicules

Two 10 t trucks will be used for both raw material supply from the railway station and also for delivery of the flour to retail outlets.

6.1.10. Civil engineering

- Buildings' description

The Industrial Mill will include the following structures

a/ Main Building

- Dimensions : length : 25 meters
  width : 12 meters
  Total ground surface of 300 square meters

- Ground floor for industrial use and office area

- First floor for industrial use (300 square meters)

- Second floor with a useful surface of 180 square meters

- Roofing covering 300 square meters

A part of the main building surface will be reserved to the four flour silos utilizing the full height of the building.

b/ A auxiliary building for the production of energy covering a ground surface of 25 square meters

c/ A set of four grain silos with a capacity of 250 T each. These silos are located 10 meters from the limits of the main building

d/ A 350 square meters surface covered with concrete for storage of flour bags.

- Civil engineering technology

The ossature of the main building will be made up of a metallic frame supporting concrete floors. Walls will be erected with bricks or parpens.

- Civil works

. Earthworks : Landscraping on building occupation area. Compacted embankment for service roads.

. Reinforced concrete :

Reinforced concrete works will be used for all foundations, girders, basement for the principal metallic frame structure, floor pavement, basement for machinery and equipment.

. Masonry works : external and internal walls

. Metal structure works : Metallic ossature for the principal structure - Metal boarding in the upper part of the building for wind protection

. Roofing : Galvanized iron sheet

. Metallic frame for windows and doors

SOFRECO

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INDUSTRIAL MILL

OPERATIONS AND MACHINERY

GENERAL LAY-OUT

PRODUCTION LINE DIAGRAM

COST SCHEDULES

SOFRECO

OPERATIONS AND MACHINERY IN THE INDUSTRIAL MILL

OPERATIONS	MACHINES	COUNTRY OF ORIGIN (a)	Prouucts and by-products
1. GRAIN STORAGE	1 bucket conveyor 4 grain silos diameter : 6 m height : 1,5 m	S.A. S.A.	
2. GRAIN CLEANING	1 bucket elevator 1 feeder 1 cleaner separator 1 cyclone 1 magnetic belt 1 weighter	S.A. S.A. S.A. S.A. S.A. E	1/ Cleaned grain 2/ Half grain Dead grain Straw - sand Metallic particles
3. DEHULLING	1 bucket elevator 2 feeder 2 dehullers 2 cyclones 1 mixer 1 winnower + 1 cyclone	S.A. S.A. E S.A. S.A. S.A.	1/ Dehulled grain 2/ Bran 3/ Broken and dead grains
4. GRINDING	1 bucket elevator 1 feeder 1 hammermill + cyclone 1 sieve filter	S.A. S.A. S.A. S.A.	1/ Heterogenous flour
5. SIEVING	1 plansichter	E	1/ Homogeneous flours of different grading
5. FLOUR STORAGE	1 feeding bucket elevator 4 flour silos 4 flour extractors 2 weighing / bagging machines 1 bucket elevator	S.A. S.A. S.A. E S.A.	Homogeneous and mixed flours

(a)
E : Europe

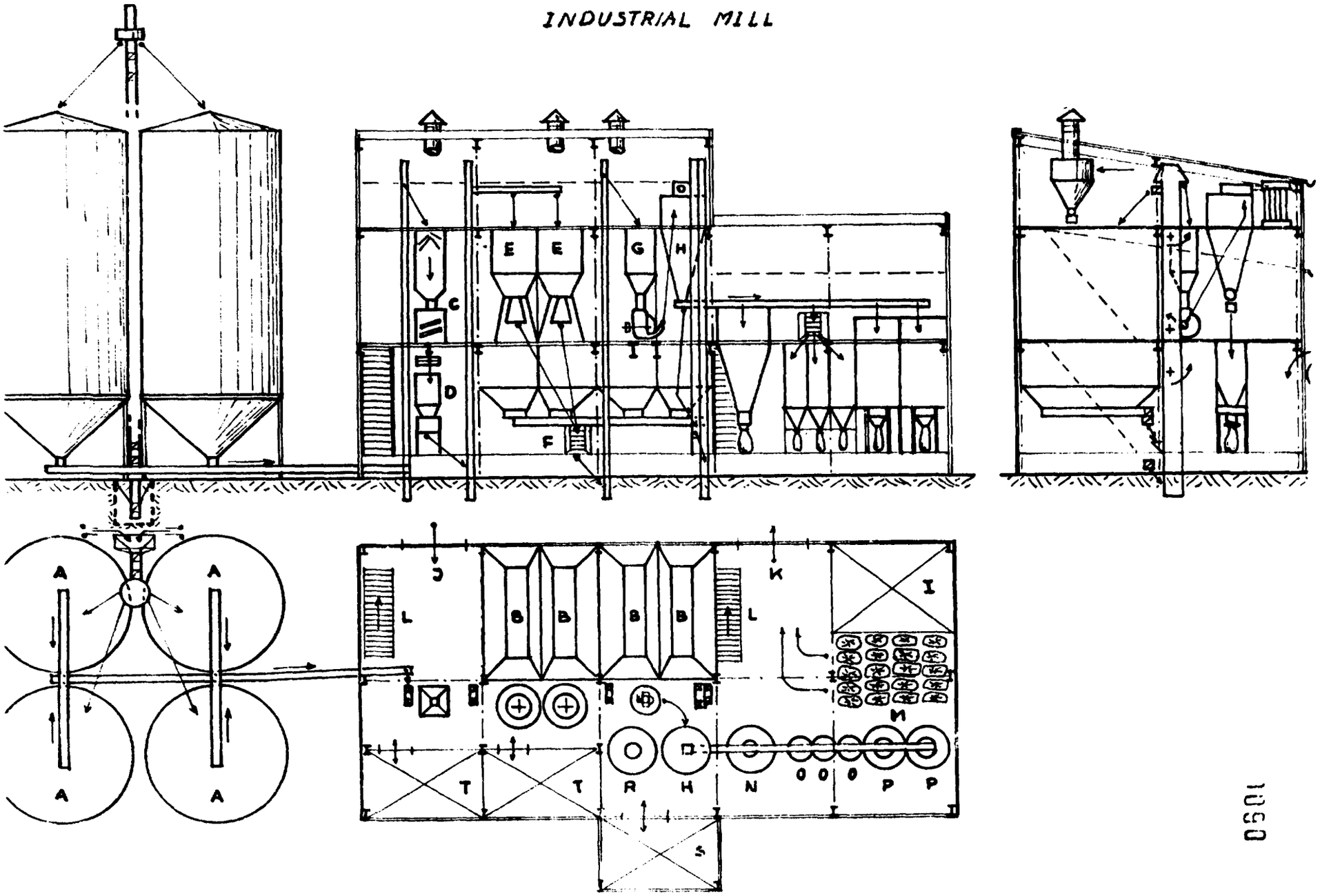
S.A. : South Africa or Europe

INDUSTRIAL MILL

Legend for lay-out shown on next page

A. Four (4) silos for raw grains
B. Four (4) storage chambers for flours
C. Cleaner separator
D. Automatic scale
E. Dehüllers
F. Winnover
G. Hammermill
H. Hammermill cyclone
I. Spare parts room
J. Main entrance
K. Exit door for finished products
L. Staircase
M. Storage area for finished products
N. Weighing bagging machine for raw flour
O. Three (3) bag-filling machine for sifted flours
P. Two (2) automatic weighing bagging machine for plastic bags
R. Bran bag filling machine
S. Diesel engine room
T. Management office.

INDUSTRIAL MILL



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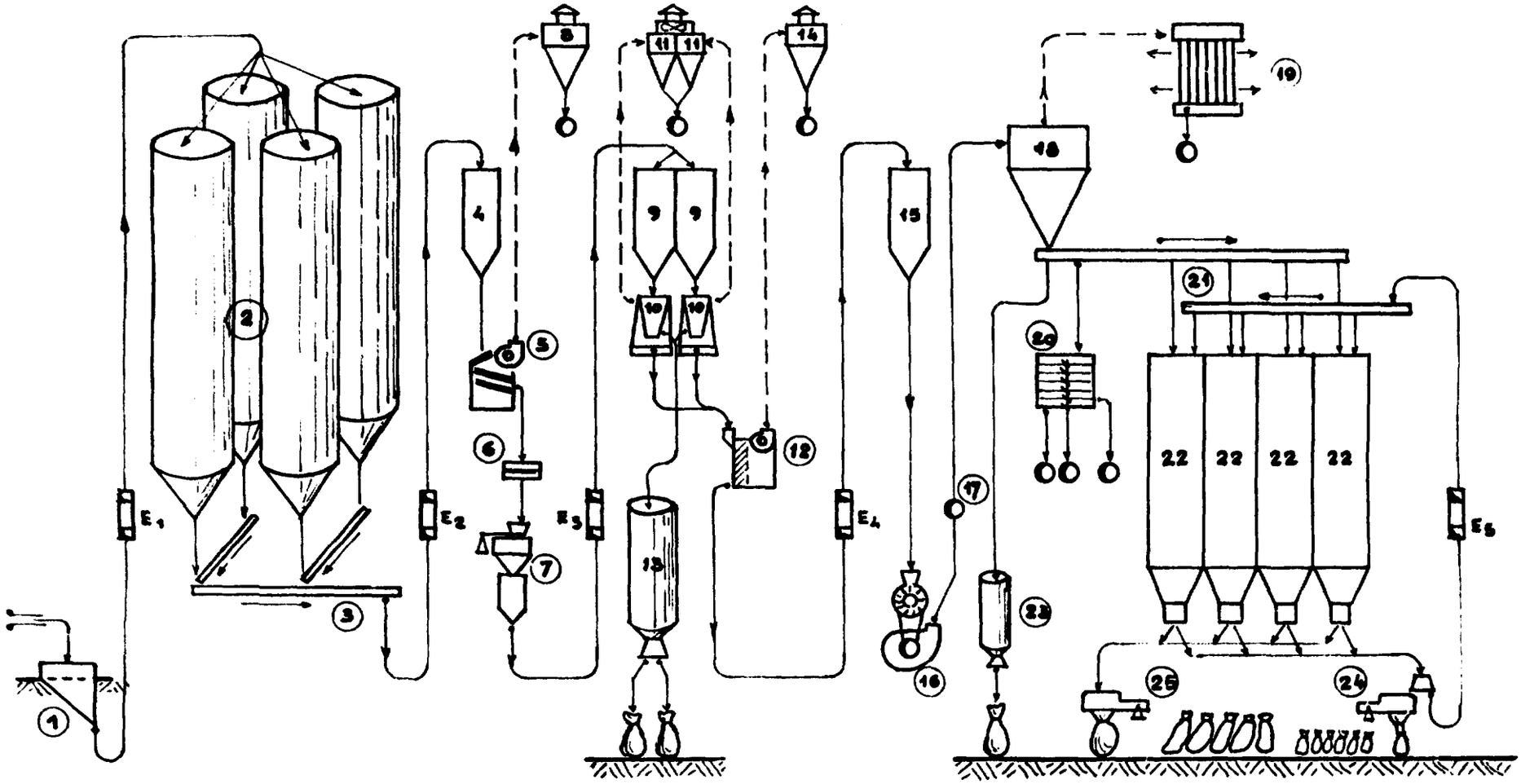
SOFRECO

INDUSTRIAL MILL

Legend for diagram shown on next page

1. Discharge pit
2. Raw grain silos
3. Helicoïdal screw system
4. Cleaner separator grain feeder
5. Cleaner separator
6. Magnetic apparatus
7. Automatic scale
8. Cleaner separator cyclone
9. Dehuller grain feeder
10. Abrasive cone dehuller
11. Dehuller cyclones
12. Winnower
13. Feeding bushel for direct bran bagging
14. Winnover cyclone
15. Hammermill grain feeder
16. Hammermill
17. Aspirator for pneumatic transportation
18. Hammermill cyclone
19. Filtering sleeves
20. Rotary sieve classifier
21. Helicoïdal screw system for flour silo feeding
22. Flour storage cells
23. Feeding bushel for raw flour bagging
24. Automatic weighing bagging machine for plastic bags
25. Automatic weighing bagging machine for coton bags.

INDUSTRIAL MILL



INDUSTRIAL MILL

Schedule 6.2. : Estimate of investment cost : equipment

ESTIMATE OF INVESTMENT COST

Equipment

Project component No. _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1			Production equipment						
	4		Metallic silos			8 250	33 000		33 000
	1		Cleaner - separator			3 500	3 500		3 500
	1		Magnetic apparatus			600	600		600
	1		Automatic weigher			3 000	3 000		3 000
	2		Cone dehuller			15 000	30 000		30 000
	1		Winnower			1 000	1 000		1 000
	1		Hammermill			16 000	16 000		16 000
	1		Planchister			3 000	3 000		3 000
	4		Flour extractor			2 500	10 000		10 000
	1		Weighing/bagging machines			30 000	30 000		30 000
	1		Heat Sealer			12 000	12 000		12 000
2			Auxiliary Equipment						
	1		Diesel engine			14 000	14 000		14 000
	1		Cyclone for cleaner			800	800		800
	1		Cyclone for winnower			800	800		800
	2		Cyclone for dehuller			900	1 800		1 800
	1		Sieve filter			900	900		900
	6		Bucket elevator			6 000	36 000		36 000
	4		Bushels - Grain feeders			250	1 000		1 000
	1		Mixer			5 000	5 000		5 000
			Handling equipment piping			9 000	9 000		9 000
3			Transportation assembly & erection				40 000	14 000	54 000
4			Spare parts				2 900		2 900
5	2		Trucks				40 000		40 000
				TOTAL			294 300	14 000	308 300

INDUSTRIAL MILL

Schedule 6.3. : Summary sheet - investment cost : equipment

SUMMARY SHEET - INVESTMENT COST

Equipment

PROJECT COMPONENT		INVESTMENT COST CARRIED OVER		
NO.	**DESCRIPTION**	**FOREIGN**	**LOCAL**	**TOTAL**
1.	Production equipment	142 100		142 100
2.	Auxiliary equipment	69 300		69 300
3.	Assembly & erection	40 000	14 000	54 000
4.	Spare parts	2 900		2 900
5.	Transportation vehicule	40 000		40 000
	TOTAL	294 300	14 000	308 300

INDUSTRIAL MILL

Schedule 6.4. : Estimate of investment cost : civil engineering works

ESTIMATE OF INVESTMENT COST

Civil engineering works

Project component NO. _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1.	3 150	m^2	Site preparation and development			10		31 500	31 500
2.			Buildings and special civil works						
	300	sq/m	Foundation			140	37 800	4 200	42 000
	300	sq/m	First floor			200	54 000	6 000	60 000
	200	sq/m	Second floor			200	36 000	4 000	40 000
	300	sq/m	Roofing			100	27 000	3 000	30 000
	60	sq/m	Civil works for indoor silos			200	10 800	1 200	12 000
	144	sq/m	Civil works for outdoor silos			100	12 960	1 440	14 400
			TOTAL				178 560	51 340	229 900

INDUSTRIAL MILL

Schedule 6.5. : Summary sheet - investment cost : civil engineering works

SUMMARY SHEET - INVESTMENT COST				
Civil engineering works				
PROJECT COMPONENT		INVESTMENT COST CARRIED OVER		
NO.	DESCRIPTION	FOREIGN	LOCAL	TOTAL
1.	Site preparation		31 500	31 500
2.	Building	178 560	19 840	198 400
TOTAL		178 560	51 340	229 900

INDUSTRIAL MILL

Schedule 6.6. : Estimate of production cost : civil engineering works

ESTIMATE OF PRODUCTION COST

Civil engineering works

Projet component No. _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1.			MAINTENANCE AND REPAIR OF WORKS OF : Site preparation and development					315	315
2.			Buildings and special civil works					3 970	3 970
			TOTAL					4 285	4 285

6.2. SEMI-INDUSTRIAL MILL

The semi-industrial mill has a 10 to 12 tons milling capacity.
The semi-industrial mill is working on a two 8 hours shift basis during 254 days per year.

6.2.1. Raw material storage

The semi-industrial mill has no separate storage facilities as grain bags will be stored in the main building. The building has been designed with sufficient capacity to allow the storage of raw grains needed for a full month of operations.
Grains will be supplied every two weeks in bags per 145 tons delivery.

6.2.2. Grain cleaning

A bucket elevator will convey raw grains to the cleaner.
The cleaner will be more rudimentary than the one which equips the industrial mill. The foreign matters will be lifted by a fan into a cyclone. A magnetic belt will eliminate all metallic particules.

6.2.3. Grain dehulling

Grain handling to the dehuller will be made by a bucket elevator.
The semi industrial mill will be equiped with abrasive disks mounted on an horizontal shaft rotaring inside a barrel shaped metal casing. The grain is pushed forward inside the casing by the continuous rotating movements of the abrasive disks. The contact of the grains against the abrasive disks produces the bran. The dehulling capacity of the machine ranges from 600 to 800 Kg per hour with an average of 700 kg. The extraction rate is expected to be 82 per cent

Bran is then aspirated by a fan and directed to a cyclone incorporating two discharge outlets, one for direct bagging, the second for automatic weighing / bagging.

6.2.4. Grain milling

A bucket elevator will be used to convey the dehulled grains to the hammermill. The grinding technology chosen for the semi-industrial mill is similar to that for the industrial mill.The grinding capacity of the hammermill will match the capacity of the dehuller. The flour is extracted from the hammermill by a fan and directed to a cyclone with two discharge outlets, one for feeding a weighing bagging machine, the other being connected to a flour sifter.

6.2.5. Flour sieving

A rotary vibratory sifter will be used for flour sieving. This apparatus will allow to produce flour of different grades.

6.2.6. Flour storage

The upper outlet of the hammermill cyclone is also connected to a suction filter with filtration sleeves. A bucket elevator will permit to feed a 5 ton capacity storage cell.

6.2.7. Energy

Energy will be supplied by a 50 horse-power watercooled diesel engine. Fuel consumption will be 10 liters per hour. The fuel tank has a 3 cubic/meter capacity

6.2.8. Spare parts

Spare parts for the semi-industrial mill will include electrical motors, pulleys, nuts, bolts, hammermill screens.

6.2.9. Transportation vehicule

The semi-industrial mill will need one 10 ton truck for transportation of raw material and finished products to retail outlets.

6.2.10. Civil engineering

The Semi-Industrial project incorporated a one floor building presenting the following dimensions.

Length	25 meters
Width	8 meters
Height	7 meters

Walls will be erected with bricks and the roof will be supported by a metallic frame structure.

