PROJECT PROFILE ON GLUCOSE PRODUCTION

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ADDIS ABEBA CITY ADMINISTRATION INVESTMENT COMMISSION
A.A

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I. Executive summary

This project profile is prepared to assess the viability of running Glucose factory, in Addis Abeba city administration. Hence Market, Technical, Organizational and Financial study was made to investigate the viability of the envisaged project.

This project profile on Glucose factory has been developed to support the decision –making process based on a cost benefit analysis of the actual project viability. This profile includes marketing study, production and financial analysis, which are utilized to assist the decision-makers when determining if the business concept is viable. Ethiopia has a private sector driven Glucose industry. According to the latest data sourced from Ethiopian investment commission (EIC) there are more about 3 companies registered to involve in production of glucose and related products. The status of these companies is: one is on pre-implementation stage, two of them are on implementation stages.

The location of the plant will be decided on the basis of access to raw materials, infrastructure namely power, water, transport and telecom to easy access to international market. The most locally available raw materials for the factory are maize.

The factory at full capacity operation can process 100,000 quintals of maize seed to produce 50,000 quintals of glucose, per year based on 260 working days and their shifts of 24 hours per day.

The total investment capital including establishing the factory is Birr 302.188 million. Out of the total investment capital, the owners will cover Birr 90.65 million (30 %) while the remaining balances amounting to Birr 211.53 million (70 %) will be secured from bank in the form of term loan.

As indicated in the financial study, the cash flow projection of the project shows surplus from the first year on. The net cash flows of the project range from Birr 51.22 Million in the first year to Birr 86.65 million at the end of the 10^{th} year of operation. At the end of the 10^{th} year of operation period the cumulative cash balance reaches Birr 1.97 billion. The Benefit-cost ratio and Net present value (NPV) have been calculated at 17% discount factor (D.F) for 10 years of the project activity. Accordingly, the project has NPV of 200 million Birr at 17%D.F. and the benefit-cost ratio of 1.12 at 17% D.F.

Therefore, from the aforementioned overall market technical and financial analysis we can conclude that the Glucose factory business is a viable and worthwhile.

1. BACKGROUND INFORMATION

1.1 Introduction

This document was undertaken to show glucose production sector investment profile in Addis Ababa. In compiling the report, information from Addis Ababa investment commission, Addis Ababa trade and industry development, Ethiopian custom commission and published sources have been augmented.

Amount of import glucose has been increasing steady in Ethiopia. Imported glucose can serve as a raw material in different industries such as in pharmaceutical, food, textile, paper and many other industries. Especially, in pharmaceutical industry glucose has versatile use in developing different drugs and relief feed supplements.

The provision of adequate glucose is of fundamental importance to Ethiopian's present and future demand of pharmaceutical, food, textile, paper and many other industries. In Ethiopia, the demand for glucose is expected to increase considerably in the next few decades as a result of increased population growth, urbanization and increasing income levels.

1.2 Product Description and Application

Glucose syrup is a sweetening liquid which is made from the hydrolysis of starch in glucose syrup processing plant. Generally, corn, rice, wheat, potato or cassava is used to make glucose syrup, because they are the rich source of starch.

Glucose syrups are derived from starch sources such as maize, wheat and potatoes. Offering alternative functional properties to sugar as well as economic benefits, glucose syrups are extremely versatile sweeteners, and are widely used in food manufacturing and other industries. They are a key

ingredient in confectionery products, beer, soft drinks, sports drinks, jams, sauces and ice creams, as well as in pharmaceuticals and industrial fermentations.

Glucose syrup is a liquid starch hydrolysate of oligo and polysaccharides and made from any source of starch, wheat, rice, and potatoes are the most common sources. Due to the high glucose content in the final product, it tastes sweeter. That is why it serves as a great ingredient for candy, fondant, canned baked foods, and beer. Glucose uses do not limit to these because it can be used in various places throughout the food industry.

1.3 Project Location and Justification

1.3.1 Location of Addis Ababa

Addis Ababa is the seat of the Ethiopian federal government. It is located on the central highlands of Ethiopia in the middle of Oromia Region. The absolute location is around the intersection point of 901'48''N latitude and 38°44′24″E longitudes. This is very near to the geographical center of the country. It is, therefore, equidistant to the peripheral areas or is equally accessible to almost all parts of Ethiopia. Addis Ababa is located on a well-watered plateau surrounded by hills and mountains. The city is in the highlands on the edge of the Ethiopian rift valley or the eastern slopes of the Entoto Mountain ranges bordering the Great Rift Valley. The total area of Addis Ababa is about 540 km^2 of which 18.2 km^2 are rural. Addis Ababa's built-up urban area spans 474 km^2. It is also the largest city in the world located in a landlocked country.

1.3.2 Demography of Addis Ababa

According to the CSA (2013) population projection, Ethiopia's total population reaches about 105 million people in 2022. Of the total population 22.9% (24 million people) live in urban areas.

Ethiopia's urban population is expected to triple by 2037 (World Bank, 2015). Addis Ababa hosts an estimated 3,859,638 people. Currently, Addis Ababa is experiencing an annual growth rate of 3.8% and is estimated to reach 4,696,629 inhabitants by 2032 (CSA, 2015).

1.3.3 Economic activity of Addis Ababa

The transformation of Addis Ababa has especially been rapid since 1991. According to the data from the city's Bureau of Finance and Economic Development (2006), per capital income of Addis Ababa has grown from USD 788.48 in 2010 to USD 1,359 in 2015. The city also achieved a decline in the poverty index from a high of 29.6 in 2012 to 22.0 in 2014. Moreover, the current poverty headcount index for Addis Ababa is estimated at 18.9 while the poverty severity account for 5 and 1.8 index points respectively. Even though, the poverty status of Addis Ababa has an improvement over previous years, there is still much work to be done to curb both the incidence and severity of poverty.

The major contributor to the economic growth of the city is the implementation of publicly financed mega urban projects like condominium housing, the Light Rail Transit, the international airport and industrial zone development (The state of Addis Ababa, 2017). The existence of international large and medium-size enterprises in and around Addis Ababa have also significant role in creating huge opportunity for employment and technology transfer. Furthermore, there are strong demand for goods and services following the existence of many embassies and inter-governmental organizations like the African Union, the United Nations Economic Commission for Africa.

The manufacturing sector's contribution to Addis Ababa's GDP is high. Despite the fact that 86% of the industries in the city are micro and small scale (cottage and handicrafts, and small-scale), the majority of the country's large and medium scale industries are found in the city. Noticeable increases are also registered currently in other aspects of industrial growth.

The service sector is both the largest contributor to the city's economy and the largest employer. It contributes to 76.4% of the city's GDP while industry's share makes up (almost all) the rest. This sector is dominated by three major sub-sectors: Transport and communication; Real estate, Renting and Business services; and Trade, Hotel and Restaurants. According to the state of Ethiopian Cities 2015 report, the service sector has also been responsible for more than 50% of the growth in the estimated annual growth of the city's GDP. Although 75% of employment in the city is also generated in the service sector, a large proportion of the employed work in low skill and low paying jobs as shop salespersons, petty and 'gullit' traders, sales workers in small shops, domestic helpers or doorkeepers and restaurant service workers.

Analysis of the economic structure of Addis Ababa reveals that the services sectors (63%) dominates with industry (36%) in second place indicating that these sectors account for almost all of the Addis Ababa's GDP (The State of Addis Ababa, 2017).

