بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

الَّذِي خَلَقَ {السَّمَاوَاتِ وَالأَرْضَ فِي سِتَّةِ أَيَّامٍ ثُمَّ اسْتَوَى عَلَى
مُ مَا يَلِجُ فِي الأَرْضِ وَمَا يَخْرُجُ مِنْهَا وَمَا يَنْزِلُ مِنَ السَّمَاءِ
وَمَا يَعْرُجُ فِيهَا وَهُوَ مَعَكُمْ أَيْنَ مَا كُنْتُمْ وَاللَّهُ بِمَا تَعْمَلُونَ بَصِيرٌ }

صدق الله العظيم

(الحديد:3)

Dedication

This research is dedicated to my parents and brothers fortheir continues support, encouragement, and their understanding throughout the period of my studies.

To my colleagues and General family members who assisted and encouraged us in various ways.

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المستخلص

يواجه اقليم درافور مشكلة كبيرة في مجال مواد البناء ويعتبر الاسمنت من المواد الاساسية ذات الاهمية القصوى في مجال البناء ولكن نسبة لبعد الاقليم عن مصادر الانتاج وعدم توفر مصانع محلية والمسائل الامنية ادى إلى ارتفاع اسعار الاسمنت بصورة كبيرة وانعكس ذلك في العدد الكبير من سكان الاقليم وبما ان اقليم درافور غنية بالمواد الخام الداخلة في صناعة الاسمنت مثل الرخام والبوزلانا مما يتطلب دراسة جدوى لإنشاء مصانع صغيرة للاسمنت في دارفور الذي يستهدف حل مشاكل الاسمنت كلياً في الاقليم وعليه فإن الدراسة تر تكز اساساً على الجانب الفني والإقتصادي.حيثتمت إجراء در اسة الجدوى الفنية بما يتعلق بالمعدات والماكينات وتم مسبقاً التاكد من جودة ووفرة المواد الخام في الاقليم . وايضاً اجريت دراسة الجدوى الاقتصادية بغرض تقييم المشروع اقتصادياً وأظهرت نتائج التحليل الاقتصادي والفني جدوى المشروع وفائدته ما يختم بان انشاء مصانع صغيرة للإسمنت في الإقليم يؤدي إلى حل مشاكل البناء وتطوير الإقليم ككل واستيعاب عدد مقدر من العمالة و الفائدة الاقتصادية الغير مباشرة المصاحبة لمثل هذه المشاريع التنموية ويعتبر مشروع اسمنت جامعة نيالا ذات السعة الانتاجية 300 طن في اليوم من اوائل المصانع لإنتاج الاسمنت البورتلاندي والبوزلاني في دارفور اذا تم انشاءه ويقدر التكلفة الكلية لإنشاء المصنع بحوالي 11507400$ ايضاً أكد التحاليل المالية سداد راس المال الكلي في خلال عام واحد فقط ويوفرالمشروع ضرائب للدولة والعمالة سنوياً 7911765.6 $.

Abstract

Darfur region is suffer from Problems of construction materials especially Cement, which considered as the most important item, since the region is so far from the Production areas and no local factories available in addition there security issues, all these problems led to increase the Cement prices, which in turm reflect at the people of the region. Darfur region potentially rich with the raw material for cement production (Marble and Poozzlna).This makes the region important in terms of investigation of the Feasibility of establishment of Cement Factories to resolve the problems. So the Study based on Techno- and Econo- Feasibility Study as a trial to solve these problem. The Technical part discussed the Equipment and Machinery upon the Geophysical Studies to ensure the quality and quantity of the raw material. However the economical part evaluates the project.The analysis results show the feasibility of the project ,that led to conclude the construction of Mini-Cement plant in the region to resolve the construction and development related problems in addition to the new market for local workforce and the indirect economical benefits from Such developmental projects. Nyala cement factory with a production capacity of 300 tons per day a pioneer Portland and poozzlana. Such a suggested factory in south Darfur, estimated by a cost of 115,074,00 $, and total annual profit 13461074.4$.if the estimation is true the factory will pay back the capital cost within a year , and also the project will provide annual taxes value of 7911765.6 $.

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List of Abbreviation

Abbreviation	Name
MCP	Mni- Cement Plant
VSK	Vertical shaft Killen
ASTM	American Society for testing and material
BS EN	British Standard European national
ENV	Environmental Visioning and Imaging
PCA	Principal Components Analysis
ASTER	The Advanced Space borne Thermal Emission and Reflection Radiometer
SWIR	Short Wave Infrared Radiometer
VNIR	Visible and Near Infrared Radiometer
CPA	Principal components analysis
OPC	Ordinary Portland cement
PPC	Pozzlana Portland cement
NPV	Net present value

Chapter one

Introduction

1.1.General introduction:

Darfur region is suffering from a severe lack of infrastructure and basic services such as roads, bridges, and transportation and other, which negatively affects the establishment of large factories among which is the cement industry, which require large investments and the need to provide infrastructure and basic materials, energy , and other supplies. Strategic industries and most of the cement-based industries to economies of scale of large production capacity ranging between (2000 - 20,000) tons per day and require a huge reserves of material, liquidity and communities for the consumption of the product and the lack of components necessary and required for the cement industry in many countries, except to the innovation of small cement plants technique ranging from (20 - 300) tons of clinker per day.**[1]** Accordingly, Darfur region geographical location which is far from the center and the areas of cement production in Sudan, lead to increased of cement prices. the availability of the raw materials for cement production i.e. Marble, Clays and pozzlana in Darfur region enable establishing and resettlement of small-scale cement production plants since the investment costs are very small compared with the large factories. Area of jruof is one of the areas with high abundance of raw materials in the region, many geological and physical studies conducted regarding the potential resources

1.2.Research-problem

Generally the problem in the availability of building materials in Darfur region, since cement is one of the basic and essential materials in construction works i.e. Bridges, roads, buildings and many others, cement represents the

backbone of the construction work so the issue has been the focus in the cement. Where there is a real problem in availability and high price of cement in Darfur, today the tone of cement between (2000-3200) SDG .

1.3. Research importance

The establishment of small cement plant in the state of South Darfur is very important for these reasons:

1. Distance of region from the center and high price of cement in Darfur
2. Nyala city located at the center of Darfur region, where connecting the other Darfur states and the railway line pass through Nyala.
3.The availability of raw materials for cement industry in South Darfur state.
4.Nyala is the second largest city in Sudan in terms of population, according to the last population census, after the Khartoum state.
5.The establishment of cement factory in Darfur is a humanitarian necessity
6. last important is the economic income and improve the level of economic.

In spite of plenty cement production in Sudan, the prices remain very high in Darfur states ,here show the important of establishment a cement plant in Darfur to resolve construction problem and improving people's environment

1.4. Research objectives:

The objectives of establishment a cement plant in Darfur region are many which is summarized in one point

1.To conduct techno-econo- feasibility study of small cement plant in Darfur region.

1.6. Research layout:

In addition to chapter one which reflects the research out lines this dissertation consists of six chapters, chapter two gives the literature review and previous studies, chapter three presents the mythology of research , chapter Four show the techno- feasibility study, chapter five included the econo- feasibility study, chapter Six conclusion and recommendation

Chapter Two

Literature Review and previous studies

2.1 Preface

This section contains the theoretical background of materials cement in terms of structure and process of cement manufacturing and the heat required for the production of clinker ,rates of the constituent materials cement and some previous studies in the cement industry . The previous study overview the technology of cement production at small capacity (mini-cement plant) , many examples from which the ethiopian model which conducted on 2010 and the main model output could be mentioned as the following profile which envisages the establishment of a mini-cement plant with a capacity of 60,000 tons per annum.The present demand for the proposed product is estimated at 1.5 million tonnes per annum.The demand is expected to reach 2.6 million by the year 2010.The plant will create employment opportunities for71persons. The total investment requirement is estimated at 4,566190.476$, out of which 3,809523.81$ is required for plant and machinery. the project is financially viable with an internal rate of return (irr) of 16% and a net present value (npv) of 1510476.19 $ discounted at 8.5 %.[2]

2.2. Definition of Cement

Portland cement is resulting from material grinding, powder burning limestone (calcium carbonate) mud, materials that contain ratios of oxides (alumina, iron and silica) ,should not be used limestone containing high levels of oxides, magnesium and al kali because it affects the quality of cement product [3]

2.3. Theoretical background of materials cement

Cement materials is chemical compounds react with water or with each other in the presence of water to produce (Silica calcium)(C-S-H) that lead to the cohesion of the Moraine the oxides of calcium, silicon, aluminum and iron are considered as mineral basic of materials cement and puzolana containing silica and gypsum

