MAGNESIUM OXIDE POWDER MANUFACTURING
INDUSTRY ESTABLISHMENT

(Executive Summary)

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I. INTRODUCTION

Magnesium oxide is the most important industrial magnesium compound with its main application in the steel and refractory industry. It is also largely used in many other industrial sectors including the food and animal feed industries. The raw materials for the production of magnesium oxide are both natural magnesium carbonate and brucite or magnesium chloride from seawater and brines.

For the production of magnesium oxide (MgO/magnesia), two general production process routes are used:

- Starting from magnesium carbonate, by a high temperature de-carbonization reaction, magnesium carbonate itself may be obtained from magnesite mines (natural or dry process route)
- Starting from magnesium chloride, through various processes like the high temperature hydrolysis reaction and magnesium hydroxide (Mg(OH)2) precipitation.

Magnesium chloride may be obtained from brines, the dissolution of magnesium rich minerals with hydrochloric acid (HCl) and seawater (synthetic or wet process route) [108, European Commission, 2006].

The use of the process route starting from magnesium chloride mentioned above (wet process route) is decreasing because the energy requirements are three times higher than those of the magnesium oxide production process starting from magnesium carbonate (dry process route).

This chapter covers the production of magnesium oxide (MgO/magnesia) of which there are different types – DBM, CCM, FM by using the dry process route based on mined natural magnesite (magnesium carbonate MgCO3).
The Ethiopian Government has encouraged the enormous potential in construction material manufacturers and has provided several incentives to encourage entrepreneur in this business, including discounted/free land, tax incentives and duty free exports.

These incentives have attracted various local and foreign entrepreneurs. The primary aim of this project summary is to identify the viability Magnesium Oxide in Ethiopia by showing the financial requirements and the rate of return on the intended investment.

1.1. Objective Of The Project
The proposed project intends to setup in Addis Ababa city and will be able to produce 10,000 tons of MgO powder per year. The Rated plant capacity is 10,000 tons of magnesium oxide powder per annum working on 8 Hours single shift. The plant will have the capacity to operate in double shifts, producing 20,000 Tons of magnesium oxide powder.

The total capital cost of the project is 60 million Ethiopian Birr (2.9 million USD) and 61 employees will be deployed directly on the project. The civil works and installation of plant is estimated to complete in six months.

1.2. Production of magnesium oxide
1.2.1. Production of magnesium oxide from crude magnesite and dolomite:
The production of MgO utilizes magnesite (MgCO3) as the main input material and furnace oil as energy source. The production process involves decomposition of the MgCO3 to MgO and CO2 and hence the release of CO2 to the atmosphere in the form of gas. All sorts of calcinations process which involves the input of carbonate rocks undertake the same phenomena. The final product will be subjected to milling for size reduction until 85% the materials pass the 150um sieve openings.
Magnesium oxide is the high-temperature product of the calcinations of magnesium carbonates. Although magnesite deposits are found in every state, only a small portion is pure enough for industrial magnesia manufacturing. To be classified as magnesite, the rock must contain at least 50 percent magnesium carbonate. When the rock contains 30 to 45 percent magnesium carbonate, it is referred to as dolomite. Magnesium oxide is manufactured in various kinds of kilns by one of the following reactions:

\[ \text{MgCO}_3 + \text{heat} \rightarrow \text{CO}_2 + \text{MgO} \]

\[ \text{CaCO}_3 \cdot \text{MgCO}_3 + \text{heat} \rightarrow 2\text{CO}_2 + \text{CaO} \cdot \text{MgO} \] (dolomitic magnesia)

1.2.2. Production of Magnesium Oxide from brine

While mining is one source, another important source of magnesium oxide is obtained from processing seawater and underground deposits of brine which contain magnesium chloride. The remainder of this summary will follow the extraction and processing of magnesium oxide from a typical brine source. The process for extraction from seawater would follow basically the same route, differing only in the concentration of magnesium in seawater.

Brine is essentially a saturated salt solution which, in this case, contains magnesium chloride, calcium chloride and water. Since the concentration of magnesium in this brine source is around 9%, it takes about 10 liters of brine to produce just 0.5 kg of magnesium oxide. In order to extract magnesium from brine, another ingredient is needed. Typically this ingredient is lime or calcium oxide (CaO) which is obtained from a mineral source such as dolomitic limestone (CaMg(CO3)2). When heated to high temperatures the carbon dioxide is driven off leaving calcined dolomite in the above reaction.