An auxiliary building will protect the diesel engine. Its dimensions are the following :

Length	8 meters
Width	5 meters
Height	5 meters

SOFRECO

SEMI-INDUSTRIAL MILL

OPERATIONS AND MACHINERY

GENERAL LAY-OUT

PRODUCTION LINE DIAGRAM

COST SCHEDULES

OPERATIONS AND MACHINERY IN THE SEMI-INDUSTRIAL MILL

OPERATIONS	MACHINES	COUNTRY OF ORIGIN (a)	Products and by-products
1. GRAIN RECEPTION	1 scale for raw grain	S.A	
2. GRAIN CLEANING	1 bucket elevator 1 feeder 1 cleaner separator 1 cyclone 1 magnetic belt	S.A B S.A B S.A	1/ Cleaned grain 2/ Half grain Dead grain Straw-Sand Metallic particles
3. DEHULLING	1 bucket elevator 1 feeder 1 dehuller 1 cyclone	S.A B B B	1/ Dehulled grain 2/ Bran
4. GUINDING	1 bucket elevator 1 feeder 1 hammermill + cyclone	S.A B S.A	Heterogeneous flour
5. SIEVING	1 plansichter 1 sieve-filter 2 scales (100 kg weight	S.A S.A E	1/ Homogeneous flours of different grading
6. FLOUR STORAGE	1 feeding bucket elevator 1 flour silos 1 weighing/bagging machine	S.A S.A E	Homogeneous and mixed flours

(a) : COUNTRY OF ORIGIN

S.A. : South Africa or Europe

B : Botswana

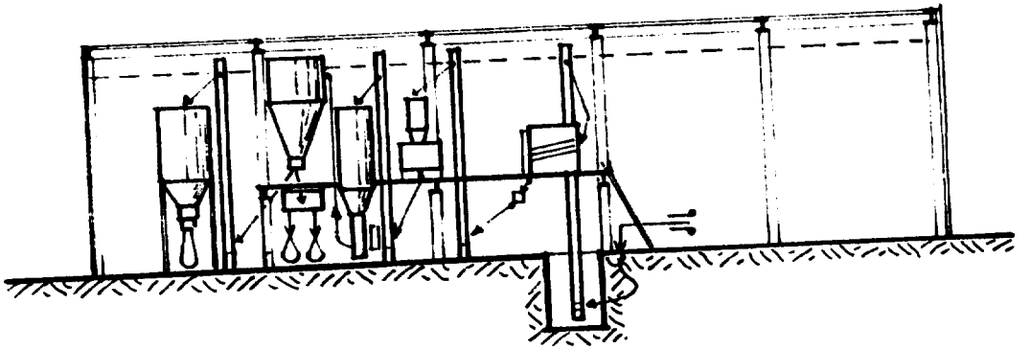
E : Europe

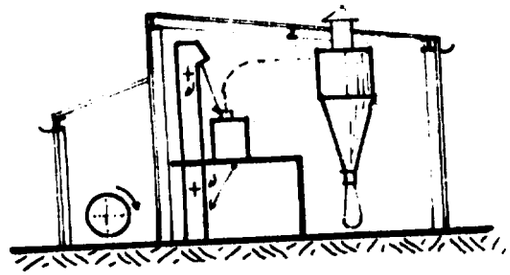
SEMI-INDUSTRIAL MILL

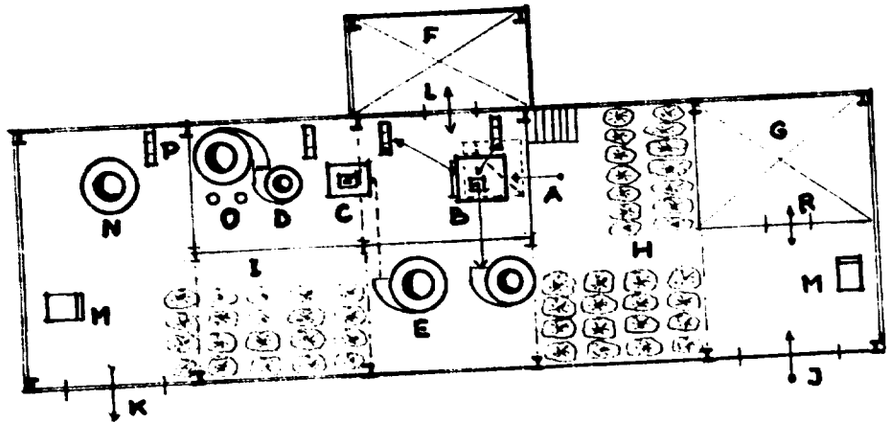
Legend for lay-out shown on next page

A. Discharge pit for raw grains
B. Cleaner separator
C. Dehuller
D. Hammermill
E. Dehuller cyclone
F. Auxiliary building for diesel engine
G. Management and accounting office
H. Storage area for raw grains
I. Storage area for finished products
J. Entrance door for raw grain
K. Exist door for finished products
L. Entrance door of auxiliary building
M. 2 Weighing scales
N. Weighing - bagging machines
O. Weighing bagging machines for light flour
P. Bucket elevator
R. Office door

SEMI-INDUSTRIAL MILL







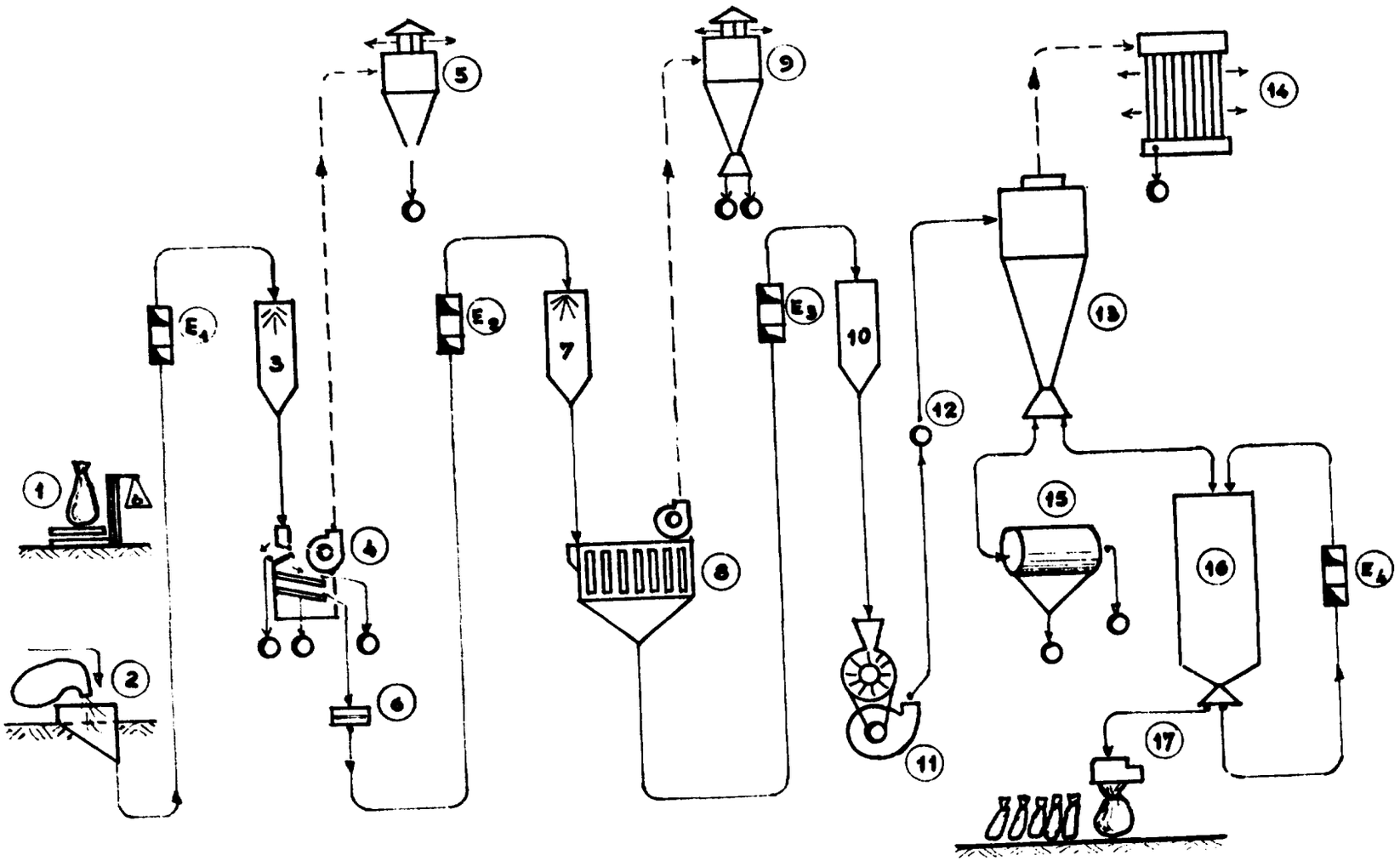
SEMI-INDUSTRIAL MILL

Legend for production line diagram shown on next page

1. Raw grain scale
2. Discharge pit for raw grains
3. Cleaner separator grain feeder
4. Cleaner separator
5. Cleaner separator cyclone
6. Magnetic belt
7. Dehuller feeding tank
8. Abrasive disk dehuller
9. Dehuller cyclone
10. Hammermill grain feeder
11. Hammermill
12. Suction fan for pneumatic transport
13. Hammermill cyclone
14. Filtering sleeves
15. Rotary vibratory sifter
16. Flour tank for direct bagging
17. Automatic weighing bagging machine

E1 - E2 - E3 - E4 - Bucket elevators

SEMI - INDUSTRIAL MILL



SEMI INDUSTRIAL MILL

Schedule 6.2. : Estimate of investment cost : equipment

ESTIMATE OF INVESTMENT COST

Equipment

Project component No. _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1.			PRODUCTION EQUIPMENT						
	1		- Scale			2 000	2 000		2 000
	1		- Cleaner separator			3 000	3 000		3 000
	1		- Dehuller			2 200		2 200	2 200
	1		- Hammermill			5 000	5 000		5 000
	1		- Auto heigher			12 000	12 000		12 000
	1		- Planchister			800	800		800
2.			AUXILIARY EQUIPMENT						
	1		- Cleaner cyclone			600		600	600
	1		- Dehuller cyclone			600		600	600
	1		- Filtering sleeves			700	700		700
	2		- Scales			400	800		800
	1		- Diesel engine			5 000	5 000		5 000
	4		- Bucket elevator			4 000	16 000		16 000
	3		- Bushel			250		750	750
			- Handling equipment			1 250		1 250	1 250
3.			TRANSPORT, ASSEMBLY, ERECTION			14 500	10 000	4 500	14 500
4.			SPARE PARTS			2 000	2 000		2 000
5.			TRANSPORTATION VEHICULE			15 000	15 000		15 000
					TOTAL		72 300	9 900	82 200

SEMI INDUSTRIAL MILL

Schedule 6.3. : Summary sheet - **investment cost : equipment**

SUMMARY SHEET - INVESTMENT COST

Equipment

PROJECT COMPONENT		INVESTMENT COST CARRIED OVER		
NO.	**DESCRIPTION**	**FOREIGN**	**LOCAL**	**TOTAL**
1	Production equipment	22 800	2 200	25 000
2	Auxiliary equipment	22 500	3 200	25 700
3	Assembly & erection	10 000	4 500	14 500
4	Spare parts	2 000		2 000
5	Transportation vehicule	15 000		15 000
	TOTAL	72 300	9 900	82 200

Schedule 6.4. : Estimate of investment cost : civil engineering works

ESTIMATE OF INVESTMENT COST

Civil engineering works

Project component NO. _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1	1 000	M^2	Site preparation and development			5		5 000	5 000
2	200	M^2	Buildings and special civil works			150	24 000	6 000	30 000
TOTAL							24 000.	11 000	35 000

SEMI INDUSTRIAL MILL

Schedule 6.6. : *Estimate of production cost : civil engineering works*

ESTIMATE OF PRODUCTION COST									
Civil engineering works									
Projet component No. _____ Description _____									
NO.	**QUANTITY**	**UNIT**	**ITEM DESCRIPTION**	**LOCAL**	**FOREIGN**	**UNIT COST**	**COST**		
							Foreign	**Local**	**TOTAL**
			Maintenance and repair of works of:						
1			- Site preparation and development			1 %		50	50
2			- Buildings and special civil works			2 %		600	600
TOTAL								650	650

6.3. THE SERVICE MILL

Both the industrial and semi-industrial mills are working on a continuous flow milling system. The service mill is designed so as to process separately in a discontinuous flow the small batches of grains brought by individual to the Service mill.

6.3.1. Raw material storage

As the Service mill is processing only numerous small quantities of grain, no storage facilities for raw grain are needed. The building will nevertheless present sufficient space for 3 days grain storage in case commercial operations would be envisaged.

6.3.2. Grain dehulling

The dehuller is similar to that used in the semi-industrial mill. It is made up of a series of abrasive stone disks mounted on a horizontal shaft rotating inside a metal casing. Bran formed during abrasion is aspirated through an air outlet by a suction fan and directed to a cyclone.

The dehulling capacity of the abrasive disk dehuller ranges from 600 to 800 Kg per hour with an average of 700 Kg.

6.3.3. Grain milling

The hammermill is made up of a series of small hammers fixed on a horizontal shaft.
The flour will pass through a metal screen and will be pneumatically conveyed to a cyclone equiped with two discharge outlets. The first discharge outlet is utilized for direct bagging, the second discharge outlet is connected to filtering sleeves.

6.3.4. Flour storage

The building will provide sufficient space to allow for the storage of 3 day production in case of commercial operations.

6.3.5. Energy

Energy will be provided with a watercooled 35 horsepower diesel engine.

6.3.6. Spare part

Spare parts will include line shafts, belts, pulleys, nuts, holts, belt guards and hammermill screens.

6.3.7. Transportation

No transportation means will be required as farmers will bring themselves their grain to the service mill.

6.3.8. Civil works

The Service Mill will need a one floor building presenting the following dimensions :

Length	15 meters
Width	8 meters
Height	5 meters

Walls will be made up of bricks.

SERVICE MILL

OPERATIONS AND MACHINERY
PRODUCTION LINE DIAGRAM
COST SCHEDULES

OPERATIONS AND MACHINERY IN THE SERVICE MILL

OPERATIONS	MACHINES	COUNTRY OF ORIGIN	Products and by-products
1. GRAIN	1 scale for raw grain	S.A.	
2. DEHULLING	1 dehuller 1 cyclone	B B	1/ Dehulled grain 2/ Bran 3/ Broken and dead grains
3. GRINDING	1 hammermill 1 cyclone	S.A. B	Heterogeneous flour
4. FLOUR RECEPTION	1 scale 1 filtering sleeves	S.A. S.A.	
5. FLOUR STORAGE			

(a) : COUNTRY OF ORIGIN

S.A. : South Africa or Europe

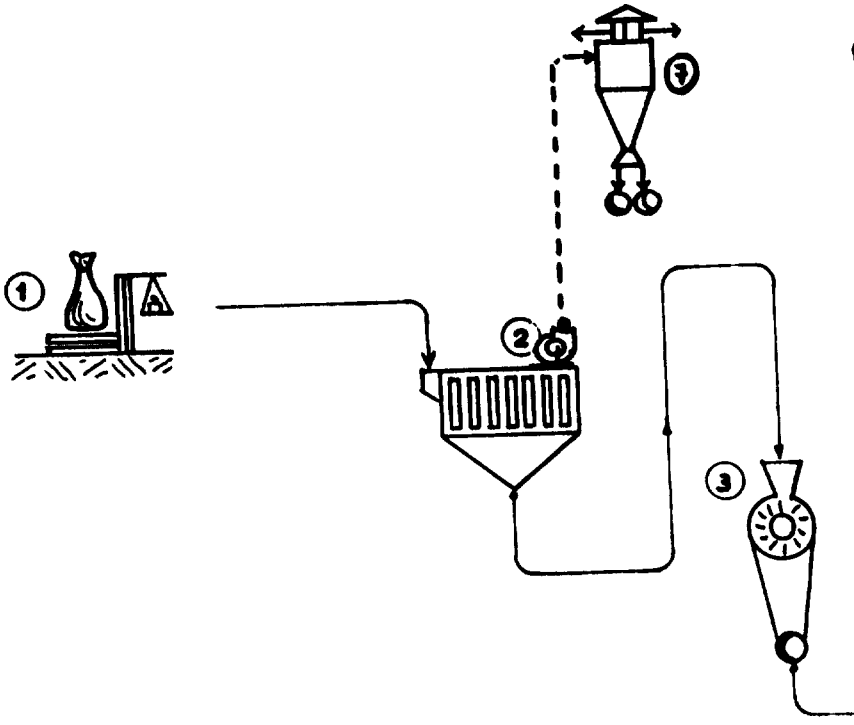
B : Botswana

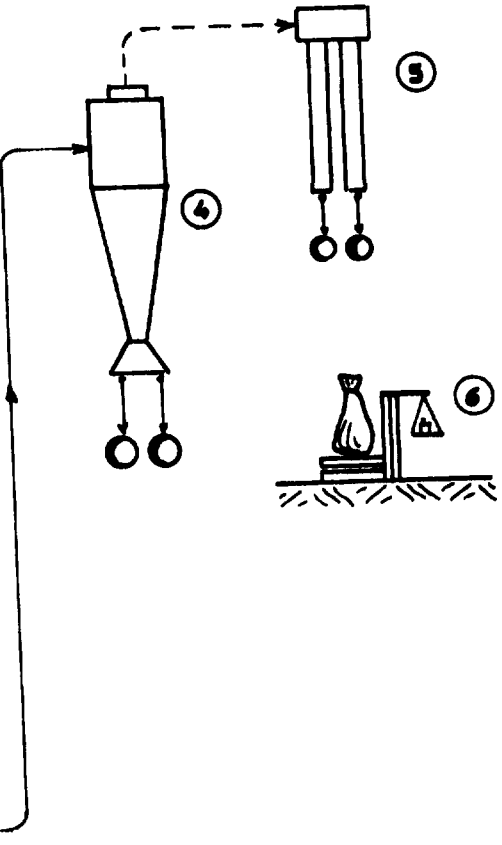
SERVICE MILL

Legend for production line diagram shown on next page

1. Scale for raw grains
2. Abrasive disk dehuller
3. Hammermill
4. Hammermill cyclone
5. Filtering sleeves
6. Scale for flour

SERVICE MILL

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SERVICE MILL

Schedule 6.2. : Estimate of investment cost : equipment

ESTIMATE OF INVESTMENT COST

Equipment

Project component No. _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1	1		Production equipment						
	1		Dehuller			2 000		2 000	2 000
	1		Hammermill			1 200	1 200		1 200
2			Auxiliary equipment						
	1		Hammermill cyclone			600		600	600
	1		Dehuller cyclone			600		600	600
	2		Scales			400	800		800
	1		Diesel engine			4 000	4 000		4 000
	1		Intermediate drive package			400	400		400
3			Transportation and assembly				700	300	1 000
						TOTAL	7 100	3 500	10 600

SERVICE MILL

Schedule 6.3. : Summary sheet - investment cost : equipment

SUMMARY SHEET - INVESTMENT COST				
Equipment				
PROJECT COMPONENT		INVESTMENT COST CARRIED OVER		
NO.	**DESCRIPTION**	**FOREIGN**	**LOCAL**	**TOTAL**
1	_ Production equipment	1 200	2 000	3 200
2	Auxiliary equipment	5 200	1 200	6 400
3	Transportation & assembly	700	300	1 000
TOTAL		7 100	3 500	10 600

SERVICE MILL

Schedule 6.6. : Estimate of production cost : civil engineering works

ESTIMATE OF PRODUCTION COST									
Civil engineering works									
Projet component No. _____ Description _____									
NO.	**QUANTITY**	**UNIT**	**ITEM DESCRIPTION**	**LOCAL**	**FOREIGN**	**UNIT COST**	**COST**		
							Foreign	**Local**	**TOTAL**
1			Building and special civil works					150	150
TOTAL								150	150

SERVICE MILL

Schedule 6.4. : Estimate of investment cost : civil engineering works

ESTIMATE OF INVESTMENT COST

Civil engineering works

Project component NO. _____ Description _____

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1		300	Site preparation & development			1		300	300
2		120	Buildings and special civil works			80	2 000	7600	9 600
TOTAL							2 000	7 900	9 900

6.4. MILLING TECNOLOGY : OTHER ALTERNATIVES

6.4.1. Industrial mill

The Industrial mill considered in this study has been designed for the lowest milling capacity with the smallest industrial equipments available today. Large economies of scale can nevertheless be derived from larger units which integrate the processing of flour into finished products such as bakery products, pasta, etc.. A F.A.O.'s project concerning an Industrial mill of this type has been carried out at ZINDER in NIGER. At the start, the mill capacity was entirely devoted to the processing of local millet and sorghum. However, two major factors, i.e. the shortage of cereals on the local market and the free import of maïze from U.S.A., conducted the Niger Governmental Authorities to utilize the Industrial mill for the production of maïze flour. The quality of processed maïze prove satisfactory as the consumption by local population rose immediatly. The products obtained were coarse and fine semolina, fine flours for bakeries and biscuit factories, baby food and feedstock. Such integrated unit necessitates heavier investment which have not been investigated in this study as government policies in BOTSWANA aim at Developing small units for rural industrialization.

6.4.2. Semi-industrial and Service mill

The milling technology developed by the Canadian based International Development Research Center concerns mostly the dehuller made of abrasive disks rotating in a metal casing. This technology has been tested in BOTSWANA, proved satisfactory and was further developed at the Rural Industries Innovation Center at KANYE.

.../...

Such milling technology, presents the advantage, over other systems, of having been experimented in BOTSWANA since 1978. This constitutes the main reason which supports our recommendation for this system.

However, other technologies exist such as the microcyclomat grinder which has been developed in FRANCE for WEST AFRICAN countries. Thus, the ULTRAFINE COMPANY has designed a grinder for the specific use of sorghum and millet.

6.4.3. Storage facilities

The BOTSWANA climate is particularly dry and flour conservation can be easily handled. Thus, sorghum flour is stored in metal silos for a fifteen day period without any risk of fermentation as in WESTERN AFRICA.

Indeeds, for WEST AFRICAN Countries, it is recommended to use grinders in which hot air is insufflated. This dry and warm atmosphere (70° Celsius degree) allows for the neutralization of the germ diastases and thus permit to avoid the biochemical deterioration of the flour stored.