Addis Ababa has a great share in the economy of the country due to its attractiveness to businesses, companies, individuals and foreign direct investment. Overall primacy index of the city is 24.8 based on urban employment and unemployment survey (CSA 2015). According to the State of Addis Ababa 2017 report, the simultaneous high rates of economic growth and urbanization in Addis Ababa indicates a likely further rising dominance of the city in Ethiopia's economy as well as growing agglomeration of economic activities in and around the city.

1.4. Why is it beneficial to invest in Addis Ababa?

Addis Ababa is the largest and most economically significant city in the country. Ethiopia's urban population share is only 17 percent (as of 2012, World Bank 2015). The city is the only urban area in Ethiopia capable of delivering scale economies in terms of concentrated demand, specialization, diversity and depth of skills, innovation, and technology transfers. Thus, investors will be benefited in getting capable human power from the market.

The capital is the country's main industrial hub. The city dominates industrial capacity in almost all the braches of light manufacturing that Ethiopia prioritizes. As a result Addis Ababa completely dominates production in various subsectors. This can be taken as the political and social stability of the city.

Overall, the city has a beautiful environment, favorable location, and strong industrial base. Its advantage as an economic powerhouse of the country and human resource center are the most attractive features for local and overseas investors.

Moreover, investors will be getting a comprehensive set of incentives for priority sectors. These include:

- Customs duty free privilege on capital goods and construction materials, and on spare parts whose value is not greater than 15% of the imported capital goods' total value.
- Investors have the right to redeem a refund of customs duty paid on inputs (raw materials and components) when buying capital goods or construction materials from local manufacturing industries.
- Income tax exemption of up to 6 years for manufacturing and agro-processing, and up to 9 years for agricultural investment.

- Additional 2-4 years income tax exemption for exporting investors located within industrial parks and 10-15 years exemption for industrial park developers.
- Loss Cary forward for half of the tax holiday period. Several export incentives, including Duty Draw-Back, Voucher, Bonded Factory, and Manufacturing Warehouse, and Export Credit Guarantee schemes.

1.4.1. The city benefit from the investment

The city will be benefited from investment. These are discussed below.

- Employment opportunity

  Investment is expected to provide direct and indirect employment. These range from unskilled causal workers, semi-skilled and skilled employees.

- Improving growth of the economy

  Through the use of locally available materials and exporting products, the investment contributes towards growth of the economy by contributing to the growth of domestic product. These eventually attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of local materials will be payable directly to the producers. In addition, domestic products save foreign exchange and exports also bring money to the country.

2. Marketing study

2.1 Market analysis summary

The current drive and emphasis by the government on the diversification of the industrial base away from the other sector presents an opportunity for production industry to a valuable contribution towards achieving goal. Having undertaken a thorough and comprehensive research of the market we realized that there was a vast opportunity for domestic products. Aware of the fact operating in such a market is largely dependent on good networking; the promoter intends to establish networks and strategic relationships with various wholesalers and retailers to ensure a steady stream of orders. In so doing the owner intend to ensure that the products they produce are of extremely high quality and fully serve the customers purpose.

2.2 The Supply of Glucose

2.2.1 Local Supply

The demand for glucose in Ethiopia is entirely met through import. Thus, there is no production company involved in producing glucose in the country.

2.2.2 Import

Amount of import glucose has been increasing steady in Ethiopia. Imported glucose can serve as a raw material in different industries such as in pharmaceutical, food, textile, paper and many other industries. Especially, in pharmaceutical industry glucose has versatile use in developing different drugs and relief feed supplements. The demand for glucose in Ethiopia is entirely met through import. The historical import data of glucose is shown in table 1.

As shown in table 1, import of glucose has been growing from year to year with minor fluctuations. The yearly average level of import which was about 4,135.36 tons during the period 2012-2014 has increased to a yearly average of 4,502.14 tons during the period 2015 - 2017. In the recent year (2021) the level of import has reached to a level of 5,204.97 tons. Compared to the preceding years (2015 - 2018) the total increase is about 12% or annual average growth rate of 14%.

In terms of value, the country was on the average spending 43.6 million Birr during the period 2012-2014. The expenditure for importing glucose has increased to annual average of Birr 50.4 million during the period 2015-2017. During the recent two years (2020 & 2021), the annual expenditure for importing glucose has reached to a level of Birr 91.6 million. The increase for the demand of glucose is believed to be due to the establishment of a number of end user industries.

In estimating the current effective demand for glucose, it is considered as reasonable to assume that the present demand for the product would be the average of the imported quantity of the recent two years i.e. year 2020 and 2021. Accordingly, the present (year 2022) effective demand for glucose is estimated at 3,874.84 tons.

Table 1: Import calcium carbonate from 2012 to 2021

Year	Quantity (Tons)	Value (`000 Birr)
2012	4,086.31	41,287.61
2013	4,011.13	41,384.80
2014	4,308.66	48,130.07
2015	4,908.92	56,275.08
2016	3,508.35	34,814.69
2017	5,089.16	60,101.90
2018	1,851.41	27,497.42
2019	-	-
2020	2,544.71	53,592.14
2021	5,204.97	129,628.88
Total	88,674.54	1,084,662.32

Sources: Ethiopian Revenue and customs Authority, compiled by consultant

2.3 Demand Projection

Glucose in its different form is used as a constituent of foods, medicine, and other applications in the tanning and dyeing. Considering the growth of population and the increasing number of food and pharmaceutical manufacturing enterprises demand is projected by applying a 10% annual growth rate(Source: Ethiopian Revenues and Customs Authority).

The future demand for glucose depends mainly on the growth of the manufacturing sector particularly the food and pharmaceuticals. During the past ten years, the annual average growth of demand has been more than 14% per annum. As per the data of the Ethiopian Investment Agency there are a number of chemical projects which are licensed for implementation. When the projects become operational the demand for the product will undoubtedly increase significantly. By

considering the past trend, which was 14% annual growth rate, and future prospects of the industrial sector demand for glucose is assumed conservatively to grow by 10% per annum. The total demand projection and the supply gap worked based on the above assumptions are presented in table 2.

Table 2: Projected demand for glucose from 2023 to 2032

Year	Glucose
2023	4,262
2024	4,689
2025	5,157
2026	5,673
2027	6,240
2028	6,865
2029	7,551
2030	8,306
2031	9,137
2032	10,050

The demand projection, executed in table 2 reveals that the demand for Glucose will grow from 4,262 tons in the year 2023 to 6,240 tons and 10,050 tons by the year 2027 and year 2032, respectively.

3. Production Technology and engineering

The technology selection for the main product starch compared two front-end fractionation technologies: dry and wet processes. In general, wet fractionation tends to be relatively costly, however, produces higher-valued co products and has less starch loss than dry fractionation. Cleaning, steeping, fiber separation, gluten separation, germ separation and the final starch washing and drying are the major processes of the selected technology. Similarly, modification of the manufactured starch can be done in two process alternatives, namely, enzymatic and acid modification. The plant considers the dry acid process as a primary route for certain applications while the other approach is mainly product and enzyme specific.

3.1 Technology

Glucose plant processes are based on a common, yet modern, approach of enzymatic hydrolysis and evaporation to get dried product.

