



Pre-feasibility Study

CHINA CLAY PROCESSING PLANT

December 2023

“The figures and financial projections are approximate due to fluctuations in exchange rates, energy costs, and fuel prices etc. Users are advised to focus on understanding essential elements such as production processes and capacities, space, machinery, human resources, and raw material etc. requirements. Project investment, operating costs, and revenues can change daily. For accurate financial calculations, utilize financial calculators on SMEDA's website and consult financial experts to stay current with market conditions”

Small and Medium Enterprises Development Authority
Ministry of Industries and Production
Government of Pakistan

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1. DISCLAIMER

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2. EXECUTIVE SUMMARY

Kaolin (China clay) is a hydrated aluminum silicate crystalline mineral (kaolinite); formed over millions of years by residual weathering or hydrothermal decomposition (a chemical process caused by heat and water) of granite rocks. Hydrous kaolin is characterized by its fine particle size, plate like or lamellar particle shape and chemical inertness. In Pakistan, China Clay resources are found in all the provinces.

The proposed processing plant is for crushing and grinding of ore Kaolin (China Clay) to produce Clay Powder. China Clay powder is used in various industries like rubber, paper, ceramics, glass, paint, plastic and others. Each industry requires different grades of clay in terms of size and content of different minerals. China clay is used most commonly for paper coating and as raw material for making ceramics products.

The unit is proposed to be ideally located in Chakwal, Khushab, Mianwali, Attock, Dera Ghazi Khan in Punjab, Nagar Parkar in Sindh, Khuzdar in Balochistan or Shah Dehri, Swat in Khyber Pakhtunkhwa. These areas are ideal for setting up the proposed unit as China Clay mines are located in these areas due to which access to raw material is easy. Availability of skilled labor and well-established distribution channels exist or can be established easily.

This “Pre-feasibility Document” provides details for setting up a unit for the “Processing of China Clay”. The processing unit has a capacity of processing 10,080 tons of China clay powder in a year at the maximum capacity. The initial capacity utilization in Year One is assumed to be 60%, which means an annual production of 6,048 tons of powdered China clay. The operational capacity of the unit is expected to grow by 10% per annum to achieve the maximum capacity of 90% in 4th year of operations.

The proposed China Clay Processing plant will be set up on 13,500 sq. ft (3-kanal) of land, which will be purchased. The project requires a total investment of PKR 127.97 million. This includes capital investment of PKR 115.43 million and working capital of PKR 12.54 million. It is proposed that the project shall be financed through 100% equity. The Net Present Value (NPV) of project is PKR 22.99 million with an Internal Rate of Return (IRR) of 23% and a Payback period of 4.82 years.

The proposed project will provide direct employment opportunities to 38 people. High return on investment and steady growth of business is expected with the entrepreneur having some prior experience or education in the related field of business. The legal business status of this project is proposed as Private Limited company.

3. INTRODUCTION TO SMEDA

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs).

With a mission "to assist in employment generation and value addition to the national income, through development of the SME sector, by helping increase the number,

scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify policy, access to finance, business development services, strategic initiatives and institutional collaboration and networking initiatives. Preparation and dissemination of prefeasibility studies in key areas of investment has been a successful hallmark of SME facilitation by SMEDA.

Concurrent to the prefeasibility studies, a broad spectrum of business development services is also offered to the SMEs by SMEDA. These services include identification of experts and consultants and delivery of need-based capacity building programs of different types in addition to business guidance through help desk services.

National Business Development Program for SMEs (NBDP) is a project of SMEDA, funded through Public Sector Development Program of Government of Pakistan.

The NBDP envisages provision of handholding support / business development services to SMEs to promote business startup, improvement of efficiencies in existing SME value chains to make them globally competitive and provide conducive business environment through evidence-based policy-assistance to the Government of Pakistan. The Project is objectively designed to support SMEDA's capacity of providing an effective handholding to SMEs. The proposed program is aimed at facilitating around 314,000 SME beneficiaries over a period of five years.

4. PURPOSE OF THE DOCUMENT

The objective of the pre-feasibility study is primarily to facilitate potential entrepreneurs in project identification for investment. The project pre-feasibility may form the basis of an important investment decision and in order to serve this objective, the document/study covers various aspects of project concept development, start-up, and production, marketing, finance and business management.

The purpose of this document is to provide information to the potential investors about establishing a "China Clay Processing Plant". The document provides a general understanding of the business to facilitate potential investors in crucial and effective investment decisions.

The need to come up with pre-feasibility reports for undocumented or minimally documented sectors attains greater imminence as the research that precedes such reports reveal certain thumb rules; best practices developed by existing enterprises by trial and error, and certain industrial norms that become a guiding source regarding various aspects of business set-up and its successful management.

Apart from carefully studying the whole document one must consider critical aspects provided later on, which form the basis of any investment decision.

5. BRIEF DESCRIPTION OF PROJECT & PRODUCTS

Kaolin, also called China clay, is a soft white clay that is an essential ingredient in the manufacture of porcelain (vitrified pottery with a white, fine-grained body that is usually translucent, as distinguished from earthenware, which is porous, opaque, and coarser.). It is widely used in manufacturing of paper, rubber, paint, and many other products. Kaolin is named after the hill in China (Kao-ling) from which it was mined for centuries.

China clay or Kaolin is a microcrystalline hydrated silicate of aluminum, (Al_2O_3 , 2SiO_3 , $2\text{H}_2\text{O}$), approximately corresponding to 46% silica, 40% alumina and 14% water. The commercial grades generally contain small amounts of quartz, oxides of iron and titanium, oxides and silicate of calcium and magnesium, potash and soda.

Kaolin is commercially valued for its whiteness and fine particle size which distinguishes it from other clays, such as, ball clay (Ball clays are kaolinitic sedimentary clays that commonly consist of 20–80% kaolinite, 10–25% mica, 6–65% quartz) and fire clay (a range of refractory clays used in the manufacture of ceramics, especially fire brick).

China clay is formed as the result for the decomposition of granite (in situ granite), an igneous rock composed of associated crystals of mica, quartz feldspar, the latter consisting essentially of silicates of alumina, with variable proportions of silicates of potash, soda or lime under the prolonged influence of weathering and exposure to water and carbon dioxide. Under great pressure, the feldspar crystals are decomposed, the soda or potash being extracted, leaving the hydrated silicate of alumina. This process known as kaolinization and it converts the granite into a friable mass of clay mixed with the under decomposed crystals of quartz and mica. The quality of China clay depends on the completeness with which the alkalies, iron and other constituents have been leached out during the decomposition.