2.4.Manufacturing of cement and energy sources

From definition of Portland cement given above it can be seen that it is made primarily from a combination of a calcareous material such as limestone or chalk and of silica and alumina found as clay or shale. The process of manufacture consists essentially of grinding the raw material into Avery fine powder mixing them intimately in predetermined proportions and burned in a large rotary kiln at a temperature of 1400c when the material sinters and partially fuses into clinker .The clinker is cooled and ground to afine powder with some gypsum added and the resulting product is the commercial Portland cement used throughout the world. The mixing and grinding of the raw material can be done either in water or in dry condition ,hence the names wet and dry process. The mixture is fed into a rotary kiln, sometimes (in the wet process) as large as 7 m (in diameter The kiln is slightly inclined. the mixture is fed at the upper end while pulverized coal (or other source of heat) is blown in by an air blast at the lower end of the kiln, where the temperature may reach about 1500C the amount of coal required for manufacturing of one tone of cement is between 100 kg and about 350 kg ,depending on the process used. Nowadays, gas and various combustible materials are also used. As the mixture of raw material moves down the kiln, it encounters progressively higher temperature so that various chemical changes take place along the kiln..First any water is driven off and co2 is liberated from the calcium carbonate. Further, the dry material undergoes a series of chemical reactions

until, finally, in the hottest part of kiln, some 20 to 30 per cent of material becomes liquid, and lime, silica and alumina recombine. The mass then fuses into balls, 3 to 25 mm in diameter known as clinker .afterwards, the clinker drops into coolers, which provide means for an exchange of heat with the air subsequently used for the combustion of the pulverized coal. The cool clinker, which is very hard, is intergroup with gypsum in order to prevent flash-setting of the cement. The grouped material that is cement. [3]

2.5.Basic chemistry of cement:

We have seen that the raw materials used in the manufacture of Portland cement consist mainly of lime, silica, alumina and iron oxide. These compounds interact with one another in the kiln to form a series of more complex products and from a small residue of uncombined lime which has not had sufficient time to react, of chemical equilibrium is reached. However, equilibrium is not maintained during cooling, and the rate of cooling will affect the degree of crystallization and amount of amorphous material present in the cooled clinker.The properties of this amorphous material, known as glass, differ considerably from those of crystalline compounds of a nominally similar chemical composition. Another complication arises from the interaction of the liquid part of the clinker with the crystalline compounds already present. Cement can be considered as being in frozen equilibrium, the cooled products are assumed to reproduce the equilibrium existing at the clinkering temperature. This assumption is, in fact, made in the calculation of the compound composition of commercial cement: The potential composition is calculated from the measured quantities of oxides present in the clinker as if full crystallization of equilibrium products had taken place. Four compounds are regarded as the major constituents of cement: they are listed

in table 2-1 together with their abbreviated symbols. This shortened notation, used by cement chemists, describes each oxide by one letter, viz.

CaO=C ,SiO2=S ,Al2O3=A ,and Fe2O3 =F .**[3]**

Table 2.1 .main compounds in Portland cement [3]

Name of compound	Oxide composition	Abbreviation
Tricalcium silicate	3CaO.SiO2	C3S
Dicalcium silicate	2CaO.SiO2	C2S
Tri calcium aluminates	3CaO.Al2O3	C3A
Tetracalciumaluminoferrite	4CaO.Al2O3.Fe2O3	C4AF

The calculation of the potential composition of Portland cement is based on the work of R.H. Bogue and others, and is often referred to as, Bogue composition. Bogues, equation for the percentages of main compounds in cement are given below. The terms in brackets represent the percentage of the given oxide in the total mass of cement.

C3s =4.07(Cao)-7.60(SiO2)-6.72(Al2O3)-1.43(Fe2O3)-2.85(SO3)

C2s =2.87(Sio2)- 0.754(3CaO.SiO2)

C3A =2.65(Al2O3)- 1.69(Fe2O3)

C4F =3.04(Fe2O3)

The silicates C_3S are the most important compounds which are responsible for the strength of hydrated cement paste.In reality, the silicates in cement are not pure compounds ,but contain minor oxides in solid solution . These oxides have significant effects on the atomic arrangements crystal form, and hydraulic properties of the silicates.The presence of the C3A in cement is undesirable: it contributes little or nothing to the strength of cement except at early ages, and when hardened cement paste is attacked by sulfates, the formation of calcium sulfo-aluminate (etringite) may cause disruption.

However, C3A benefit in the production of cement since it facilitates the combination of lime and Silica.C4AF is also present in cement in small quantities, and compared with the other three compounds it does not affect the behavior significantly. However, it reacts with gypsum to form calcium sulfo-ferrite and its presence may accelerate the hydration of the silicate.The amount of gypsum added to the clinker is crucial, and depends upon the C3A content and the alkali content of cement .Increasing the fineness of the cement has the effect of increasing the quantity of C3A available at early ages ,and this raises the gypsum requirement .An excess of the gypsum leads to expansion and consequent disruption of the set cement paste.The optimum gypsum content is determined on the basis of the generation of heat of hydration so that desirable rate of early reaction occurs which ensures that there is little C3A available for reaction after all the gypsum has combined . The American standard(ASTM) C 150-05 and the British standard(BS EN 197-1) specify the amount of gypsum as the mass of sulfur trioxide (SO3) present .In addition to the main compound listed in table 2.1 there exist minor compounds such as Mgo, TIO2, Mno3, K2o and Na2o, they usually amount to not more than a few percent of the mass of cement .Two of the minor compound are of interest: the oxides of sodium and potassium, N2ao and K2o, known as the alkalis (although other alkalis also exist in cement).They have been found to react with some aggregates, the products of the alkali-aggregate reaction causing disintegration of the concrete and have also been observed to affect the rate of the gain of strength of cement. It should, therefore be pointed out that the term minor compounds refers primarily to their quantity and not necessarily to their importance. In addition, general idea of the composition of cement can be obtained from table2.2, which gives the oxide composition limits of Portland cements. Table 2.3 gives the oxide composition of atypical

cement and the calculated compound composition, obtained by means of Bogues equations.

Table 2.2 Approximate composition limits of Portland cement. [3]

Oxide	Content , per cent
Cao	60-67
Sio2	17-25
Al2o3	3-8
Fe2O3	0.5-6
MgO	0.1-4
Alkalis	0.2-1.3
SO3	1-3

Two terms used in table 2.3 require explanation. The insoluble residue, determined by treating with hydrochloric acid, is a measure of adulteration of cement, largely arising from impurities in gypsum. BS EN 197-1 limits the insoluble residue to 5 per cent of the mass of cement and filler, for cement, the ASTM C 150 limit is 0.75 per cent.

2.6. Steps of cement manufacturing process:

the production of cement in manufacturing is completed in five Steps:

1.Raw materials Preparation-Limestone crushing**:**

Process introduction: Limestone is the main raw material in cement production, and most factories are located near the limestone by blasting or use the loader to the mining of raw materials limestone, transported to the crusher into fragments. The main raw material: limestone, clay, iron ,are show in fig 2.1

Fig.2.1. Limestone, Clay, Iron

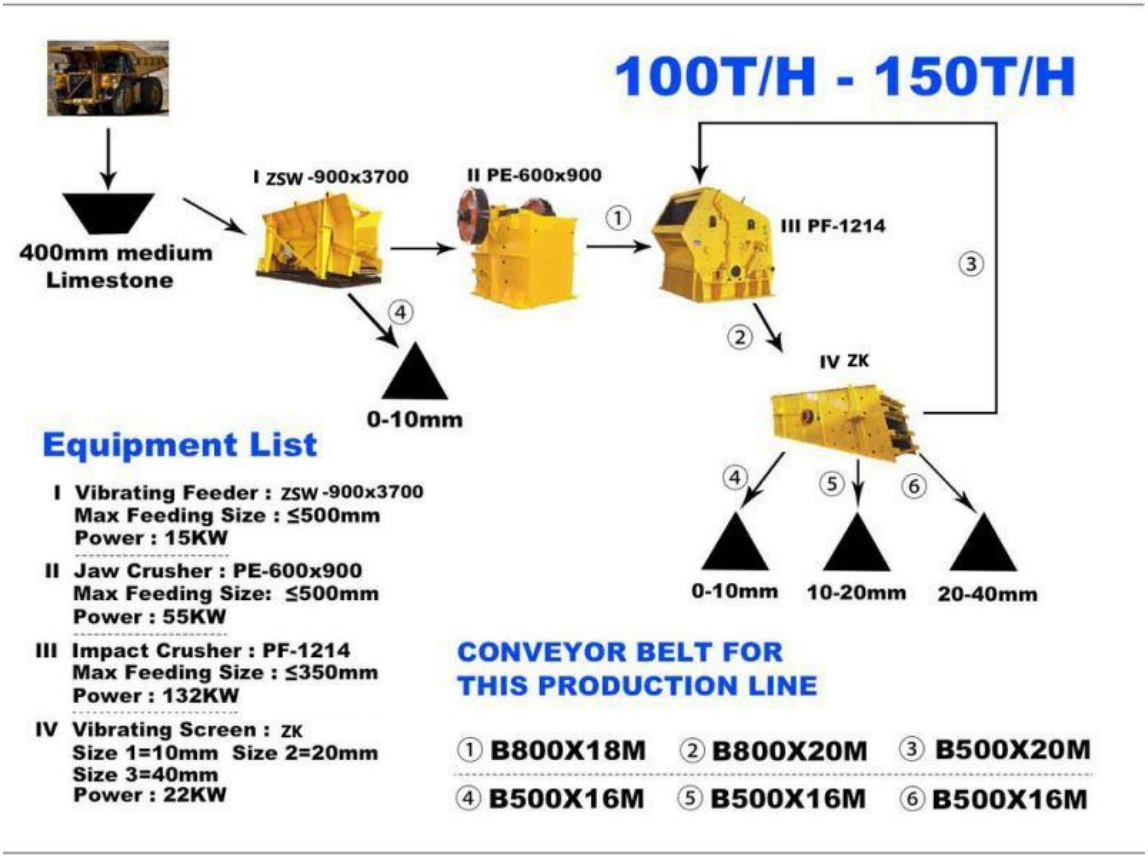


Fig 2.2.Crushing of raw material

2.Raw material grinding -Limestone, clay, iron and other raw materials**:** use the of ball mill or vertical mill raw material is ground to a powder, and then by conveyor transport for storage and further material mixed

Fig.2.3.Grinding of raw material

3.Calcining clinker-raw material powder after homogenization:

The homogenized material enters the preheating decomposition system, decomposition rate of 95%, into the rotary kiln, clinker. List of equipment and processes are Preheated, Decomposition furnace, Rotary kiln, Ball mill, Cooler, Clinker conveyor belt, Belt conveyor, Dust collecting equipment etc.

