Pre-Feasibility Study

REFINED GUAR SPLIT

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Ministry of Industries & Production

Government of Pakistan

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1 INTRODUCTION TO SMEDA

The Small and Medium Enterprise Development Authority (SMEDA) was established with the objective to provide fresh impetus to the economy through the launch of an aggressive SME support program.

Since its inception in October 1998, SMEDA had adopted a sector SME development approach. A few priority sectors were selected on the criterion of SME presence. In depth research was conducted and comprehensive development plans were formulated after identification of impediments and retardants. The all-encompassing sector development strategy involved recommending changes in the regulator y environment by taking into consideration other important aspects including financial aspects, niche marketing, technology up-gradation and human resource development.

SMEDA has so far successfully formulated strategies for sectors including, fruits and vegetables, marble and granite, gems and jewelry, marine fisheries, leather and footwear textiles, surgical instruments, urban transport and dairy. Whereas the task of SME development at a broader scale still requires more coverage and enhanced reach in terms of SMEDA's areas of operation.

Along with the sector focus a broad spectrum of business development services is also offered to the SMEs by SMEDA. These services include identification of viable business opportunities for potential SME investors. In order to facilitate these investors, SMEDA provides business guidance through its help desk services as well as development of project specific documents. These documents consist of information required to make well- researched investment decisions. Pre-feasibility studies and business plan development are some of the services provided to enhance the capacity of individual SMEs to exploit viable business opportunities in a better way. This document is in the continuation of this effort to enable potential investors to make well-informed investment decisions

2 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, finance and business management.

3 PROJECT PROFILE

The project is related to setting up Guar Split Processing Unit. The document highlights all the marketing, management, and financial aspects required for the establishment and successful running of the project.

3.1 Project Brief

Guar Split Processing is about obtaining semi finished product of guar split that is further sold to refinery to obtain guar powder of special grades. Apart from this the guar split can also be utilized for different commercial purposes. In addition the by products obtained from the process are Churi and Korma that are used as feed for cattle and poultry.

3.2 Opportunity Rationale

Guar gum as natural gums is advantageous as natural gelling agent for different industrial purposes. Guar Gum and its derivatives are widely used in various industries such as food, animal feed, textile, pharmaceuticals, personal care, health care, nutrition, cosmetics, paper, explosives, mining and oil drilling. The commercial usages of guar gum are detailed in table 1 as under:

Table 1: Uses of Guar

Technical	
Industry/description	Applications
Textile	Gives excellent film formatting and thickening properties when used for sizing, finishing and printing. Reduces wrap breakage, reduce dusting while sizing and gives better efficiency in production.
Paper	Improve sheet formation, folding and denser surface for the printing. Improved erasive and writing properties, better bonding strength and increased hardness. Due to improve adhesion it gives better breaking, mullen and folding strengths.
Explosive	As waterproofing agent mixed with ammonium nitrate, nitroglycerin etc. Cross linking agents for gel and slurry explosive systems.
Mining	Used as flocculants to produce liquid solid separation.

	It acts as a depressant for talc or insoluble gangue mined along with the valuable minerals. Used in flotation.
Food	
Industry/description	Applications
Baked Goods	Increases dough yield, gives greater resiliency and improves texture and shelf life. In pastry filling it prevents weeping (syneresis) of the water in filling keeping the pastry crust crisp.
Beverages	Provide outstanding viscosity control and reduces calories in low calories beverages.
Confections	Control viscosity, bloom, gel creation, glazing and moisture retention to produce the highest grade confectionary.
Dairy	Thickens milk, yogurt, kefir and liquid cheese products. Helps maintain homogeneity and texture of ice creams and sherbets.
Frozen Food Products	Guar gum reduces crystal formation. Act as a binder and stabilizer to extend shelf life of ice cream.
Meat	Function as lubricant and binder.
Dressing & Sauces	Improve the stability and appearances of salad dressing, barbecue sauces, relishes. Ketchups and others
Pet Food	Forms gels and retains moisture. Act as thickening, stabilizer and suspending agent for veterinary preparations.
Misc.	Dry soups, instant oatmeal, sweet desserts, canned fish in sauce and animal feed etc.
Others	
Industry/description	Applications
Pharmaceutical	As binder or as disintegrator in tablets. Main ingredient in some bulk-forming laxatives.
Cosmetics & Toilertries	Thickener in toothpaste. Conditioner in shampoos

3.3 Market Entry Timing

The Guar Split Processing Unit may be started round the year, but considering harvest season with respect to guar seed availability would be more economical. Keeping in view the Guar harvesting in October-November, it is suggested that the processing plant should be ready for processing by the month of September.