The grains received at the mills and magnetic separators to completely eliminate the extraneous mater present. The cleaned grain is stored in concrete silos. The grain is transported to steeping vat by elevators and conveyors through a weighing machine. Warm matter is circulated through the vats to loosen the husk and soften the gluten. During the steeping, a part of the soluble salts and proteins of the traisin get dissolved and when the solid matter content of the water reaches percent at 6-10 ie it is replaced by fresh steep water. The washed water is concentrated by evaporation and is used as cattle feed. After steeping the softened grains are passed over vibrating screens to remove any adhering foreign matter and then ground in attrition mills consisting of two plates with protruding teeth. The ground mass is passed in to wooden, V shaped, germs from the rest of the mass. The floating germs are skimmed over by sweep paddles, washed on screens dried and sold to oil

extraction plants. The mixture of starch gluten, husks add fiber recovered at the bottom and sent to vibrating screens to eliminate excess water and soluble substances. It is then thoroughly milled in fine grinders to fine slurry known as starch milk. The grinders may be either Buhror stone mills or preferably vertical mill make of stainless steel. The starch milk is processed in centrifuges to remove husk and fiber which are washed free of adhering starch in the counter current system and washing fed back to the main starch stream.

The resulting slurry is passed through high speed continuous centrifuges where the lighter gluten is separated from the heavier starch. In the first stage, the heavy starch layer is taped in such a way that least possible amount of starch goes in which the overflow of gluten, thus maintaining gluten purity. In the latter stages the process is reversed to ensure the purity of the starch. The gluten from the first stage is concentrated and pressed into cake. The glutenous starch from the latter stages is fed back to the main stream at the husk separation stage. The deglutenized starch milk is dewatered in a perforated bucket centrifugal machine to a moisture content of about 30-36 percent. It is flash dried and packed or passed on to other division for the manufacture of starch derivatives.

Wet milling or the classical milling process is the only process for the manufacture of starch which is universally in commercial use. Starch manufactured by this process can be used by textiles, paper and food industries. Starch may be dry milled using screening and air - classification of particle size, but this process does not completely separate oil, starch, and hull and can only be used by food industry. Better separation is obtained by wet - milling. To better understand the milling process, it is necessary to examine the structure of the corn kernal. The principal parts of the kernel are the tip cap, the main entry for water absorption by the kernel which consists of 0.8% of the kernel the pericarp or hull (5%) the germ or embryo (11%) and the endosperm (82%). The tip cap and pericarp

comprise the fiber fraction in wet -milling or the bran fraction is dry milling. The germ is composed mainly of protein and lipids, whereas the endosperm consists of starch granules embedded in proteinaceous cell walls. An average composition of corn grain on a dry basis is 71.3% starch, 9.91% protein and 4.45% fat (29-30). The normal water content is 10 - 15%.

Cleaning & Soaking: - The maize received at the site is weighed, cleaned by grain cleaners and stored in silos. When required it is cleaned by screening to remove colour, sand, and other foreign material, and then by aspiration to remove the lighter dust and chaff. This operation is known as dry cleaning of maize, which removes dust, broken grain and foreign matters. This reject from the grain is mixed with cattle feed. After cleaning, the grains are once again weighed for steeping.

Steeping: - In steeping process, steep acid or sulphurous acid is produced by turning sulphur in a rotary burner. Generated sulphur di-oxide is cooled and absorbed in an absorption tower. The sulphurous acid formed is then pumped to steep tank. The weighed grain is already been added in the steep tank when sulphurous acid is pumped. The grain is soaked for 48 hours in warm steep acid the temperature being maintained at 50-55^{o}C. Steeping requires careful control of water flow temperature (50 - 55 ^{o}C), sulphur dioxide concentration, 0 % and PH at 3- 4. Corn introduced to the steeps at a moisture content of 15% attains a moisture content of 45% at the end of 30 - 40 h. This water absorption rate is accelerated by the sulphur dioxide in the steep water ad results in a 55 - 65 % increase in kernel volume. Sulphur dioxide was first added to corn steep water to prevent the growth of putrefactive micro organisms, but it is indispensible in maximizing starch yield. It acts on the nitrogen - containing components of corn which consist of 10% albumin and non-protein nitrogen, 10% globulin, 38% zein and 42% glutelin. Sulphur di-oxide effects softening of the glutelin matrix, followed by dispersion. This action allows maximum starch release and recovery especially

from the horny endosperm. Although sulphur dioxide inhibits the growth of microorganisms after several hours its concentration decreases and lactic acid bacteria start to grow.

Steep Liquor Concentration: - During the steeping period, solubles are leached out of the maize grain and the steeped liquor is drawn off from the steeping tanks. It is concentrated to about 50% solids in three stages. Vapours coming out of the evaporators are condensed and the hot water from condenser is used for making steep acid again.

Crude Gem Oil Recovery: - The grain after steeping is dewatered in a DSM dewatering screen. The softened corn kernels are degenerated between two studded steel plates, one rotating and one stationary, which tear the kernels apart and extricate the corn germs without crushing them. An attrition null is used for this purpose and mill gap is so adjusted to maximize the amount of germ freed, but minimize rupture of germ, which would cause loss of oil and present problems in the purification step. The germs together with the slurry are sent to a hydroclone ie a cyclone separator, when the particles separate by density, the endosperm and fibre leaving in the hydroclone underflow and germ from the centre. The germ fraction is then pumped onto screens, wahsed several times to remove residual starch, dewatered to 50-55% water content, and go for expelling and oil recovery. Primary grinding is a difficult separation process since maize has to be partially broken to remove the outer fibrous layer (pericarp) remove the germ from endosperm by partially breaking it without damaging the germs.

Fiber Separation: - The cyclone underflow is milled a second time for complete release of the starch granules. Some mills use a Bauer mill, which is a combination of attrition impact mill, some favor use of Entoleter mill, which is an impact mill only. Following the second milling, the kernel suspension contains starch, gluten and fiber. The fiber is removed by flowing the slurry over fixed

concave screens. The fiber is retained on the screen while the starch and gluten pass through. Collected fiber is slurred and screened to remove residual starch and protein. The fiber is later consumed with 21% gluten for feed use.

Gluten Separation & Concentration: - The starch - gluten suspension, commonly known as mill starch is concentrated by centrifugation to reduce soluble material. The low density of gluten, compared to starch, permits easy separation by centrifugation. Protein content is thus reduced to 1 - 2%. The starch suspension from the centrifugal separator is diluted and subjected to 8 - 14 stages of hydroclone washing. The concentrated starch underflow from this process is once again diluted and passed through a final battery of hydroclones to wash the starch and remove the last traces of protein.

Mixed Feed Processing: - Washed and filtered fibers, from step 4 corn rejects from step 1, concentrated liquor from step 2 and gluten from the previous step are mixed in the required proportions to the desired protein content, suitable for making cattle feed. The mixed feed is dried in flash drier and nulled to the required size.

Starch Washsing, Dewatering and Drying: - The starch suspension may be processed dry and marketed as unmodified corn starch, modified by chemical or physical means, gelatinized and dried, or hydrolyzed to corn syrup. The wet milling process requires Ca 0.2 m^3 water/100 kg. Corn or (20 gal/100 gal). This water must be removed before marketing. The corn is usually dewatered by centrifugation, followed by injection into a column of hot air (200 - 260^oC). The starch granules dry very rapidly and are collected in cyclones. A large amount of energy is consumed in evaporating and drying starch making the wet milling process the second most energy intensive food industry.