Fig.2.4.Kiln and Clinker unit

4.Cement grinding-Clinker gypsum ,mix materials:

The Clinker and gypsum is mixed in a ball mill cement grinding into a qualified drug cement. The use of the powder selecting machine can conveniently adjust cement drug, to achieve energy saving production the equipment used in this department such as Ball mill, Powder selecting machine, Bucket elevator, Air chute, FU chain conveyor, Dust collector etc.

Fig.2.5. Grinding Clinker and gypsum mix

5.Cement storage ,packaging Finished:

The use of packaging machines and automatic loading machine can achieve the shipment of bagged cement factory, use bulk cement equipment can realize bulk cement canning factory ,the main Equipment are Conveying equipment, Dust collecting equipment, Belt conveyor ,Elevator Air chute, Spiral screw etc.[4]

Fig.2.6. Cement Storage

2.7. Mini- Cement Plant in Ethiopia

In addition to the mentioned in preface about the Ethiopia model which is contain the

2.7. 1 Market Study

1.Past Supply

All local cement is produced in the three factories, Mugher, Mesebo and Dire Dawa. The combined capacity of these three factories is about 1.3 million tones per annum,In addition to domestic production, the country also imports some amount of cement from European and Asian countries

the researcher assume the present level of supply is about 1.2million tones, satisfies only 80 % of the demand ,the present effective demand for cement is estimated at 1.5 million tones.[2]

2. Projected Demand

The future demand for cement ,considering all the above factors and the growth trend in supply observed from the historical data, future demand is forecasted to grow at a rate of 10%, annually. Accordingly, projected demand

for cement ranges from1.6million tons in the year 2005 to 5.7 million tons by the year 2018

2.7.2. Plant Capacity

According to the market studied, the demand gap for cement product begins with 200,000 tones for the year 2004, and will reach to 1,300,000 tones by the year 2010 .Such a plant will operate 24 hours a day, and for 300 days a year, producing a total of 60,000 tonnes of cement.

2.7.3.Production Program me

The anticipated mini-cement plant will start its operation at 75 % in the first year, 85 % in the second year ,and at 100 % in the third year and then after.

2.7.4. Materials and inputs

The details of raw materials requirement for cement production is shown in Table 2.1

Table 2.3 Raw materials requirement and cost ($)

Sr. No.	Description	Qty. (Tones)	Unit Cost	Total Cost$
1	Limestone, (72-76)%	61,000	2.381	145238.1
2	Clay, (6-10)%	10,000	0.04761	476.19
3	Sandstone, (8-12)%	6,500	3.095	20119.04
4	Pumice, (2-4)%	3,210	3.05714	9813.42857
5	Gypsum, (4-5)%	2,400	5.71428	13714.28571
	Grand Total Cost	-	-	189361.0443

1. auxiliary materials

Three-ply paper bag is required for packing cement. Addis Ababa Cement Plant is engaged in the production of this bag, and procurement can be processed locally. A total of 1.2 million sacks of 50 kg each is required. The annual expenditure on paper bags is estimated at 285714.2857$.

2. UTILITIES

VSKs of MCPs do require energy in the range of 1000-1100 kcal of heat per kg of clinker. Similarly, consumption of electrical power in MCPs is in the order of 120 units per ton of cement as compared to large cement plants, which lies in the range of 100-110 units per ton. Consequently, electricity and fuel oil are highly required. Water is also essential for human consumption and for production process. Annual requirement of utilities is 162514.3$ for Electricity, to 7200,000 Kwh,50,000 m3 for water by 3,571.43$ and fuel oil requirement annually 6,200,000 liter by cost 738,100$ and over all cost of 904,181 $

2.7.5. Machinery and Equipment

The list of machinery and equipment required is summarized in four section such as preparation section, burning, clinker and auxiliaries section. The total investment cost of these machinery and equipment is estimated at 3809523.81 $, of which 3571428.571 $ is required in foreign currency.

2.7.6. Land, Building and Civil works

The site area of 10,000 m^2 is required for the plant under consideration. Of this, an area of about 1,500 m^2 will be covered by production buildings, including auxiliary buildings. At the rate of 95.24 $ per m^2, the investment cost for buildings will be 142857.143 $. The cost of l and leasing ,at the rate of 0.09524 $ per m^2 and for 70 years land holding, will be 66,666.667 $. Thus ,the total cost of land, building and civil works assuming that the total land lease cost will be paid in advances 209523.81$.

2.7.7. Manpower and training requirement

The envisaged mini-cement plant requires 71 employees. The man power requirement and corresponding labor cost including employees 'benefits the total annually cost 29571.43$

2.7.8. Financial analysis

The financial analysis of the Mini-Cement Plant project is based on the data presented in the previous chapters and the following assumptions:

1. Total initial investment cost:

The total initial investment cost of the project including working capital is estimated at 4,566,190.5 $, of which 88 per cent will be required in foreign currency.

2. Production cost:

The annual production cost at full operation capacity is estimated at 1,852,380.96 $ .The material and utility cost accounts for 65.1 per cent while repair and maintenance take 1.3 percent of the production cost.

3. Profitability

According to the projected income statement, the project will start generating profit in the 1st year of operation. Important ratios such as profit to total sales ,net profit to equity (Return one quity) and net profit plus interest on total investment (return on total investment) show an increasing trend during the lifetime of the project.The income statement and the other indicators of profitability show that the project is viable.

4. Break-even Analysis

The break-even point of the project including cost of finance when it starts to operates at full capacity (year 3) is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable cost}} = 63\%$$

5. Pay-Back Period

The investment cost and income statement projection are used to project the payback period. The project's initial investment will be fully recovered within 6 years.

6. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 16% and the net present value at 8.5% discount rate is 1,510,476.2 $.

7. Economic benefits

The project can create employment for 71 persons .In addition to supply of the domestic needs, the project will generate 180952.4 $ per annum in terms of tax revenue .The Regional Government can collect employment, income tax and sales tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. An addition to more details from this dissertation in appendex. [A]

2.7.9.Geophysical Survey in south Darfur

2.7.9.1.Preface:

This section generally show the marble and limestone in area of study use remote sensing and digital image to evaluate the deposit.At national level the were many regions had a great potentials for industries related to cement production, many studies conducted covering the most aspects regarding the cement production among which is the geophysical and geochemical study with the aid of remote Sensing and Digital image by Dr Khalid Mustafa Kheiralla and others in 2012 which conducted in south Darfur region at jurif area[5]. The findings of the study shows that the area are promising , the raw

materials are available with a quality and quantities encouraging the establishment of industries related to cement production at the area ,The scope of the current study is based on that findings with techno-Economical study completing the work of the mentioned team and to meet the objectives of the study mentioned before , this section shows the details of the of the geophysical survey and geochemical analysis to introduce its findings to the feasibility study.[5]

2.7.9.2.The Marble in South Darfur

Marbles are common all over northern part of Nyala town, South Darfur and found at patches form as a member of the basement complex rocks. The project area located in the South Darfur state and situated in the northern part of the state, bounded by longitudes 24°57'36.89" and 25°03'03.36" East and latitudes 12°33'04.80" and 12°29'45.36" North. It has an area of approximately 45 square kilometers show in fig 2.1.The area characterized by flat topography low elevated ridges and drainage pattern characterize the most of the area especially in southern part of the area .The study is required to be conducted estimate of reserve for marble using geological mapping for the manufacturing of cement. This quarry lies within a cluster of maximum 100 km north Nyala town and 10 km north Duma village. This is work will be based on the geological/ structural mapping using field work, Landsat image processing and GIS means in all activities. Nevertheless, previous geological and geochemical works and previous data have been taken in consideration in assessments plans beside a field ground work. [5]

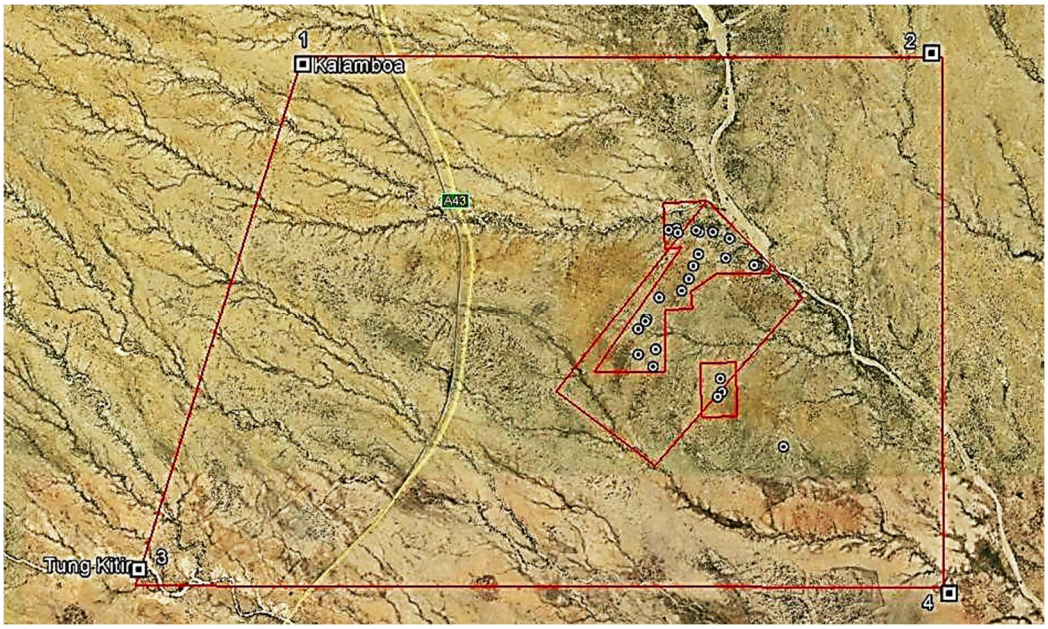


Fig 2.7. Location of the study area

2.7.9.3. Geological and Structural mapping

The Geological map used to evaluate the marble deposits in the area of study ,The products of the digital image processing and the field ground work beside the previous map implement the geological interpretation to perform the geological map and other major structural elements in the area, Fig.2.2 show the Geological structural