CHAPTER 7

PLANT ORGANIZATION AND OVERHEAD COSTS

7. PLANT ORGANIZATION AND OVERHEAD COSTS

7.1. INDUSTRIAL MILL

7.1.1. Plant organization

The production process consists of various successive operations. The plant organization reflects the various production operations.

- The cleaning section where raw grain is cleaned from foreign matters such as stones and impurities which may damage machinery and equipment

- The decorticating unit where bran is extracted from raw grain through the dehullers

- The grinding unit where dehulled grain are processed into flour

- The sifting unit where homogeneous flours are obtained from the flour coming out from the hammermill

- The storing and bagging unit where flour bags are filled, weighed and sealed.

7.1.2. Overhead costs

a/ Factory overheads

The maintenance unit is responsible for the maintenance and reparation of the plant. Maintenance cost are estimated at one per cent of the original value of site works and at two per cent of the value of the civil engineering works.

b/ Administrative overheads

- The insurance premium for the plant is estimated at 0.15 % of the value of the initial fixed investment costs.

- Land changes correspond to the lease fee specified in chapter 3.

c/ Depreciation

- Industrial building - Depreciation rate calculated on a straight line basis over ten years. 15 % being an investment allowance in the year of first use and 100 % being an annual allowance granted at a rate of 10 % a year for ten years (according to BOTSWANA Income Tax Act).

- Plant and machinery - Depreciation rate calculated on a straight line basis over ten years and 100 % being an annual allowance granted at a rate of 10 % a year for ten years.

7.2. SEMI-INDUSTRIAL MILL

7.2.1. Plant organization

Cost centers for the Semi-industrial Mill are similar to those involved in the Industrial Mill.

7.2.2. Overhead costs

a/ Factory overheads

Maintenance costs are calculated as a percentage of the value of site works and civil engineering works.

b/ Administrative overheads

- The insurance premium represents approximately 15 percent of the total value of the investment outlay

- Land charge corresponds to rates specified in chapter 3

c/ Depreciation

- Industrial buildings are depreciated over a period of ten years

- Plant machinery and equipment are depreciated over a period of five years only, due to their expected life time.

- Special amortization allowances granted by the Income Tax Act are applied.

7.3. SERVICE MILL

7.3.1. Plant organization

The Service Mill being the simplest type of milling operation production is not divided into various cost centers.

7.3.2. Overhead costs

a/ Mill overheads

Maintenance costs are estimated at 1,5 percent of the value of the building

b/ Administrative overheads

The rate for insurance premium is similar to that which applies to the Industrial and Semi-Industrial Mills.

There is no land charge as tribal land is concerned

c/ Depreciation

- The building is depreciated over a period of 10 years
- Machinery and equipment are depreciated over a five year period.

INDUSTRIAL MILL

Schedule 7 : Overhead costs (alternative 1)

	SERVICE COST CENTRES												ADMINISTRATION AND FINANCE COST CENTRES					
Cost items	Social service	Plant management	Off-site transport	Purchasing	Stores	Repair and maintenance	Power, heat, light	Steam	Water supply	Laboratories	Effluent disposal	Subtotal 1-11	General administration	Personnel	Training	Accounting and bookkeeping	Sub-total 13-16	TOTAL 1 - 16
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A. Maintenance (from sched.6.7.)						4285						4285						4 285
B. Insurance													800				800	800
C. Communication				x														
D. Travel				x														
E. Rents																		
F. Recurring land charges (from schedule 5.2)													95				95	95
G. Royalties (from schedule 6.1)																		
H. Property taxes																		
I. Effluents											x							
J. Licenses, fees																		
K. Subtotal						4285						4285	895				895	5 180
L. Depreciation																22990	22 990	22 990
Building																29090	29 090	29 090
Machinery																8000	8 000	8 000
Vehicule																		
M. Subtotal																60 080	60 080	60 080
N. Total						4285						4285	895			60 080	60 975	65 260

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SEMI INDUSTRIAL MILL

Schedule 7 : Overhead costs (alternative 1)

	SERVICE COST CENTRES												ADMINISTRATION AND FINANCE COST CENTRES					
Cost items	Social service	Plant management	Off-site transport	Purchasing	Stores	Repair and maintenance	Power, heat, light	Steam	Water supply	Laboratories	Effluent disposal	Subtotal 1-11	General administration	Personnel	Training	Accounting and bookkeeping	Sub-total 13-16	TOTAL 1 - 16
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A. Maintenance (from sched.6.7.)						650						650						650
B. Insurance													200				200	200
C. Communication																		
D. Travel																		
E. Rents																		
F. Recurring land charges (from schedule 5.2)													30				30	30
G. Royalties (from schedule 6.1)																		
H. Property taxes																		
I. Effluents																		
J. Licenses, fees																		
K. Subtotal						650						650	230				230	880
L. Depreciation																		
Building													3 500				3 500	3 500
Machinery													13 440				13 440	13 440
Vehicule													3 000				3 000	3 000
M. Subtotal													19 940				19 940	19 940
N. Total						650						650	20 170				20 170	20 820

SERVICE MILL

Schedule 7 : Overhead costs (alternative 1)

Cost items	SERVICE COST CENTRES												ADMINISTRATION AND FINANCE COST CENTRES					
	Social service	Plant management	Off-site transport	Purchasing	Stores	Repair and maintenance	Power, heat, light	Steam	Water supply	Laboratories	Effluent disposal	Subtotal 1-11	General administration	Personnel	Training	Accounting and bookkeeping	Sub-total 13-16	TOTAL 1 - 16
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A. Maintenance (from sched.6.7.)						150						150						150
B. Insurance													30				30	30
C. Communication																		
D. Travel																		
E. Rents																		
F. Recurring land charges (from schedule 5.2)																		
G. Royalties (from schedule 6.1)																		
H. Property taxes																		
I. Effluents																		
J. Licenses, fees																		
K. Subtotal						150						150	30				30	180
L. Depreciation																		
Building																990	990	990
Machinery																2320	2 320	2 320
Vehicule																		
M. Subtotal																3310	3 310	3 310
N. Total						150						150	30			3 310	3 340	3 490

CHAPTER 8

MANPOWER

8. MANPOWER

8.1. INDUSTRIAL MILL

8.1.1. Labor

a/ Skilled labor will operate mill machinery and equipment. This qualified labor will include the following personnel :

- One (1) silo operator to assure the grain reception from outside supplier, grain storage and grain supply to mill equipment.

- Two (2) mill equipment operators. One dehuller operator for controlling the throughput flow and retention time inside the dehuller for proper dehulling . One hammermill operator to assure the proper working of the machine and control the flour texture.

- One (1) flour silo operator.

This personnel will be supervised by a mill foreman who will also take in charge mill maintenance. Three teams comprising such personnel will be constituted for each 8 hour shift.

b/ Unskilled labor will execute the following tasks:

- bag filling
- bag weighing
- heat sealer operation
- sewing machine operation
- bag loading and off loading

Five employees are necessary to execute these tasks. Only one 8 hour shift is provided for these operations.
Two delivery truck drivers will be employed for the supply of raw grain and delivery of flour. They will work on a 8 hour basis daily.

8.1.2. Staff

The management team of the mill will include the following staff :

- 1 General Manager heading the company who will be directly responsible for mill operation profitability

- 1 Production Director responsible for mill operation

- 1 Purchasing and Sales Manager who will assure the regular supply of raw grains to the mill and market sorghum flour . He will maintain and develop business relations with wholesalers, retailers and supermarkets.

- 2 Qualified accountants responsible for bookeeping, billings to clients, wages and salaries payments, payments to suppliers, cash management and preparation of annual financial statements.

- 2 secretaries for typing and filing.

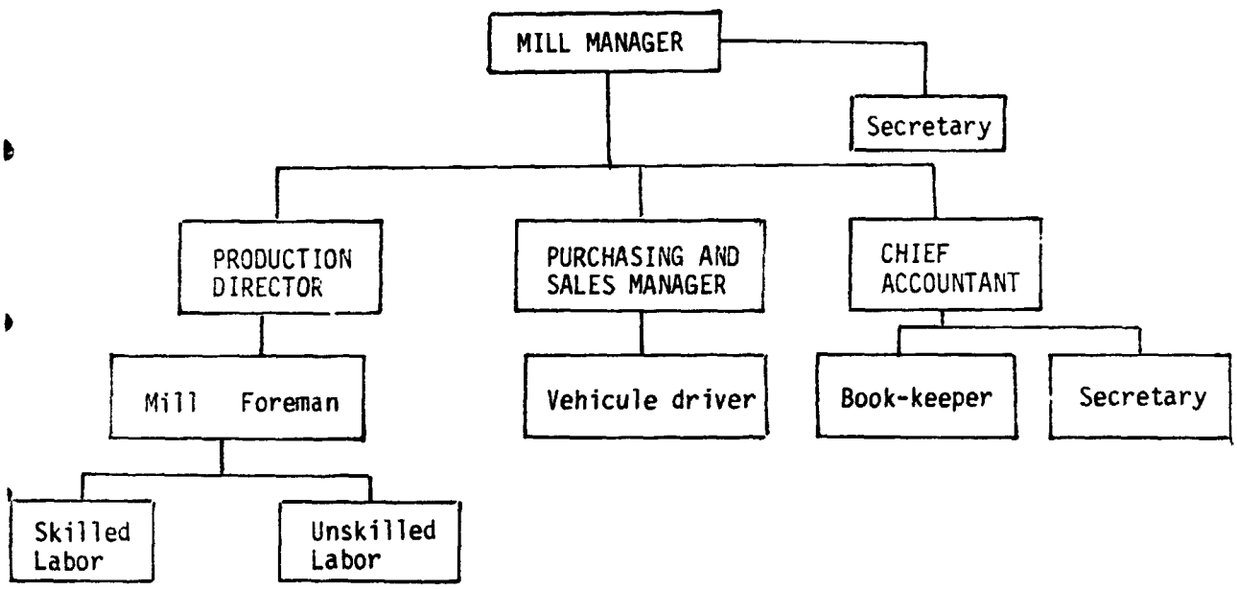
8.1.3. Training and foreign assistance

Two expatriate experts will be hired for assisting the local staff during the first two years of operation. On the job training will thus be provided by these two expatriate experts.

The local Mill Manager and Production Manager will be trained by a experienced foreign Mill engineer. They are both expected to gradually take over responsabilities.

Commercial Manager and the two accountants are available locally.

8.1.4. Organization structure



8.2. SEMI-INDUSTRIAL MILL

8.2.1. Labor

a/ Skilled labor accomplishing the same tasks will be required for the operations of the Semi-Industrial Mill.

Skilled labor will comprise the following staff :

- a Mill foreman
- a Dehuller operator
- a Hammermill operator

This personnel will be recruited for two 8 hour working shifts.

b/ Unskilled labor will be in charge of bag filling and bag handling. It will include a weighing machine operator, a truck driver and four people for handling.

8.2.2. Staff

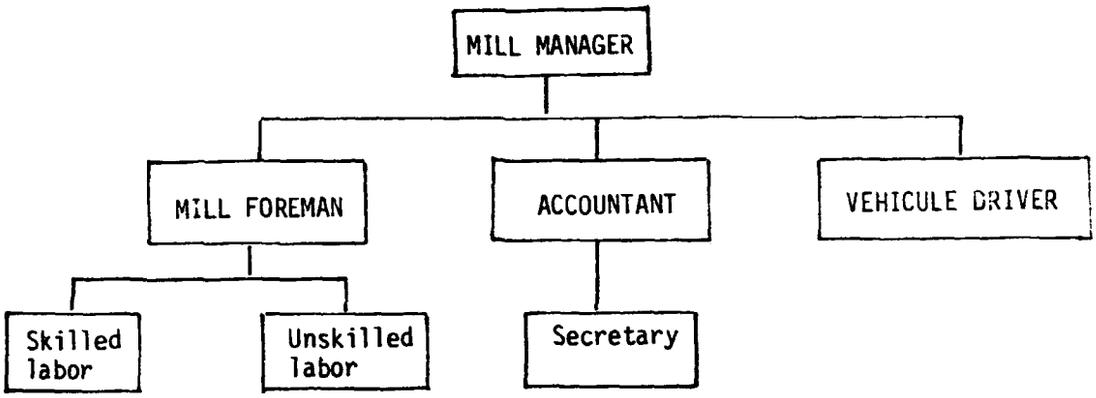
The Managerial staff will comprise a Mill Manager, a Mill Accountant and a Secretary. The Mill Manager will be in charge of the General Management of the Mill and will be directly involved in production and marketing activities.

Technical training will be provided by the RIIC in Kanye which will supply the dehuller.

8.2.3. Training

Technical training will be provided by the Rural Innovation Center (RIIC) in Kanye through a three week training session.

8.2.4. Organizational structure



8.3. SERVICE MILL

8.3.1. Labor

One (1) Mill Supervisor assisted by three unskilled workers for operating the diesel engine,the dehuller and the hammermill will suffice to satisfy labor requirements.

8.3.2. Staff

The Mill Manager will be responsible for the profitability of the Service Mill . In this respect he will collect service fees from clients, purchase fuel for the diesel engine, do the book-keeping and undertake promotional efforts to sell the Milling Service.

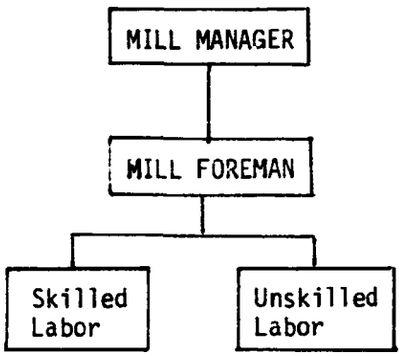
8.3.3. Training

The Rural Industrial Innovation Center (RIIC) at Kanye has developed a three week training session for the personnel who are going to operate the dehuller and the hammermill.

Training in Service Mill installation and mechanical skills as well as training in basic cash system and record keeping is included in the session.

RIIC provide food, accommodation and the Instruction Training staff. Training costs are included in the price "package" for RIIC.

8.3.4. Organizational structure



INDUSTRIAL MILL

Schedule 8.1. : Manning table - labour

MANNING TABLE - LABOUR : Variable and fixed

Department		Wage categories (no. of workers)						
Function	Shift	Skilled		Unskilled		Subtotal		TOTAL
		Foreign	Local	Foreign	Local	Foreign	Local	
Mill supervision and maintenance	I		1				1	1
	II		1				1	1
	III		1				1	1
Mill operations: - storing - cleaning - dehuller - grinding	I		4				4	4
	II		4				4	4
	III		4				4	4
Weighing & packaging & handling	I				5		5	5
	II							
	III							
Transportation	I		2				2	2
	II							
	III							
	I							
	II							
	III							
TOTAL LABOUR			17		5		22	22

INDUSTRIAL MILL

Schedule 8.2. : Estimate of production costs : wages

ESTIMATE OF PRODUCTION COSTS - WAGES

DEPARTMENT (project componen)		Variable costs wage categories (no. of workers)			Fixed costs wage categories (no. of workers)	
		Skilled	Unskilled	TOTAL	Unskilled	TOTAL
No.	Description	Local	Local	Local	Local	Local
1	Mill supervision	3				
2	Mill operation	12				
3	Packaging		5			
4	Transporation				2	
Total no. of workers		15	5		2	22
Working hours per day		120	40		16	
Working days per year		306	306		306	
Hours per year		36 720	12 240		4 896	
Wages per hour		0.60	0.50		0.50	
Surcharge ( )						
Wages per year		22 032			2 448	
TOTAL	30 600			28 152		2 448

INDUSTRIAL MILL

Schedule 8.3. : Manning table-staff

MANNING TABLE-STAFF

Department	Salary categories (No. of staff)								Sub-Total		
Function	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	TOTAL
Mill manager		1								1	1
Production manager		1								1	1
Sales Manager		1								1	1
Accountant		2								2	2
Secretary		2								2	2
Foreign Assistance											
Mill Manager											
Production Manager											
TOTAL STAFF		7								7	7

INDUSTRIAL MILL

Schedule 8.4. : Estimate of production costs : salaries

ESTIMATE OF PRODUCTION COSTS - SALARIES

Department (project component)		Salary categories (No. of staff)							
No.	Description	local	local	local	local	local	foreign	foreign	TOTAL
1	Mill manager	1							1
2	Production manager		2						2
3	Sales manager			1					1
4	Accountant				2				2
5	Secretary					2			2
5	Expatriate expert								
	Mill manager (a)						1		1
	Production Director (a)							1	1
	Total No. of staff	1	2	1	2	2	1	1	10
	Working months per year	12	12	12	12	12	12	12	
	Man-months per year	12	24	12	24	24	12	12	
	Salaries per month	800	600	500	300	200			
	Surcharge (%)								
	Slaries per year	9 600	14 400	6 000	7 200	4 800	80 000	30 000	
	TOTAL 42 000								

(a) Foreign Assistance : for the first two years of operations only.

SEMI INDUSTRIAL MILL

Schedule 8.1. : Manning table - labour

MANNING TABLE - LABOUR : Variable and fixed								
Department		Wage categories (no. of workers)						
Function	Shift	Skilled		Unskilled		Subtotal		TOTAL
		Foreign	Local	Foreign	Local	Foreign	Local	
MILL SUPERVISION & MAINTENANCE	I		1				1	1
	II		1				1	1
	III							
CLEANING & DEHULLING	I		1				1	1
	II		1				1	1
	III							
GRINDING	I		1				1	1
	II		1				1	1
	III							
WEIGHTING & PACKAGING UNIT	I				1		1	1
	II				1		1	1
	III							
HANDLING & TRANSPORTATION	I				4		4	4
	II							
	III							
TOTAL LABOUR			6		6		12	12

SEMI INDUSTRIAL MILL

Schedule 8.2. : Estimate of production costs : wages

ESTIMATE OF PRODUCTION COSTS - WAGES

DEPARTMENT (project componen)		Variable costs wage categories (no. of workers)			Fixed costs wage categories (no. of workers)	
		Skilled	Unskilled	TOTAL	Unskilled	TOTAL
No.	Description	Local	Local	Local	Local	Local
	Mill mechanic	2				
	Dehulling unit	2				
	Grinding unit	2				
	Packaging unit		2			
	Handling unit		3			
	Transport unit		1			
Total no. of workers		6	6			
Working hours per day		48	48			
Working days per year		254	254			
Hours per year		12 192	10 192			
Wages per hour		0.60	0.50			
Surcharge (%)		7 315	6 096			
Wages per year						
TOTAL	13 411					

SEMI INDUSTRIAL MILL

Schedule 8.3. : Manning table-staff

MANNING TABLE-STAFF											
Department	Salary categories (No. of staff)								Sub-Total		
Function	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	TOTAL
Mill manager		1								1	1
Accountant				1						1	1
Secretary						1				1	1
TOTAL STAFF		1		1		1				3	3

SEMI INDUSTRIAL MILL

Schedule 8.4. : Estimate of production costs : salaries

ESTIMATE OF PRODUCTION COSTS - SALARIES

Department (project component)		Salary categories (No. of staff)			
No.	Description	local	local	local	
1	Mill manager	1			
2	Accountant		1		
3	Secretary			1	
	Total No. of staff	1	1	1	
	Working months per year	12	12	12	
	Man-months per year	12	12	12	
	Salaries per month	375	292	250	
	Surcharge (%)				
	Slaries per year	4 500	3 500	3 000	
	TOTAL 11 000				

SERVICE MILL

Schedule 8.1. : Manning table - labour

MANNING TABLE - LABOUR : Variable and fixed								
Department		Wage categories (no. of workers)						
Function	Shift	Skilled		Unskilled		Subtotal		TOTAL
		Foreign	Local	Foreign	Local	Foreign	Local	
Mill supervision and maintenance	I		1				1	1
	II							
	III							
Mill operation - cleaner - hammermill	I		2				2	2
	II							
	III							
Weighing and bagging	I		1				1	1
	II							
	III							
	I							
	II							
	III							
	I							
	II							
	III							
TOTAL LABOUR			4				4	4

SERVICE MILL

Schedule 8.2. : *Estimate of production costs : wages*

ESTIMATE OF PRODUCTION COSTS - WAGES							
DEPARTMENT (project componen)		Variable costs wage categories (no. of workers)			Fixed costs wage categories (no. of workers)		
		Skilled	Unskilled	TOTAL	Unskilled	TOTAL	
No.	Description	Local	Local	Local	Local	Local	
	Mill supervision	1					
	Mill operations	2					
	Weighing and bagging		1				
Total no. of workers		3	1				
Working hours per day		24	8				
Working days per year		254	254				
Hours per year		6 096	2 032				
Wages per hour		.60	.50				
Surcharge (%)							
Wages per year		3 658	1 016				
TOTAL	4 674						

SERVICE MILL

Schedule 8.3. : Manning table-staff

MANNING TABLE-STAFF											
Department	Salary categories (No. of staff)								Sub-Total		
Function	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	TOTAL
1 Mill manager		1									1
		1									
TOTAL STAFF		1									1

SERVICE MILL

Schedule 8.4. : Estimate of production costs : salaries

ESTIMATE OF PRODUCTION COSTS - SALARIES					
Department (project component)		Salary categories (No. of staff)			
No.	Description	local	local	local	
	Mill manager	1			
	Total No. of staff	1			
	Working months per year	12			
	Man-months per year	12			
	Salaries per month	200			
	Surcharge (%)				
	Slaries per year	2 400			
	TOTAL 2 400				

CHAPTER 9

IMPLEMENTATION SCHEDULING

9. IMPLEMENTATION SCHEDULING

9.1. INDUSTRIAL MILL

9.1.1. Project schedule

The total duration for the project implementation will spread over two years. The following sequential steps have been a differentiated in the project implementation.