First, naturally occurring brine is mixed with both calcined dolomite and water to produce an aqueous suspension containing magnesium hydroxide and calcium chloride:

\[ \text{CaCl}_2 + \text{MgCl}_2 + \text{H}_2\text{O} + (\text{CaO} \cdot \text{MgO}) + 2\text{H}_2\text{O} \rightarrow 2\text{Mg(OH)}_2 + 2\text{CaCl}_2 + \text{H}_2\text{O} \]
The magnesium hydroxide and calcium chloride produced from this reaction exist together but in two distinct physical states: magnesium hydroxide is formed as solid particles while the calcium chloride is dissolved in the liquid or watery phase. An aqueous suspension containing solid particles is also referred to as slurry. Gravity is used to separate the solids from the liquid in the aqueous suspension since magnesium hydroxide is heavier than water. If you look at a bottle of milk of magnesia, which you probably have in your bathroom medicine chest, you'll see this separation clearly.

Milk of magnesia is another name for magnesium hydroxide. The blue color indicates the watery layer containing dissolved magnesium chloride that has formed above the settled magnesium hydroxide particles. The bottom solids are then filtered to remove any remaining water and given a series of water washes to remove chlorides from the material. This results in a damp filter cake which can be seen dropping off the lower roller of the press about waist high to the operator. The washed filter cake is finally directed to a source of heat, such as a rotary kiln, where it is thermally decomposed (calcined) to produce magnesium oxide:

$$2\text{Mg (OH)}_2 + \text{heat} \rightarrow 2\text{MgO} + 2\text{H}_2\text{O(steam)}$$

The original or "parent" magnesium hydroxide particle is usually a large and loosely bonded particle. Exposure to thermal degradation causes this particle to alter its structure so that the surface pores are slowly filled in while the particle edges become more rounded.

Thermal alteration dramatically affects the reactivity of magnesium oxide since less surface area and pores are available for reaction with other compounds. Several types of kilns can be used in the calcinations step. Calcinations not only convert magnesium hydroxide to magnesium oxide, but are also the most important step for determining how the final product will be used.
1.2.3. Different grades of magnesium oxide

Three basic types or grades of "burned" magnesium oxide can be obtained from the calcinations step with the differences between each grade related to the degree of reactivity remaining after being exposed to a range of extremely high temperatures.

A. Dead burned magnesium oxide (Sintered magnesia)

Most (about 85%) MgCO3 and Mg (OH)3 is converted into sintered magnesia (also known as magnesia clinker or dead burned magnesia. Sinter quality depends not only on chemical composition but also on the bulk density or porosity; a high density gives a better product.

Sintering capability decreases considerably with increasing purity, making a high density difficult to achieve. The final bulk density of the sinter depends on chemical composition, sintering temperature and time and the degree of compression of materials prior to sintering. The material is usually sintered in lamp form. Temperatures used when calcining to produce refractory grade magnesia will range between 1500°C - 2000°C and the magnesium oxide is referred to as "dead-burned" since most, if not all, of the reactivity has been eliminated. Refractory grade MgO is used extensively in steel production to serve as both protective and replaceable linings for equipment used to handle molten steel. Magnesite Grain- dead-burned magnesia in granular form in size is suitable for refractory purposes. Seawater Magnesite-Dead-burned magnesia made by a chemical process using seawater or other solutions (brines).

B. Hard burned magnesium oxide

A second type of magnesium oxide produced from calcining at temperatures ranging from 1000°C - 1500°C is termed "hard-burned". Hard burned caustic magnesia has a loose bulk density of 1200kg/m3 (bulk density 2000kg/m3).
Due to its narrow range of reactivity, this grade is typically used in applications where slow degradation or chemical reactivity is required such as with animal feeds and fertilizers.

### C. Light burned magnesium oxide

The third grade of MgO is produced by calcining at temperatures ranging from 600°C - 1000°C and is termed "light-burn" or "caustic" magnesia. Due to the material's wide reactivity range, industrial applications are quite varied and include plastics, rubber, paper and pulp processing, steel boiler additives, adhesives, and acid neutralization to name just a few.

Caustic magnesia is a vary reactive, finely crystalline material that is produced by burning MgCO3 or Mg (OH)2 slightly above the decomposition temperature. Caustic magnesia was formerly produced exclusively from cryptocrystalline magnesite with a low iron content but is now also obtained from all types of magnesite and Mg (OH)2.