Physical characteristics that influence commercial utility include brightness, glossiness, abrasiveness and viscosity. It often contains small amounts of impurities in the form sand material and small stones. Kaolin is produced and consumed in the country in crude & processed forms. The major use of crude China clay is in Cement Industry and of processed China clay is in Ceramic Industry. The clay deposits are often soft and easily extracted, with no blasting required.

For use in the paint and other industries, China clay is obtained by directing high pressure jets of water on the faces of clay deposits. It forms a watery and sludge (thick, soft, wet mud or a similar viscous mixture of liquid and solid components, especially the product of an industrial or refining process.) from which the impurities in the clay are separated. The sludge passes on to further settling tanks where further coarse¹, mica particles filter out. The refinement process consists of washing, settling and

¹ Coarse particles are the relatively large airborne particles mainly produced by the mechanical break-up of even larger solid particles

filtering and ends with the production of a wet cake of purified clay which is then broken down, dried in ground and dispatched to the users.

Due to the excessive use as a raw material in many industries, demand of China clay is increasing day by day. The unit is proposed to be ideally located in any area in Chakwal, Khushab, Mianwali, Attock, Dera.Ghazi Khan, in Punjab Nagar Parkar in Sindh, Khuzdar in Balochistan or Shah Dehri, Swat in Khyber Pakhtunkhwa. These areas have abundant availability of raw material and also offer the benefits of easy availability of skilled and unskilled labor and access to distribution channels is also easy in these areas.

5.1. Uses of China Clay

China clay is used in Pakistan in different types of industries; including Paper, Ceramics, Rubber and Paint. It is used as an important raw material in these industries. Kaolin is an important ingredient in ink, organic plastics, some cosmetics, and many other products where its fine particle size, whiteness, chemical inertness, and absorption properties give it a particular value.

- **Filling and Coating of Paper**

Approximately 40 percent of the kaolin production is used for filling and coating of paper. In filling, the kaolin is mixed with the cellulose fibers to become an integral part of the paper sheet; giving it body, color, opacity, and printability. In coating, the kaolin is plated along with an adhesive on the paper's surface to give it gloss, color, high opacity, and greater printability. Kaolin used for coating has most of the kaolinite particles less than two micrometers (10^{-6} meter) in diameter.

- **Ceramic Industry**

Kaolin is used extensively in the ceramic industry, where its high fusion temperature and white burning characteristics makes it particularly suitable for the manufacture of whiteware (China), porcelain, and refractories. Absence of iron, alkalies, or alkaline earths in the molecular structure of kaolinite confers upon it these desirable ceramic properties.

In the manufacture of whiteware, the kaolin is usually mixed with approximately equal amounts of silica and feldspar and a somewhat smaller amount of plastic light-burning clay known as ball clay. These components are necessary to obtain the proper properties of plasticity, shrinkage, vitrification (a progressive partial fusion of a clay or of a body as a result of a firing process), etc., for forming and firing the ware. Kaolin is generally used alone in the manufacture of refractories.

The reason for using China clay in this industry is the properties it possesses; like easy molding, fine texture, etc. which made it easier to use.

- **Skin Care**

China clay may also be used for removing impurities from the skin. One can get the China clay from the Kaolinite clay suppliers and can prepare a homemade mask,

which will treat the sensitive and acne prone skin. At the time of winters, this clay is useful enough to treat the problems of the dry skin. It is rich in minerals and its healing properties are very useful for the skin.

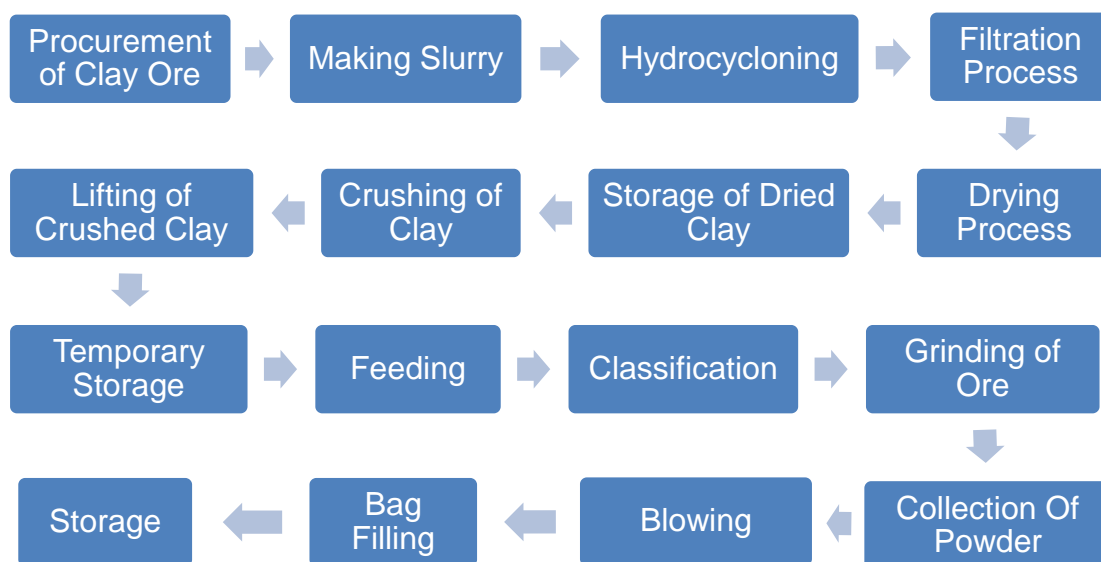
- **Other Uses**

Substantial tonnages of kaolin are used for filling rubber to improve its mechanical strength and resistance to abrasion. For this purpose, the clay used must be extremely pure kaolinite and exceedingly fine grained. Kaolin is also used as an extender and flattening agent in paints. It is frequently used in adhesives for paper to control the penetration into the paper.

5.2. Production Process Flow

Figure 1 shows process flow of China Clay processing.

Figure 1: Process Flow



A brief description of process flow is given below:

Procurement of Raw China clay stones:

China clay, in the form of powder, is the final product of this manufacturing process. As a first step of manufacturing, the raw China clay in the form of stones is procured from the miners. The mines for China Clay rocks are located in Chakwal, Khushab, Mianwali, Attock, Dera Ghazi Khan, in Punjab, Nagar Parkar in Sindh, Khuzdar in Balochistan and Shah Dehri Swat in Khyber Pakhtunkhwa. Raw China Clay stones contain some impurities, for example sand material and small stones, which need to be removed during the manufacturing process. The procured raw material is transported to China clay processing unit.