1. Preliminary design, basic engineering and general lay-out

The initial phase of project implementation gives the general characteristics of the project, defining the technologies selected, the capacity rating of equipment at each processing stage with regard to capacity needs at next production stage, the general lay-out of equipment.

2. Preparation of tender documents

Upon client's agreement on main characteristics defined in the preceding phase, tender documents are prepared giving all relevant informations to tenderers for bidding.

3. Bid comparison and contractor selection

Bids from tenderers are evaluated and compared. Technical choices retained by contractors and financial conditions are appraised. This phase of the project implementation includes contract negotiation.

4. Detailed engineering

Once the contract awarded, the contractor has to execute detailed engineering corresponding to specifications of main equipment and machinery.

5. Equipment and machinery manufacturing

This phase corresponds to the time required for manufacturing the machinery in contractor's shop.

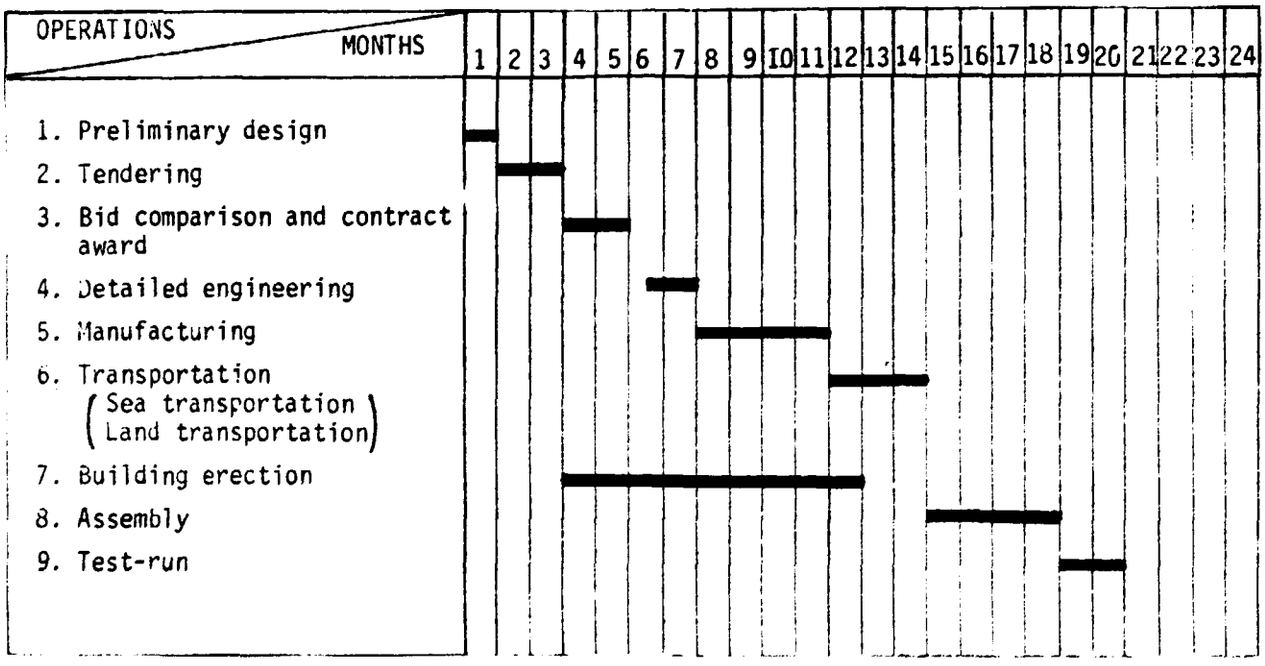
6. Transportation

The delivery of equipment from manufacturer's shops in Europe to the project site will involve sea transportation and land transportation both in Europe and in Africa.

7. Building erection

8. Equipment assembly and installation

9. Test-run and provisional acceptance



9.1.2. Project management

The services of an engineering consulting firms will be required to monitor and supervise the project. The consultants will be responsible for :

- basic design
- tendering with preparation of general technical specifications
- selection of contractor
- project supervision including detailed engineering supervision, inspection, manufacturing and assembly in contractor's workshop, technical control of assembly and erection, work schedule supervision.

In accordance with rates which are regionally applicable for milling engineering services, preliminary design will account for 0,6 per cent of the total project cost, tendering for 1,20 per cent and supervision for 2,40 per cent. European consulting firm would charge a project fee fixed at about 8 per cent of the total project cost.

9.2. SEMI-INDUSTRIAL MILL

9.2.1. Project schedule

The total duration for the project implementation will be one year. The sequential steps involved in the project implementation are as follows :

1. Preliminary design

2. Tendering

3. Bid comparison and orders

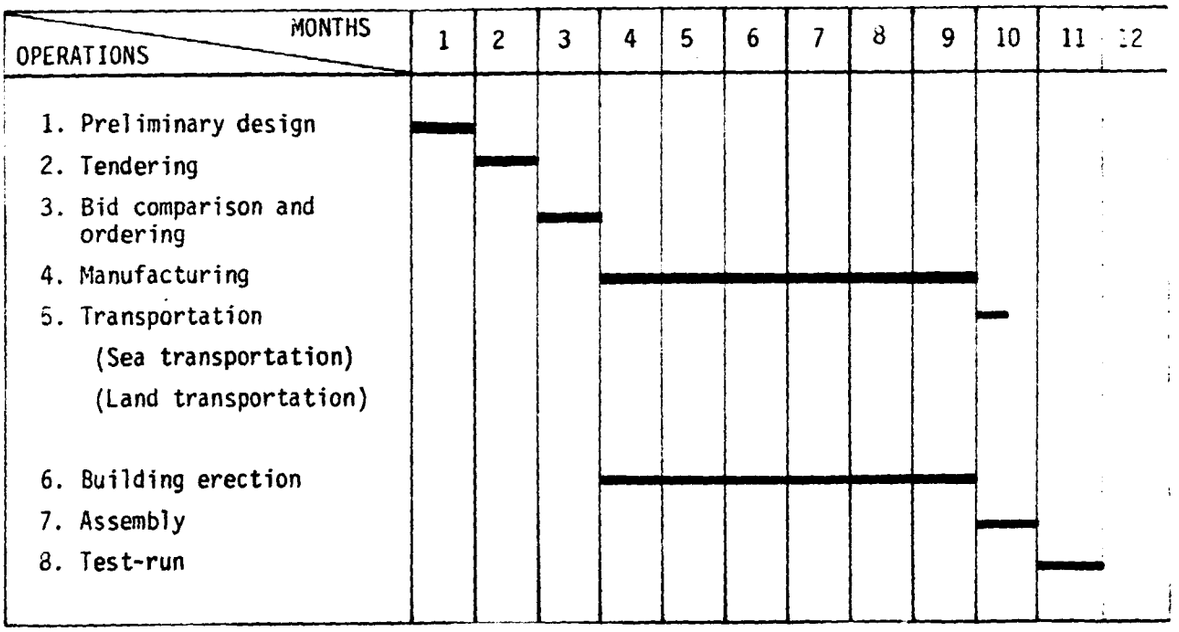
4. Equipment and machinery manufacturing

5. Transportation

6. Building erection

7. Equipment assembly and erection

8. Test run



9.2.2. Project management

The project concerning the semi-industrial mill will be managed by a team comprising a civil works engineer from a local consultant firm and a milling technologist having developed experience in the milling technology existing presently in BOTSWANA.

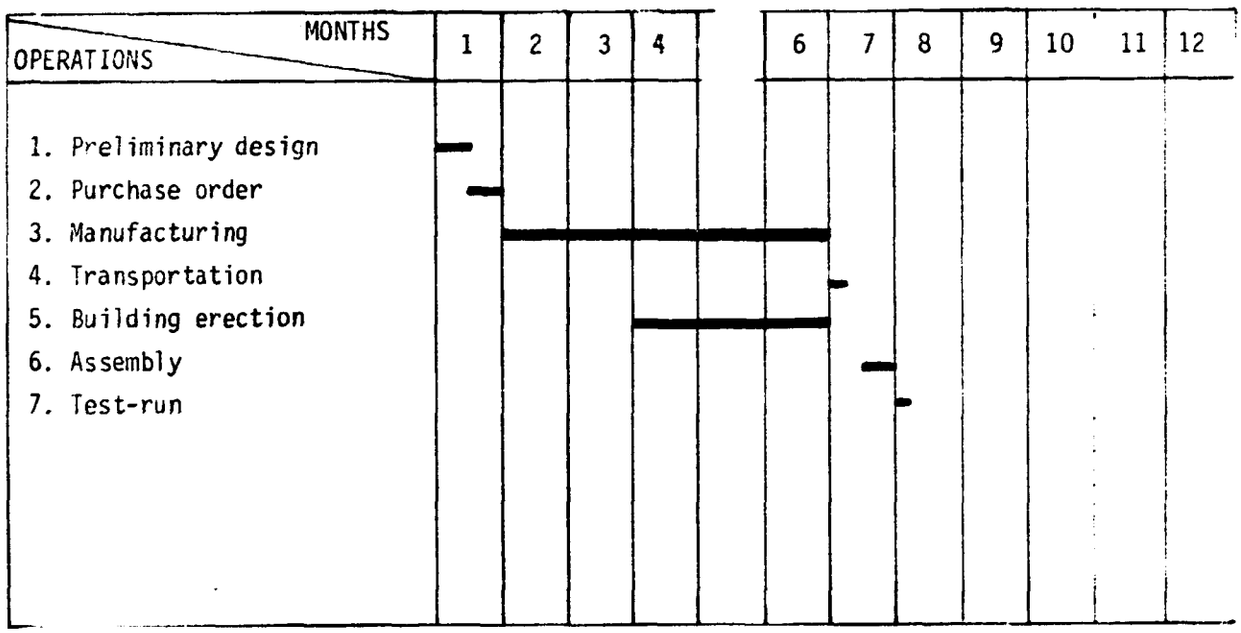
9.3. SERVICE MILL

9.3.1. Project schedule

The total duration of the project will be one year.

The implementation stages are the following :

- tendering
- bid comparison and orders
- equipment manufacturing
- transportation
- building erection
- equipment assembly and erection
- test-run



9.3.2. Project management

The project will be implemented under the direction of the future mill manager assisted by an industrial development agency such as the RIIC in Kanye.

INDUSTRIAL MILL

Schedule 9. : Estimate of investment cost : project implementation

ESTIMATE OF INVESTMENT COST

Project implementation

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1.			Preliminary design				3 230		3 230
2.			Detailed engineering				4 840		4 840
3.			Tendering and bid comparison				6 460		6 460
4.			Supervision and coordination				8 070		8 070
					TOTAL		22 600		22 600

SEMI INDUSTRIAL MILL

Schedule 9. : Estimate of investment cost : project implementation

ESTIMATE OF INVESTMENT COST

Project implementation

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1			Preliminary design					701	701
2			Tendering and bid comparison					1 406	1 406
3			Supervision coordination					2 813	2 813
			TOTAL					4 920	4 920

SERVICE HILL

Schedule 9. : Estimate of investment cost : project implementation

ESTIMATE OF INVESTMENT COST

Project implementation

NO.	QUANTITY	UNIT	ITEM DESCRIPTION	LOCAL	FOREIGN	UNIT COST	COST		
							Foreign	Local	TOTAL
1			Management of project implementation supervision, co-ordination test run and take over of civil works, equipment and plant					1 000	1 000
						TOTAL		1 000	1 000

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FINAL REPORT

Feasibility study on Sorghum Milling Industry in BOTSWANA

(Volume II - Financial and Economic Evaluation)

CHAPTER 10

FINANCIAL AND ECONOMIC EVALUATION

10. FINANCIAL AND ECONOMIC EVALUATION

10.1. TOTAL INVESTMENT COST

- The Industrial Mill represents a total initial investment outlay of 560 800 pulas. Such important investment value is principally due to the necessity of importing most production equipment from S.A. and Europe,and also due to the high cost of civil works related to a two-floor building. The milling capacity of the mill requires a constant supply of raw grains which also necessitates the construction of four grain silos. The total cost estimate for this project are based on South African prices which are 40 per cent lower than European prices for similar project.

  Net working capital requirement amounts at 440 941 pulas when operating at full capacity (1980 price basis). As raw material bought from outside source is delivered upon direct payments from the mill, the net working capital is greatly increased.

- The Semi-Industrial Mill represents a total initial investment outlay of 122 120 pulas of which equipment value accounts for about 50 percent. The working capital amounts at 72 586 pulas.

- The total initial investment for the Service Mill represents 21 500 pulas. The net working capital is relatively small as no raw material inventory has to be financed.

10.2. PROJECT FINANCING

10.2.1. Financing institutions

The National Development Bank was established with a view to promoting the economic development of BOTSWANA.

The rate of interest charged by the National Development Bank is 12 % on medium term loan. The Interest charges per annum arecalculated on the remaining outstanding capital according to the reducing balance method.

The maximum grace period for loan reimbursement is two years and the minimum period one year.

The Barclays Bank which has a subsidiary in BOTSWANA is also lending monney to entrepreneur and private firms. The lending rate ranges between 13 and 14 per cent according to the risk content of the project.

The Industrial Mill will be financed partly with equity and with medium term loan. The loan will be paid in two successive installments. A first installment of 400 000 pulas with a grace period of two years will be released at the beginning of the first year of construction, a second installment of 120 000 pulas to be released at the beginning of the first year of operation, with a grace period of one year.

The Semi-Industrial Mill will be financed with a bank Loan to be released in two installments.A first installment of 90 000 pulas and a second installment of 40 000 pulas paid at the beginning of the second year. The grace period for the two loan installments is one year.

The Service Mill is partly financed with a 10 000 pulas loan which will be reimbursed over a period of 4 years.

10.3. FINANCIAL ANALYSIS

All calculations in this study have been based on an annual inflation rate of 10 % as general price level increase. The financial performances obtained by the three mills will be appraised from profitability ratios. Profitability ratios are of two types : those showing profitability in relation to sales, and those showing profitability in relation to investment. Together those ratios provide information on the Mills' efficiency of operation.

10.3.1. Profitability in relation to investment

The ratio of the net operating profit in a normal year to the original investment outlay (including fixed assets, preproduction capital expenditures and net working capital) measures the financial performance of the invested capital. It is preferable for comparative purpose to compute a net operating profit rate of return excluding interest charges as the three projects are burdened with different interest changes. Thus, the relationship studied is independent of the way the firm is financed.

Industrial Mill	$\frac{478\ 084}{1\ 001\ 741}$	=	47.72 %
Semi-Industrial Mill	$\frac{79\ 547}{194\ 706}$	=	40.85 %
Service Mill	$\frac{3\ 842}{22\ 440}$	=	17.12 %

10.3.2. Profitability in relation to sales or milling margin

The ratio of the net profit in a normal year of full production to sales revenues measures the operational performance of the equipment.

Industrial Mill	$\frac{478\ 084}{3\ 057\ 420}$	=	15.63 %
Semi-Industrial Mill	$\frac{79\ 547}{647\ 900}$	=	12.27 %
Service Mill	$\frac{3\ 842}{22\ 860}$	=	16.80 %

The turnover ratio which relates sales to total fixed assets measures the relative efficiency with which the firm utilizes its resources in order to generate output.

Industrial Mill	$\frac{3\ 057\ 420}{1\ 001\ 741}$	=	3.05
Semi-Industrial Mill	$\frac{647\ 900}{194\ 706}$	=	3.33
Service Mill	$\frac{22\ 860}{22\ 440}$	=	1.02

10.3.3. The payback period method

The payback period is the number of years it takes the three mills to recover the original investment from net profits earned by the projects adding financial costs and depreciation.

Industrial Mill	4.5 Years
Semi-Industrial Mill	4.2 Years
Service Mill	6 Years

a/ Industrial Mill

Item \ Years	1	2	3	4	5
Net Profit			94 409	317 842	597 336
Interest			148 800	39 600	26 400
Depreciation			60 080	60 080	60 080
Industrial = 1 001 741			303 289	417 505	683 816

Calculation of payback period

	Amount paid-back	Investment (working capital included)	Balance at end of year
Year 1		420 600	
Year 2		140 200	
Year 3	303 289	900 752	597 463
Year 4	417 505	749 144	331 639
Year 5	683 816	414 715	0

The original investment cost including working capital will be recovered 4.7 years after the beginning of the construction period.

b/ Semi-Industrial Mill

Items \ Years	1	2	3	4
Net profit		26 025	66 960	117 716
Interest		24 240	10 320	7 200
Depreciation		20 924	20 924	20 924
Semi-industrial : 194 706		71 189	98 204	145 840

Calculation of payback period

	Amount paid-back	Investment (working capital included)	Balance at end of year
Year 1		122 120	122 120
Year 2	71 189	169 898	98 709
Year 3	98 204	125 204	27 000
Year 4	145 840	58 702	-

The original investment cost including working capital will be recovered 3,7 years after the beginning of the construction period.

c/ Service Mill

Years	1	2	3	4	5	6	7	8	9
Net profit		9 054	3 258	923	5 910	9 919	12 752	14 503	16 440
Interest		2 100	600	300					
Depreciation		3 310	3 310	3 310	3 310	3 310	5 230	5 230	5 230
		- 3 644	652	4 533	9 220	13 229	17 982		

Calculation of the payback period

Year	Amount paid-back	Investment	Balance at end of year
1		21 500	21 500
2	- 3 644	23 050	26 694
3	652	26 657	26 005
4	4 533	26 692	22 159
5	9 220	22 196	12 976
6	13 229	13 055	0

The original investment cost will be recovered about 6 years after the begining of the construction period.

10.3.4. The break even analysis

The following ratio gives the break even point :
Fixed production cost - sales revenues - variable production cost.

a/ Industrial Mill

Financial figures have been taken at year 8 when full capacity is reached . They are discounted at the current inflation rate.

- Break even point calculation

Total revenues	3 057 420
Total variable cost	2 225 850
Total fixed cost	92 860

Total quantity of flour produced : 10 924 T

$$BEP = \frac{92\ 860}{279.9 - 203.7} = 1\ 219 \text{ tons or } 11\ \% \text{ of full capacity}$$

- Sensitivity analysis

At full capacity utilization, the project breaks even at a selling price thus calculated :

$$\frac{92\ 860}{\text{variable revenue/ton}} = 10\ 924 \text{ tons}$$

x = 8.50 pulas
203.7 + 8.50 = 212.20
Comparing the selling price for which the project breaks even at full capacity with the prevailing market price, the industrial mill has a safety margin of

$$\frac{270 - 212.20}{270} = 21.4\ \%$$

b/ Semi-industrial mill

Financial figures are taken at year 4 when full capacity is reched and are discounted at the current inflation rate.

- Break even point calculation

Total revenues	647 900
Total variable cost	492 344
Total fixed cost	32 804

Total quantity of flour produced 2 291 Tons

$$BEP = \frac{32\ 804}{282.8 - 214.9} = 483 \text{ Tons or } 21\ \% \text{ of full capacity}$$

- Sensitivity analysis

At full capacity, the project breaks even at the following selling price

$$\frac{32\ 804}{\text{Variable revenue}} = 2\ 291$$

Variable revenue = 14.32

214.9 + 14.32 = 229.22

The safety margin of the Semi-Industrial Mill is as follows :

$$\frac{270 - 229.22}{270} = 15\ \%$$

b/ Service mill

Financial figures are taken at year 7 when full capacity is reached and are discounted at the current inflation rate.