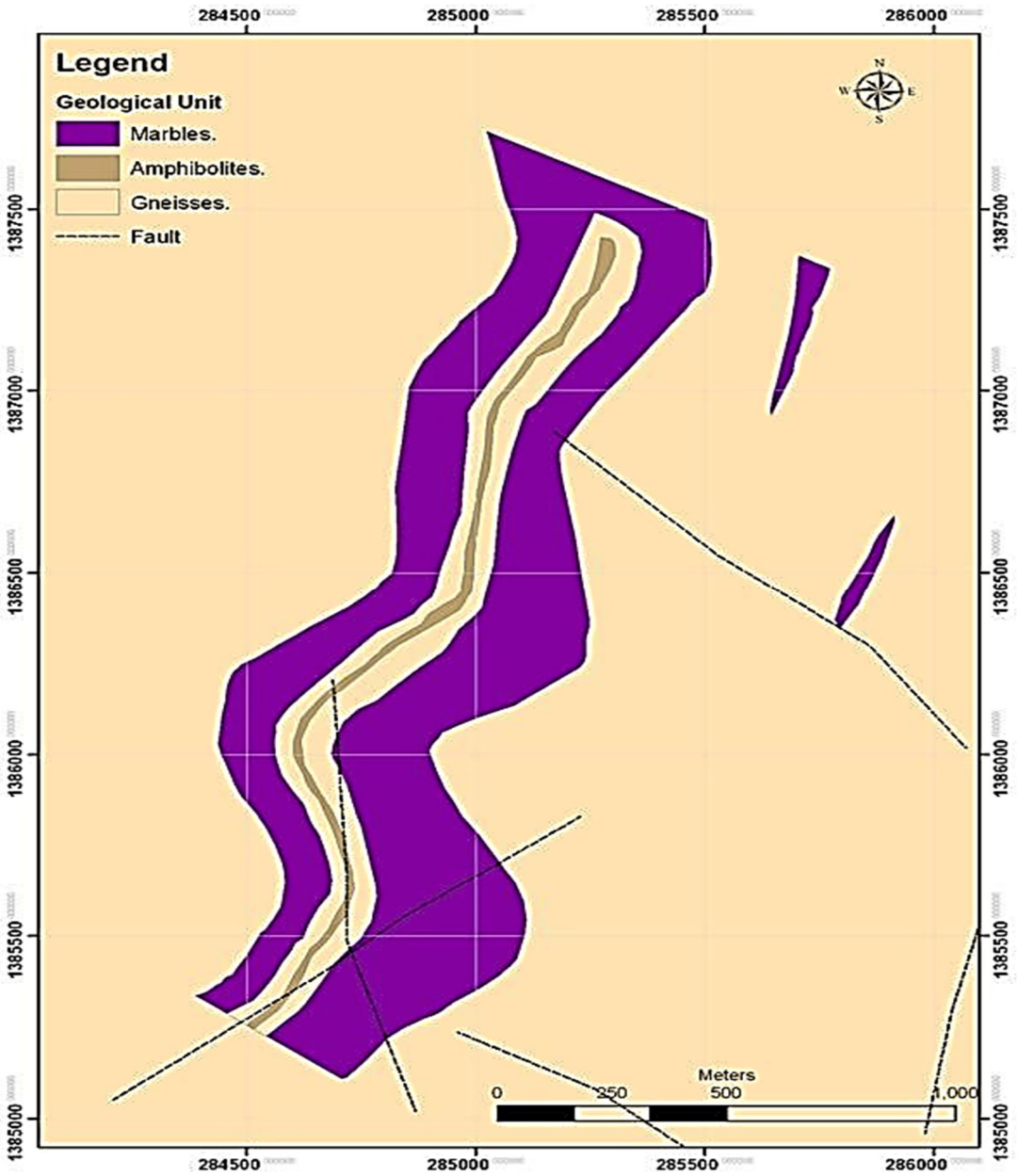


Fig.2.8.Geological map of the study area

The general geological units are summarized from the oldest to the youngest as follows:

I. High-grade granitic gneisses

II. Basic Meta volcanic

III. Marbles and cal-silicate rocks

2.7.9.4. Reserve estimation

The estimate of reserve is based on the Remote sensing investigation, Geological structure mapping, Geochemical survey and Geochemical analysis Estimation of the reserve (ER) is obtained from the total area(A) of the deposit multiplied by the average depth (Z) of the marble obtained from boreholes

ER =A * Z m3

ER =A*Z*D [tone]

The total area is 1265000 m^2 , and average depth is 12 m.The density (D) of marble is 2.7 g/cm^3, so the reserve estimated is:

*1265000*12 = 15180000*m^3

*5180000*2.7= 40986000 tons*

2.7.9.5. Result of marble deposits in the area of study:

According to the standard values of the main oxides for cement industry the chemical analysis shows 80% of samples marble deposits in this area is suitable for cement industry based on CaO, MgO and SiO_2.

In Darfur region there are many different places for raw material uses in Cement Manufacturing such as marble rock , buozolana and limestone ,and the Figure 3.16 show the locations of raw material in Darfur region like (Miedob volcanic, Tagabo volcanic, Jebel marra volcanic,Saraf omra kaolin, Rahd abiad kaolin, Jourf marbel ,El-fashir ,Genina ,Zalegi ,Nyala and Dein).This all at show in Figuer 2.3. then the more details found in appendex [B].