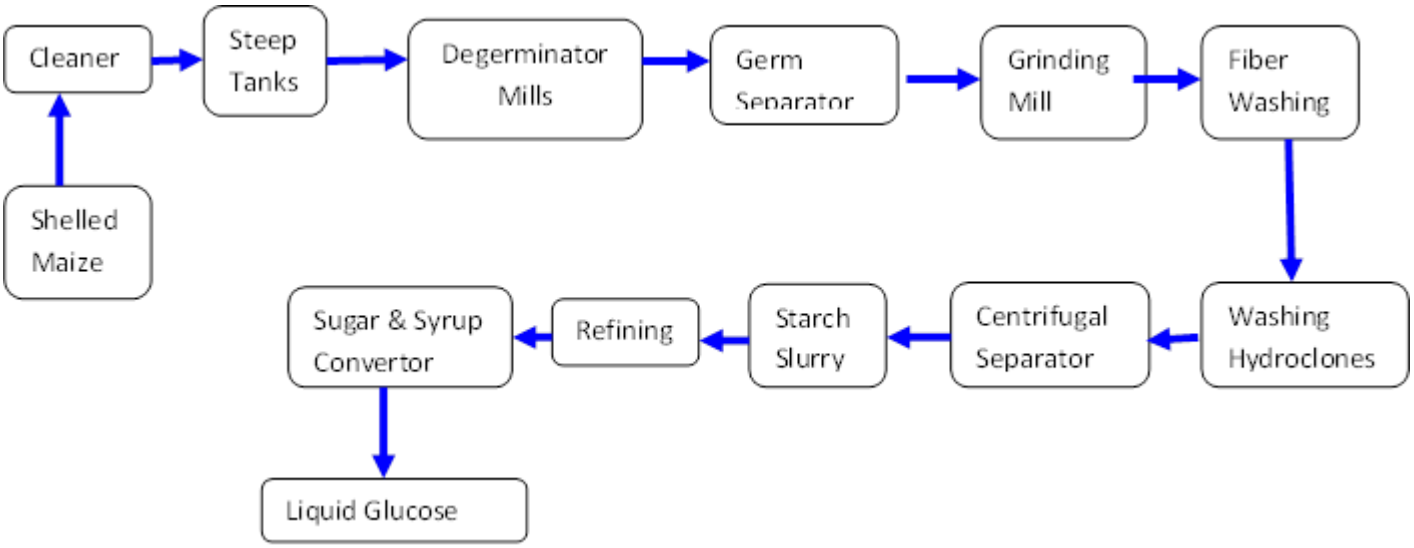

Figure 1: Process Flow Diagram for the Manufacturing of Glucose

3.1.1 Environmental and Social Impact Assessment

Typically, any developmental projects also trigger a set of environmental and social impacts. These environmental and social due to development projects occur in different forms. An Environmental and Social Impact Assessment (ESIA) has to be carried out to study the potential environmental and social impacts due to the production Glucose. Potential environmental and social impacts due to the production of glucose on attributes like air quality, noise, water quality, soil, flora, socio-economic, etc. have to be assessed as part of the ESIA study. Appropriate mitigation measures to help minimize/avoid impacts from the development have to be recommended in the study. The measures include avoidance measures, mitigation measures and environmental enhancement measures. Social responsibility cost estimated to be 1% of fixed investment costs.

3.1.2 Production program and plant capacity

The plant is expected to operate at 70% of its rated full capacity at the beginning and will grow by 5% each year considering the market penetration traits and consumer perception for local products. The production program of the envisaged plant is given in table 3.

Table 3: Glucose production program

Year of Production	**1st Year**	**2nd Year**	**3rd Year**	**4th-10th Year**
Capacity utilization	70%	80%	90%	100
Glucose (tons)	3,500	4,000	4,500	5,000

The capacity of corn processing plant complex is determined by considering different technical and financial factors such as market demand, raw material availability and supply reliability, technology and availability of machinery and equipment in the world market with the proposed capacity (economies of scale), investment and skilled labor requirement.

In determining the plant capacity of the glucose production plant, the future demands of the product and the economies of scale of the available technologies were taken into consideration. According to the data obtained from the market study, the demand for glucose raises from 4,262.32 tons to 10,050.34 tons from years 2023 to 2032.

Hence, based on the demand gap and the minimum economic of scale for glucose production, a plant with a capacity of 5,000 ton of glucose per annum is proposed.

3.1.3 Materials and inputs

Raw & Auxiliary Materials

The basic raw material is corn grain which can be made readily available from the market through cooperatives or farmers. Other sources of starch include wheat, cassava, potato, rice and so on. The viability of a corn processing plant depends upon the availability and uninterrupted supply of raw material to the unit. The materials and inputs required by the glucose plant comprise basic raw materials, auxiliary raw materials and utilities.

According to the Central Statistics Authority, maize production in 2019/2020 (2012E.C.) was about 96.35 million quintals. if productivity increases at present rates. Maize is basic raw materials for the production of glucose of different DE include food grade starch and enzymes. The auxiliary raw materials required by the glucose plant are H_2SO_4 and NaOH (Caustic soda).

Assumption: 1kg of corn seed generate 655g of starch powder,

2.25 litter of liquid glucose is extracted from 450g of starch,

the specific gravity of glucose = $1.54*10^{-3}$

Mass of produced glucose = $\rho * V = 1.54g/ml * 225ml = 346.5gm$

Plant capacity = 5,000 ton/annum (liquid glucose)

Working day per year = 300days Working hour per day= 3shift*8hrs=24hrs.

Amount of starch required = 6,500 tons' corn per year

Amount of corn required = 10,000 tons per year

60ml of H_2SO_4 is used for each 50g of starch

Thus, the annually required (needed) H_2SO_4 will be calculated as;

H_2SO_4 needed annually =7,800 K litter /year=26 K litter /day

Take Density of H_2SO_4= 1840 kg/m^3

NaOH need for annually= 34.26 tons

The total annual cost of raw material is estimated at Birr 306,176,800, which is locally available. The annual requirement of this raw material is shown in table 4.

Table 4: Annual raw & auxiliary materials requirement & cost

Sr. No.	**Description**	**Unit**	**Quantity**	**Unit price**	**Total cost (`000 Birr)**
1	corn seed	Quintal	100,000	3,000.00	300,000,000.00
2	H_2SO_4	liter	7,800,000	120.00	936,000.00
3	NaOH	kg	34,260	80	2,740,800.00
4	Packing material	Pcs	100,000	25.00	2,500,000.00
	Total				**306,176,800.00**

3.2 Engineering

3.2.1 Land, buildings and civil works

The required area (m^2) and construction cost for the production facilities essential for the successful operation of the processing plant is shown in Table 5. A total area ready for the processing plant is 10,000 m^2 out of which 5,170 m^2 is to be covered by building while uncovered area of 4,830m^2 is left storage of waste materials and future expansions. In order to estimate the land lease cost of the project profiles it is assumed that all the project will be located in different land level from level 1/1 to level 4/3, their current market lease price is from 39,073.31 birr per M ^{2} to 2,800.71 birr per M ^{2}respectively. Therefore, for the profile a land lease rate of birr 3,885 per M ^{2} have been taken, which is between the ranges.

The cost of construction of building should be appropriate to the size and expected profitability of business, costs of building generally differs by the type of construction materials used, the type of foundation, wall height and location. The current building cost for simple storage and processing room is from 10,000.00 Birr per m^2 to 25,000.00 Birr per m^2. The total construction cost of buildings and civil works, at a rate of Birr 20,000 per m^2 is estimated at Birr 103.10 million. Therefore, the total cost of land lease and construction of buildings and civil works is estimated at Birr 141.95 million.

The proposed plant layout comprises the following buildings and structures.