- Break-even point calculated

Total revenues	22 860
Total variable cost	11 059
Total fixed cost	5 890

Total quantity of grain processed 762 Tons

$$BEP = \frac{5\ 890}{30 - 145} = 380\ T$$

- Sensitivity analysis

$$\frac{5\ 890}{\text{variable revenue}} = 762$$

Variable revenue = 7.73

7.73 + 14.5 = 22.23

The safety margin of the service mill is the following

$$\frac{30 - 22.23.}{30} = 25.9\ \%$$

10.3.5. Net present value and internal rate of return methods

The discount rate used in the study has been fixed at 15 % .

	Net present value	International rate of return
Industrial Mill	2 138 053	50.77 %
Semi-Industrial Mill	422 334	62.41 %
Service Mill	3 187	17.35 %

The Semi-Industrial Mill presents the highest internal rate of return whilst its simple rate of return ranks second after the Industrial Mill.

The simple rate of return is calculated on the basis of utilization of full production capacity whereas the internal rate of return takes into account the first years of operations when production is gradually increasing up to full production capacity.

A comparison of the present values is not significant as the two projects differs by the importance of their investment outlays. It should be noted that the Industrial Mill considered in this study represents the minimum investment size existing in this type of technology. A 100 ton capacity Mill would certainly offer a higher internal rate of return than that of the Semi-Industrial Mill. It has not been considered in this study as it does not correspond to decentralized industrialization policies prevailing in BOTSWANA.

The Service Mill appears as the less profitable, this being principally due to the very small fee paid for the Mill Service.

A service fee of 4 thebe per kilogram instead of only three would tremendously increase the profitability of the Service Mill.

Sensitivity Analysis

a/ Considering a reduction of 10 % in the selling price of sorghum flour, the financial analysis provides the following results :

	Net present value	Internal rate of return
Industrial Mill	996 628	34 %
Semi-Industrial Mill	157 104	34,6 %

This selling price of 245 pulas per ton corresponds to the lowest prices at which maize flour is sold in BOTSWANA.

b/ Considering now a reduction of 10 % in the selling price of sorghum and deducting revenues from bran sales :

	Net present value	Internal rate of return
Industrial Mill	521 868	25,65 %
Semi-Industrial Mill	21 511	18 %

Bran being produced in large quantities may well exceed the actual potential demand for such by-products. Revenues from bran sales can therefore be considered as hypothetical, thus diminishing the profitability of the two projects.

c/ The investment cost for the Industrial Mill corresponds to the value of a project contracted by South African firm.

The investment cost of a similar project executed by an European contractor would be increased by 40 per cent

The European equipment having a longer life duration, the total investment value is amortized over a 14 year period. The salvage value is then estimated at 4/14 of the value of the original investment. The sensitivity analysis gives the following internal rates of return.

i/	Sorghum selling price	270 Pulas / ton
	Bran selling price	70 Pulas / ton
	Internal rate of return	42 %
ii/	Sorghum selling price	245 Pulas / ton
	Bran selling price	70 Pulas / ton
	Internal rate of return	25 %
iii/	Sorghum selling price	245 Pulas / ton
	No bran sales	
	Internal rate of return	20 %

These internal rates of return take into account an inflation rate of 10 per cent per annum.

10.3.6. National economic evaluation

a/ Foreign exchange savings

The two project alternatives will lead to foreign exchange savings.

Industrial alternative :	14 914 261	x	2	=	29 828 522 pulas
Semi-Industrial alternative :	2 670 195	x	8	=	21 361 560 pulas

b/ Employment effect

- Industrial Mill

  The two (2) Industrial Mills will generate employment for 48 persons of which 10 will have managerial positions.

- Semi-Industrial Mill

  The eight (8) Semi-Industrial Mills will create employment for 120 persons of which 24 will share Managerial responsabilities.

- Service Mill

  The ten (10) Service Mills will create employment for a total of 50 persons.

External trade statistics - Custom and excice department

TABLE 1

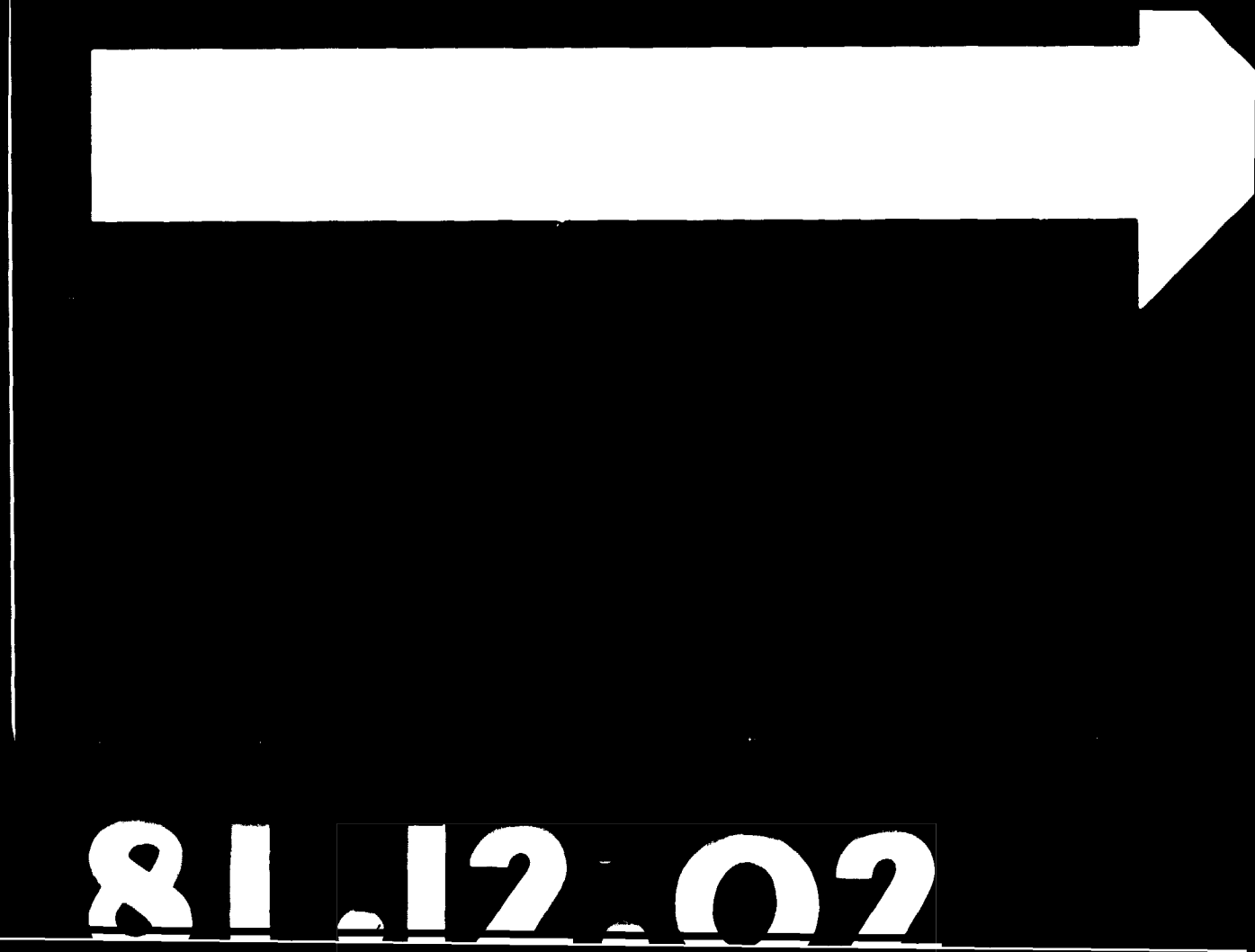
TOTAL CONSUMPTION OF CEREALS IN BOTSWANA
(IN THOUSANDS OF TONS)

YEAR	1975	1976	1977	1978	1979	TOTAL
1/ National crop production	62 500	118 177	82 000	32 000	7 450	302 127
Sorghum	33 800	55 540	35 000	15 500	4 300	144 140
Maïze	28 700	62 637	42 000	14 000	2 250	149 587
Millet			5 000	2 500	900	8 400
2/ Grain imports	6 544	12 552	22 764	21 389	54 549	117 798
Wheat	20	23	15	7	6	71
Rice	275	478	855	905	1 064	3 577
White maïze	5 658	10 723	15 755	14 633	26 984	73 753
Yellow maïze	324	19	204	333	1 023	1 903
Other maïze	3	10	14	5	38	70
Sorghum	137	1 254	5 912	5 471	25 408	38 182
Others	127	45	9	35	26	242
3/ Imports of milling products	32 890	40 440	54 791	58 493	79 842	266 456
Malt	967	2 101	2 169	3 209	5 011	13 457
Wheat flour	12 516	15 890	17 650	18 772	23 901	88 729
Maïze flour	18 321	21 159	32 787	34 473	43 440	150 180 (a)
Other cereal flour	65	206	155	141	702	1 269
Maïze samp & rice	811	891	1 957	1 820	6 547	12 026
Other worked cereals	100	125	53	53	122	453
Flakes of potatoes/fruit	85	66	15	19	105	290
Starches - inulin - gluten	25	2	5	6	14	52
4/ Grain exports	13 266	3 638	1 248	9 121	1 412	28 685
Wheat	201	174	449	337	280	1 441
Rice	-	-	-	-	4	4
White maïze	8 416	2 429	496	8 763	90	20 194
Yellow maïze	272	377	207	19	1 019	1 894
Other maïze	-	1	8	-	-	9
Millet	50	3	8	-	-	61
Grain sorghum	4 327	654	80	2	19	5 082
5/ Exports of milling products	59	95	409	961	292	1 816
Malt		95	409	940	156	1 600 (b)
Maïze flour	59			20	126	205
Other cereal				1	10	11
TOTAL	88 608	167 806	157 898	101 800	140 137	656 249 (c)

(a) 187 725 tons in grain equivallent at an extraction rate of 80 per cent.

(b) 2 000 tons in grain equivallent at an extraction rate of 80 per cent

(c) 695 817 tons by taking figures in grain equivallent for imports of maïze flour and export of malt .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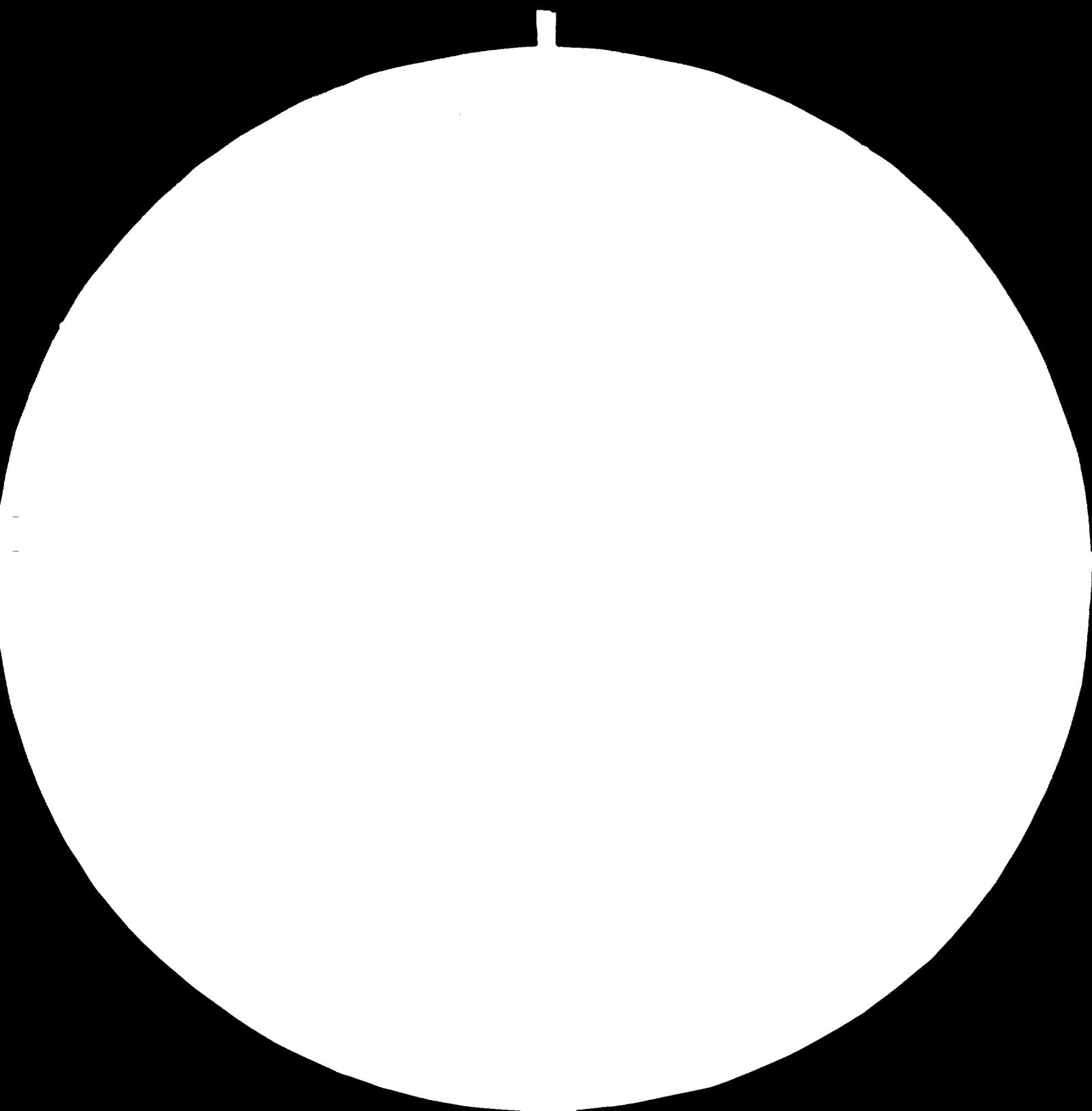

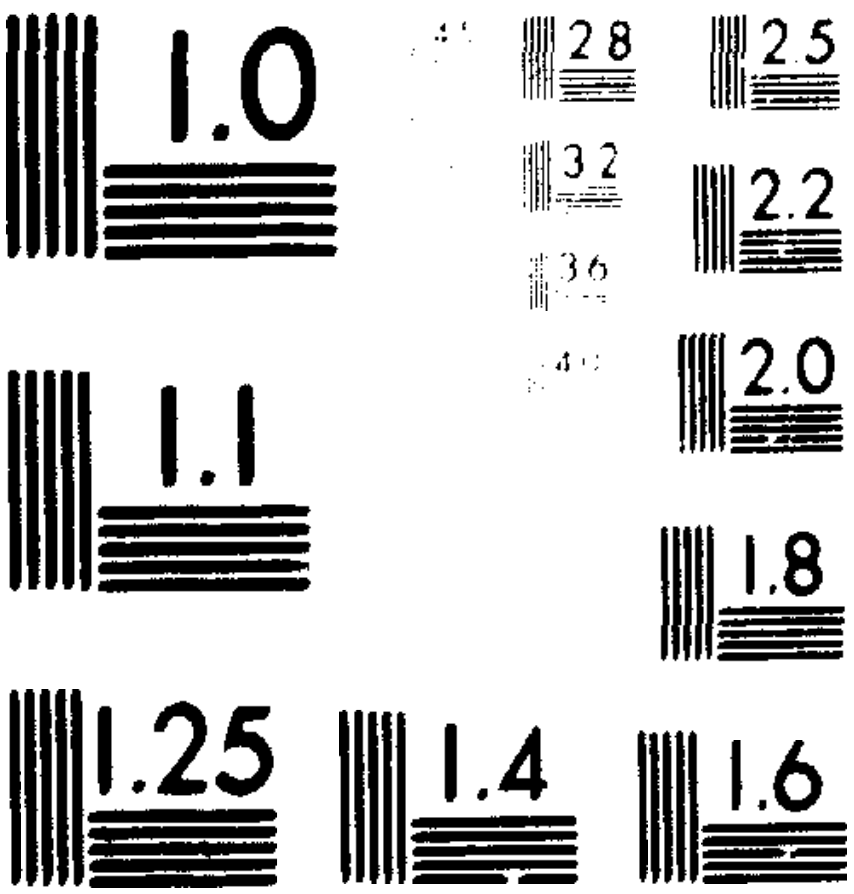

TABLE 2

MARKETING SURVEY : PURCHASE FREQUENCIES FOR DIFFERENT PROCESSED CEREALS SOLD IN GABORONE

(expressed in percentage of total sales)

	SORGHUM	MAIZE PRODUCT (super/special samps)	WHEAT PRODUCT (bread & cake flour)	TOTAL
TEST N° 1 Place : FRASERS GABORONE Date : September 3 - 1980 Time : 4.30 - 5.30 PM	49	39	12	100
TEST N° 2 Place : Consumer Coop. Soc. Date : September 4 - 1980 Time : 4.30 - 5.30 PM	50	39	11	100
TEST N° 3 Place : FRASER GABORONE Date : September 9 - 1980 Time : 4.30 - 5.30 PM	50	26	24	100
TEST N° 4 Place : Consumer Coop. Soc. Date : September 10 - 1980 Time : 4.30 - 5.30 PM	52	31	17	100
TEST N° 5 Place : Consumer Coop. Soc. Date : September 6 - 1980 (Sat) Time : 11.30 - 12.30	44	46	10	100
TEST N° 6 Place : Consumer Coop. Soc. Date : Sept 18 - 1980 Time : 4.30 - 5.30	34	50	16	100
TEST N° 7 Place : FRASERS Date : September 21 - 1980 Time : 10.30 - 11.30 AM	21	65	14	100
TEST N° 8 Place : Consumer Coop. Soc. Date : September 21 1980 Time : 11.45 - 12.45	30	45	25	100
	$\mu = 41.25$	$\mu = 42.60$	$\mu = 16.15$	100

SOFRECO

TABLE 3

BOTSWANA : SORGHUM AND MAIZE PRODUCTION

Year	Sorghum estimated production	Maize estimated production	Total
1950	40 824	6 350	47 174
1951	45 360	6 350	51 710
1952	36 288	2 722	30 010
1953	49 896	4 536	54 432
1954	58 968	7 257	66 225
1955	58 968	7 257	66 225
1956	53 504	9 072	72 576
1957	54 432	6 350	60 782
1958	54 432	7 258	61 690
1959	54 432	5 443	59 875
	μ = 51 710	μ = 6 259	μ = 57 969
1960	36 288	3 629	39 917
1961	68 040	14 062	82 102
1962	45 360	3 175	48 535
1963	31 752	5 443	37 195
1964	18 144	907	19 051
1965	3 175	1 905	5 080
1966	18 144	1 361	19 505
1967	36 288	5 443	37 195
1968	12 700	10 886	23 586
1969	30 391	18 144	48 535
	μ = 30 028	μ = 64 955	μ = 36 523
1970	8 164	2 722	10 886
1971	73 936	18 144	92 080

SOFRECO

Table 3 (continued)

1972	68 300	10 300	78 600
1973	10 300	22 300	32 600
1974	72 300	33 900	106 200
1975	33 800	28 700	62 500
1976	55 600	62 600	118 200
1977	35 000	42 000	77 000
1978	15 500	14 000	29 500
1979	4 300	2 250	6 550
	μ_1 = 37 720	μ_4 = 23 692	μ_6 = 61 412

Source : Ministry of Agriculture

Source : Agricultural statistics - Planning and statistics unit - Ministry of agriculture

TABLE 4

PRODUCTION OF SORGHUM IN BOTSWANA - 1970 - 1979

REGION DISTRICT / YEAR	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	198
1/ SOUTH REGION											
1.1. BAROLONG District			5 500				578			105	
1.2. NGWAKETSE S. District							1 921			125	
1.3. NGWAKETSE N. District							4 694			100	
1. SOUTH REGION					18 300	7 100	7 193			330	
2/ GABORONE REGION											
2.1. BAMALETE District							639			15	
2.2. KWENENG S. District			20 300				7 613			230	
2.3. KWENENG N. District							3 548			25	
2.4. KGATLENG							5 079			430	
2. GABORONE REGION					33 100	12 000	16 879			700	
3/ CENTRAL REGION											
3.1. MAHALAPYE							2 235			640	
3.2. PALAPYE							1 979			230	
3.3. SEROWE							3 333			130	
3.4. MMADINARE							4 855			150	
3. CENTRAL REGION			41 600		13 000	6 300	12 402			1 150	
4/ FRANCISTOWN REGION											
4.1. TATI							8 561			720	
4.2. TUTUME							8 009			680	
4. FRANCISTOWN REGION					6 600	7 900	16 570			1 400	
5/ MAUN REGION											
5.1. N GAMILAND W.							882			60	
5.2. N GAMILAND E.							1 169			80	
5.3. CHOHE							445			30	
5. MAUN REGION			1 000		1 300	500	2 496			170	
TOTAL			68 300		72 300	33 800	55 540	35 000	15 500(1)	3 750(2)	

(1) National estimate only - (2) The production of 5 500 tons by freehold farmers is not taken into consideration.