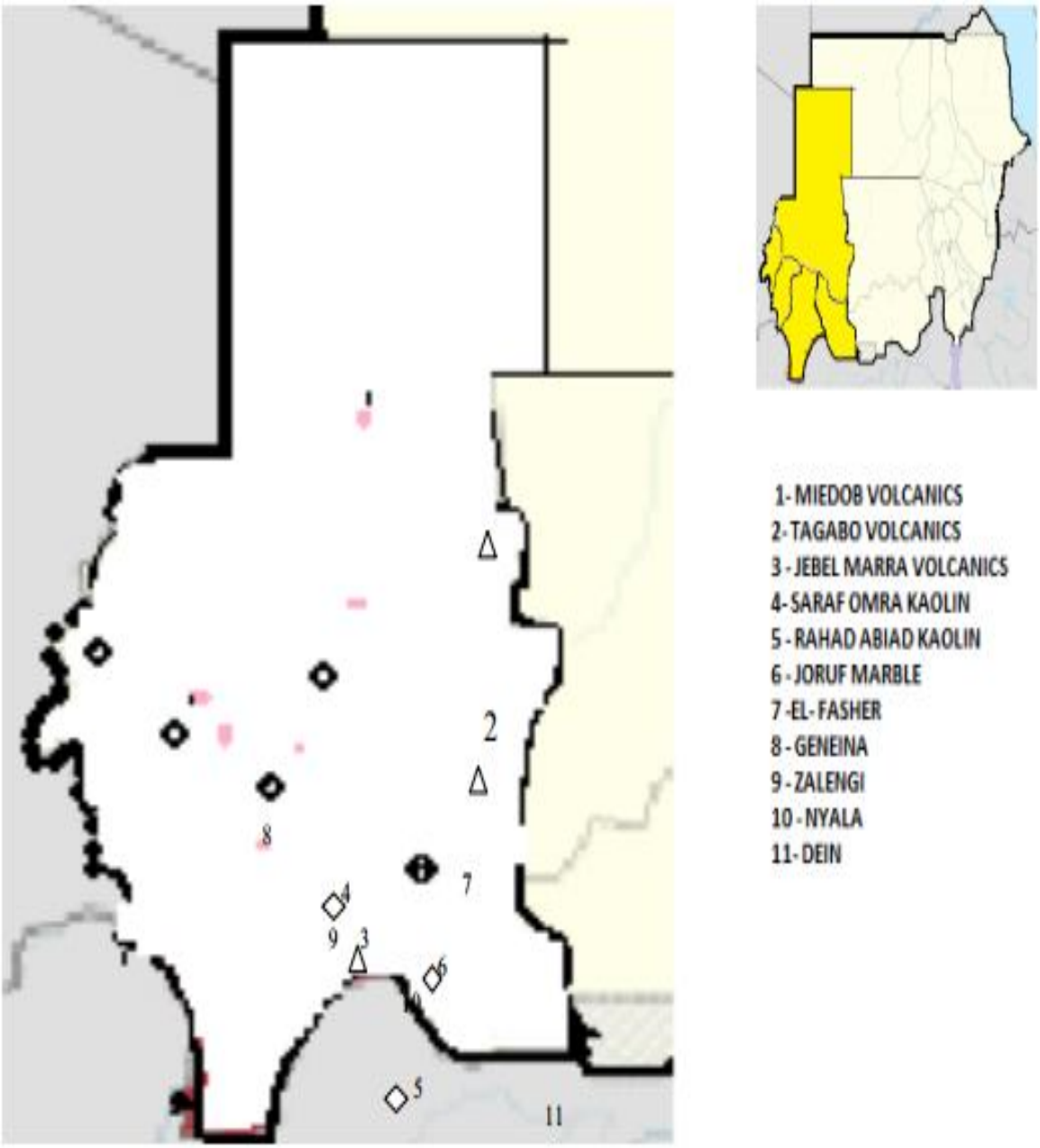
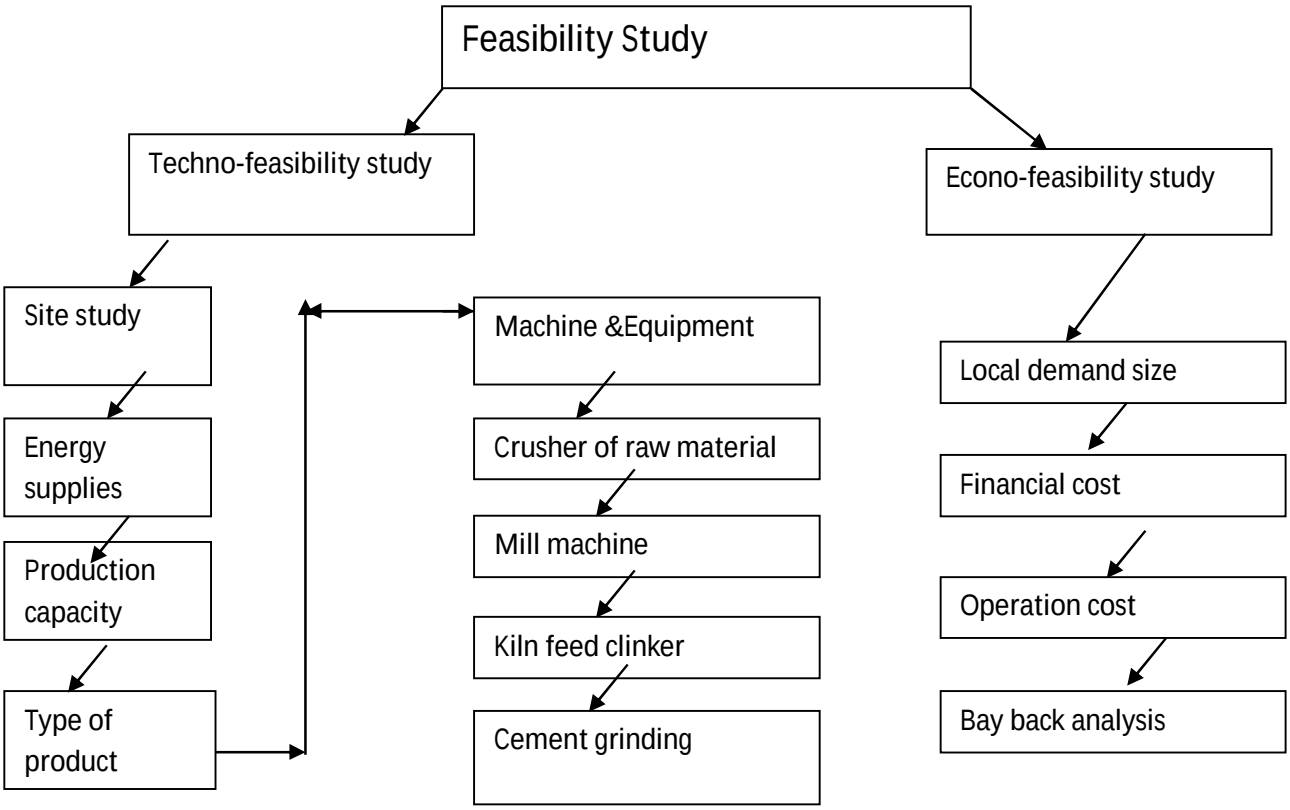


Fig.2.9. The raw material in Darfur region

Chapter Three

Methodology

The Research methodology comprises two parts following the modern scientific methods in conducting econo-and techno- feasibility study and analysis the financial and economic indicators for the project and the chart blow flow the sequence of the feasibility study.



3.1.Feasibility study :

As the flow chart illustrate this work conducted considering that the feasibility study consist of techno- an ecno- feasibility.

3.1.1. The techno- feasibility part:

1.Site study:

give an over view for the area of the plant and the raw material supplies.

2.Energy supply:

Give an over view for the supplies of the energy for veracious production activities i.e Electrical energy and cocke-breez.

3.Production capacity :

Determine the expected visible production plan.

4.Type of production:

The type of production are Portland cement and bozolana Portland cement

5.Machines and equipments:

This site discuss in details the specification of machines and equipments accessory for plant operation including the crusher of raw materials ,mill machines ,kiln feed clinker and the cement grinding.

3.1.2. Econo-feasibility part:

This part discuss the financial and cost of the factory through all stages starting from initial cost up to operation and income expectations, it includes:

1.local demand size:

It to estimate from the market survey of the demand for the region

2.Financial cost:

The cost of establishment of the plant it present the financial cost

3.Operation cost:

Represent the cost of different operations expenses in the plant.

4.pay back period:

Discuss to estimate The time for recovery the initial costs.

Chapter Four

Techno- feasibility study

4.1. Preface

This chapter discuss the techno- feasibility study, which include the site study, energy supplies, the limits for the production capacity, the type of products and, the machines and equipment's. This be upon the findings and recommendations of the geophysical survey and the chemical analysis, which represented in the previous chapter, which is the initial guidance for the starting of the techno-economical feasibility study.

4.2. The aim of the study (project target):

the study aim to consider the factors that justify the establishment of small cement plant in South Darfur state through conducting techno-economic feasibility study in Jrouf area 60 km north of Nyala city with production Capacity 300 tons per day.

4.3. Name of the project:

Nyala University Cement factory

4.4. Project stockholders

20% for Capital cost University of Nyala and 80% for Capital by other investments or loan

4.5.The,location:

Jrouf area which is located in South Darfur state ,north of Nyala town about 60 km at El Fasher-nyala-line where raw materials are large potential abundance estimated by 40 million tons of marble according to the geological study in Chapter three, and the overall area of raw material about 400 fadan (1680000meter sugar),the landholding own Nyala university

4.6. The implementation period of the project:

Estimate the period of project implementation approximated to time laps of eight months to a one year.

4.7. The production capacity:

the capacity of Factory production planned to be 300-tonper day at present with a plan in the future to raise the output to 600 tons per day, which is the maximum design capacity per day.

4.8. Product type:

Ordinary Portland cement (OPC) and Portland Buzzlana cement (PPC)

4.9. The technical side:

It was ascertained the existence and quality of raw materials in the region with sufficient quantities to meet the production capacity with a potentials and quality class that met the international standards. The table 4.1 shows that material analysis in Jrouf area.

Table.4.1.Show the Chemical composition of Joruf marble[6]

Materials	Chemical Composition (%)								
	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	SO_3	Na_2O	K_2O	LOI
MARG1	2.82	1.3	1.16	56.12	0.485	0.007	0.273	0.081	37.5
MARG2	9.75	0.13	0.21	52.97	1.875	-	2.887	0.0003	
MARG3	0.07	0.023	0.022	45.45	1.68		0.69	0.014	43.8
MARG4	0.76	0.33	0.5	54	1.03	-	-	-	-

Table.4.2.Show the standard Chemical properties of Portland- Pozzolana cement[7]

Constituents	Portland pozzolan cement	
	ASTM C595 – (2003)[63]	IS: 1489: (1991)[62]
Magnesium Oxide (MgO), max,%	6	6
Sulphur trioxide (SO_3), max, %	4	3
Loss on ignition max %	5	5

4.10. The machines And equipment for cement production:

the machines and Equipment of cement production lines with all accessories including:

1. Crusher for raw material department:
2. Raw mill department:
3. kiln feed clinker department :
4. Cement grinding unit

All the selected machines have the capacity to produce between (13-25) tons per hour **[8]**

4.10.1. Crusher for raw material department

1. Operating principle:

The machine is driven by motor, through the motor wheels; the eccentric shaft is driven by the triangle belt and slot wheel to make the movable jaw plate.Movable jaw plate and cheek plate can be crushed and discharged

through the discharging opening fig 4.1 show crusher machine for raw material.

Fig 4.1.Crusher department of raw material (limestone)

2. The crushing department for raw material has an accessory as :

1.Lime stone hopper with rail lining: with storage capacity of 200

2. Fabricated pin gate and frame with dimension of : 800 x 400 mm

3. Vibrating feeder at show in fig 4.2.

Fig.4.2.Vibrating feeder

Size: 1 meter x 3 meter.

Capacity:50mt/ hour.

Drive motor :vibro motor.