Table 5 Building costs

S/No	Descriptions	Total area in M^2	Estimated cost per square meter (in Birr)	Total estimated cost (in Birr)
1	Raw materials receiving and store	2,000	20,000.00	40,000,000.00
2	Production room	150	20,000.00	3,000,000.00
4	Filling and packing room	500	20,000.00	10,000,000.00
5	Packing materials store	500	20,000.00	10,000,000.00
6	Final products store	500	20,000.00	10,000,000.00
7	Finished products delivery veranda	100	20,000.00	2,000,000.00
8	Boiler room	100	20,000.00	2,000,000.00
9	workshop	120	20,000.00	2,400,000.00
10	Generator room	20	20,000.00	400,000.00
11	Power station room	20	20,000.00	400,000.00
12	Administration office 5,360=13,400,000	300	20,000.00	6,000,000.00
13	Production and technical office	200	20,000.00	4,000,000.00
14	Toilet and shower for female	40	20,000.00	800,000.00
15	Room for cloth changing for female	40	20,000.00	800,000.00
16	Toilet and shower for male	40	20,000.00	800,000.00
17	Room for cloth changing for male	40	20,000.00	800,000.00
18	parking	500	5,000.00	2,500,000.00
19	Fence	1,200 M*2	3,000.00	7,200,000.00
	TOTAL	5,170 M^2		103,100,000.00

Table 6 Land lease period in Addis Abeba

Sector of development activity	Period of lease	Down payment
Education, health, culture and sports	90	10%
Industry (manufacturing)	70	10%
commerce	60	10%
For urban agriculture	15	10%
For others	60	10%

Sources: - city government of Addis Abeba land development and management bureau

Table 7 Land lease floor price in Addis Abeba

S/No	Land level	Current land lease floor price per M^2	Current lease price per M^2 (Market price)
1	1/1	2,213.25	39,073.31
2	1/2	2,165.47	36,825.73
3	1/3	1,900.19	34,578.15
4	¼	1,552.93	31,119.21
5	1/5	1,531.91	29,096.45
6	2/1	1327.39	27,073.71
7	2/2	1,221.18	25,050.96
8	2/3	1,191.17	23,028.21
9	2/4	1,074.39	21,005.46
10	2/5	1,027.84	18,982.71
11	3/1	994.71	16,959.96
12	3/2	960.21	14,937.21
13	3/3	927.84	12,914.46
14	¾	904.77	10,891.71
15	3/5	873.74	8,868.96
16	4/1	814.06	6,846.21
17	4/2	786.45	4,823.46
18	4/3	748.80	2,800.71

Sources: - city government of Addis Abeba land development and management bureau

3.2.2 Machinery and equipment

One of the core machines in glucose production is the Hydrolysis tank (converter). The total cost of machinery and equipment is estimated at about Birr 109.80 million, which is required in foreign currency. Lists of required machinery and equipment are shown in table 8.

Table 8: Lists of required machinery and equipment

S/N	Description	UOM	Number of Equipment	Unit Cost of Equipment(Birr)	Total Cost of the Equipment(Birr)
1	Maize mill machinery	pcs	set	85,000,000.00	85,000,000.00
2	Sulfuric acid tank	pcs	2	1,500,000.00	3,000,000.00
3	Blender/mixer(slurry preparation tank)	"	1	3,000,000.00	3,000,000.00
4	Hydrolysis tank(converter)	"	1	2,500,000.00	2,500,000.00
5	Wooden neutralization vat	"	2	750,000.00	1,500,000.00
6	Filter	"	1	150,000.00	150,000.00
7	Centrifuge	"	1	2,000,000.00	2,000,000.00
8	Dryer	"	1	2,500,000.00	2,500,000.00
9	Cooling tower	"	2	1,000,000.00	2,000,000.00
10	Vessels and tank	"	10	440,800.00	4,408,000.00
11	Boiler	"	1	3,000,000.00	3,000,000.00
12	Pumps	"	6	127,680.00	766,080.00
				Total	**109,824,080.00**

3.2.3. Lists of machinery suppliers

ALIBABA

Hangzhou (Yuhang District)
969 West Wen Yi Road Yu Hang District, Hangzhou 311121 Zhejiang Province, China Tel: (+86) 571-8502-2088 Fax (Mainland China): (+86) 571-8656-1717 Fax (Hong Kong, Macao and Taiwan regions of China and Overseas): (+86) 571-8376-8429

KAIFENG SIDA

Kaifeng Sida Agricultural Products Equipment Co.,Ltd.

Mobile Phone:Jolie：0086-18438491113

Email:sida@cnstarchmachine.com

Telephone:86-371-26630769

Fax:86-371-26630769

Address:No.18 WEILIU ROAD, Yellow Dragon Industry Park, KAIFENG CITY, HENAN PROVINCE, CHINA.**Zip**:475100

Country/Region:China

4. Organizational structure

The selection of structure of the envisaged project is made based on the existing structure of manufacturing plants operating in the country, the capacity, complexity and technology mix of the plant. Organizational structure principles such as specialization, coordination, and departmentalization are also considered for design of structure that best suits the envisaged project

4.1 Manpower Requirement and Estimated Annual manpower costs

Description	Number	Monthly salary	Annual salary, Birr
plant manager	1	30,000.00	360,000.00
Administration and finance manager	1	15,000.00	180,000.00
Human resource manager	1	7,500.00	90,000.00
Secretary	1	5,000.00	60,000.00
Marketing and sales officer	1	10,000.00	120,000.00
Sales manager	1	15,000.00	180,000.00
Accountant	1	10,000.00	120,000.00
Production unit leader	1	15,000.00	180,000.00
Senior Mechanic	3	10,000.00	360,000.00
Senior Electrician	3	10,000.00	360,000.00
Purchaser	1	10,000.00	120,000.00
Operator	16	4,000.00	704,000.00
Ass. Operator	16	2,000.00	352,000.00
Store keeper	2	5,000.00	120,000.00
Quality manager	1	15,000.00	180,000.00
Microbiologist	1	10,000.00	120,000.00
Boiler technician	1	3,000.00	36,000.00
Guard	4	1,400.00	67,200.00
Driver	1	3,000.00	36,000.00
Cleaners	12	1,500.00	216,000.00
Sub total	69		4,033,200.00
Grand total			4,793,200.00

5. Financial Analysis

5.1 General

The financial analysis evaluation of Glucose production project is mainly consisted of capital investment as well as operating and maintenance costs. The capital investment costs include fixed investment costs (initial fixed investment and replacement costs) and working capital, while operating and maintenance costs comprise current expenses related to material inputs, manpower cost, utility, repair and maintenance costs, spare parts, Overheads, Sales and distribution, interest and depreciation expenses.

The financial analysis and evaluation has been conducted taking assumptions:

1. It is assumed that about 70% of the total capital investment costs including the working capital requirement could be covered through development bank loans of short and long-term credits. The remaining balance 30% will be covered by equity capital contribution of the project owner.
2. Even though the project might secure loans under different term and conditions as well as from different financial sources, for the purpose of calculation of debt service scheduling, the current development bank of Ethiopia credit terms and conditions have been used. Consequently. It is assumed that the project will secure loan facility on the basis of 11.5 % annual interest rate.
3. Even though the estimated project production life is more 10 years, the financial analysis has been undertaken for a period interval covering the first 10 years only, during which time

most of the capital assets are assumed to be deprecated, debts recovered and pay-back period accomplished.