Source : Agricultural research center

TABLE 5

CHARACTERISTICS OF SEEDS DEVELOPED AND MARKETED BY THE AGRICULTURAL RESEARCH CENTER

	OPEN POLIVATED VARIETIES				HYBRID VARIETIES					
SEED VARIETIES / CHARACTERISTICS	MARUPANTSE	SEGAOLANE	KANYE STO	8D	NK 283	DC 59	SS K52	NK 222 (2)	DC 36 (2)	NK 300
Maturity time	4 months	3/4 months	3/4 months	3/4 months	3 months	3/4 months	3/4 months	3/4 months	3/4 months	
(1) Farmer acceptance	good	very good	poor	medium	NIA	NIA	NIA	NIA	NIA	NIA
- Yields	Average	good	Average	Average	high	high	high	Average	Average	Very h
- Drought resistance	fairly good	good	poor	good	good	good	good	good	good	fairly
- Insect resistance	fairly good	good	poor	good	fairly good	fairly good	Fairly good	good	good	fairly
- Color	pink	white	white	red	red	red	red	red	red	re
- Consumer acceptance	fairly good	very good	NIA	Fair	NIA	NIA	NIA	NIA	NIA	NIA
- Region	Kgatleng area	South and North east	NIA		Barolong	Barolong	Barolong	NIA	NIA	NIA
- Origin	local	local	local	USA	USA	S.A.	S.A.	USA	S.A.	USA
- Date of introduction	—	—	—	1950	1969	1969	1979	1969	1969	1969

(1) No information available

(2) Varieties recently introduced

INDUSTRIAL MILL

Schedule III.1 - Initial fixed investment costs

Item	Investment category	From schedule	Foreign currency	Local currency ($ thousand)	Total cost
	Site preparation and development			31 500	31 500
	Structures and civil works - Buildings and civil works		178 560	19 840	198 400
	Plant machinery and equipment		294 300	14 000	308 300
	TOTAL INITIAL FIXED INVESTMENT COSTS		472 860	65 340	538 200

INDUSTRIAL MILL

Schedule 10 - 1/2 : Fixed investment cost

PERIOD	CONSTRUCTION																											
YEAR	1			2			3			4			5			6			7			8			9			
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	
FIXED INVESTMENT COSTS																												
1/ Site preparation and development		23 625	23 625		7 875	7 875																						
2/ Structure and civil works	133 920	14 880	148 800	44 640	4 960	49 600																						
3/ Plant machinery and equipment	220 725	10 500	231 225	73 575	3 500	77 075																80 000		80 000				

SECTION 1

vestment cost

	5			6			7			8			9			10			11 & 12			TOTAL		
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt.	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
																							31 500	31 500
																						178 560	19 840	198 400
										80 000		80 000										294 300	14 000	308 300

SECTION 2

INDUSTRIAL MILL

Schedule 10-2/1 : Preproduction capital expenditures, by category

Item	Investment category	Foreign currency	Local currency ($ thousand)	TOTAL
1.	Preliminary design	3 230		3 230
2.	Detailed engineering	4 840		4 840
3.	Tendering and bid comparison	6 460		6 460
4.	Supervision and coordination	8 070		8 070
		22 600		22 600

INDUSTRIAL MILL

Schedule 10 - 2/2 : Preproduction capital expenditure, by year

PERIOD	CONSTRUCTION																							
YEAR	1			2			3			4			5			6			7			8			9	
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
Preproduction capital expenditure	16 950		16 950	5 650		5 650																				

SECTION 1

Total expenditure, by year

5		6			7			8			9			10			11 & 12			TOTAL		
LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
																				22 600		22 600

SECTION 2

INDUSTRIAL MILL

Schedule 10 - 321 . Calcul . working capital

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
PRODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	100
Raw materials			1 273 440	1 957 077	2 450 453	3 050 512	3 734 149	4 097 989	4 500 128	4 959 715	5 457 602	6 012
Labor + staff			96 558	105 996	116 886	128 502	141 570	155 364	170 610	188 034	206 910	227
Foreign staff			172 900	189 800								
Utilities			51 768	79 558	100 265	124 008	151 800	166 980	183 678	202 045	222 250	24
Spare parts			5 320	5 840	6 440	7 080	7 800	8 560	9 400	10 360	11 400	12
Factory overhead			5 699	6 256	6 899	7 584	8 356	9 170	10 070	11 098	12 212	13
Factory costs			1 605 675	2 344 528	2 696 943	3 347 686	4 043 675	4 438 063	4 873 886	5 371 852	5 910 314	6 51
Administrative overhead			1 190	1 307	1 441	1 584	1 745	1 915	2 103	2 318	2 551	2
Distribution costs			122 397	188 105	237 065	293202	358 909	395440	431 792	476 281	524 171	57
Operating costs			1 729 272	2 533 940	2 935 449	3 612 472	4 404 329	4 833 468	5 307 781	5 849 851	6 437 096	7 092
Financial costs			148 800	39 600	26 400	13 200						
Depreciation			60 080	60 080	60 080	60 080	60 080	68 080	68 080	68 080	68 080	68
PRODUCTION COSTS			1 938 152	2 633 620	3 021 929	3 685 752	4 464 409	4 901 548	5 375 861	5 917 931	6 505 176	7 16

INDUSTRIAL MILL

Schedule 10 - 3/2 : Calculation of working capital : working capital requirements

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	2
PRODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	100
I. Current assets												
A. Accounts receivable	30	12	144 106	211 162	244 621	301 039	367 027	402 789	442 315	487 488	536 425	591 0
B. Inventory												
a/ imported material	30	12	106 078	163 025	205 456	254 108	311 055	341 362	374 861	413 144	454 618	500 8
b/ spare parts	360	1	5 320	5 840	6 440	7 080	7 800	8 560	9 400	10 360	11 400	12 5
c/ finished products	15	24	67 405	98 445	113 335	139 420	169 928	186 485	204 785	225 699	248 356	273 6
C. Cash in hand	15	24	22 476	21 511	15 380	17 457	19 958	21 903	24 052	26 508	29 169	32 1
D. Current assets			345 385	499 983	585 232	719 104	875 768	961 099	1 055 413	1 163 199	1 279 968	1 410 2
II. Current liabilities												
A. Accounts payable			5 433	8 350	10 523	13 015	15 932	17 484	19 200	21 161	23 285	25 6
III. Working capital												
A. Net working capital			339 952	491 633	574 709	706 089	859 836	943 615	1 036 213	1 142 038	1 256 683	1 384 5
B. Increase			339 952	151 681	83 076	131 380	153 747	83 779	92 598	105 825	114 645	127 8
IV. Total production costs			1 938 152	2 633 620	3 021 929	3 685 752	4 464 409	4 901 548	5 375 861	5 917 931	6 505 176	7 160 1
Less : Raw material			1 273 440	1 957 077	2 466 453	3 050 512	3 734 149	4 097 989	4 500 128	4 959 715	5 457 602	6 012 9
Utility			65 198	100 199	126 278	156 181	191 182	209 810	230 399	253 929	279 420	307 8
Depreciation			60 080	60 080	60 080	60 080	60 080	68 080	68 080	68 080	68 080	68 0
V. Required cash balance			539 434	516 264	369 118	418 979	478 998	525 669	577 254	636 207	700 074	771 3

INDUSTRIAL MILL

Item	Investment category
1.	Initial fixed investment costs
2.	Pre-production capital expenditures
3.	Working capital (at full capacity)

Foreign currency	Local currency ($ thousand)	TOTAL
472 860	65 340	538 200
22 600		22 600
421 187	19 754	440 941
916 647	85 094	1 001 741

INDUSTRIAL MILL

Schedule 10 - 6/2 : Total investment cost

PERIOD	CONSTRUCTION													
YEAR	1			2			3	4	5	6	7	8		9
PRODUCTION PROGRAMME							50 %	70 %	80 %	90 %	100 %	100 %		100 %
	FC	LC	Tt	FC	LC	Tt	Tt	Tt	Tt	Tt	Tt	FC	LC	Tt	Tt
1. Fixed investment costs															
a/ initial	354 845	49 005	403 850	118 215	16 335	134 550									
b/ remplacement												80 000		80 000	
2. Preproduction capital expenditures	16 950		16 950	5 650		5 650									
3. Working capital							339 952	151 681	83 076	131 380	153 747			33 779	92 598
TOTAL INVESTMENT COSTS	371 595	49 005	420 800	123 865	16 335	140 200	339 952	151 681	83 076	131 380	153 747	80 000		163 779	92 598

SECTION 1

estment cost

	4	5	6	7	8			9	10	11	12	TOTAL		
	70 %	80 %	90 %	100 %	100 %			100 %	100 %	100 %	100 %			
	Tt	Tt	Tt	Tt	FC	LC	Tt	Tt	Tt	Tt	Tt	FC	LC	Tt
												472 860	65 340	538 200
					80 000		80 000					80 000		80 000
												16 950	5 650	22 600
	151 681	83 076	131 380	153 747			33 779	92 598	105 825	116 8	127 873		1 384 556	1384 556
	151 681	83 076	131 380	153 747	80 000		163 779	92 598	105 825	116 8	127 873	569 810	1 455 546	2025 356

SECTION 2

INDUSTRIAL MILL

Schedule 10 - 7/1 : Total initial assets

Item	Investment category	Foreign currency	Local currency	TOTAL
1.	Initial fixed investment costs	472 860	65 340	538 200
2.	Preproduction capital expenditure	22 600		22 600
3.	Currents assets	429 350	19 762	449 112
	TOTAL	924 810	85 102	1 009 912

INDUSTRIAL MILL

Schedule 10 - 7/2 : Total assets

PERIOD	CONSTRUCTION														
YEAR	1			2			3	4	5	6	7	8			9
							50 %				100 %	100 %			100 %
	FC	LC	Tt	FC	LC	Tt	Tt	Tt	Tt	Tt	Tt	FC	LC	Tt	Tt
1. Fixed investment costs															
a/ initial	358 645	49 005	403 650	118 215	16 335	134 550									
b/ replacement												80 000		80 000	
2. Preproduction capital expenditures	16 950		16 950	5 650		5 650									
3. Current assets							345 385	154 598	85 249	133 872	156 664			85 331	94 314
TOTAL ASSETS	371 595	49 005	420 600	123 865	16 335	140 200	345 385	154 598	85 249	133 872	156 664	80 000		165 331	94 314

SECTION 1

assets

	4	5	6	7	8			9	10	11	12	TOTAL		
				100 %	100 %			100 %	100 %	100 %	100 %			
	Tt	Tt	Tt	Tt	FC	LC	Tt	Tt	Tt	Tt	Tt	FC	LC	Tt
												472 860	65 340	538 200
					80 000		80 000					80 000		80 000
	154 598	85 249	133 872	156 664			85 331	94 314	107 786	116 769	130 242			1410 210
345	154 598	85 249	133 872	156 664	80 000		165 331	94 314	107 786	116 769	130 242			2 028 410

SECTION 2

INDUSTRIAL MILL

Schedule 10 - 8/1 : Sources of finance

Item	Sources of finance	Local currency	Foreign currency	TOTAL
1.	Promoters			
	Equity	340 800		340 800
2.	Financial institutions			
	Loans	520 000		520 000
	TOTAL	860 800		860 800

INDUSTRIAL MILL

Schedule 10 - 8/2 : Sources of initial funds

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
PRODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	100 %
Equity capital	20 600	140 200	180 000									
Loans (1)	400 000											
(2)			120 000									
Current liabilities			5 433	2 917	2 173	2 492	2 917	1 552	1 716	1 961	2 124	2 369
TOTAL	420 600	140 200	305 433	2 917	2 173	2 492	2 917	1 552	1 716	1 961	2 124	2 369

INDUSTRIAL MILL

Schedule 10 - 8/3 : Cash flow table for financial planning

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
PRODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	10(
A. Cash inflow												
1. Financial resources total	420 600	140 200	305 433	2 917	2 173	2 492	2 917	1 552	1 716	1 961	2 124	2
2. Sales revenue		2 032 561	3 122 582	3 940 907	4 871 808	4 871 808	5 955 736	6 556 296	7 191 170	7 914 978	8 707 414	9 602
B. Cash outflow												
1. Total assets	420 600	140 200	345 385	154 598	85 249	133 872	156 664	165 331	94 314	107 786	116 769	130
2. Operating costs			1 729 272	2 533 940	2 935 449	3 612 472	4 404 329	4 833 468	5 307 781	5 849 851	6 437 096	7 092
3. Debt service												
a/ interest			148 800	39 600	26 400	13 200						
b/ repayments			80 000	110 000	110 000	110 000	110 000					
4. Corporate tax				171 137	321 642	415 120	521 964	572 162	635 358	698 966	770 783	854
C. Surplus / deficit			34 537	116 224	464 340	589 636	765 696	986 887	1 155 433	1 260 336	1 384 890	1 527
D. Cumulative cash balance			34 537	150 761	615 101	1 204 737	1 970 433	2 957 320	4 112 753	5 373 089	6 757 979	8 285

INDUSTRIAL MILL

Schedule 10 - 9 : Net income statement

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
PRODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	100
1. Sales			2 032 561	3 122 582	3 940 907	4 871 808	5 955 736	6 556 296	7 191 170	7 914 978	8 707 414	9 00?
2. Production			1 938 152	2 633 620	3 021 929	3 685 752	4 464 409	4 901 548	5 375 861	7 917 931	6 505 176	7 16(
3. Gross profit			94 409	483 962	918 978	1 186 056	1 491 327	1 654 748	1 815 309	1 997 047	2 202 238	2 44?
4. Tax				171 137	321 642	415 120	521 964	572 162	635 358	698 966	770 783	d5?
5. Net profit			94 409	317 825	597 336	770 936	969 363	1 082 586	1 179 951	1 298 081	1 431 455	1 58?
6. Undistributed profit			94 409	317 825	597 336	770 936	969 363	1 082 586	1 179 951	1 298 081	1 431 455	1 58?
7. Accumulated undistributed profits			94 409	412 234	1 009 570	1 780 506	2 749 869	3 832 455	5 012 406	6 310 487	7 741 942	9 32?

INDUSTRIAL MILL

Schedule 10 - 10 : Projected balance sheet

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
PRODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	100
A. Assets	420 600		880 642	1 091 384	1 580 893	2 244 321	3 106 601	4 190 739	5 372 406	6 672 448	8 106 027	9 696
1. Current assets												
a/ cash balance			34 537	150 761	615 101	1 204 737	1 970 433	2 957 320	4 112 753	5 373 089	6 757 979	8 285
b/ current assets			345 385	499 983	585 232	719 104	875 768	961 099	1 055 413	1 163 199	1 279 968	1 410
2. Fixed assets	420 600	560 800	500 720	440 640	380 560	320 480	260 400	272 320	204 240	136 160	68 080	0
B. Liabilities	420 600		880 642	1 091 384	1 580 893	2 244 321	3 106 601	4 190 739	5 372 406	6 672 448	8 106 027	9 696
1. Current liability			5 433	8 350	10 523	13 015	15 932	17 484	19 200	21 161	23 285	25
2. Loans												
(1)	400 000	400 000	320 000	240 000	160 000	80 000	-					
(2)			120 000	90 000	60 000	30 000	-					
3. Equity	20 600	160 800	340 800	340 800	340 800	340 800	340 800	340 800	340 800	340 800	340 800	340
4. Reserves			94 403	412 234	1 009 570	1 780 506	2 749 869	3 832 455	5 012 406	6 310 487	7 741 942	9 329

INDUSTRIAL MILL

Schedule 10-11

Cost item	
1. Direct materials and inputs	
2. Direct manpower : labour and staff	
3. Factory overhead costs :	3.1. Manpower costs
	3.2. Overhead materials
	3.3. Other factory overheads
	FACTORY COSTS
4. Administrative overhead costs :	
	4.1. Manpower costs
	4.2. Overhead materials
	4.3. Other administrative overheads
5. Sales and distribution costs :	
	5.1. Manpower costs
	5.2. Others
	OPERATING COSTS
6. Financial overhead costs : interests	
7. Depreciation	
	TOTAL PRODUCTION OR MANUFACTURING COSTS

: Total production costs

Foreign currency	Local currency ($ thousand)	TOTAL
1 996 794		1 996 794
	30 600	30 600
	14 400	14 400
	4 285	4 285
1 996 794	49 285	2 046 079
	21 600	21 600
	895	895
	6 000	6 000
184 056		184 056
2 180 850	77 780	2 258 630
53 546	6 534	60 080
2 234 396	84 314	2 318 710

INDUSTRIAL MILL

Schedule 10 - 12 : Production costs schedule

PERIOD	PRODUCTION					
YEAR	3			4		
PRODUCTION PROGRAMME	50 %			70 %		
	FC	LC	Tt	FC	LC	Tt
1. Direct materials	1 330 528		1 330 528	2 042 476		2 042 476
2. Direct manpower		40 698	40 698		44 676	44 676
3. Factory overheads		24 851	24 851		27 280	27 280
FACTORY COSTS	1 330 528	65 549	1 396 077	2 042 476	71 955	2 114 432
4. Administrative costs	172 900	29 918	202 818	189 800	32 843	222 643
5. Sales and distribution	122 397	7 980	130 377	188 105	8 760	196 865
OPERATING COSTS	1 625 825	103 447	1 729 272	2 420 381	113 559	2 533 940
6. Financial costs		148 800	148 800		39 600	39 600
7. Depreciation	53 546	6 534	60 080	53 546	6 534	60 080
TOTAL PRODUCTION COSTS	1 679 371	258 781	1 938 152	2 473 927	159 693	2 633 620

	5			6			7		
	80 %			90 %			100 %		
	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
	2 042 476	2 573 158		2 573 158	3 181 600		3 181 600	3 893 749	
	44 676		49 266	49 266		54 162	54 162		59 670
	27 280		30 083	30 083		33 072	33 072		36 436
	2 114 432	2 573 158	79 349	2 652 507	3 181 600	87 234	3 268 834	3 893 749	96 106
	222 643		36 217	36 217		39 816	39 816		43 865
	196 865	237 065	9 660	246 725	293 202	10 620	303 822	358 909	11 700
	2 533 940	2 810 223	125 226	2 935 449	3 474 802	137 670	3 612 472	4 252 658	151 671
	39 600		26 400	26 400		13 200	13 200		
	60 080	53 546	6 534	60 080	53 546	6 534	60 080	53 546	6 534
	2 633 620	2 863 769	158 160	3 021 929	3 528 348	157 404	3 685 752	4 306 204	158 205

SECTION 2

7			8			9				
100 %			100 %			100 %			10	
FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	L
393 749		3 893 749	4 273 529		4 273 529	4 693 206		4 693 206	5 172 120	
	59 670	59 670		65 484	65 484		71 910	71 910		79
	36 436	36 436		39 986	39 986		43 910	43 910		48
393 749	96 106	3 989 855	4 273 529	105 470	4 378 999	4 693 206	115 820	4 809 026	5 172 120	127
	43 865	43 865		48 139	48 139	52 863	52 863	52 863		58
358 909	11 700	370 609	393 490	12 840	406 330	431 792	14 100	445 832	476 281	15
252 658	151 671	4 404 329	4 667 019	166 449	4 833 468	5 124 998	182 783	5 307 781	5 648 401	201
53 546	6 534	60 080	59 546	6 534	66 080	59 546	6 534	66 080	59 546	6
306 204	158 205	4 464 409	4 726 565	172 983	4 899 548	5 184 544	189 317	5 373 851	5 707 947	207