Its MgO content ranges from 65 to 99 wt % and may even reach 99.9%. The magnesia is often ground prior to use. Extreme reactive caustic magnesia may have a surface area of up to 160m²/g. Caustic magnesia is produced industrially by calcining lump MgCO3 (up to 50mm) or finer material in shaft, rotary or multiple –hearth kilns. Heat exchange kilns are also employed.

In the case of Mg (OH) 2, dewatered filter cakes are usually calcined in lump form at about 9500C in multiple hearth kilns. These kilns generally contain ten shelves (hearths), one above the other; each hearth is provided with four burners in the vertical cylindrical kiln wall. The material is feed continuously into the top of the kiln and its residence time can be adjusted via the rake that rotates above each hearth. The calcining condition must be carefully adapted to the contaminants in the feed otherwise over burning results in excess growth of the reactive MgO crystallites which lowers their activity. When heated from
600°C to 1000°C, magnesium carbonate thermally decomposes to produce magnesium oxide and carbon dioxide:

$$MgCO_3 + \text{heat} \rightarrow MgO + CO_2(gas)$$

Light burned caustic magnesia becomes hydrated in cold water and is soluble in dilute acid. It has a loose bulk density of 300-500 kg/m³ and a specific surface area of 10-65 m²/g.

1.2.4. **Key environmental issues**

Magnesium oxide (MgO/magnesia) is the most important industrial magnesium compound and is mainly used in the steel and refractory industry, but also in many other industrial sectors. Different types of magnesium oxide are produced by using the dry process route, such as dead burned magnesia (DBM), caustic calcined magnesia (CCM), fused magnesia (FM).

The manufacture of MgO is energy intensive as MgO, and particularly DBM, is manufactured at very high temperatures. The energy demand for MgO production ranges between 6 and 12 GJ/t MgO and is determined by different factors. In 2010, natural gas, petroleum coke and fuel oil were used as fuels. The key environmental issues associated with magnesium oxide production are air pollution and the use of energy. The firing process is the main source of emissions and is also the principal user of energy. Depending on the specific MgO production processes, plants cause emissions to air, water and land (as waste). In addition, the environment can be affected by noise and odours. The key polluting substances emitted to air are dust, nitrogen oxides, sulphure dioxide and carbon oxides (CO, CO₂).

1.2.5. **Applied processes and techniques**

Raw magnesite is mined, crushed, ground or milled and sieved before being fired. More than 98% of the mined magnesite is used for the production of the different magnesia products. The chemical reaction of de-acidifying magnesite is endothermic and depends on a high firing temperature. Several firing
processes and firing steps are needed to produce the different types of magnesium oxide CCM, DBM and/or FM. Several kiln types are used, such as multiple hearth furnaces, shaft kilns or rotary sintering kilns. For the production of fused magnesia special electric arc kilns are used.

1.2.6. The use of magnesia
Sintered or dead burned magnesia is primarily used in the refractory industry. Example areas of application for refractory products using magnesia are:

- the steel industry, e.g. for electric arc furnaces, basic oxygen furnaces or other furnaces, steel converters, hot metal transport and machinery
- the cement industry, e.g. for the inlets of preheaters, cement kilns and coolers
- the non-ferrous metal industries, e.g. for furnaces
- the lime industry, e.g. for the inlets of lime kilns
- the glass industry, e.g. for melting furnaces, regenerator chambers.

For caustic calcined magnesia, the main applications can be found in:
- the agricultural industry as feed or fertilizer
- the steel production industry as slag conditioner
- the construction industry as floor covering and for insulation
- the manufacture of cellulose, paper, chemicals, pharmaceuticals, flame-proofing and sweeping materials
- The environmental protection industry.

Based on a worldwide data, magnesia production of 16.7 million tons in 2008. Magnesia is mainly used for the production of refractory products. 65 % of magnesia used for refractories is produced in order to be used in the steel
industry, 15% in the cement industry, 7% of magnesia production is used for other refractory applications, such as in the non-ferrous metals industries or in the glass industry and finally 13% of total production is used for other applications. These other applications are very varied and a total of 80 applications are known – most of them are for CCM. The main applications can be found in agriculture as feed or fertilizer, in the construction industry as floor covering and for insulation, in the manufacture of cellulose, paper, chemicals, and pharmaceuticals, flame-proofing and sweeping materials as well as in environmental protection.

No statistics/assessments are available showing the distribution and the use of natural magnesia. However, it can be assumed that there are no significant differences to synthetic magnesia. Worldwide, the specific use of refractory products containing magnesia is decreasing; however, worldwide steel production is increasing with the result that, from a global perspective, the demand for refractory products containing magnesia is still continuously increasing. This figure also includes magnesia (MgO) used for slagging (10% of the overall MgO consumption).