4. It is assumed that the project will be start up production activity at 70 % capacity. During years 2 & year 3 the projects is anticipated to gradually increase capacity utilization to reach 100% in year 4. Therefore, starting from year 4 the project will be operational at full capacity.
5. For the project under reference promotional, sales and distribution expenses have been estimated at 3% of the sales revenue.
6. Maintenance and spare parts costs are 1.5% of the fixed investment costs.
7. Furniture and fixture costs assumed to be 500,000.00

5.2 Initial Fixed investment costs

Table 9 Initial Fixed investment costs

S/No	Fixed investment type	Unit of measurement	Quantity	Unit price	Total Amount	Remarks
1	Land	Square meter	10,000	555 birr/year	38,850,000.00	The period of land lease will be 70 years and 10% of the total lease amount will be paid in the first year
2	Buildings and civil works	Square meter	5,670	lump sum	103,100,000.00	
	Sub total				**141,950,000.00**	
3	Machineries	set	2	Lump sum	109,824,080.00	
4	Transformer	set	1	Lump sum	2,000,000.00	
5	Weighbridge	Set	1	Lump sum	4,000,000.00	
6	Truck and vehicles	Pcs	2	Lump sum	6,000,000.00	
7	Furniture and fixture	Pcs			500,000.00	
	SUB TOTAL				122,324,080.00	
	Fixed capital investment costs				264,274,080.00	
8	pre-operational expenses				2,000,000.00	
	Working capital				35,914,000.00	
	TOTAL INVESTMENT COSTS				302,188,080.00	

5.3 Working capital

Working capital is the financial means required for smooth operation and maintenance of a project mathematically, it is a difference between current assets and current liabilities. In the particular case of the project under consideration, the current assets comprise receivables, inventories (local and imported material inputs, spare parts, work in progress, and products ready for delivery) and cash in hand, while current liabilities comprise accounts payable to creditors. See Annex table 16 detail annual working capital calculation.

5.4 Project Financing

Fixed capital investment costs and working capital requirements are assumed to be financed by equity capital of the owner and through loans of short and long-term credits.

The company obtains loans under different terms and condition as well as from different sources, for the purpose of calculation of debt service scheduling the current development bank of Ethiopia credit terms and conditions have been used. Accordingly, it is assumed that the company will be able to obtain loan 70% of the total investment costs for construction of different buildings for purchase of machineries. The remaining balance that of the total investment costs will be expected to be covered by equity contribution of the project promoter.

5.5 Production costs

As it is depicted in Annex Table 13 major categories of the total production costs are assembled into the following cost elements.

5.5.1 Material inputs

In the project under study the basic material inputs (see in table 4) are corn seed, Sulphur dioxide, and, packing materials etc. Therefore, the current prevailing local and international market prices have been used for estimation of material inputs costs. At full capacity operation the material inputs costs are estimated at Birr 306.17 million per annum.

5.5.2 Utilities

In estimating costs of utility expenses for operation and maintenance of the project, Costs of fuel, oil and lubricant, electricity and water consumptions have been taken in to consideration, the rates of which have been estimated on the basis of the proposed capacity utilization program of the project and at the current official charging rates. At full capacity operation the project will have the following utility expense per annum which amounts to Birr 6.089 million.

Table 10 Utilities of the factory'000"Birr

Utility"000"Birr		Start-up			Full Capacity
Capacity utilization		70 %	80 %	90 %	100 %
Project year		1	2	3	4
Item description	Unit of measurement				
Fuel					
Gasoline for service vehicle	100km*260days*32Birr/LIT*8km/Li	104	104	104	104
Gasoline for transport truck	(200km*300days*32Birr/LIT*5km/Li)*3	1,152	1,152	1,152	1,152
Sub-Total		1,256	1,256	1,256	1,256
Change of oil and lubricant	10% of the fuel consumption	126	126	126	126
Sub-Total		1,382	1,382	1,382	1,382
Electricity	260days*24 hrs*650kwh* 1.00Birr/kwh	2,839	3,245	3,650	4,056
Sub- Total		2,839	3,245	3,650	4,056
Water	365days*100m^3/day*15 Birr/m^3	384	438	493	548
Sub -Total		384	438	493	548
Telecommunication					
Telephone	5 lines* 1,500Birr/month/line+18Birr/line/month	31.08	31.08	31.08	31.08
Mobile	5 lines*1,500 Birr/month/line	30.00	30.00	30.00	30.00
Fax	2line*1,000Birr/month + 17 Birr/line/month	12.40	12.40	12.40	12.40
Internet	2,500 Birr/month	30.00	30.00	30.00	30.00
Sub-Total		**103.48**	**103.48**	**103.48**	**103.48**
TOTAL		**4,708.48**	**5,168.48**	**5,628.48**	**6,089.48**

5.5.3 Over heads

In the expenses under this title have been included land and building taxes, buildings, vehicles as well as machinery and equipment insurance, vehicles annual inspection; postage, telephone and e. mail, stationery and office supplies; printing and copying; audit fee; cash indemnity etc. The overhead costs and divided in to direct overheads and administration overheads.

Table 11 Overhead costs

Direct Overhead"000"Birr		Year 1	Year 2	Year 3	Year 4
Annual land lease Payment		5,550	5,550	5,550	5,550
Insurance					
Building and Civil works	0.10%	113.10	113.10	113.10	113.10
Machinery and Equipment	0.20%	94.50	94.50	94.50	94.50
Motor vehicle and Truck	1%	60	60	60	60
Vehicles annual inspection and registration	25,000 Birr per annum per vehicle	50.00	50.00	50.00	50.00
Work cloth	Two times per annum per workers at 1,000 Birr	140	140	140	140
Cleaning and sanitation	An estimate of 300 Birr/day	78.00	78.00	78.00	78.00
Sub Total		6,085.60	6,085.60	6,085.60	6,085.60
Administration Overhead "000' Birr					
Audit fee	40,000 Birr per annum	40.00	40.00	40.00	40.00
Office cleaning and sanitation	2,000 Birr per month	24.00	24.00	24.00	24.00
Stationery and office supplies	2,000 Birr per month	20.00	20.00	20.00	20.00
Printing and Copy	2,000 Birr per month	24.00	24.00	24.00	24.00
Sub Total		**108.00**	**108.00**	**108.00**	**108.00**
GRAND TOTAL		**6,193.60**	**6,193.60**	**6,193.60**	**6,193.60**

5.5.4 Financial costs

As it has been outlined earlier under" project Financing" the current Development Bank of Ethiopia credit terms and conditions for newly establishing projects have been used to compute the financial costs, estimated to be incurred in connection with that of the total investment costs assumed to be covered through loan financing. The amount of the loan capital to be obtained and the financial costs to be incurred thereof have been determined depending on the amount of fixed investment cost and pre-production expenses.

5.5.5 Depreciation

Table 12 Depreciation in Birr"000"

Period			Start-up			
Capacity utilization			70 %	80 %	90 %	100 %
Project year			1	2	3	4
Item description	Original Value					
Structure and civil works	103,100,000.00	5% of original value	5,155	5,155	5,155	5,155
Machinery and equipment	109,824,080.00	15 % of original value	16,474	16,474	16,474	16,474
Transformer	2,000,000.00	15 % of original value	300	300	300	300
Motor vehicles and trucks	6,000,000.00	15% of original value	900	900	900	900
Weighbridge	4,000,000.00	15 % of original value	600	600	600	600
Office equipment and furniture	500,000.00	20 % of original value	100	100	100	100
Pre-production expenses	2,000,000.00	25% of original value	500	500	500	500
Total			24,029	24,029	24,029	24,029

5.6 Break Even point and ROI

5.6.1 Break Even point (BEP)

Three kinds of break-even point

A. BEP Sales Revenue(BR)

B. BEP production (Volume)

C. BEP Percentage (%)

A. Break-even point(BEP) Sales

To determine BEP Annual Sales, multiply annual sales found in income statement by the annual fixed cost, and divided by Annual sales less Annual variable cost.

$$\text{BEP (sales)} = \frac{\text{Annual sales x Annual fixed costs}}{\text{Annual sales} - \text{Annual variables costs}}$$

Annual sales = 450,000,000 Birr

Average Unit selling price = 4,500 Birr/quintal

$$\text{BEP (sales)} = = \frac{\text{Annual sales x Annual fixed costs}}{\text{Annual sales} - \text{Annual variables costs}} = = \frac{450{,}000{,}000 \text{ x } 59{,}342{,}000}{450{,}000{,}000 - 211{,}014{,}000}$$