Raw China Clay rocks, extracted from mines at different locations in Pakistan, show slightly different chemical compositions. For example, China Clay rocks extracted from

Chakwal may have slightly different chemical composition from the clay extracted from Nagar Parker Sindh. Raw China clay rocks with different chemical compositions are suitable to process China Clay powder which is used in different industries. As a quality control measure, it is important that raw material is kept separately so that end product may be identified for selling to the relevant industry.

Slurry Making

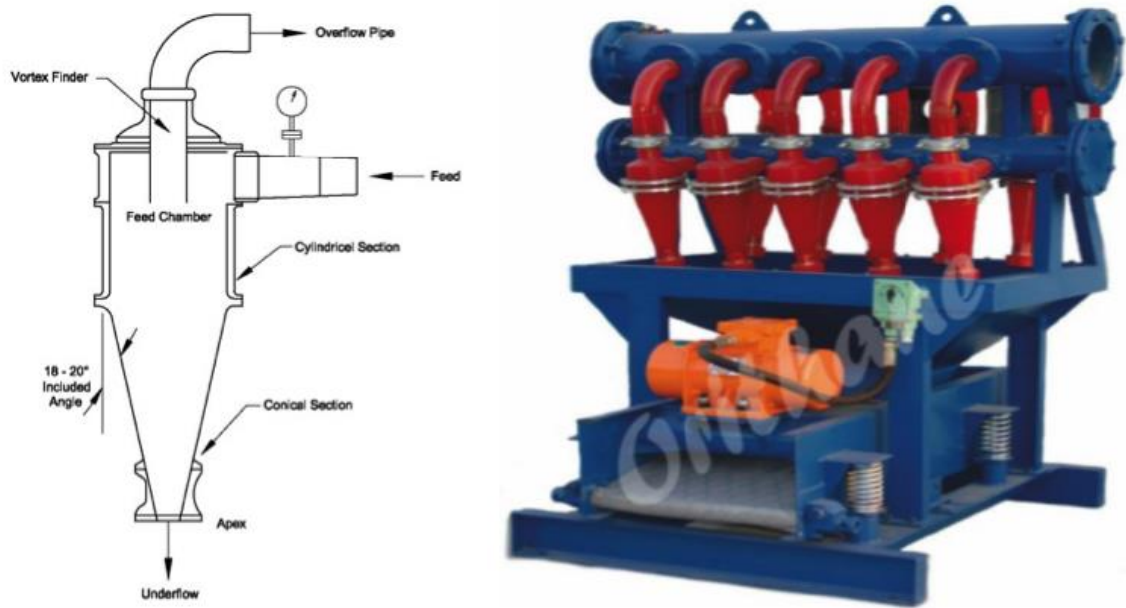
China Clay, as procured from the miners, is mixed with water in tanks to make a slurry. This clay slurry contains impurities which were part of China clay ore, initially procured from miners. The China Clay content in the slurry is only around 10% of the total weight of the slurry. To remove impurities, the slurry is processed through hydro-cyclones. Making of slurry is shown in Figure 2.

Figure 2 Making Slurry



Hydro-Cycloning

A hydro-cyclone is a device to classify, separate or sort particles in a liquid suspension. A hydro-cyclone is used to separate sand, stones and other impurities from clay slurry. Slurry is injected to the machine through feeding pipes. When it enters the unit, it begins traveling in a circular flow in the cone shape cylinder. Here the liquid is rotated and the heavier particles move downward in a spiral motion to the separation chamber of the machine. The particles collected in this separation chamber are removed through lower outlet. The clay water is drawn to the separator's vortex and up through the outlet. Figure 3 shows cross-section of a hydro-cyclone machine.

Figure 3 Hydro-cyclone**Filtration Process**

The slurry obtained after hydro-cycloning process is pumped into the filter presses such that clay is distributed evenly during the fill cycle. Clay builds up on the filter cloth, forming a cake and exits the filter plates through the corner ports. After the filter process, the clay will have around 15-20% of moisture content. Figure 4 shows a filter press.

Figure 4 Filtration Process**Drying Process**

This clay in the cake form is dried in open sunlight to remove the residual moisture. A clean area or plastic sheet/ apron is used to sun-dry the cakes. Once dried, the moisture reduces to around 5%.

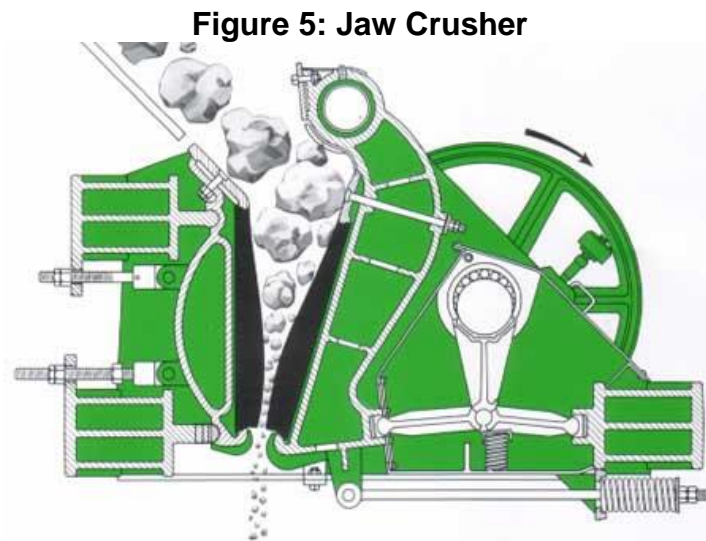
Storage of Dried Clay

Sundried cakes of China Clay is stocked at a dry place to protect from water and moisture. From storage area, the dried cakes are taken for crushing with the help of mini pay loaders/fork lifters.

Crushing of Ore

To make clay powder, the dried cakes of China clay are fed to the jaw crusher with the help of pay loaders/ fork lifters. The dried cakes are crushed into small pieces with the help of two parallel or tangent solid surfaces, which apply force to crush the material into smaller pieces.

Figure 5 shows crushing of rock into small pieces using a jaw crusher.



Lifting of crushed Ore

Bucket elevator is used to transport or elevate goods and materials from one place to another quickly and easily. Once the clay cakes are crushed into small pieces, these are lifted from the outlet of the jaw crusher and loaded into a hopper through a bucket elevator. The buckets are connected to either a chain or belt, which moves and lift them from bottom to top of elevator. Figure 6 shows lifting of crushed material.