4. Crusher

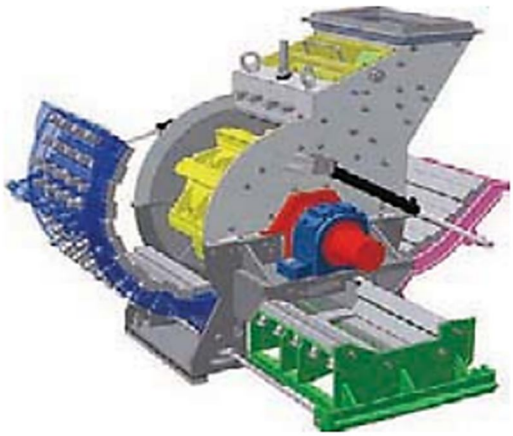


Fig. 4.3. Crusher of raw material

Capacity: 50 mt/ hour.

Feed size: 50 mm lime stone lumps

Product size :-10 mm, 80%

5. Crusher inlet & outlet chute.m.s. fabricated as per our drawing, to be fabricate at site.

6. Bucket elevator with two way discharge chute: 2 nos.

Size: 600 x 1200 as per drg height.

Capacity: 20 mt/ hour.

Drive motor :5.5 kw/1440 rpm 415 volts,50hz, tefc motor.

Drive gear box:n u 8, ratio 60:1

Two way chute :m.s. fabricated at site as per ourdrawing.

7. Belt conveyor:2 nos.

Size:600 mm wide as per drg.

Capacity:50mt/ hour.

Drive motor:7.5 kw/1440 rpm 415 volts, 50hz, tefc motor.

Drive gearbox:n u-8, ratio 40:1

8.Hammer crusher :for clay/additives 11 kw 1440 rpm

9. stock pile/silo:6 mtdia x 8 mt height customer scope.

stock pile with m.s. fabricated hoppers as per ourdrawing.

10. Slide gate for m.s. hopper: 4 nos.m.s. Fabricated4 nos. 500 x500mm.

11. Weigh feeder with discharge chute:1 no.

Capacity:40mt/ hour.

Power: 5 kw/1440 rpm 415 volts, 50hz, tefc motor.

Gearbox:nuv-8, ratio 60:1

12. Weigh feeder for coke breeze:3 nos.

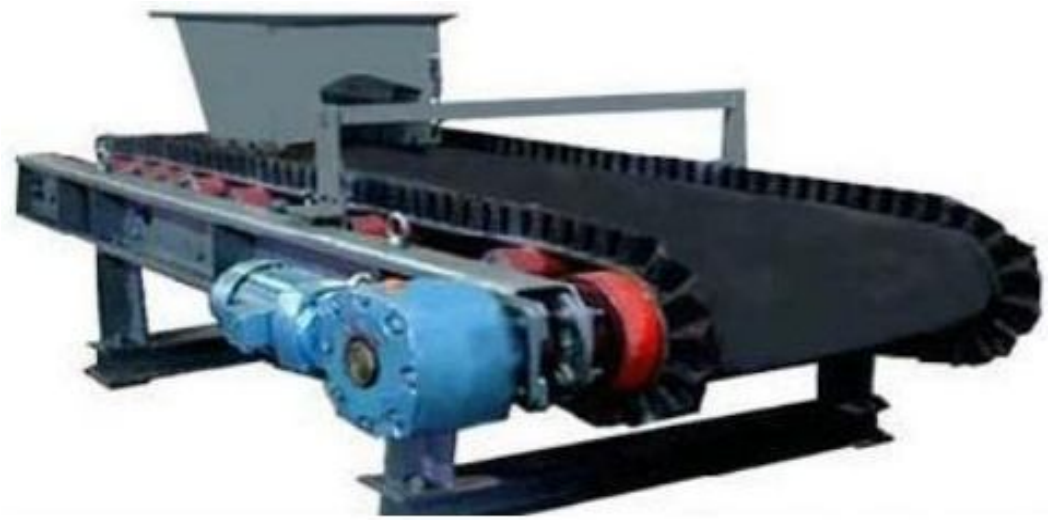


Fig.4.4.Feeder for Coke breeze

Clay: 5tph

Additives:5tph

Power:2.2kW each

13. Raw feed belt conveyor

Size: 600 mm x 40 meter long. (approx.)

Capacity:15mt/ hour.

Drive motor:5 kw/1440 rpm 415 volts, 50hz, tefc motor.

Drive gearbox:nu-8, ratio 40:1

4.10.2. Raw mill department

1. The application

SCM Super-micro Mill is widely used in making fine powder or micro powder, and the raw materials should be non-inflammable under the hardness 9 grade such as coal , glist , talc, graphite, fluorite, calcite, limestone, calcite, and kaolin,

Fig.4.5.Raw mill department

2. The accessory of the grinding mill department:

14. Motorized double flap valve

Fig.4.6. motor valve

Size:300 mm x 300 mm.

Drive motor:geared motor 1 kw output rpm 30.

15.Rawmill close circuit ball mill.

Size:2400 mm dia x 10000 mm long.

no. of compartment : 2

Capacity:10mt/hour

Drive motor: 600kw, tefchigh tension slip ring 4154 volts 50 hz motor.

Gear box: two stage helical gear box, ratio 6.3:1, 800 kw.

Mill main bearings .:thermite type white metal 120 degree self-aligning force lubricated bearings.

Mill liners : manganese steel lifter waybic liner.

Mill speed:19 rpm.

16. Bucket elevator:2 nos.

Fig.4.7 becket elevator

Size: 400 mm x 1000 mm.

Capacity: approx 15 mtr height.

Power:3.7 kw each.

17.r.c.c. storage silo: customer scope 2 nos.

Blending silo:100 m.t.

Storage capacity:400mt

18.roots blower(high pressure): 30 kw, 3000 rpm

19.roots blower(low pressure) :20 kw, 1440, rpm

20. Silo accessories doors aeration box, rotary valves:1 set. (m.s. fabricated)

21.dust bag filter for storage silo: anual.

22. Air compressor for silo:25 kw, 3000 mm

4.10.3. kiln feed and clinker department :

Fig.4.8.kiln feed and clinker department

1. The accessory of kiln department:

23.Slide gate: 400 x 400 rpm

24.Rotary vane feeder400 mm dia rotary valve with chain sprockets chain & drive geared motor 3.7 kW.

25) Screw conveyor/ air slide

Size: 300 mm dia x 3.5 meter long.

Capacity: 10 mt/ hour.

Drive motor:2.2 kw/1440 rpm 415 volts, 50 Hz, tefc motor.

Gearbox: nu-8, ratio 40:1

26. Elevator:600 x 1200

Kiln feed hopper with overflow screw conveyor: 2 nos.

Capacity: 20 mt

28. Metering screw conveyor

Withdyno drive:2 nos.

Power:2.2-kw dyno drive motor

29. nodilizer supporting structure &discharge chute :4 nos.

Size: 2500 mm dia x 400 mm deep.

Capacity:7mt/ hour.

Drive motor:15 kw/1440 rpm 415 volts, 50hz, tefc motor.

Gearbox:nu-8, ratio 50:1

Scraper drive:2.2 kW geared motor.

30.Vertical shaft kiln:4 nos.

Model: “d.s.” 312

Capacity:75 tpd

Size 2600 mm dia x 11.3 mtr height

Rotary grate :fabricated from 2076-is Discharge valve: three stage dozing valve Motorized mechanical.

Air stack : 900dia x 33 mtr. Height.

Blower for kiln: customer scope roots blower 100 hp.

31. Clinker belt conveyor

Size: 500 mm dia x as per drg.Taper screw conveyor.

Capacity: 7.5 mt.

Drive motor: 3.7 kw/1440 rpm 415 volts, 50Hz, nu-8 ratio 50:1

Gearbox: nu-8, ratio 50:1

4.10.4. Cement grinding unit

The accessory of Cement grinding department including the parameters blow**:**

32. Jaw crusher for clinker:1 no.

Fig.4.9.jaw crusher for clinker

Capacity: 20 tph

Power: 15 kw

33. stock pile :customer scope. Withm.s. fabricated hopper: 3nos.

Storage capacity : clinker: 60 mt.

Gypsum: 15 mt.

Additive: 15 mt.

34. Slide gate for clinker gypsum additive hopper : 3 nos.

35. Table feeder for clinker qty. :1 no.

Size: 1000 mm dia table

Capacity: 10 mt

Drive motor: 3.7kw 1000 rmp 415 volts 50 hztefc motor.

Gearbox: nuv-6 ratio 70:1

36. Table feeder for gypsum additiveqty.: 2 no.

Size: 600 mm dia table

Capacity: 5mt

Drive motor : 2.2 kw 1000 rmp 415 volts 50 tefc motor.

Gearbox:nuv-4 ratio 70:1

37.Belt conveyorqty.:1 no

Fig.4.10. Belt conveyor

Size: 400 mm dia x 18 meter long c/c or suit at site.

Capacity: 30 mt/hour

Belting size : 400 mm x 28 oz x 4 ply x 3 x 1.5mm on 24 gr.

Drive pulley: 500 mm dia x 600 mm face with as per is 8531 1977.

Tail pulley: 400 mm dia x 600 mm face width as per is 8531 1977.

Belt speed: 0.5 to 1 m/s

troughing angle: 20 degree

Construction :conveyor will be supported by mc 100 stringer and short support (1 mtr. maximum) will be provided with skirt board deck plate feed point. Chute a structure.

38. Cement grinding mill

The cement-grinding mill is one of most important unit in cement grinding.

1.Application principle of Cement grinding unit the ball mill is the key equipment for regrinding. it is widely used for the cement, the silicate product, new type building material, fire-proof material, chemical fertilizer, black and non-ferrous metal, glass, ceramics and etc. our ball mill can grind ore or other materials that can be grinded either by wet process or by dry process and the fig. blow is one of ball mill unit.