BEP (Sales) = 111,738,345 Birr

B. BEP production

To determine BEP production volume, divided BEP sales by the unit selling price (USP)

BEP production = 72,951,847/25 = 24,831 quintals

C. $$\text{BEP percentage} = \frac{\text{Annual fixed costs x 100\%}}{\text{Annual sales} - \text{Annual variables costs}}$$

$$= \frac{59{,}342{,}000 \text{ x } 100\%}{450{,}000{,}000 - 211{,}014{,}000}$$

= 25%

5.6.2 Return on investment

Return on investment = Net profit /Total capital requirement

= 42,702,000/302,188,080

= 14%

The return on owners' investment (ROOI)

= Annual net profit /owners' investment

= 42,702,000/90,656,424

= 47%

5.7 Project benefits

For financial analysis and evaluation of the given project, the current raw price, and packing materials buying price and final packed processed Glucose price at the project gate has been taken as a basis. Consequently, based on the recent market survey, price has been indicated in table 15.

As it has been stated earlier the project is envisaged to reach full capacity operation four years after commencement of production activities which are assumed to begin with 70% of the estimated total capacity.

Thus, according to the computation in Annex Table 16 and Annex Table 18, the net income and cash flow statements analysis revealed that at full capacity operation the project will generate a total income (gross revenue) amounting to 450 million Birr per annum. The Net Income Statement shows a steady growth of gross profit starting from 44.60 million Birr in year 1 reaching the peak of 100.34 million Birr in year 10. In its 10 years of manufacturing activities, the project is expected to generate

a total net profit of 460.02 Birr and contribute 247.70 million Birr to the government treasury in form of 35% income tax.

According to the current investment Law, machinery and equipment are anticipated to be imported duty- free. The liquidity position of the project is very strong. The corresponding Annex Table 18 of "Cash Flow Statement" shows the positive cumulative cash balance of Birr 1.97 billion and the project will not face any cash shortage throughout its production life.

The computation of the pay-back period as depicted in Annex table 23 indicates that the project will be able to reimburse itself from its net cash-income within six years after commencement of production activities, the period which is considered to be very good for the project of this nature.

In Annex Table 24 of the Benefit-cost ratio and Net present value (NPV) have been calculated at 17% discount factor (D.F) for 10 years of the project activity. Accordingly, the project has NPV of 200 million Birr at 17%D.F. and the benefit-cost ratio of 1.12 at 17% D.F. These results are most appreciable, especially, when related to the external capital borrowing interest rate which ranges from 8.50% to 18.5 % for newly establishing projects.

Break-even point (BEP) have been undertaken the project under study when implemented will have BEP at about 47% operation of the estimated full capacity

In addition to this, finally, summary of financial efficiency tests have been conducted in Annex table 22, Accordingly, all efficiency ratios indicated positive trends and consequently, it can be inferred that the project can operate in the frame work of free market mechanism on commercially and financially viable basis and is remunerative.

ANNEXES

NNEX II

CALCULATION OF ANNUAL PRODUCTION COSTS

Table 13 Annual total production costs"000"

Period	Start-up			Full capacity						
Capacity utilization	70 %	80 %	90 %	100 %	100 %					
Project Year	1	2	3	4	5	6	7	8	9	10
Cost category										
I. Material inputs including packing materials	192,891	244,942	275,559	306,177	306,177	306,177	306,177	306,177	306,177	306,177
II. Labor	4,793	4,793	4,793	4,793	4,793	4,793	4,793	4,793	4,793	4,793
III. Utility	4,709	5,169	5,629	6,090	6,090	6,090	6,090	6,090	6,090	6,090
IV. Repair and Maintenance and spare parts (1.5 % of fixed cost)	3,964	3,964	3,964	3,964	3,964	3,964	3,964	3,964	3,964	3,964
VI Direct overheads	6,086	6,086	6,086	6,086	6,086	6,086	6,086	6,086	6,086	6,086
A. Direct Production costs	212,443	264,954	296,031	327,110	327,110	327,110	327,110	327,110	327,110	327,110
VII. Administration over head	108	108	108	108	108	108	108	108	108	108
VIII. Marketing and Promotional expense 3 % of sales revenue	9,450	10,800	12,150	13,500	13,500	13,500	13,500	13,500	13,500	13,500
B. Operating costs	222,001	275,862	308,289	340,718	340,718	340,718	340,718	340,718	340,718	340,718
Interest	24,326	22,906	21,322	19,557	17,587	15,393	12,946	10,217	7,175	3,782
Depreciation	24,029	24,029	24,029	24,029	23,529	23,429	17,344	5,155	5,155	5,155
C. Total production costs	270,356	322,797	353,640	384,304	381,834	379,540	371,008	356,090	353,048	349,655

ANNEX IV
CALCULATION OF WORKING CAPITAL REQUIREMENTS

I. Minimum requirement of current assets and liabilities
   A. Accounts receivable: 26 days at total production costs minus depreciation and interest
   B. Inventory
      1. Material inputs: 26 days
      2. Spare parts : 90 days
      3. Work under process: two days at direct costs
      4. Product ready for delivery: 8 days at direct costs plus administration overheads
   C. Cash on hand : 360 days
   D. Accounts payable 26 days for material inputs and utilities

ii. Working capital requirement

Table 14 Calculation of working capital

Cost category	Minimum Days of coverage	Coeff-icient of turnover	Project year									
			Start up			Full capacity						
			1	2	3	4	5	6	7	8	9	10
I. Current asset												
A. A/R	26	10	22,200	27,586	30,829	34,072	34,072	34,072	34,072	34,072	34,072	34,072
B. Inventory												
1. Material inputs	26	10	19,289	24,494	27,556	30,618	30,618	30,618	30,618	30,618	30,618	30,618
2. Spare parts	90	4	991	991	991	991	991	991	991	991	991	991
3. Work under process	2	130	1,634	2,038	2,277	2,516	2,516	2,516	2,516	2,516	2,516	2,516
4. Product ready for delivery	8	32.5	6,645	8,260	9,217	10,173	10,173	10,173	10,173	10,173	10,173	10,173
C. Cash on hand	90	4	4,915	5,030	5,145	5,260	5,260	5,260	5,260	5,260	5,260	5,260
D. Current assets			55,674	68,400	76,015	83,630	83,630	83,630	83,630	83,630	83,630	83,630
II. Current liabilities A. A/p	26	10	19,760	25,011	28,119	31,227	31,227	31,227	31,227	31,227	31,227	31,227
III. Working capital												
A. Net working capital			35,914	43,389	47,896	52,403	52,403	52,403	52,403	52,403	52,403	52,403
B. Increasing in working capital			35,914	7,475	4,507	4,507	0	0	0	0	0	0

ANNEX V

PROJECTED SALES REVENUE

Table 15 projected sales revenue

Period					Start up			Full capacity						
Capacity utilization		U/m	Quantity at full capacity	Unit price	70 %	80 %	90 %	100 %						
Item description	Product mix													
Project year					1	2	3	4	5	6	7	8	9	10
	Glucose	ton	5,000	55,000	192,500	220,000	247,500	275,000	275,000	275,000	275,000	275,000	275,000	275,000
	Other by products	Quintals	50,000	3,500	122,500	140,000	157,500	175,000	175,000	175,000	175,000	175,000	175,000	175,000
GRAND TOTAL					315,000	360,000	405,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000

ANNEX VI

PROJECTED NET INCOME STATMENT

Table 16 Projected Net income statement "000"