Figure 6: Lifting of Crushed Material Using Bucket Elevator**Temporary Storage**

The bucket elevator automatically transfers the ore from bucket into a hopper. Once the material in the hopper reaches its full capacity, it is released from its bottom through an opening of 8-12 inch diameter. Hoppers are rectangular or circular in cross section but have sides that slope at about a 60° angle. Slanted sides make it easier for the contained material to flow out. Figure 7 shows the storage tank for crushed material.

Figure 7: Storage Hopper

Feeding

From the hopper, the ore is released to the classifier through a vibrating feeder. Vibrating feeder is like a conveyor belt which carries the crushed material from the hopper to the classifier for further processing of the crushed clay. For moving the ore on vibrating feeder, it uses both gravity and vibration. Gravity is used to determine the direction and vibration is used to move the material. Vibrating feeders are mainly used to transport a large number of smaller objects. Figure 8 shows a vibrating feeder.

Figure 8: Vibrating feeder



Classification

The output of vibrating feeder becomes the input for the classifier in which the machine classifies the crushed ore according to their size so that the process of grinding (converting of stones into powder form) can be done effectively and efficiently. This operation also separates the dust.

Grinding of Ore

After classifying the ore particles, the next step is grinding. In this process, the ore is ground into a soft powder using a grinding mill. Ore is fed into the grinder to convert it into fine powder. In this process, the ore stones are ground until the particle size is reduced up to 25–35 μm (micrometer). If the particle size is not in the above provided range it will be recycled. Figure 9 shows a grinding mill.

Figure 9: Grinding Machine



Collection of Powder

After converting the ore into powder, it is transferred from grinding machine into a hopper through a pipe. Figure 10 shows the powder collection tank.

Figure 10: Powder collection tank.



Blowing

Blower is the machine used to fill the bag with the air so that bag opens up which makes the filling of the bag easy. The bags are then ready to be filled by the finished product. Figure 11 shows industrial blowing machine used in China Clay manufacturing.

Figure 11: Blowing machine.



Bag Filling

At this stage, the powdered clay is ready for packing and transporting. The powdered clay is packed into standard sized bags of 25 kg. Figure 12 shows bag filling of powdered clay.

Figure 12: Bag filling of Powdered China clay.

Quality Checks

Quality tests are carried out on the final product of China Clay powder to ensure that the product meets the required standards and the customers' requirements. Following four main quality tests are carried out:

- The brightness of the prepared powder is tested which should be in range of $92 \pm 1\%$ (ISO i.e., International Organization for Standardization)
- Water panel color shade on glass plate is tested and the result should be pure white
- Density is tested and it should be $2.65 \text{ (g/cm}^3\text{)}$
- pH of 10% solution (10 grams of China clay powder is dissolved in 100 ml of water) is checked which should be between 5-7.

5.3. Installed and Operational Capacities

The proposed processing unit, at 100% capacity, will produce 10,080 tons of China clay powder per year. During the first year of operation, the proposed unit is expected to achieve 60% of its overall production capacity which translates into producing 6,048 tons of powdered China clay. The unit would operate in a single shift of 8 hours for 280 days in a year.

The installed and operational capacities of the proposed unit for the initial year are shown in Table 1.

Table 1: Installed and Operational Capacity

Plant	Capacity	Capacity per machine per day (tons)	No of Machines	Installed Capacity per day (tons)	Annual Installed Capacity	Annual Installed Capacity of Plant ² (tons)	Annual Installed Capacity of Plant @60% (tons)
Jaw Crusher	50 tons/ hour	400	1	400	112,000	10,080	6,048
Bucket Elevator	10 tons	80	1	80	22,400		
Classifier	6 tons/ hour	48	1	48	13,440		
Grinding Mill	4.5 tons/ hour	36	1	36	10,080		
Powder Collector	6 tons/ hour	48	1	48	13,440		

² Annual installed capacity of plant has been calculated based on the machine, which has minimum capacity. i.e., grinding machine.

6. CRITICAL FACTORS

The following factors should be taken into account while making investment decision:

- Technical know-how of industry
- Availability of skilled labor
- Knowledge of market demand and supply
- Strict quality checks
- Use of modern technology
- High dependence on industrial units as purchasers
- Limited target market, as industrial units are main buyers
- Uninterrupted supply of electricity

7. GEOGRAPHICAL POTENTIAL FOR INVESTMENT

For the success of this processing plant, it is necessary to determine the target market of the product. The mines of China clay are located in Chakwal, Khushab, Mianwali, Attock, Dera Ghazi Khan, in Punjab Nagar Parkar in Sindh, Khuzdar in Balochistan and Shah Dehri Swat in Khyber Pakhtunkhwa.

As the mines are located in above mention locations, the ideal place for establishing the processing unit of China clay are these areas for having a ready access to raw materials. Availability of skilled and unskilled labor would also be easy and access to distribution channels or developing the distribution channels would not be a difficult task.

8. POTENTIAL TARGET MARKETS

For the success of this business, it is necessary to identify and understand the target markets. Potential target market for the proposed unit would be industrial units. The products in which China clay is used as raw material are widely produced in Pakistan. Government is also introducing policies that encourage local production by giving tax holidays/exemptions and other incentives. Considering the above facts, the opportunity looks promising for potential investors to earn good profits

9. PROJECT COST SUMMARY

A detailed financial model has been developed to analyze the commercial viability of the proposed China Clay Processing unit. Various costs and revenue related assumptions along with results of the analysis are outlined in this section.

The projected Income Statement, Cost of Goods Sold, Cash Flow Statement and Balance Sheet are attached as Annexure.

9.1. Project Economics

All the figures in this financial model have been calculated after carefully taking into account the relevant assumptions and the target market.

9.2. Project Cost

Total investment cost of the project has been calculated to be PKR 127.97 million. The project will be financed through 100% Equity.

Table 2 provides the detail of estimated cost for the proposed manufacturing unit.

Table 2: Project Cost

Description	Cost (PKR)
Land	36,000,000
Building / Infrastructure	51,270,800
Plant & Machinery	11,235,000
Furniture & fixtures	1,205,000
Office equipment	1,192,000
Office vehicles	11,776,600
Pre-operating costs	2,600,692
Incorporation costs	150,000
Total Capital Costs	115,430,092
Working Capital	12,536,345
Total Investment	127,966,437

9.2.1. Land

A plot of land with an area of 3 Kanal (13,500 sq. ft) for the proposed project will be acquired at a cost of PKR 36 million in an industrial area. Breakup of the land requirement is provided in Table 3.