SECTION 3

	10			11			12		
	100 %			100 %			100 %		
Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
4 693 206	5 172 120		5 172 120	5 691 252		5 691 252	6 269 972		6 269 972
71 910		79 254	79 254		87 210	87 210		96 084	96 084
43 910		48 394	48 394		53 252	53 252		58 671	58 671
4 809 026	5 172 120	127 648	5 299 768	5 691 252	140 462	5 831 714	6 269 972	154 755	6 424 727
52 863		58 262	58 262		64 111	64 111		70 634	70 634
445 832	476 281	15 540	491 821	524 171	17 100	541 271	577 897	18 840	596 737
5 307 781	5 648 401	201 450	5 849 851	6 215 423	221 673	6 437 096	6 847 869	244 229	7 092 098
66 080	59 546	6 534	66 080	59 546	6 534	66 080	59 546	6 534	66 080
5 373 851	5 707 947	207 984	5 915 931	6 274 969	228 207	6 503 176	6 907 415	250 763	7 158 178

SECTION 4

INDUSTRIAL MILL

Schedule 10 - 13 : Cash flow table and calculation of present value for a project witjout outside financing

RIOD	CONSTRUCTION											
AR	1	2	3	4	5	6	7	8	9	10	11	12
ODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100	100
Cash inflow												
1. Sales revenues			2 032 561	3 122 582	3 940 907	4 871 808	5 955 736	6 556 296	7 191 170	7 914 978	8 707 414	9 602 772
Cash outflow												
1. Total investment outlay	420 600	140 200	339 952	151 681	83 076	131 380	153 747	163 779	92 598	105 825	114 645	127 873
2. Operating costs			1 729 272	2 533 940	2 935 449	3 612 472	4 404 329	4 833 468	5 307 781	5 849 851	6 437 096	7 092 098
3. Corporate tax				171 137	321 642	415 120	521 964	572 162	635 358	698 966	770 783	854 915
Net cash flow	- 420 600	- 140 200	- 36 663	265 824	600 740	712 836	875 696	986 887	1 155 433	1 260 336	1 384 890	1 527 886
Present value (at 15 %)	- 365 739	- 106 051	- 24 105	151 986	298 727	308 187	329 209	322 618	328 435	311 502	297 698	285 586
Cumulative net cash flow	- 420 600	- 560 800	- 597 463	- 331 639	269 101	981 987	1 857 633	2 844 520	3 999 953	5 260 289	6 645 179	8 173 065

INDUSTRIAL MILL

Schedule 10 - 15 : Foreign exchange savings

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	12
PRODUCTION PROGRAMME	0	0	50 %	70 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	100 %
Cash inflows												
Sales revenues			2 032 561	3 122 582	3 940 907	4 871 808	5 955 736	6 556 296	7 191 170	7 914 978	8 707 414	9 602 792
Cash outflows												
1/ Investment outlay	371 595	123 865	324 722	144 886	79 354	125 494	146 859	156 442	88 450	101 084	109 509	122 144
2/ Operating costs			1 625 825	2 420 381	2 810 223	3 474 802	4 252 658	4 667 019	5 124 998	5 648 401	6 215 423	6 847 869
Flow of foreign exchange savings	- 371 595	- 123 865	82 014	557 335	1 051 330	1 271 512	1 556 219	1 732 835	1 977 722	2 165 493	2 382 482	2 632 779
Cumulative foreign exchange savings	- 371 595	- 495 460	- 413 446	143 889	1 195 219	2 466 731	4 022 950	5 755 785	7 733 507	9 899 000	12 281 482	14 914 261

SEMI INDUSTRIAL MILL

Schedule 10-1/1 : Initial fixed investment costs

Item	Investment category	From schedule	Foreign currency	Local currency ($ thousand)	Total cost
1	Site preparation and development	6-5		5 000	5 000
2	Structures and civil works Buildings and civil works	6-6	24 000	6 000	30 000
3	Plant machinery and equipment	6-3	72 300	9 900	82 200
4	Total initial fixed investment costs		96 300	20 900	117 200

SEMI-INDUSTRIAL MILL

Schedule 10-1/2 : Fixed Investment Cost

PERIOD	CONSTRUCTION																									
YEAR	1			2			-3			4			5			6			7			8			9	
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
FIXED INVESTMENT COSTS																										
1/ Site preparation and development		5 000	5 000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2/ Structure and civil works	24 000	6 000	30 000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3/ Plant machinery and equipment	72 300	9 900	82 200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	141 000	19 000	160 000	-	-	-	-	-

SECTION 1

	5				6			7			8			9			10			11			TOTAL		
Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5 000	5 000
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24 000	6 000	30 000
-	-	-	-	-	-	-	141 000	19 000	160 000	-	-	-	-	-	-	-	-	-	-	-	-	213 300	28 900	242 200

SECTION 2

SEMI-INDUSTRIAL MILL

Schedule 10 - 2/1 : Preproduction capital expenditures, by category

Item	Category	Foreign currency	Local currency	TOTAL
1.	Preliminary design		701	701
2.	Tendering and bid comparison		1 406	1 406
3.	Supervision - coordination		2 813	2 813
	TOTAL		4 920	4 920

SEMI-INDUSTRIAL MILL

Schedule 10 - 2/2 : Preproduction capital expenditure, by year

PERIOD	CONSTRUCTION																																	
YEAR	1			2			3			4			5			6			7			8			9			10			11				
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC
Preproduction capital expenditure		4 920	4 920																															

SEMI-INDUSTRIAL MILL

Schedule 10-3/1 : Calculation of working capital

PERIOD	CONSTRUCTION										
YEAR	1	2	3	4	5	6	7	8	9	10	11
Production Programme		50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Raw material		251 865	415 265	607 807	670 252	736 862	811 797	890 895	978 319	1 078 232	1 186 472
Labour staff		29 537	32 466	35 640	39 302	43 207	47 601	52 239	57 365	63 224	69 571
Utilities (fuel) (petrol)		13 031	21 485	31 446	34 590	38 049	41 855	46 040	50 644	55 708	61 279
Spare parts		1 210	1 330	1 460	1 610	1 770	1 950	2 140	2 350	2 590	2 850
Factory overhead costs		786	864	949	1 046	1 150	1 267	1 391	1 527	1 683	1 852
Factory costs		296 429	471 410	677 302	746 850	821 033	904 470	992 705	1 090 205	1 201 437	1 322 024
Administrative overhead costs		278	306	336	370	407	448	492	540	596	655
Sales costs		24 163	39 988	58 579	64 629	71 036	78 317	85 841	94 179	103 905	114 357
Operating costs		320 870	511 704	736 167	811 799	892 475	983 235	1 079 038	1 184 924	1 305 938	1 437 036
Financial costs		10 800 13 440	10 320	7 200	4 080	960	-	-	-	-	-
Depreciation		20 924	20 924	20 924	20 924	20 924	35 500	35 500	35 500	35 500	35 500
TOTAL PRODUCTION		366 034	542 948	764 291	836 803	914 359	1 018 735	1 114 538	1 220 424	1 341 438	1 472 536

SEMI-INDUSTRIAL MILL

Schedule 10 - 3/2 : Calculation of working capital : working capital requirements

PERIOD	CONSTRUCTION										
YEAR	Minimum days of coverage	Coefficient of turn-over	2	3	4	5	6	7	8	9	10	11
			50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
I. Current assets												
A. Account receivable	30	12	26 739	42 642	61 347	67 650	74 373	81 936	89 919	98 743	108 828	119 758
B. Inventory												
- imported material	15	24	10 494	17 303	25 325	27 927	30 703	33 825	37 121	40 764	44 927	49 436
- spare parts	360	1	1 210	1 330	1 460	1 610	1 770	1 950	2 140	2 350	2 590	2 850
- finished products	9	40	7 502	11 932	17 145	18 906	20 785	22 899	25 130	27 596	30 415	33 468
C. Cash in hand	15	24	3 201	3 321	3 998	4 248	4 523	4 939	5 428	5 952	6 560	7 219
D. Current assets			49 146	76 528	109 275	120 341	132 154	145 549	159 730	175 405	193 320	212 726
II. Current liabilities												
A. Accounts payable	30	12	1 368	2 255	3 300	3 639	4 001	4 408	4 838	5 312	5 855	6 443
III. Working capital												
A. Net working			47 778	74 273	105 975	116 702	128 153	141 141	154 892	170 093	187 465	206 283
B. Increase			47 778	26 495	31 702	10 727	11 451	12 988	13 751	15 201	17 372	18 818
IV. Total production costs			366 034	542 948	764 291	836 803	914 359	1 018 735	1 114 538	1 220 424	1 341 438	1 472 536
Less : Raw material			251 865	415 265	607 807	670 252	736 862	811 797	890 895	978 319	1 078 232	1 186 472
Utility			16 412	27 059	39 605	43 674	48 014	52 897	58 051	63 748	70 258	77 311
Depreciation			20 924	20 924	20 924	20 924	20 924	35 500	35 500	35 500	35 500	35 500
V. Required cash			76 833	79 700	95 955	101 953	108 559	118 541	130 092	142 857	157 448	173 253

SEMI INDUSTRIAL MILL

Schedule 10-6/1 : Total initial investment costs

Item	Investment category	Foreign currency	Local currency ($ thousand)	TOTAL
1.	Initial fixed investment costs (from schedule 10-1/1)	96 300	20 900	117 200
2.	Pre-production capital expenditures (from schedule 10-2/1)		4 920	4 920
3.	Working capital (at full capacity)	65 327	7 259	72 586
		161 627	33 079	194 706

SEMI-INDUSTRIAL MILL

Schedule 10 - 6/2 : Total investment costs

PERIOD	CONSTRUCTION																									
YEAR	1			2			3			4			5			6			7			7			d	
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
1 Fixed investment costs																										
a Initial fixed	96 300	20 900	117 200																							
b. Replacement fixed																			141 000	19 000	160 000	141 000	19 000	160 000		
2 Preproduction expense		4 920	4 920																							
3 Working capital increase						47 788			26 495			31 702			10 727			11 451			12 988			12 988		
TOTAL INVESTMENT COSTS	96 300	25 820	122 120			47 788			26 495			31 702			10 727			11 451	141 000	19 000	172 988	141 000	19 000	172 988		

5		6			7			7			8			9			10			11			TOTAL		
LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
					141 000	19 000	160 000	141 000	19 000	160 000															
	10 727			11 451			12 988			12 988			13 751			15 201			17 372			18 816			
	10 727			11 451	141 000	19 000	172 988	141 000	19 000	172 988			13 751			15 201			17 372			18 816			

SECTION 2

SEMI-INDUSTRIAL MILL

Schedule 10 - 7/1 : Total initial assets

Item	Investment category	Foreign currency	Local currency	TOTAL
1.	Initial fixed investment costs	96 300	20 900	117 200
2.	Preproduction capital expenditure		4 920	4 920
3.	Currents assets	68 858	5 988	74 846
	TOTAL	165 158	31 808	196 966

INDUSTRIAL MILL

Schedule 10 - 7/2 : Total assets

CONSTRUCTION	1			2			3			4			5			6			7			8			9			10			11			TOTAL		
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
	96 300	20 900	117 200																141 000	19 000	160 000														
		4 920	4 920																																
						49 146			27 382			32 747			11 066			11 813			13 395			14 181			15 675			17 915			19 40		
	96 300	25 820	122 120			49 146			27 382			32 747			11 066			11 813	141 000	19 000	173 395			14 181			15 675			17 915			19 40		

SEMI-INDUSTRIAL MILL

Schedule 10 - 8/1 : Sources of finance

Item	Sources of finance	Local currency	Foreign currency	TOTAL
1.	Promoters			
	Equity	33 120		33 120
2.	Financial institutions			
	Loans	130 000		130 000
	TOTAL	163 120		163 120

SEMI-INDUSTRIAL MILL

Schedule 10 - 8/2 : Sources of initial funds

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
Equity capital	33 120											
Loans	90 000	40 000										
Current liabilities		1 368	887	1 045	339	362	407	430	474	543		
TOTAL	123 120	41 368	887	1 045	339	362	407	430	474	543		

SEMI-INDUSTRIAL MILL

Schedule 10 - 8/3 : Cash-flow table for financial planning

PERIOD	CONSTRUCTION										
YEAR	1	2	3	4	5	6	7	8	9	10	11
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
. Cash inflow											
1. Financial resources total	123 120	41 368	887	1 045	339	362	407	430	474	543	588
2. Sales revenue		392 180	645 964	945 392	1 043 932	1 147 054	1 262 050	1 389 339	1 523 920	1 677 248	1 845 160
. Cash outflow											
1. Total assets	122 120	49 146	27 382	32 747	11 066	11 813	173 395	14 181	15 675	17 915	19 406
2. Operating costs		320 870	511 704	736 167	811 799	892 475	983 235	1 079 038	1 184 924	1 305 938	1 437 036
3. Debt services											
Interests		24 240	10 320	7 200	4 080	960					
Repayments		18 000	26 000	26 000	26 000	26 000	8 000				
4. Corporate tax		121	36 056	63 385	72 495	81 443	71 160	96 180	106 224	117 533	130 41d
. Surplus/Deficit	1 000	18 171	35 389	80 938	118 831	134 725	26 667	200 370	217 571	236 405	25d 8dd
. Cumulative cash balance	1 000	19 171	57.560	138 498	257 329	392 054	418 721	619 091	836 662	1 073 067	1 331 955

SEMI-INDUSTRIAL MILL

Schedule 10 - 9 : Net income statement

PERIOD	CONSTRUCTION										
YEAR	1	2	3	4	5	6	7	8	9	10	11
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100
1. Sales		392 180	645 964	945 392	1 043 932	1 147 054	1 262 050	1 389 339	1 523 920	1 677 248	1 845 160
2. Production costs		366 034	542 948	764 291	836 803	914 359	1 018 735	1 114 538	1 220 424	1 341 438	1 472 536
3. Gross profit		26 146	103 016	181 101	207 129	232 695	243 315	274 801	303 496	335 810	372 624
4. Tax		121	36 056	63 385	72 495	81 443	71 160	96 180	106 224	117 533	130 418
5. Net profit		26 025	66 960	117 716	134 634	151 252	172 155	178 621	197 272	218 277	242 206
6. Undistributed profits		26 025	66 960	117 716	134 634	151 252	172 155	178 621	197 272	218 277	242 206
7. Accumulated undistributed profits		26 025	92 985	210 701	345 335	496 587	668 742	847 363	1 044 635	1 262 912	1 505 118

SEMI-INDUSTRIAL MILL

Schedule 10 - 10 : Projected balance sheet

PERIOD	CONSTRUCTION										
YEAR	1	2	3	4	5	6	7	8	9	10	11
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
A. Assets	123 120	199 513	214 360	307 121	416 094	541 708	706 270	885 321	1 083 067	1 301 887	1 544 681
1. Current assets cumulutative											
a. cash balance	1 000	19 171	57 560	138 498	257 329	392 054	418 721	619 091	836 662	1 073 067	1 331 955
b. current assets	49 146	76 528	109 275	120 341	132 154	132 154	145 549	159 730	175 405	193 320	212 726
2. Fixed assets	122 120	101 196	80 272	59 348	38 424	17 500	142 000	106 500	71 000	35 500	0
B. Liabilities	123 120	199 513	214 360	307 121	416 094	541 708	706 270	885 321	1 083 067	1 301 887	1 544 681
1. Current liability		1 368	2 255	3 300	3 639	4 001	4 408	4 838	5 312	5 855	6 443
2. Long+short term loans :											
long	90 000	72 000	54 000	36 000	18 000						
short		40 000	32 000	24 000	16 000	8 000					
3. Equity capital	33 120	33 120	33 120	33 120	33 120	33 120	33 120	33 120	33 120	33 120	33 120
4. Reserves		26 025	92 985	210 701	345 335	496 587	668 742	847 363	1 044 635	1 262 912	1 505 118

SEMI INDUSTRIAL MILL

Schedule 10-11 : Total production costs

Cost item	Foreign currency	Local currency ($ thousand)	TOTAL
1. Direct materials and inputs (from schedule 4-2)	438 845		438 845
2. Direct manpower : labour and staff (from schedule 8-2 and 8-4)		13 411	13 411
3. Factory overhead costs			
3.1. Manpower costs (from schedules 8-2 and 8-4)			
3.2. Overhead materials (from schedule 4-2)			
3.3. Other factory overheads (from schedule 7)		650	650
FACTORY COSTS	438 845	14 061	452 906
4. Administrative overhead costs			
4.1. Manpower costs(from schedules 8-2 and 8-4)		11 000	11 000
4.2. Overhead materials (from schedule 4-2)			
4.3. Other administrative overheads (from schedule 7)		230	230
5. Sales and distribution costs			
5.1. Manpower costs (from schedules 8-2 and 8-4)			
5.2. Others (from schedule 3-2)	40 088		40 088
OPERATING COSTS	478 933	25 291	504 224
6. Financial overhead costs : interests (from cha			
7. Depreciation (from schedule 7)	16 860	4 064	20 924
TOTAL PRODUCTION OR MANUFACTURING COSTS	495 793	29 355	525 148

SEMI INDUSTRIAL MILL

Years	2			3		
	FC	LC	Tt	FC	LC	Tt
1. Direct material	266 106		266 106	438 080		438 080
2. Direct Manpower		16 227	16 227		17 837	17 837
3. Factory overhead		786	786		864	864
Factory costs	266 106	17 013	283 119	438 080	18 701	456 781
4. Administrative costs		13 588	13 588		14 936	14 936
5. Distribution costs	24 163		24 163	39 988		39 988
Operating costs	290 269	30 601	320 870	478 067	33 637	511 704
6. Financial costs		24 240	24 240		10 320	10 320
7. Depreciation	16 860	4 064	20 924	16 860	4 064	20 924
TOTAL PRODUCTION	307 129	58 905	366 034	494 927	48 021	542 948

	4			5			6	
	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
	433 080	640 713		640 713	706 452		706 452	776 681	
	17 837		19 580	19 580		21 592	21 592		23 737
	864		949	949		1 046	1 046		1 150
	456 781	640 713	20 529	661 242	706 452	22 638	729 090	776 631	24 837
	14 936		16 396	16 396		18 080	18 080		19 877
	39 988	58 529		58 529	64 629		64 629	71 030	
	511 704	699 242	36 925	736 167	771 081	40 718	811 799	847 711	44 764
	10 320		7 200	7 200		4 080	4 080		960
	20 924	16 860	4 064	20 924	16 860	4 064	20 924	16 860	4 064
	542 948	716 102	48 189	764 291	787 941	48 862	836 803	864 571	49 788

SECTION 2

Production cost Schedule

6		7			8			9	
LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
	776 681	855 602		855 602	939 075		939 075	1 031 313	
23 737	23 737		26 151	26 151		28 700	28 700		31 516
1 150	1 150		1 267	1 267		1 391	1 391		1 527
24 837	801 568	855 602	27 418	883 020	939 075	30 091	969 166	1 031 313	33 043
19 877	19 877		21 898	21 898		24 032	24 032		26 390
	71 030	78 317		78 317	85 341		85 841	94 179	
44 764	892 475	933 919	49 316	983 235	1024 915	54 123	1079 038	1 125 491	59 433
960	960								
4 064	20 924	30 545	4 955	35 500	30 54	4 955	35 500	30 545	4 955
49 788	914 359	964 464	54 271	1 018 735	1055 460	59 078	1114 538	1 156 036	64 388

SECTION 3

	9			10			11		
t	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
039 075	1 031 313		1 031 313	1 136 530		1 136 530	1 251 601		1 251 601
28 700		31 516	31 516		34 734	34 734		38 221	38 221
1 391		1 527	1 527		1 683	1 683		1 852	1 852
069 166	1 031 313	33 043	1 064 356	1 136 530	36 417	1 172 947	1 251 601	40 073	1 291 674
24 032		26 390	26 390		29 086	29 086		32 005	32 005
85 841	94 179		94 179	103 905		103 905	114 357		114 357
179 038	1 125 491	59 433	1 184 924	1 240 435	65 503	1 305 938	1 364 958	72 078	1 438 037
35 500	30 545	4 955	35 500	30 545	4 955	35 500	30 545	4 955	35 500
114 538	1 156 036	64 388	1 220 424	1 270 980	70 458	1 341 438	1 395 503	77 033	1472 536

SECTION 4

SEMI-INDUSTRIAL MILL

Schedule 10 - 13 : Cash-flow table and calculation of present value for a project without outside financing