II. MARKETING STUDY
The Ethiopia Government has been showing concern over the supply of Magnesium Oxide and lime products to various consumers within in the country. Demand has been steadily increasing and there has been no indication of any new, local producer of lime which could meet this demand. Indeed, there is a continued increase in lime imports. The existing small-scale lime burning operations have been besieged by costly increases in energy and their output is on the decline.

2.1. Demand – Supply Analysis
Total Magnesium Oxide supply from both local and imports over the last five years is shown in the table below.
TABLE 4.1
- Total MgO Supply 2009-2013 in tons

<table>
<thead>
<tr>
<th>YEAR</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>MgO</td>
<td>16727.18</td>
<td>18585.75</td>
<td>20650.83</td>
<td>22945.37</td>
<td>25494.86</td>
</tr>
</tbody>
</table>

Source: ERCA (Ethiopian Custom and Revenue Authority) annual report

A part from the anomaly in the table, the figures confirm the Government projections that lime supply should grow by an average of ten percent (10%) per annum. Given the aggressive increase in the construction sector in Ethiopia, it is fair to assume the demand may increase beyond the given figure. Assuming this trend is correct then the following projections can be made:

2.2. Demand Projected

Table 4.2:

<table>
<thead>
<tr>
<th>Projected demand of MgO Years</th>
<th>MgO demand/year/tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>31160.38</td>
</tr>
<tr>
<td>2016</td>
<td>34276.42</td>
</tr>
<tr>
<td>2017</td>
<td>37361.3</td>
</tr>
<tr>
<td>2018</td>
<td>40723.81</td>
</tr>
<tr>
<td>2019</td>
<td>44388.96</td>
</tr>
<tr>
<td>2020</td>
<td>48383.96</td>
</tr>
<tr>
<td>2021</td>
<td>52738.52</td>
</tr>
<tr>
<td>2022</td>
<td>57484.99</td>
</tr>
<tr>
<td>2023</td>
<td>62658.64</td>
</tr>
<tr>
<td>2024</td>
<td>68297.91</td>
</tr>
</tbody>
</table>

2.2.1. New Opportunities

The demand for Magnesium Oxide is reflected by the various potential customers. These industries include agriculture, cement manufacture, chemical industries and paint manufacture. Table below summarizes the demand for Magnesium Oxide. Agriculture is and will remain the mainstay of
Ethiopian economy. Magnesium Oxide will play a significant role in this economy. Government is conscious of the prices of fertilizer being imported for the crucial agriculture sector of the economy. The country's requirements of fertilizers are 200,000 TPA, of which 40% is Magnesium Oxide. If the plant comes on stream this would call for 80 000 TPA of pulverized Magnesium Oxide.

2.2.2. Export Opportunities

- Little has been done on opportunities existing in the neighboring countries,
- There are huge amount of imports from India and china. These countries in Horn of Africa including Ethiopia are traditional supplier of magnesium oxide. Ethiopia would not be a natural target for MgO powder. Ethiopia's export opportunities give a good indication as to where market opportunities lie,
- There is a lot of scope for construction and a subsequent demand for raw materials. Reconstruction in Somali and South Sudan opportunities will abound for their rehabilitation. Activities in the mineral sector have also grown generally. It is a market that should be looked at in detail in the short to medium term. A number of industries in Ethiopia need high grade magnesium oxide.

2.3. Marketing Strategy

The industrial units for the production of Magnesium oxide products could be developed as a cluster of a number of units manufacturing different products. In this cluster, a number of units could be setup for manufacturing Magnesium oxide board products. This would enable the individual units to achieve better economics of production since it would be possible to transport the raw materials in bulk at an economical price and also to market wide range of product from one center of production.
The cluster approach would also help in developing and refining the skills of manpower to be employed in these units through joint programs of training and demonstration. The following strategy could be adopted by the unit for better market access.

Long term contract with MgO board project authorities for supplying the cement based products on mutually agreed terms and conditions as the project would be the main buyer,

- Ensuring the quality of the products as per requirement of the project authorities,
- Direct sales to projects in private sector,

All construction projects viz building construction in both in public and private sector, road construction, bridges could be the target market for the project. In most of the private housing construction, normally the red bricks have been used in the past; however, their cost is quite prohibitive on account of heavy transport cost. The unit has to strive for a placement of red bricks by cement concrete bricks both on cost considerations as well as on advantages associated with the use of cement bricks viz less consumption of cement in the construction for wall construction and plastering. The marketing team of the unit has to create awareness among the prospective buyers about the advantages associated with the use of cement bricks.