Table 3: Breakup of Required Land Area

Break Up of Land Area	% Break-Up	Area Sq. Ft.
Admin Block (Table 4)	6%	808
Processing Unit area (Table 5)	91%	12,292
Open Area	3%	400
Total Area	100%	13,500

Table 4: Admin Block Area

Admin Block	Numbers	Length (Ft)	Width (Ft)	Area Sq. Ft.
Offices	1	24	10	240
Conference Room	1	14	12	168
Reception	1	10	8	80
Kitchen	1	10	8	80
Washrooms	5	8	6	240
Total Area				808

Table 5: Processing Plant Area

Plant Area	Length (Ft)	Width (Ft)	Area Sq. Ft.
Raw Material Area	60	30	1,800
Slurry Tanks	30	30	900
Hydrocycloning Area	16	12	192
Filtration Area	30	20	600
Drying Area	50	40	2,000
Dried Clay Storage	30	20	600
Crushing Plant Area	100	50	5,000
Finished Product Area	40	30	1,200
Total Area			12,292

9.2.2. Building

The China Clay Processing Unit will be set up on owned land of 3 Kanal (13,500 sq. ft). Industrial electricity connection (B2a) having load from 110 to 120 kW is required for proposed project.

Table 6 shows the construction cost of the building.

Table 6: Cost of Building/ Infrastructure

Processing/Plant Area	Area Sq. Ft.	Construction Cost Per Sq. Ft	Construction Cost (Rs.)
Admin Block	808	4,000	3,232,000
Processing Unit area	12,292	3,900	47,938,800
Driveways	400	250	100,000

Total Infrastructure			51,270,800
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9.2.3. Machinery and Equipment

Table 7 provides details of machinery and equipment required for the project.

Table 7: Machinery and Equipment

Cost Item	Capacity	No.of Items	Unit Price (PKR)	Total Cost (PKR)
Hydrocyclone	10m ³ /hour	3	315,000	945,000
Filter Press Machine	3000 litre chamber/ 30mm cake	1	1,600,000	1,600,000
Jaw Crusher	50ton/hour	1	475,000	475,000
Bucket Elevator	10 tons	1	150,000	150,000
Hopper	16 ton/hour	2	465,000	930,000
Vibrating Feeder	180 ton/hour	1	315,000	315,000
Classifier	6 ton/hour	1	465,000	465,000
Grinding Mill	4.5ton/hour	1	1,550,000	1,550,000
Powder Collector	6 Ton/Hour	1	160,000	160,000
Bag Filler	150 m ³ /hour	1	160,000	160,000
Blower	45 kilo Watts	1	80,000	80,000
Main Motor	45 kilo Watts	1	70,000	70,000
Analytical Engine (FM Motor)	18.5 kilo Watts	1	140,000	140,000
Air Compressor	11 kilo Watts	1	95,000	95,000
Mini Payloader		1	4,100,000	4,100,000
Total Cost (PKR)				11,235,000

9.2.4. Furniture & Fixtures

Table 8 provides details of the furniture and fixture requirement of the project.

Table 8: Furniture and Fixtures

Cost Item	Number of Items	Unit Cost (PKR)	Total Cost (PKR)
Office Table	2	30,000	60,000

Cost Item	Number of Items	Unit Cost (PKR)	Total Cost (PKR)
Executive Tables	2	50,000	100,000
Executive Chairs	3	25,000	75,000
Office Chairs	6	15,000	90,000
Visitors Chairs	4	15,000	60,000
Sofa Set	2	60,000	120,000
Conference Room Furniture	1	200,000	200,000
Decorations			500,000
Total Cost (PKR)			1,205,000

9.2.5. Office Equipment

Detail of office equipment required for the proposed project is provided in Table 9.

Table 9: Office Equipment

Cost Item	No.	Unit Cost (PKR)	Total Cost (PKR)
Laptop Computers	2	120,000	240,000
Desktop Computers	2	65,000	130,000
Printers	1	40,000	40,000
Security Cameras (2MP)	12	3,500	42,000
DVR	1	5,000	5,000
LEDs	2	65,000	130,000
Air Conditioners	3	180,000	540,000
Water Dispensers	2	25,000	50,000
Wi-Fi / Internet Routers	1	15,000	15,000
Total Cost (PKR)			1,192,000

9.2.6. Office Vehicle

Detail of office vehicle required for the project is provided in Table 10.

Table 10: Office Vehicle

Cost Item	Number of Vehicles	Unit Cost (PKR)	Total Cost (PKR)
Motorcycle	1	161,600	161,600
Dumper Truck	1	11,615,000	11,615,000
Total			11,776,600

9.2.7. Pre-Operating Cost

Details of pre-operating cost for the project are provided in Table 11.

Table 11: Pre-Operating Cost

Description	Months	Total (PKR)
Transformer (200 KVA) & Connection Charges	1	1,127,629
Telephone/ Internet Connection charges	1	5,000
Water Connection Charges	1	92,000
Electricity Bill	1	431,063
Administration expense	4	945,000
Total		2,600,692

9.2.8. Working Capital

Table 12 provides details of working capital requirements for the project.

Table 12: Working Capital

Description	Basis	Number of Months	Total Cost (PKR)
Equipment spare part inventory	Equivalent to 2 months Repair and Maintenance Expense	2	112,350
Raw material inventory	Equavivalent to Half month(s) Production requirement of raw material	0.5	11,255,470
Upfront insurance payment	1.5% of Machinery Cost		168,525
Cash			1,000,000
Total			12,536,345

9.3. Financial Feasibility Analysis

The financial feasibility analysis given in Table 13 provides the information regarding projected IRR, NPV and payback period of the study based on 100% equity.

Table 13: Financial Feasibility Analysis

Description	Values
IRR	23%
NPV (PKR)	22,991,104
Payback Period (years)	4.82
Projection Years	10
Discount Rate used for NPV	20%

9.4. Financial Feasibility Debt Financing

The financial feasibility analysis given is shown in

Table 14. It provides the information regarding projected IRR, NPV and payback period of the study based on combination of equity (50%) and debt (50%) financing for the proposed project.

Table 14: Financial Feasibility Debt Financing

Description	Project
IRR	20%
NPV (PKR)	7,996,152
Payback Period (years)	5.46
Projection Years	10
Discount Rate used for NPV	19%

9.5. Breakeven Analysis

Breakeven analysis is provided in Table 15.