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	TOTAL
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
A. Cash inflow												
1. Sales revenue		392 180	645 964	945 392	1 043 932	1 147 054	1 262 050	1 389 339	1 523 920	1 677 248	1 845 160	11 872 23
B. Cash outflow	122 120	368 769	574 255	831 254	895 021	985 369	1 227 383	1 188 969	1 306 349	1 440 843	1 586 272	10 526 60
1. Total investment out-lay	122 120	47 778	26 495	31 702	10 727	11 451	172 983	13 751	15 201	17 372	18 818	488 40
2. Operating costs		320 870	511 704	736 167	811 799	892 475	983 235	1 079 038	1 184 924	1 305 938	1 437 036	9 263 18
3. Corporate tax		121	36 056	63 385	72 495	81 443	71 160	96 180	106 224	117 533	130 418	775 01
C. Net cash flow	- 122 120	23 411	71 709	114 138	148 911	161 685	34 667	200 370	217 571	236 405	258 888	1 345 63
D. Net present value (at 15 %)	- 106 191	17 709	47 146	65 259	74 048	69 903	13 033	65 502	61 845	58 429	55 651	422 33
E. Cumulative net cash flow	- 122 120	- 98 709	- 27 000	87 138	236 049	397 734	432 401	632 771	850 342	1 086 747	1 345 635	1 345 63

SEMI-INDUSTRIAL MILL

Schedule 10 - 14 : Cash flow table and calculation of present value for a project with outside financing

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	TOTAL
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
A. Cash in flows												
1. Sales revenue		392 180	645 964	945 392	1 043 932	1 147 054	1 262 050	1 389 339	1 523 920	1 677 248	1 845 160	11 872 2
B. Cash out flows												
1. Total investment costs	33 120	363 231	584 080	832 752	914 374	1 000 878	1 232 395	1 175 218	1 291 148	1 423 471	1 567 454	10 418 1
a. Equity funds	33 120											33 1
b. Replacement of asset							160 000					160 0
c. Repayment of bank loan		18 000	26 000	26 000	26 000	26 000	18 000					140 0
d. Interests on bank loan		24 240	10 320	7 200	4 080	960						46 8
2. Operating costs		320 870	511 704	736 167	811 799	892 475	983 235	1 079 038	1 184 924	1 305 938	1 437 036	9 263 1
3. Corporate tax		121	36 056	63 385	72 495	81 443	71 160	96 180	106 224	117 533	130 418	775 0
C. Net cash flow	- 33 120	28 949	61 884	112 640	129 558	146 176	29 655	214 121	232 772	253 777	277 706	1 454 1
D. Present value	- 28 800	21 898	40 686	64 403	64 425	63 198	11 148	69 997	66 166	62 723	59 696	495 5

SEMI-INDUSTRIAL MILL

Schedule 10 - 15 : Foreign exchange savings

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	TO
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
A. CASH INFLOWS												
1. Sales revenues		392 180	645 964	945 392	1 043 932	1 147 054	1 262 050	1 389 339	1 523 920	1 677 248	1 845 160	
B. CASH OUTFLOWS												
1. Total investment outlay	96 300	43 000	23 845	28 532	9 654	10 306	155 689	12 376	13 680	15 635	16 936	
2. Operating costs		290 269	478 068	699 242	771 081	847 711	933 919	1 024 916	1 125 492	1 240 435	1 364 958	
FLOW OF FOREIGN EXCHANGE SAVINGS	- 96 300	58 911	144 051	217 618	263 197	289 037	172 442	352 047	384 748	421 178	463 266	
CUMULATIVE FOREIGN EXCHANGE SAVINGS	- 96 300	- 37 389	106 662	324 280	587 477	876 514	1 048 956	1 401 003	1 785 751	2 206 929	2 670 195	

SERVICE MILL

Schedule 10-1/1 : Initial fixed investment costs

Item	Investment category	From schedule	Foreign currency	Local currency ($ thousand)	Total cost
1	Site preparation and development	6-7		300	300
2	Structures and civil works				
	Buildings and civil works	6-7	2 000	7 600	9 600
3	Plant machinery and equipment	6-3	7 100	3 500	10 600
4	Total initial fixed investment costs		9 100	11 400	20 500

SERVICE MILL

Schedule 10 - 1/2 : Fixed investment costs

PERIOD	CONSTRUCTION																								
YEAR	1			2			3			4			5			6			7			8			
	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	F
1/ Site preparation and development		300	300																						
2/ Structures and civil works	2 000	7 900	9 900																						
3/ Plant and machinery	7 100	3 500	10 600																14 200	7 000	21 200				

SECTION 1

5			6			7			8			9			10			11			TOTAL		
FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
																						300	300
																					2 000	7 900	9 900
						14 200	7 000	21 200													21 300	10 500	31 800

SECTION 2

SERVICE MILL

Schedule 10 - 2/1 : Preproduction capital expenditures, by category

Item	Category	Foreign currency	Local currency	TOTAL
	Management of project implementation		1 000	1 000
	TOTAL		1 000	1 000

SERVICE MILL

Schedule 10 - 2/2 : Preproduction capital expenditure, by year

CONSTRUCTION																																
1			2			3			4			5			6			7			8			9			10			11			TOTAL		
FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
	1 000	1 000																														1 000	1 000

SERVICE MILL

Schedule 10 - 3/1. Calculation of working capital

Period											
Years	1	2	3	4	5	6	7	8	9	10	11
Production Programme	Construction	30 %	50 %	65 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %
Labor + staff		8 560	9 400	10 328	11 389	12 521	13 794	15 138	16 624	18 322	20 161
Utilities		1 955	3 581	5 110	6 936	8 578	10 501	11 524	12 655	13 947	15 347
Spare parts		1 210	1 330	1 460	1 610	1 770	1 950	2 140	2 350	2 590	2 850
Factory overheads		181	199	219	241	265	292	321	352	388	427
Factory costs		11 906	14 510	17 117	20 176	23 134	26 537	29 123	31 981	35 247	38 785
Administrative overhead		36	40	44	48	53	58	64	70	78	86
Operating costs		11 942	14 550	17 161	20 224	23 187	26 595	29 187	32 051	35 325	38 871
Financial costs		2 100	600	300							
Depreciation		3 310	3 310	3 310	3 310	3 310	5 230	5 230	5 230	5 230	5 230
Production costs		17 352	18 460	20 771	23 534	26 497	31 825	34 417	37 281	40 555	44 101

ERVICE MILL

Schedule 10 - 3/2. Calculation of working capital : working capital requirements

Period	Construction										
Years	1	2	3	4	5	6	7	8	9	10	11
Production programme		30 %	50 %	65 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %
A/ Inventory											
Spare parts		1 210	1 330	1 460	1 610	1 770	1 950	2 140	2 350	2 590	2 850
Cash in hand		503	481	514	553	608	670	735	807	889	979
Current assets		1 713	1 811	1 974	2 163	2 378	2 620	2 875	3 157	3 479	3 829
Current liabilities											
accounts payable		163	298	426	578	714	875	960	1 054	1 162	1 278
A/ Net working cap.		1 550	1 513	1 548	1 585	1 664	1 745	1 915	2 103	2 317	2 551
B/ Increase in											
working capital		1 550	- 37	35	37	79	81	170	188	214	234
Total production costs		17 352	18 460	20 771	23 534	26 497	31 825	34 417	37 281	40 555	44 101
less :											
Utility		1 955	3 581	5 110	6 936	8 578	10 501	11 524	12 655	13 947	15 347
Depreciation		3 310	3 310	3 310	3 310	3 310	5 230	5 230	5 230	5 230	5 230
Required cash balance		12 087	11 569	12 351	13 288	14 609	16 094	17 663	19 396	21 378	23 524

SERVICE MILL

Schedule 10-6/1 : Total initial investment costs

Item	Investment category	Foreign currency	Local currency ($ thousand)	TOTAL
1	Initial fixed investment costs	9 100	11 400	20 500
2	Preproduction capital		1 000	1 000
3	Working capital	470	470	940
		9 570	12 870	22 440

SERVICE MILL

Schedule 10 - 6/2 : Total investment costs

PERIOD	CONSTRUCTION																								
YEAR	1			2			3			4			5			6			7			8			9	
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
1. Fixed investment costs																									
(a) initial	9 100	11 400	20 500																						
(b) replacement																			14 200	7 000	21 200				
2. Preproduction capital		1 000	1 000																						
3. Working capital increase						1 550			- 37			35			37			79			81			170	
TOTAL	9 100	11 400	21 500			1 550			- 37			35			37			79	14 200	7 000	21 281			170	

SECTION 1

Total investment costs

4		5			6			7			8			9			10			11			TOTAL		
LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te	FC	LC	Te
																							9 100	11 400	20 500
						—		14 200	7 000	21 200													14 200	7 000	21 200
																								1 000	1 000
	35			37			79			81			170			188			214			234			2 551
	35			37			79	14 200	7 000	21 281			170			188			214			234			42 251

SECTION 2

SERVICE MILL

Schedule 10 - 7/1 : Total initial assets

Item	Investment category	Foreign currency	Local currency	TOTAL
1.	Initial fixed investment costs	9 100	11 400	20 500
2.	Preproduction capital expenditure		1 000	1 000
3.	Current assets	1 000	346	1 346
	TOTAL	10 100	12 746	22 846

SERVICE MILL

Schedule 10 - 7/2 : Total assets

PERIOD	CONSTRUCTION																							
YEAR	1			2			3			4			5			6			7			8			9	
	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC
1/ Fixed investment costs																										
(a) initial	9 100	11 400	20 500																							
(b) replacement																			14 200	7 000	21 200					
2/ Preproduction capital		1 000	1 000																							
3/ Current asset increase						1 713			98			163			189			215			242			255		
TOTAL ASSETS	9 100	12 400	21 500			1 713			98			163			189			215	14 200	7 000	21 242			255		

SECTION 1

	5			6			7			8			9			10			11			TOTAL		
	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt	FC	LC	Tt
																							9 100	11 400	20 500
								14 200	7 000	21 200													14 200	7 000	21 200
																								1 000	1 000
	163			189			215			242			255			282			322			350			3 829
	163			189			215	14 200	7 000	21 242			255			282			322			350			46 529

SECTION 2

SERVICE MILL

Schedule 10 - 8/1 : Sources of finance

Item	Sources of finance	Foreign currency	Local currency	TOTAL
1.	Promoters			
	Equity	23 800		23 800
2.	Financial institutions			
	Loans	10 000		10 000
	TOTAL	33 800		33 800

SERVICE MILL

Schedule 10 - 8/2. Source of initial funds

Period	Construction					
Years	1	2	3	4	5	6
Production programme		30 %	50 %	65 %	80 %	90 %
Equity capital	11 500	12 300				
Loans	10 000					
Current liabilities		163	298	426	578	714
TOTAL	21 500	12 463	298	426	578	714

	7	8	9	10	11	
	100 %	100 %	100 %	100 %	100 %	
	875	960	1 054	1 162	1 278	
	875	960	1 054	1 162	1 278	

SERVICE MILL

Schedule 10- 8/3. Cash flow table for financial planning

Period	Construction										
Years	1	2	3	4	5	6	7	8	9	10	11
Production programme		30 %	50 %	65 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %
A. Cash inflow											
1. Financial ressources	21 500	12 463	135	128	152	136	161	85	94	108	116
2. Sales revenues		8 298	15 202	21 694	29 444	36 416	44 577	48 920	53 721	59 207	65 151
B. Cast outflow											
1. Total assets	21 500	1 713	98	163	189	215	21 442	255	282	322	350
2. Oparating costs		11 942	14 550	17 161	20 224	23 187	26 595	29 187	32 051	35 325	38 871
3. Debt service											
Interest		2 100	600	300							
Repayment		2 500	2 500	2 500	2 500						
4. Corporate taxes				323	2 068	3 472	2 573	5 076	5 764	6 528	7 367
C. Surplus/deficit		2 506	- 2 411	1 375	4 615	9 678	- 5 872	14 487	15 728	17 140	18 679
D. Cumulatetive cash		2 506	95	1 470	6 085	15 763	9 891	24 378	40 106	57 246	75 925

SERVICE MILL

Schedule 10 - 9 . Net income statement

Period	Construction										
Years	1	2	3	4	5	6	7	8	9	10	11
Production programme		30 %	50 %	65 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %
1. Sales		8 298	15 202	21 694	29 444	36 416	44 577	48 920	53 721	59 207	65 151
2. Production costs		17 352	18 460	20 771	23 534	26 497	31 825	34 417	37 281	40 555	44 101
3. Gross profit		(9 054)	(3 258)	923	5 910	9 919	12 752	14 503	16 440	18 652	21 050
4. Tax				323	2 068	3 472	2 573	5 076	5 754	6 528	7 367
5. Net profit				600	3 842	6 447	10 179	9 427	10 686	12 124	13 683
6. Undistributed				600	3 842	6 447	10 179	9 427	10 686	12 124	13 683
7. Accumulated		(9 054)	(12 312)	(11 712)	(7 870)	(1 423)	8 756	18 183	28 869	40 993	54 676

SERVICE MILL

Schedule 10 - 10. Projected balance sheet

Period	Construction										
Years	1	2	3	4	5	6	7	8	9	10	11
Production programme		30 %	50 %	65 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %
A. Assets	21 500	31 463	29 098	26 726	24 378	24 514	33 431	42 943	53 723	65 955	79 754
1. Current assets											
a) cash balance		2 506	95	1 470	6 085	15 763	9 891	24 378	40 106	57 246	75 925
b) current assets		1 713	1 811	1 974	2 163	2 378	2 620	2 875	3 157	3 479	3 829
2. Fixed assets	21 500	18 190	14 880	11 570	8 260	4 950	20 920	15 690	10 460	5 230	0
3. Losses		9 054	12 312	11 712	7 870	1 423					
B. Liabilities	21 500	31 463	29 098	26 726	24 378	24 514	33 431	42 943	53 723	65 955	79 754
1. Current liability		163	298	426	578	714	875	960	1 054	1 162	1 278
2. Short + medium terms loans	10 000	7 500	5 000	2 500							
3. Equity	11 500	23 800	23 800	23 800	23 800	23 800	23 800	23 800	23 800	23 800	23 800
4. Reserves							8 756	18 183	28 869	40 993	54 676

SERVICE MILL

Schedule 10 - 11 : Total production costs

Cost item	Foreign currency	Local currency	TOTAL
1. Direct materials and inputs	6 385		6 385
2. Direct manpower : labour and staff		4 674	4 674
3. Factory overhead costs : 3.1. Manpower costs			
3.2. Overhead materials			
3.3. Other factory overheads		150	150
FACTORY COSTS	6 385	4 824	11 209
4. Administrative overhead costs :			
4.1. Manpower costs		2 400	2 400
4.2. Overhead materials			
4.3. Other administrative overheads		30	30
5. Sales and distribution costs :			
5.1. Manpower costs			
5.2. Others			
OPERATING COSTS	6 385	7 254	13 639
6. Financial overhead costs : interests			
7. Depreciation	1 620	1 690	3 310
TOTAL PRODUCTION OR MANUFACTURING COSTS	8 005	8 944	16 949

Schedule 9 - 11 : Production cost schedule

Costs	2			3			4			5				6			7			8				9			10			11		
	FC	LC	TC	FC	LC	TC	FC	LC	TC	FC	LC	TC	FC	LC	TC	FC	LC	TC	FC	LC	TC		FC	LC	TC	FC	LC	TC	FC	LC	TC
Direct material	3 365		3 365	4 931		4 931	6 570		6 570	8 546		8 546	10 388		10 388	12 951		12 951	13 664		13 664	15	664	15 005	-	15 005	16 537		16 537	18 190		18 190
Direct Manpower		5 656	5 656		6 236	6 236		6 824	6 824		7 525	7 525		8 273	8 273		9 116	9 116		10 000	10	000		10 000	10 904		12 006	12 006		13 207	13 207
Factory overheads		101	101		111	111		219	219		241	241		266	266		292	292		321		321		321	352		386	386		424	424
Factory costs	3 365	5 837	9 008	4 931	6 465	11 397	6 570	7 043	13 613	8 546	7 766	16 312	10 388	8 539	18 927	12 951	9 408	21 687	13 664	10 323	23	987	15 005	11 326	26 331	16 537	12 698	29 035	18 190	13 918	32 108
Administrative costs		2 940	2 940		3 232	3 232		3 648	3 648		3 932	3 932		4 301	4 301		4 738	4 738		5 200	5	200		5 710	5 710		6 296	6 296		6 925	6 925
Distribution costs																															
Operating costs	3 365	8 777	11 942	4 931	9 697	14 628	6 570	10 691	17 261	8 546	11 698	20 244	10 388	12 839	23 188	12 951	14 146	26 595	13 664	15 523	29	187	15 005	17 036	32 041	16 537	18 724	35 261	18 190	20 843	39 033
Financial costs		2 300	2 300		600	600		300	300																						
Depreciation	1 620	1 690	3 310	1 620	1 690	3 310	1 620	1 690	3 310	1 620	1 690	3 310	1 620	1 690	3 310	3 040	2 190	5 230	3 040	2 190	5	230	3 040	2 190	5 230	3 040	2 190	5 230	3 040	2 190	5 230
TOTAL PRODUCTION	4 985	12 567	17 552	6 551	11 987	18 538	8 190	12 681	20 871	10 166	13 388	23 554	11 988	14 529	26 517	15 991	16 336	31 825	16 704	17 711	34	417	18 045	19 226	37 271	19 577	20 970	40 545	21 230	23 033	44 263

SERVICE MILL

Schedule 10 - 13. Cash flow table and calculation of present value for a project without outside financing

Period	Construction											
Years	1	2	3	4	5	6	7	8	9	10	11	
Production programme		30 %	50 %	65 %	80 %	90 %	100 %	100 %	100 %	100 %	100 %	
A. Cash inflow												
1. Sales revenues		8 298	15 202	21 694	29 444	36 416	44 577	48 920	53 721	59 207	65 151	382 63
B. Cash outflow												
1. Total investment outlay	- 21 500	-1 550	+ 37	-35	-37	-79	-21 281	-170	-188	- 214	- 234	- 45 25
2. Operating costs		-11 942	-14 550	-17 161	-20 224	-23 187	-26 595	-29 187	-32 051	-35 325	-38 871	- 240 09
3. Corporate tax				-323	-2 068	-3 472	-2 573	-5 076	-5 754	-5 528	-7 367	- 33 16
C. Net cash flow	- 21 500	- 5 194	689	4 175	7 115	9 678	- 5 872	14 487	15 728	17 140	18 679	55 12
D. Present value at 15 %	- 18 696	- 3 929	453	2 387	3 538	4 184	- 2 208	4 736	4 471	4 236	4 015	3 18
E. Cumulative net cash flow	- 21 500	- 26 694	- 26 005	- 21 830	- 14 715	- 5 037	-10 909	3 578	19 306	36 446	55 125	55 12

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Schedule 10 - 14 : Cash-flow table

PERIOD	CONSTRUCTION											
YEAR	1	2	3	4	5	6	7	8	9	10	11	TOTAL
PRODUCTION PROGRAMME	0	50 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
A. CASH INFLOWS												
1. Sales revenues		8 298	15 202	21 694	29 444	36 416	44 577	48 920	53 721	59 207	65 151	382 630
B. CASH OUTFLOWS	- 11 500	- 28 842	- 17 650	- 20 284	- 24 792	- 26 659	- 50 368	- 34 263	- 37 805	- 41 853	- 46 238	- 340 254
1. Total investment costs												
a/ equity funds	- 11 500	- 12 300										- 23 800
b/ replacement of equipment							- 21 200					- 21 200
c/ replacement of bank loan		- 2 500	- 2 500	- 2 500	- 2 500							- 10 000
d/ interest on bank loan		- 2 100	- 600	- 300								- 3 000
2. Operating costs		- 11 942	- 11 550	- 17 161	- 20 224	- 23 187	- 26 595	- 29 187	- 32 051	- 35 325	- 38 871	- 249 093
3. Corporate tax				- 323	- 2 068	- 3 472	- 2 573	- 5 076	- 5 754	- 6 528	- 7 367	- 33 161
C. NET CASH FLOW	- 11 500	- 20 544	- 2 448	1 410	4 652	9 757	- 5 791	14 657	15 916	17 354	18 913	42 376
D. PRESENT VALUE (at 15 %)	- 10 000	- 15 540	- 1 609	806	2 313	4 218	- 2 162	4 791	4 524	4 289	4 066	4 696

ANNEX IV

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