The unit also needs to market the cement blocks and paver blocks to road construction agencies and contractors by offering quality products at a competitive rate as compared to the blocks usually cast near the site of construction. This should be possible as the unit can avail the benefits of bulk purchase of raw materials and supply the quality goods at competitive prices to the market. The unit also needs to have some skilled peoples on contract basis who could educate and guide the supervisors, masons and workers at
construction sites in correctly laying the bricks with optimum use of cement mortar and also in plastering of the constructed walls and surfaces, so as to achieve the best results.

2.4. **Price Determination**
The price of MgO board depends up on the availability and value of raw materials. In this project, the existing price of this board is with many considerations is estimated to be Ethiopian Birr 7,500.00 tone (340 USD.)

2.5. **Marketing Channel**
The marketing channels are simplified; the product to consumers and wholesalers, while the rest is sold through the local buyers. The company will distribute its product at the farm gate and also has linkage to make the product accessible for customers.

2.6. **Plant Capacity**
In this study, a plant with annual capacity of 10,000 tons but for the first five years the project will produce only 12000 tons per year. The envisaged proposal is considering the market study and economies of scale. The plant will operate a single shift of 8 hours a day, and 300 days a year.

2.7. **Production Program**
The plant will start operation at 75% of its rated capacity in the first year. It will then build up its production capacity to 85%, 90%, 95% and 98% in the second to fifth years, respectively. The low production level at the initial stage is to develop substantial market outlets for the product. Machinery operators will also get enough time to develop the required skills and experience.
III. TECHNICAL STUDY

3.1. Location And Geological Factors Of The Project Area

3.1.1. Location

The envisage project is located in 470 KM distance from Addis Ababa.

3.2. Product Description

3.2.1. Availability of MgO in Ethiopia

Magnesite is the cheapest sources of magnesia (MgO) and the release of CO2 from this source during firing produce MgO which reacts with MgCl2 to form magnesia cement. Magnesite is found with dolomitic marble in Ethiopia, as white, fine to medium grained crystalline rocks. It occurs as linear belt extending for kilometers. Samples collected from this magnesite occurrences indicated high MgO (40-46%), low Fe2O3 (0.04-0.08 %) and A12O3 (<0.1%). The width of individual bands is generally less than 100 meters. The total indicated resource is about 1.5 million tons. The mineral raw materials are being supplied locally.

3.2.2. Manufacturing Process and its environmental impact

Laboratory trials, locally and abroad, had proved that the Ethiopian magnesite is an appropriate material for the production of caustic calcined (light burned) magnesia (MgO) suitable for the production of partition boards and other applications. Moreover, pilot production trial at a local soda factory had also proved the technical and economic feasibility of MgO production project with better quality products than the imported magnesium oxide.

The basic processes in the production of magnesia are:

- Quarrying raw magnesite;
- Preparing magnesite for the kilns by crushing and sizing;
- Calcining magnesium carbonates; and
- Miscellaneous transfer, storage, and handling operations.
A generalized material flow diagram for a magnesium oxide manufacturing plant in Figure 1.2. The plant is located in the vicinity of kibre Mengist at about 70 km from magnesite source area in Oromia region of Ethiopia.

Crude magnesite and dolomite

Quarry and mining operation
(Drilling, blasting and conveying broken

Primary crushing
(Jaw crusher)

Screen and classifications

Calcinations

Cooling

Screening

Milling
(Raymond Mill)

Finishing operations
Fig 1.1 generalized material flow diagram for a magnesium oxide manufacturing plant

IV. ORGANIZATION AND MANAGEMENT

This firm established under commercial code of Ethiopia and acquires the necessary license to invest in of Ethiopia. To accomplish the aforementioned mission the company will take into service competent workforce in the business process.

The project human resources strategy shall constitute an important element in realizing our business objectives and goals. By having enthusiastic, capable and motivated employees we intend to meet customers’ order fulfillment times and ensure their satisfaction with our products and service. This will also ensure that we build the competitive advantage of being able to comprehensively meet our customers’ needs. There will be need to evaluate jobs and remuneration packages against market benchmarks to employees for their agreed and set out tasks so as for ensure they are competitive.