Table 15: Breakeven Analysis

Particulars	Amount First Year (PKR)	Ratios
Sales (PKR) – A	321,678,000	100%
Variable Cost (PKR) – B	291,211,310	91%
Contribution (PKR) (A-B) = C	30,466,690	9%

Fixed Cost (PKR) – D	18,380,332	6%
Breakeven		
Breakeven production (tons)		3,497
Breakeven Revenue (PKR)		194,065,990
Breakeven Capacity		35%

9.6. Revenue Generation

Based on the assumption of the first year capacity utilization of 60%, sales revenue during the first year of operations is shown in Table 16.

Table 16: Revenue Generation

Units Sold (tons) (A)	No of Bags (25 kg)	Sale Price per ton (B)	Revenue (PKR) (A*B)
5,796	231,960	55,500	321,678,000

9.6.1. Raw Material Cost

Per unit cost of goods sold related to major components used in processing and total cost of goods sold based on estimated annual sales of 5,796 units is provided in Table 172.

Table 17: Raw material

Cost Item	Unit Price/ ton (PKR)	Consumpti on per ton (weight %)	Cost per unit of Finished Good (A)	Unit Sold (B)	Total Cost (C=A*B)
China Clay Ore	37,000	100%	37,000	5,796	214,452,000
Bleaching Reagent	180,000	5%	9,000	5,796	52,164,000
Total (PKR)					266,616,000

9.7. Human Resource

For the first year of operations, the human resource requirements are projected in Table 18.

Table 18: Human Resource Requirement

Description	Number of Employees	Monthly Salary per employee (PKR)	Total Monthly Salary (PKR)	Total Annual Salary (PKR)
Owner	1	150,000	150,000	1,800,000
Plant In charge	1	80,000	80,000	960,000
Foreman	1	70,000	70,000	840,000
Skilled Labour	6	42,000	252,000	3,024,000
Semi skilled Labour	8	35,000	280,000	3,360,000
Unskilled Labor	12	35,000	420,000	5,040,000
Pay Loader Operater	1	45,000	45,000	540,000
Accounts and Admin Officer	1	60,000	60,000	720,000
Accounts Assistant	1	35,000	35,000	420,000
Security Guard	4	40,000	160,000	1,920,000
Dumper Driver	1	50,000	50,000	600,000
Office Boy	1	35,000	35,000	420,000
Total	38			19,644,000

10. CONTACT DETAILS

Details of suppliers of Machinery and Equipment are provided in Table 195.

Table 19 Suppliers of Machinery and Equipment

Supplier	Machinery	Location	Contact Number	Email/ Website
ZX Crushers	Jaw Crusher		+86-13676922906	sales@zxcruasher.com
ZK Corporation	Bucket Elevator		+86-18037866379	vip@zkc corp.com
Henan Baichy Machinery Equipment Co Ltd	Grinding Mill		+86-37186555722	hnb c@baichy.co m
Shibang Group	China Clay Plant		+86-2158386189	sbm@sbmchina.c om
Al-Noor Enterprisers		Karachi	(021) 34221593	
Asia Commodities & Minerals	Raw Ore	Karachi	0213564 0350 021 3564 0355	info@asiacm.net
Fazal Engineering	Jaw Crusher	Islamabad	(051) 5537073	fazalengineering.com.pk/
Galaxy Stone	China Clay	Namak Mandi Bazaar Sawat Gemstone Peshawar		
Sg Conveyors	Bucket Elevator			sg-conveyors.business.site/
N.S Great Machine Tools	Hopper		+91 187 122 0693	
Vibro Technology	Vibrating Feeder		+91-8048429071	www.indiamart.com/vibrotechnology/
Shaheen Grinding Mills	Grinding Mill	Lahore	0321-3255733	www.shahee11ng rinding.com/

11. USEFUL LINKS

Table 20: Useful Links

Organization	Website
Small and Medium Enterprises Development Authority (SMEDA)	www.smeda.org.pk
National Business Development Program (NBDP)	www.nbdp.org.pk
Government of Pakistan	www.pakistan.gov.pk
Ministry of Industries and Production	www.moip.gov.pk
Pakistan Mineral Development Corporation (PMDC)	http://www.pmdc.gov.pk
Government of Punjab	www.punjab.gov.pk
Government of Sindh	www.sindh.gov.pk
Government of Balochistan	https://balochistan.gov.pk
Government of Khyber Pakhtunkhwa	http://kp.gov.pk
Government of Gilgit Baltistan	https://gilgitbaltistan.gov.pk
Government of Azad Jammu & Kashmir	https://ajk.gov.pk
Trade Development Authority of Pakistan	www.tdap.gov.pk
Security and Exchange Commission of Pakistan	www.secp.gov.pk
State Bank of Pakistan	www.sbp.gov.pk
Pakistan Paint Manufacturers Association	https://www.facebook.com/ppma.pk/
All Pakistan Paper Merchants Association	http://appma.com.pk/about
Pakistan Ceramics Manufactures Association	https://www.lookup.pk
Federation of Pakistan Chambers of Commerce and Industry (FPCCI)	www.fpcci.com.pk
Technical Education and Vocational Training Authority (TEVTA)	www.tevta.org
Punjab Vocational Training Council (PVTC)	www.pvtc.gov.pk
Punjab Small Industries Corporation (PSIC)	www.psic.gov.pk