Fig.4.11. Cement grinding mill unit

2. The accessory of cement grinding unit

a)Grinding mill

Fig.4.12. Grinding mill

Type of mill: open circuit gravity discharge ball mill

Size: 2.4 m dia x 12.57 m long.

Capacity : 15 m tph/blains 2800 to 3000

Inside diameter: 2400 mm.

Total length with flanges: 12.570 mtr.

Effective length: 12.0 mtr.

no. of compartment :two

Drive motor: 600kw.,tefc high tension slip ring 415 volts, 50 hz.

Gearbox: two stage helical gear box, ratio 6.3:1, 800k.w.

b) Mill shell material

Material: is 2002 gr. 2a

Thickness of shell plate: 24 mm.

C) trunions quantity:2 nos.

Material :cast steel is-1030 gr-i ultrasonically tested

Method of attachment to shell: bolting.

Bearing size:1200 mm dia x 500 mm width

d) trunion bearing housing & bush.

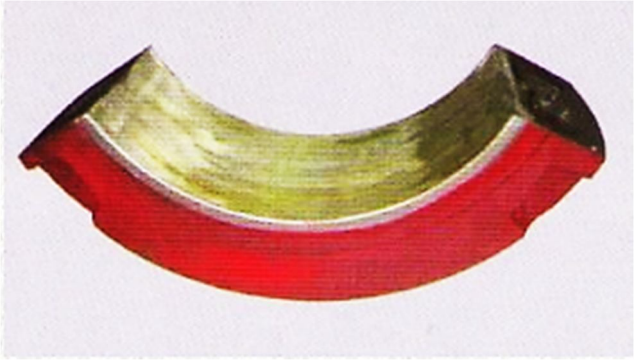


Fig.4.13. bearing housing for grinding mill

Material: fabricated from

Bush material: cast steel is 1030 spherical sealing.

Bush liner: Water-cooled babited liner (white metal)

No. required :two.

e) Shell liners

1st chamber liners :lifting/ classifying lining plate.

Thickness: 25 to 30 mm (as per profiles)

Material : Steel liner is-276 grade-ii

f) Diaphragm Type: double diaphragm between grinding & crushing compartments.

Diaphragm liner material: mn. Steel is-276 gr-ii

Thickness of plate:30 mm.

Material : fabricated from m.s.

g) Manholes

Quantity: two.

Size :600 mm x 450 mm each.

h) Girth gear

Fig.4.14. Gear for grinding mill

Material: cast steel is-2644 gr.iii or 2708 gr.3

Hardness: 225 to 235 bhn

Face width: 350 mm.

Pressure angle: 20 degree.

Type of attachment to mill: on-extended flanges of the bottom shell.

Lubrication arrangement: sump bath.

i) Pinion

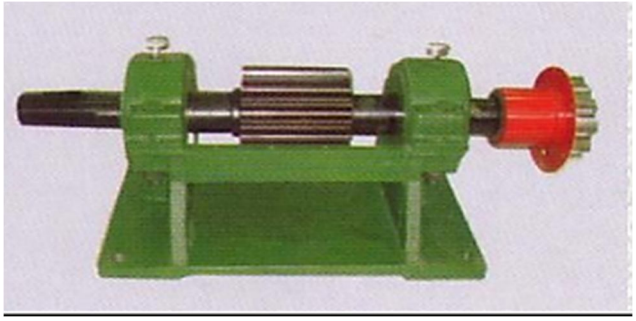


Fig.4.15.pinion gear for grinding mill

Material: forged en-24

Hardness: 240 to 260 bhn

Pressure angle: 20 degree

Face width: 400 mm.

j) Gear guard material: m.s. is-226

k)Pinion shaft

Fig.4.16. Pinion shaft for grinding mill

Pinion shaft:steel forging en-8 class iv or is 2004

Bearing type &size: Spherical roller.

K) .Main bearing lubrication system.

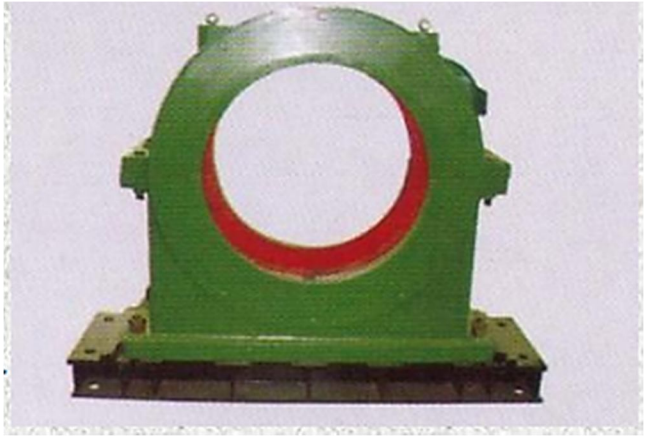


Fig.4.17. Main bearing for grinding mill

Quantity:2 nos. (1 for each bearings)

Type of pump for lub.: gear pump elec. motor device type of pump for pre jacking : electric operated high pressure gear pump.

Capacity for lubrication: 25 liters per minute.

Capacity pump or pre jacking: 350 cc/minute.

Discharge pressure pump forlubrication:3 kg./cm2.

Discharge pressure of pump fromlubrication:360 kg. cm2.

Electric motor.:2h.d. 1440 rpm – flange mounted.

39.Screw conveyor.: 1 no.

Capacity: 10 tph

Power:2.2 kw

Fan:1 no.

40. Bucket elevator/air lift:1 no.

Capacity:12.5tph

Power:11 kw

41.Dust collector system for cement storage silo: 1 no.

Fig.4.18. Dust collector system for cement Storage

Fan power: 5 kw.

42. r.c.c. cement silo with silo accessories with aeration box and manhole and rotary

Valve :customer scope.

43.Silo air comp/air blower: 11 kw, 3000 rpm

44.Slide gate 500 x 500 mm: 1 no.

45.Rotary vane feeder: 1 no.

Power:3.7 kw geared motor.

46.Screw conveyor: 1 no.

Capacity:12.5tph

Power:2.2 kw

47. Cement packing machine : customer scope

Three spot auto-packing machine 50 kg, cement bag.

48. Return screw conveyor:1 no.

Power:1.7 kw

Chapter Five

Econo-feasibility study:

5.1. Preface

In This chapter, discuss the econo- feasibility study which included the local demand size, financial cost, operation cost, the income expectation and economical analysis for the project and economical benefit.

5.2.Estemate the local demand size and the production:

The demand of cement in South Darfur is continuous and increasing due to urbanization development in the region , South Darfur state has become one of the largest Sudanese cities consuming cement in the last decade, the local cement market received a large amounts monitored and reported for the years 2013,2014 and two-thirds of 2015 as shown in the table 5.1The table below shows imports of cement in South Darfur at years 2013 and 2014 and two-thirds of 2015 in tons .[9]

Table .5.1. Quantity of cement imports in South Darfur(tons)

Year	Quantity	Import by truck	Import by rail	Total
2013	187565	25505	162060	187565
2014	286971	31008	255963	286971
2015	280186	14976	265210	280186
TOTAL		**71489**	**683233**	

All the quantity imported by trucks was consumed locally, but 50% of quantity imported by Railway consumed locally or stored and 50% transported again for other states.

Average annual demand size = average trucks transported + half of the average Railway transported. =137,701.83 tons per year only The average consumption estimates of cement in Nyala city an annual display size between (137701.83-140000) tons per year in line with demand

5.3 Estimation of the volume of production :

the volume of production in South Darfur is estimate by the market study according to the information that enable to estimate the present production Capacity of 300 tons per day in order to cover a large portion of the needs of State of cement which estimated to be 78% of local need .And there is also a plan for extension the production in the future to riseup to 600 tons per day to satisfy both the local consumption and export the excess of the production for the neighboring States.

5.4. Manpower and labor Cost:

The project provide a job opportunities employment for103 persons and the details of the manpower required and monthly cost as showing in the table 5.2.

Table.5.2.Manpower and Monthly labor Cost (Approximately):

Sr. No.	Description	Req. No.	Salary, SDG	
			Monthly	annually
	A. Administration			
1	General Manager	1	20000	240000
2	Secretary	3	1500	54000
3	Administrative Finance	1	5000	60000
4	Accountant	3	2500	90000
5	Clerks	3	2000	72000
6	Storekeeper	2	3000	72000
7	Personnel Officer	3	2500	90000
8	Purchaser	3	2500	90000
9	General Services	10	2000	240000
10	Guards	6	1500	108000
	Sub–total	34		1116000
	B. Production & Technical			
1	Production &Technical Head	1	7000	84000
2	Supervisors	3	6000	216000
3	Instrumentation Engineer	3	6000	216000
4	Mechanical Engineer	3	6000	216000
5	Electrical Engineer	3	6000	216000
6	Foreman	3	3000	108000
7	Technicians (shift)	8	3500	336000
8	Operators(skilled)	20	2500	600000
9	Unskilled Workers	18	2000	432000
10	Chemist	2	5000	120000
11	Laboratory Technicians	5	3500	210000
	Sub–total	69		2754000
	Total	103		3870000

5.5. Financial Cost:

The financial cost for the establishment small cement factory including the cost of construction (civil work)+machines+ services equipment +transmission line + water plan. The cost of machinery and equipment include but not limited to crushers, mills, tanks of mixing, kiln line with all accessories and workshop=6000000 $.This price direct from SBM Company in China. [8]

The cost of services equipment and vehicles i.e. loaders and trucks, Dozer and Cars. =1500000$

Cost of Civil works i.e. stores ,offices, construction and installation of machinery=1000000 $

Cost of Electrical transition line of 33 Kw from Nyala to ALjrouf along distance of 60 km as follows:

the equipment for electrical line:

Two electrical transformers with a capacity of 1500 KV at a Cost of 450 000 SDG = 75000 $.