Period	Start up			Full capacity						
Capacity utilization	70 %	80 %	90 %	100 %						
Project year	1	2	3	4	5	6	7	8	9	10
Item description										
Product sales revenue	315,000	360,000	405,000	450,000	450,000	450,000	450,000	450,000	450,000	450,000
Less total production costs	270,356	322,797	353,640	384,304	381,834	379,540	371,008	356,090	353,048	349,655
Gross profit	44,644	37,203	51,360	65,696	68,166	70,460	78,992	93,910	96,952	100,345
Tax	15,625	13,021	17,976	22,994	23,858	24,661	27,647	32,869	33,933	35,121
Net profit	29,019	24,182	33,384	42,702	44,308	45,799	51,345	61,042	63,019	65,224
Accumulated undistributed profit	29,019	53,201	86,585	129,287	173,595	219,394	270,739	331,780	394,799	460,023

ANNEX VII
DEBT SERVICE SCHEDULE AND COMPUTATION
PAYMENT OF EQUAL ANNUAL INSTALLMENTS

Table 17 Debt services schedule and computation

Item description	Project year									
	1	2	3	4	5	6	7	8	9	10
A. Investment and working capital										
1. Investment										
2. Increment working capital										
Total										
B. Loan receipts and balances										
1. Loan receipts	211,531	199,183	185,414	170,062	152,944	133,855	112,577	88,849	62,391	32,892
2. Outstanding balance at end of year										
a. First year loan	211,531	199,183	185,414	170,062	152,944	133,855	112,577	88,849	62,391	32,892
Total										
A. Debt service										
1. First year Loan										
a. Interest	24,326	22,906	21,322	19,557	17,587	15,393	12,946	10,217	7,175	3,782
b. Repayment of principal	12,348	13,768	15,352	17,117	19,086	21,281	23,728	26,457	29,499	32,892

ANNEX VIII
CASH-FLOW STATEMENT
FOR
FINANCIAL PLANING

Table 18 Projected Cash flow statement

Period	Start up			Full capacity						
Capacity utilization	70%	80%	90%	100%						
Project year	1	2	3	4	5	6	7	8	9	10
Item description										
A. Cash - inflow	**922,660**	842,855	946,102	1,049,350	1,032,460	1,032,460	1,032,460	1,032,460	1,032,460	1,032,460
1. Financial resource (total)	199,944	16,887	16,888	16,890						
2. Sales revenue	722,716	825,968	929,214	1,032,460	1,032,460	1,032,460	1,032,460	1,032,460	1,032,460	1,032,460
B. Cash – outflow	**770,121**	**673,871**	756,863	839,875	823,154	823,341	823,550	823,782	824,042	824,331
1. Total assets schedule including replacement	199,944	16,887	16,888	16,890						
2. Operating costs	510,542	582,417	654,292	726,173	726,173	726,173	726,173	726,173	726,173	726,173
3. Debt service (total)										
a. Interest	8,414	7,922	7,375	6,764	6,084	5,324	4,478	3,534	2,482	1,308
b. Repayment	0.00	4,271	4,762	5,310	5,921	6,602	7,361	8,207	9,151	10,203
4. Tax	51,221	62,374	73,546	84,738	84,976	85,242	85,538	85,868	86,236	86,647
C. Surplus (Deficit)	**152,539**	**168,984**	**189,239**	**209,475**	209,306	209,119	208,910	208,678	208,418	208,129
D. Cumulative cash balance	152,539	321,523	510,762	720,237	929,543	1,138,662	1,347,572	1,556,250	1,764,668	1,972,797

ANNEX XII
TOTAL INVESTMENT COSTS

Table 19 Total investment costs"000"

Period	Start up			Full capacity								
Project year	1	2	3	4	5	6	7	8	9	10	11	
Investment Category												
1. Fixed investment costs												
a. Initial fixed investment costs	78,053											
b. Replacement												
2. Pre-operational capital expenditure	500											
3. Working capital increase	25,967	3,258	3,259	3,261								
Total investment costs	104,520	3,258	3,259	3,261								

ANNEX XIII
TOTAL ASSETS

Table 20 Total Assets

Period	Start up			Full capacity								
Project year	1	2	3	4	5	6	7	8	9	10	11	12
Investment Category												
1. Fixed investment costs												
c. Initial fixed investment costs	78,053											
❖ Cost of land												
d. Replacement												
2. Pre-operational capital expenditure	500											
3. Current assets increase	121,391	16,887	16,888	16,890								
Total assets	199,944	16,887	16,888	16,890								

ANNEX XIV
SOURCES OF FINANCE

Table 21 Sources of finance

Period	Start up			Full capacity							
Project year	1	2	3	4	5	6	7	8	9	10	Total
Sources of finance											
1. Equity capital	31,356	3,258	3,259	3,261							
2. Loan capital	73,164										
3. Current liabilities	95,424	13,629	13,629	13,629							
Total finance	199,944	16,887	16,888	16,890							

ANNEX XI
SUMMARY OF FINANCIAL EFFECIENCY TESTS

Table 22 Summary of financial efficiency tests

	Project year									
Project year	1	2	3	4	5	6	7	8	9	10
Capacity utilization	70%	80%	90%	100%						
Financial ratio in %										
1. Gross profit : Revenue	14%	10%	13%	15%	15%	16%	18%	21%	22%	22%
2. Net profit : Revenue	9%	7%	8%	9%	10%	10%	11%	14%	14%	14%
3. Net profit : initial investment	10%	7%	10%	12%	13%	13%	15%	17%	18%	19%
4. Net profit : Equity	32%	25%	33%	40%	41%	43%	48%	57%	59%	61%
5. Gross profit : Initial investment	15%	11%	15%	19%	19%	20%	23%	27%	28%	29%
6. Operating costs : Revenue	70%	77%	76%	76%	76%	76%	76%	76%	76%	76%

ANNEX XV

CALCULATIONS OF PAYBACK PERIOD

Table 23 Calculation of payback period"000"

Year	Amount Paid Back			Total investment	End of year
	Net Profit	Depreciation	Total		
1	29,019	24,029	53,048	302,188	-249,140
2	24,182	24,029	48,211	7,475	-208,404
3	33,384	24,029	57,413	4,507	-155,498
4	42,702	24,029	66,731	4,507	-93,274
5	44,308	23,529	67,837	0	-25,437
6	45,799	23,429	69,228	0	+43,791

ANNEX XVI
CALCULATIONS OF NET PRESENT VALUE AT 17% D.F.

Table 24 Calculation of NPV at 17% D.F.

Project year	Gross Revenue	$1/(1+i)^n$ At 17%	Present value at 17%	Project costs			
				Total investment	Operating costs	Total	Present value at 17%
1	315,000	0.854701	269,231	302,188	222,001	524,189	448,025
2	360,000	0.730514	262,985	7,475	275,862	283,337	206,982
3	405,000	0.624371	252,870	4,507	308,289	312,796	195,301
4	450,000	0.53365	240,143	4,507	340,718	345,225	184,229
5	450,000	0.456111	205,250		340,718	340,718	155,405
6	450,000	0.389839	175,428		340,718	340,718	132,825
7	450,000	0.333195	149,938		340,718	340,718	113,526
8	450,000	0.284782	128,152		340,718	340,718	97,030
9	450,000	0.243404	109,532		340,718	340,718	82,932
10	450,000	0.208037	93,617		340,718	340,718	70,882
Total			1,887,144				1,687,137

A. Benefit- cost ratio At 17% D.F. = 1.12

B. NPV At 17% D.F. = 200,007,000 Birr