12. ANNEXURES

12.1. Income Statement

Calculations	SMEDA									
Income Statement										
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue	321,678,000	412,820,100	518,973,840	642,230,127	706,453,140	777,098,454	854,808,299	940,289,129	1,034,318,042	1,137,749,846
<i>Cost of sales</i>										
Material Cost	266,616,000	342,157,200	430,140,480	532,298,844	585,528,728	644,081,601	708,489,761	779,338,738	857,272,611	942,999,872
Packing charges	3,515,274	4,511,268	5,671,309	7,018,245	7,720,069	8,492,076	9,341,283	10,275,412	11,302,953	12,433,248
Direct Labor	12,270,500	13,166,247	14,127,382	15,158,681	16,265,265	17,452,630	18,726,671	20,093,718	21,560,560	23,134,481
Machinery Maintenance	674,100	721,287	771,777	825,801	883,608	945,460	1,011,642	1,082,457	1,158,229	1,239,305
Electricity Cost	4,777,547	5,186,892	5,632,261	6,116,821	6,644,023	7,217,619	7,841,691	8,520,681	9,259,423	10,063,174
Fuel Cost	2,666,160	3,722,670	5,091,762	6,855,549	8,204,720	9,819,409	11,751,869	14,064,637	16,832,558	20,145,205
Total cost of sales	290,519,581	369,465,565	461,434,971	568,273,941	625,246,414	688,008,795	757,162,919	833,375,644	917,386,334	1,010,015,286
Gross Profit	31,158,419	43,354,535	57,538,869	73,956,186	81,206,726	89,089,659	97,645,380	106,913,485	116,931,708	127,734,560
<i>General administration & selling expenses</i>										
Administration expense	6,840,000	7,339,320	7,875,090	8,449,972	9,066,820	9,728,698	10,438,893	11,200,932	12,018,600	12,895,958
Administration benefits expense	982,200	1,053,901	1,130,835	1,213,386	1,301,964	1,397,007	1,498,988	1,608,415	1,725,829	1,851,814
Utilities	395,214	429,077	465,919	506,004	549,615	597,065	648,690	704,859	765,970	832,459
Communications expense (phone, fax, mail, internet, etc.)	273,600	293,573	315,004	337,999	362,673	389,148	417,556	448,037	480,744	515,838
Office vehicles running expense	76,129	81,687	87,650	94,048	100,914	108,280	116,185	124,666	133,767	143,532
Office expenses (stationery, entertainment, janitorial services, etc.)	342,000	366,966	393,755	422,499	453,341	486,435	521,945	560,047	600,930	644,798
Promotional expense	804,195	1,032,050	1,297,435	1,605,575	1,766,133	1,942,746	2,137,021	2,350,723	2,585,795	2,844,375
Insurance expense	168,525	151,673	134,820	117,968	101,115	84,263	67,410	339,380	293,645	247,910
Professional fees (legal, audit, consultants, etc.)	102,600	110,090	118,126	126,750	136,002	145,930	156,583	168,014	180,279	193,439
Depreciation expense	8,376,620	8,376,620	8,376,620	8,376,620	8,376,620	8,376,620	7,667,940	12,390,958	12,390,958	12,390,958
Amortization of pre-operating costs	520,138	520,138	520,138	520,138	520,138	-	-	-	-	-
Bad debt expense	160,839	206,410	259,487	321,115	353,227	388,549	427,404	470,145	517,159	568,875
Subtotal	19,072,061	19,991,504	21,004,879	22,122,073	23,118,561	23,644,741	24,098,615	30,366,174	31,693,675	33,129,956
Operating Income	12,086,358	23,363,032	36,533,990	51,834,112	58,088,164	65,444,917	73,546,765	76,547,311	85,238,032	94,604,604
Gain / (loss) on sale of machinery & equipment	-	-	-	-	-	-	2,808,750	-	-	-
Gain / (loss) on sale of office equipment	-	-	-	-	-	-	298,000	-	-	-
Gain / (loss) on sale of office vehicles	-	-	-	-	-	-	2,944,150	-	-	-
Earnings Before Interest & Taxes	12,086,358	23,363,032	36,533,990	51,834,112	58,088,164	65,444,917	79,597,665	76,547,311	85,238,032	94,604,604
Earnings Before Tax	12,086,358	23,363,032	36,533,990	51,834,112	58,088,164	65,444,917	79,597,665	76,547,311	85,238,032	94,604,604
Tax	4,020,975	7,297,060	11,906,896	17,261,939	19,450,857	22,025,720	26,979,182	25,911,558	28,953,311	32,231,611
NET PROFIT/(LOSS) AFTER TAX	8,065,383	16,065,971	24,627,094	34,572,174	38,637,308	43,419,197	52,618,483	50,635,753	56,284,722	62,372,994

12.2. Balance Sheet

Calculations	SMEDA										
Balance Sheet											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Assets											
<i>Current assets</i>											
Cash & Bank	1,000,000	5,996,541	18,526,254	27,720,270	39,679,979	46,383,912	53,439,693	58,048,255	111,718,924	169,456,830	177,687,427
Accounts receivable		26,439,288	30,184,853	38,292,902	47,720,711	55,425,340	60,967,874	67,064,661	73,771,127	81,148,240	89,263,064
Finished goods inventory		12,631,286	16,063,720	20,062,390	24,707,563	27,184,627	29,913,426	32,920,127	36,233,724	39,886,362	43,913,708
Equipment spare part inventory	112,350	129,832	150,033	173,379	200,356	231,532	267,558	309,190	357,300	412,896	-
Raw material inventory	11,255,470	15,455,636	20,790,038	27,528,609	32,401,173	38,136,181	44,886,285	52,831,157	62,182,272	73,188,534	-
Pre-paid insurance	168,525	151,673	134,820	117,968	101,115	84,263	67,410	339,380	293,645	247,910	-
Total Current Assets	12,536,345	60,804,255	85,849,720	113,895,518	144,810,897	167,445,854	189,542,245	211,512,770	284,556,992	364,340,773	310,864,199
<i>Fixed assets</i>											
Land	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000	36,000,000
Building/Infrastructure	51,270,800	46,143,720	41,016,640	35,889,560	30,762,480	25,635,400	20,508,320	15,381,240	10,254,160	5,127,080	-
Plant & Machinery	11,235,000	10,111,500	8,988,000	7,864,500	6,741,000	5,617,500	4,494,000	22,625,316	19,576,334	16,527,353	13,478,371
Furniture & fixtures	1,205,000	1,024,250	843,500	662,750	482,000	301,250	120,500	2,065,158	1,755,385	1,445,611	1,135,837
Office vehicles	11,776,600	10,010,110	8,243,620	6,477,130	4,710,640	2,944,150	1,177,660	23,991,272	20,392,581	16,793,890	13,195,199
Office equipment	1,192,000	1,013,200	834,400	655,600	476,800	298,000	119,200	2,042,879	1,736,447	1,430,015	1,123,583
Total Fixed Assets	112,679,400	104,302,780	95,926,160	87,549,540	79,172,920	70,796,300	62,419,680	102,105,864	89,714,906	77,323,949	64,932,991
<i>Intangible assets</i>											
Pre-operation costs	2,600,692	2,080,554	1,560,415	1,040,277	520,138	-	-	-	-	-	-
Total Intangible Assets	2,750,692	2,200,554	1,650,415	1,100,277	550,138	-	-	-	-	-	-
TOTAL ASSETS	127,966,437	167,307,588	183,426,295	202,545,334	224,533,956	238,242,154	251,961,925	313,618,634	374,271,898	441,664,721	375,797,190
Liabilities & Shareholders' Equity											
<i>Current liabilities</i>											
Accounts payable		35,308,460	45,410,527	57,240,685	70,612,326	77,979,467	86,137,765	95,175,991	105,193,502	116,301,603	117,945,916
Total Current Liabilities	-	35,308,460	45,410,527	57,240,685	70,612,326	77,979,467	86,137,765	95,175,991	105,193,502	116,301,603	117,945,916
<i>Shareholders' equity</i>											
Paid-up capital	127,966,437	127,966,437	127,966,437	127,966,437	127,966,437	127,966,437	127,966,437	127,966,437	127,966,437	127,966,437	127,966,437
Retained earnings		4,032,692	10,049,331	17,338,213	25,955,193	32,296,250	37,857,724	90,476,207	141,111,960	197,396,681	129,884,838
Total Equity	127,966,437	131,999,129	138,015,768	145,304,650	153,921,630	160,262,687	165,824,161	218,442,644	269,078,397	325,363,118	257,851,274
TOTAL CAPITAL AND LIABILITIES	127,966,437	167,307,588	183,426,295	202,545,334	224,533,956	238,242,154	251,961,925	313,618,634	374,271,898	441,664,721	375,797,190