3Cables at length of 40 meters at a cost of 160000 SDG = 26666.666 $

20 Cables high tensional a cost (20 * 220) by price of 220 pounds per meter = 20 * 220 = 4400 SDG = 733.333 $.

Cost of transmission line for one km, 33 kw = 280000 Sudanese pounds and the total distance is 60 km and the total Cost for the transfer of power to distance 60 km = 60 * 280000 SDG = 16800000 SDG=2800000 $

Total cost of electricity to the plant site = transportation cost + cost of transformers + cost of cabling conductivity = 2800000+ 75000+733.33 +26666.666 = 2902399.999 $. [10]

Cost of water for the plant=60000 $Total cost …….=11462400 $

5.6. Operating costs:

The operation cost is show from the section blow:

Electricity, water, maintenance, and cost of raw materials study which is outlined in the cost of one ton of cement

5.6.1. Total cost for production of 1ton OPC Cement in South Darfur:

The operation cost for production cement is summarized in the cost of Clinker, Gypsum, Electricity, backing, and Manpower and Maintenance.

Ordinary Portland cement[11]

1. $65 – Clinker Cost (95 %)
2. $9.7 – Gypsum (5 %)
3. $9.00 - Electricity Cost (30 Unit)
4. $4.00 HDP Bag (Packing)
5. $8.00 Manpower, Maintenance and Miscellaneous

$95 Total Cost for OPC Cement per Ton in Darfur.

5.6.2. Total cost for production of 1 tone–Pozzolan cement in south Darfur:

1. $50 – Clinker Cost (80 %)
2. $9.7 – Gypsum (5 %)
3. $4.00 – pozzolanas (15 %)
4. $8.00 – Electricity Cost (30 Unit)
5. $4.00 - HDP Bag (Packing)
6. $8.00 - Manpower & Maintenance, Miscellaneous

$84.7 - Total Cost PPC Cement per Tone.

5.6.3. Total Cost for production of 1 ton Clinker in Darfur

LIME STONE 70.80 % 1204 kg per ton 6

PETCOCK 3.92 % 67 kg per ton 13.40

COKE-BREEZE 5.88 % 100 kg per ton 7.00

CLAY 18.70 % 318 kg per ton 3

IRON, BOXIDE

CILICA 0.70 % 12 kg per ton 1.43

Total …….. $ 30.83 per ton

TRANSPORT EXPANCE 13.3

MAINTENANCE 4.00

MAN POWER (TOTAL) 5.00

POWER and others 12.00

Total Cost …… $ 65 per ton.[11]

Table.5.3. the Specification of Operation cost

\Specifications	Daily cost	Monthly cost	Annually cost
Total cost for production of 300 tone cement	300*95.$=28500 $	300*95$*30=855000$	300*95$*360= 10260000$
Total cost	**28500 $**	**855000 $**	**10260000$**

Table 5.4.ShowThe summary operation cost

	Specifications	Cost (USD)
1	Cost of study (investigations of raw material deposit)	45000$
2	Total cost for cement plant (machinery +water +civil work + electric stations)	11462400 $
3	Total cost for production of 1 ton 53(opc)in Darfur	95 $
4	Total cost for production of 1 ton (ppc) Cement in Darfur	84.7 $

The Total Cost of Establishment of Small Cement plant =

45000+11462400=11507400 $

Table.5.5.the income expectation

Specifications	Daily income	Monthly income	Annually income
Sales of cement	300*1800=540000 SDG =90000 $	300*1800*30=162000 00SDG=2700000$	194400000 SDG =32400000$
The total	90000 $	2700000$	32400000$

5.7. Financial statement and economical analysis:

Our Short-term funding Estimates the age of Factory plant(life cycle) by15 years with full Depreciation and replacement and maintenance at the fifteenth year

5.7.**1The annual cash inflows**….....=32,400,000$

5.7.2. The annual cash outflows:

1. The share of year in Capital cost

•construction cost divide by the age of factory ($ 11,507,400 /15 years)=US = $767 160

2. Annual operating cost = $10260000

Total annual cost.=shear of year in the Capital cost+ annual Operating Cost=10260000 + 767160 = $ 11027160….....

The Profit before tax=annual cash inflows-total annual costs =32400000–11027160=21372840=21372840 $.....

The Funding required is the capital cost of ($ 11,507,400) (Only eleven million five hundred and seventy-four thousand dollars)

5.7.3. Total taxes:

The total taxes equal 17% of all profit from Taxes, 17% of profit to others and the last taxes is manpower and Labor Cost**.**

The profit before taxes = 21372840 $

1.The manpower and labor cost taxes =3870000 SDG = 645000 $ per annual

2. Government Taxes = 17 % of total annual Profit = 21372840 *0.17 =3633382.8 $

3. Other taxes =17% of all profit = 21372840 *0.17= 3633382.8 $

The Total annually taxes = 645000+3633382.8 +3633382.8 =7911765.6 $

4. The net profit = the profit before taxes – total annual taxes=

21372840 – 7911765.6= 13461074.4 $

5.7.4. Pay-Back Period

The Capital Cost and income Expectation of Sales are used to show the payback period. The project's initial investment will be fully recovered with in one years if the factory will operate continuous 360 days work and the production Capacity 300 tons per day

5.7.5. Economic benefits

The Factory will provide opportunity Job for 103 Persons. In addition to solve the Construction problems, the project also will generate 17% for the profit to local Government per annum in terms of tax revenue and other taxes

5.7.6.Results

1. Results of financial cost

The total cost of constructing a Cement Factory with production Capacity of 300 TPD was found to be 11507400 $. The breakdown of this cost is as following:

1.6000,000 $ represent cost of machinery and Equipment with all accessory including the technical compound, this price direct from (SBM) Company

2.1500,000 $ represent cost of mean transport vehicles. Such as 2 loaders, 2baldozer, 4 trucks, one tanker of water, and 4Cars for general services.

3. 1000,000$ represent cost of civil work construction

4. 2902399.999 $ represent cost of Electricity transmission line to distance 60km long from Nyala to Aljourf area.

5.600,00 $ Cost of water plant in factory

6. 45000 $ represent cost of team work (investigation of raw material deposit in the area of Study)

2. Result of operation Cost

The operation cost of production of cement , considering the cost of one ton of cement, are summarized as the following :

cost of Clinker, Electricity, backing, manpower and Maintenance, and then found the total cost for production of one tone (OPC) in Darfur region Equal to 95$ and 84.7$ for (PPC) from this Cost the Clinker Cost represent 62%,8.6% gypsum cost, 8.6% Electricity cost,4% backing cost, and 8% cost of manpower and maintenance through the result it show the cost of Clinker is high (62%) ,in addition the total cost of production of (PPC) 84.7$ which is less than (OPC) because of adding the 15% of raw poozzlana for the Clinker. Accordingly the total annual operation cost equal 10,260,000$ through 360 days work.

3. Income expectation Result

according to the sales prices of cement in Darfur shown in Table 5.5 it found that the total annual cash inflow 32,400,000 $,annual outflow cost 11,027,160 $, comparing the annual cash inflow against the annual cash outflow it was been found that the annual profit before taxes 21,372,840 $,and the total annual taxes to be 7,911,765.6 $ .and the total annual profit equal to 13,461,074.4 $

5.7.7. Discussion

From the results of Econo-Feasibility study regarding the initial Cost ,Operation cost and income expectation of Cement Sales in South Darfur ,the benefit of project was clearly shown since the Capital Cost of project 11,507,400 $, and the annual total profit after taxes 13,461,074.4 $ comparing this figures the feasibility of the project appears, and the recovery period for the initial investment(Capital cost) of the project will be within one year , and starting the net profits from the second year. Nowadays the price of cement in South Darfur equal 2400 SDG per ton, and the Sales price of Cement in approximated to 1800 SDG, this show the benefit of project and justify strongly the conduct of the project since its effect on reduction of the price of cement in Darfur region.

Chapter Six

Conclusion and recommendation

6.1. Conclusion

In this work the benefits expectations of Econo- Feasibility Study have been discussed, it has been emphasized on the probability of project feasibility through the full recovery of the initial investment in one years, the economical analysis shows this results .

Beyond the income expectation , indirect benefits such as job opportunity for Darfur youth and the resolving the Cement availability problem in Darfur region. In addition to potentials of the other areas suite for other industries related to cement based upon the Geological Studies

7.2. Recommendations for Future Works

300 ton per day are not enough to cover the demand size of Cement in South Darfur, and once the Darfur region has been cover by rock and marbel deposits therefore it is highly recommended to recommend the following:

1. To conduct mni-cement plant idea in all Darfur's region
2. To increase the size of production capacity of Cement factory in South Darfur of the existing 300 TPD to a Capacity of 1500 TPD to Exported to South Africa and South Sudan in future plant.
3. to investigate the Darfur region to evaluate the marble, Pozzolanic deposits and other minerals benefit.
4. It is recommended the local investment and Nyala university to entering in production blended cements that have been emphasized from the economical and environmental standpoint

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