As one of the most important factors for success in it modern business: offering ongoing training for employees, part of the duties of project manager is to conduct regular training sessions for the staffing their various areas of work. Therefore, once the professional staff with necessary academic and technical qualifications along with relevant work experience are recruited and assigned to their respective posts, the project is expected to smoothly and successfully operate. Unskilled workers needed for the project will recruit from rural villages adjacent to the project site.

4.1. MANPOWER AND TRAINING REQUIREMENTS

4.1.1. Manpower

The company will hire 67 direct workers and 16 managerial or support staffs. The manpower requirement of the plant will be 67persons, out of which 41 will
be engaged in production activities and the remaining 26 will be involved in administrative activities.

**4.1.2. Training**

At the onset training shall be supplied by the consultant and project manager of the industry. Thereafter in-house training shall be undertaken. This training will not only include produce quality maintenance and cost reduction through quality management training, but also expand to give much greater knowledge of customers, market trends, new technology aids, and time management amongst other such variables. This is to ensure that we are continuously able to anticipate our market needs a proactive approach, which is so essential if we are to gain and maintain a competitive advantage on the market.

**4.1.3. Feedback and Control**

Important notices and developments will be continuously communicated to employees to keep them abreast of developments and promoting a sense of belonging and oneness in the organization.

The project will encourage our employees to put forward any suggestions they might have regarding the improvement of any of the company’s functions—an open door philosophy. Such a culture will enhance innovativeness and creativity, in turn leading to job satisfaction and enrichment. We intend to make sure that our employees understand the goals of the firm are customer focused, proud of their work and work as a team. This will encourage employees to become entrepreneurial and customer responsible, in addition to unifying staff in customer focus and values.
4.1.4. Corporate Social Responsibility

The project recognizes the fact that the broader community in which we operate affords us our 'license to trade'. We intend to establish relationships based on trust and mutual advantage through engaging in a wide range of active social responsibility programs. Our efforts on community service will show that the company has its own community at heart, contributing towards the establishment of a good and reputable image. We intend to be a responsible corporate citizen fully contributing positively towards the environment in which we shall operate.
V. FINANCIAL STUDY

The financial analysis demonstrates that the project goes flawlessly. The projected capital investment of the project is estimated to be 59.6 million Ethiopian Birr (3 Million USD). Of which 30% is going to be covered by promoter’s own equity and 70% from bank loan. As the profit and loss statement describes, the net profit after tax increasingly grows, from its 1st year of production to the end of the 5th year. It is shown in the projected cash flow statement that the liquidity position is also very credible.

In general, the proposed project will embark on growing local demand of construction materials at a significant level. It will also have a positive impact on current government import substitution strategy, create employment opportunity for skilled and unskilled labor that are estimated to be 67 employees, and generates tax revenues for government reserve. It has socio-economic benefits to the surrounding society in particular and the country in general.
VI. CONCLUSION AND RECOMMENDATION

The manufacturing sector averaged 13.3% of GDP over the years 2009 to 2013. The growth in this sector is mainly from agro-processing industries, particularly sugar and tobacco, fertilizer and chemical manufacture. In the medium term manufacturing is expected to grow at 3.8%. In the past ten years, the agriculture sector has averaged 34% of real GDP. Any fluctuations in GDP are due to agriculture fluctuations. This sector is expected in the medium term, to grow, ahead of population growth, by an average 10.7% per annum. Magnesium Oxide, dolomite and lime products are associated with the agricultural sector and hence have a similar potential for growth. In general the economy is expected to perform positively with growth rates between 4.3 and 4.5% in the medium term.

The current imports will remain until a local supply source is developed. There does not seem to be any improvement in sight from the current local small producers to meet the high grade technical requirements. Unfortunately the small producers are also hindered by energy and technology problems which will eventually squeeze them out of the industry creating shortages of low grade products as well. In addition, there are new projects, particularly the new sugar factory and the paper and pulp project, both of which will consume significant quantities of lime.

It is vital for Ethiopia to be outward looking and participate in external markets. The Magnesium oxide project provides a great opportunity for export development and it must be developed with a major aim to export MgO and any other products that would attract external markets. The MgO plant would be designed so that it can easily increase its capacity as market evolves from the initial 10,000 to 20,000TPA. The national economy may be able to absorb this level of production in the short to medium term in the absence of a fixed export market.
6.1. Socio-Economic Justification

It contributes in supplying construction material and has made job opportunities, it create technological transfers to the country in the form of new adaptive innovations and contribute towards the government treasury in the form of taxes.

6.2. Conclusion

The project is financially viable and moreover socio-economically warranted. Therefore the establishment of the project is justified and worth to be implemented.