12.3. Cash Flow Statement

Calculations											SMEDA
Cash Flow Statement											
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
<i>Operating activities</i>											
Net profit		8,065,383	16,065,971	24,627,094	34,572,174	38,637,308	43,419,197	52,618,483	50,635,753	56,284,722	62,372,994
Add: depreciation expense		8,376,620	8,376,620	8,376,620	8,376,620	8,376,620	8,376,620	7,667,940	12,390,958	12,390,958	12,390,958
amortization of pre-operating costs		520,138	520,138	520,138	520,138	520,138	-	-	-	-	-
amortization of training costs		30,000	30,000	30,000	30,000	30,000	-	-	-	-	-
Deferred income tax		-	-	-	-	-	-	-	-	-	-
Accounts receivable		(26,439,288)	(3,745,566)	(8,108,048)	(9,427,809)	(7,704,629)	(5,542,534)	(6,096,787)	(6,706,466)	(7,377,113)	(8,114,824)
Finished goods inventory		(12,631,286)	(3,432,434)	(3,998,670)	(4,645,173)	(2,477,064)	(2,728,799)	(3,006,701)	(3,313,597)	(3,652,639)	(4,027,346)
Equipment inventory	(112,350)	(17,482)	(20,202)	(23,345)	(26,978)	(31,175)	(36,026)	(41,632)	(48,110)	(55,596)	412,896
Raw material inventory	(11,255,470)	(4,200,166)	(5,334,402)	(6,738,571)	(4,872,564)	(5,735,008)	(6,750,104)	(7,944,872)	(9,351,115)	(11,006,262)	73,188,534
Advance insurance premium	(168,525)	16,853	16,853	16,853	16,853	16,853	16,853	(271,970)	45,735	45,735	247,910
Accounts payable		35,308,460	10,102,067	11,830,158	13,371,641	7,367,141	8,158,298	9,038,226	10,017,511	11,108,101	1,644,313
Other liabilities		-	-	-	-	-	-	-	-	-	-
Cash provided by operations	(11,536,345)	9,029,233	22,579,045	26,532,229	37,914,902	39,000,184	44,913,504	51,962,686	53,670,669	57,737,906	138,115,435
Issuance of shares	127,966,437	-	-	-	-	-	-	-	-	-	-
Cash provided by / (used for) financing acti	127,966,437	-	-	-	-	-	-	-	-	-	-
<i>Investing activities</i>											
Capital expenditure	(115,430,092)	-	-	-	-	-	-	(47,354,124)	-	-	-
Cash (used for) / provided by investing acti	(115,430,092)	-	-	-	-	-	-	(47,354,124)	-	-	-
NET CASH	1,000,000	9,029,233	22,579,045	26,532,229	37,914,902	39,000,184	44,913,504	4,608,562	53,670,669	57,737,906	138,115,435

13. KEY ASSUMPTIONS

13.1. Operating Cost Assumptions

Table 21: Operating Cost Assumptions

Description	Rate/ Percentage/ Details
Furniture and fixture depreciation	15%
Machinery & equipment depreciation	10%
Building & infrastructure depreciation	10%
Vehicle depreciation	15%
Office equipment depreciation	15%
Inflation rate	10%
Wage growth rate	7.3%
Electricity price growth rate	8.8%
Office equipment price growth rate	8.0%
Office vehicle price growth rate	10.7%

13.2. Variable Cost Assumptions

Table 22 Variable Cost Assumptions

Description	Details
Fuel Cost	1% of material cost
Office expenses (stationary, entertainment, janitorial services, etc.)	5% of administration expense
Office vehicles running expense	1% of administration expense, no of vehicles
Communication expense	4% of administration expense
Machinery Cost	6% of Cost of Machinery

13.3. Fixed Cost Assumptions

Table 23 Fixed Cost Assumptions

Description	Details
Promotional Expenses	0.3 % of revenue
Administration benefits expense	5% of administration expense
Insurance Expense	1.5% of cost of machinery
Professional fees (legal, audit, consultants, etc.)	1.5% of administration expense

13.4. Revenue Assumptions**Table 24: Revenue Assumptions**

Description	Details
Sale price growth rate	10%
Initial capacity utilization	60%
Capacity growth rate	10%
Maximum capacity utilization	90%

13.5. Financial Assumptions**Table 25: Financial Assumptions**

Description	Details
Project life (Years)	10
Debt: Equity	0:100
Discount Rate used for NPV	20%

Small and Medium Enterprises Development Authority

HEAD OFFICE

4th Floor, Building No. 3, Aiwan-e-Iqbal Complex, Egerton Road, Lahore
Tel: (92 42) 111 111 456, Fax: (92 42) 36304926-7

www.smeda.org.pk, helpdesk@smeda.org.pk

REGIONAL OFFICE PUNJAB	REGIONAL OFFICE SINDH	REGIONAL OFFICE KPK	REGIONAL OFFICE BALOCHISTAN
3 rd Floor, Building No. 3, Aiwan-e-Iqbal Complex, Egerton Road Lahore, Tel: (042) 111-111-456 Fax: (042) 36304926-7 helpdesk.punjab@smeda.org.pk	5 TH Floor, Bahria Complex II, M.T. Khan Road, Karachi. Tel: (021) 111-111-456 Fax: (021) 5610572 helpdesk-khi@smeda.org.pk	Ground Floor State Life Building The Mall, Peshawar. Tel: (091) 9213046-47 Fax: (091) 286908 helpdesk-pew@smeda.org.pk	Bungalow No. 15-A Chaman Housing Scheme Airport Road, Quetta. Tel: (081) 831623, 831702 Fax: (081) 831922 helpdesk-qta@smeda.org.pk