3.4 Proposed Business Legal Status

Although the legal status of the business tends to play an important role in any setup, the Guar Split Processing Unit is proposed to be operated on a sole proprietorship basis which may extend to partnership in case of future expansion or as per entrepreneur desire.

3.5 Proposed Product Mix

The proposed processing unit will produce the Refined Guar Split as the major product, whereas the Churi and Korma will be obtain as byproducts.

3.6 Production Capacity

The proposed project has an annual processing capacity of 3,000 Tons of Guar Seed, producing 840 Tons of Refined Guar Split, and 2,100 Tons of Protein (Churi, and Korma) as byproducts.

3.7 Project Investment

For the establishment of Guar Split Processing Unit total investment required for the proposed project is Rs. 34.81m, comprising of the capital investment of Rs. 30.7 million and Rs. 4.01 m for working capital.

For the establishment of proposed Guar Split Processing Unit 40:60 Debt equity ratio is proposed.

3.8 Recommended Project Parameters

Table 2: Recommended Project Parameters

Max Capacity		Human Resource	Technology/Machinery	Location
3,000 Tons Guar Seed into 840 Tons Refined Split and 2,100 Tons Protein		35	Local + Imported Second Hand	Major Cities/Industrial estates
Financial Summary				
Description	Total Cost (Rs.)	Payback Period	IRR	NPV
Equity	60.61 mn	4.54	35%	25% 11,430,862
Project		4.44	29%	18% 23,755,592

3.9 Suitable Location

The proposed location for the project could be any of the potential areas in Balochistan and Sindh such as Hub, Lesbala, Winder, Karachi etc. with easy availability of raw material & infrastructure. As final product is of high export potential therefore it is recommended to consider possible modes of transportation for export purpose.

3.10 Key Success Factors

Strong oversees linkages
Availability of sufficient Raw Material at economical rates
Maximum control over raw materials supply end
A good tradeoff between Proximity to the port city and the raw material market or producing areas
Infrastructure must facilitate with good access to Road, Gas, Electricity and Telecommunication
Efficient logistic system

3.11 Strategic Recommendation

The project should ensure effective marketing with the oversees trading partners
The proposed project should be established in the areas having proximity to the port and guar seed markets.
Before entering into supply contracts, the logistic companies and forwarding companies should be well worked out about their resourcefulness and efficiency.

4 ABOUT GUAR GUM

4.1 History and Background

Guar (Cluster Bean) is believed to have originated in Africa, but it is being grown throughout South Asia since ancient time as a vegetable and fodder crop. Guar has been cultivated in India and Pakistan for ages to produce tender pods as fresh vegetable and other parts of the plant used as cattle feed.

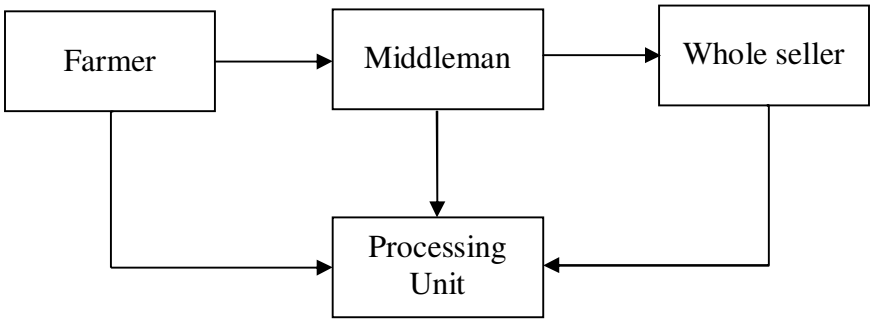
The plant is extremely drought resistant, it is a natural habitat of semi-arid regions with warm and dry weather (summer growing annual legume). The growing season of guar is 14 to 16 weeks, requires moderate flashing rainfall with plenty of sunshine. Too much rain can cause the plant to become leafier resulting less number of pods or the number of seeds per pod which affects the size and yield of seeds. The crop is generally sown

after the monsoon rainfall in the second half of July to early August and is harvested in late October till early November.

4.2 Supply Chain of Guar Seed (Raw Material)

The Guar Seed passes through the following stages to reach the end users:

Figure 1: Supply Chain of Guar Seed



4.3 Guar Seed

The dry Guar Seed contains about 20 – 30% protein and 30 – 40% carbohydrates. The seed is comprised of three parts: the seed coat (hull), the endosperm, and the germ as described by figure 2. In order to obtain pure galactomanon from the endosperm, it is separated from the hull and germ. The detail specification of guar seed is described in table 3.

Figure 2: Guar Seed

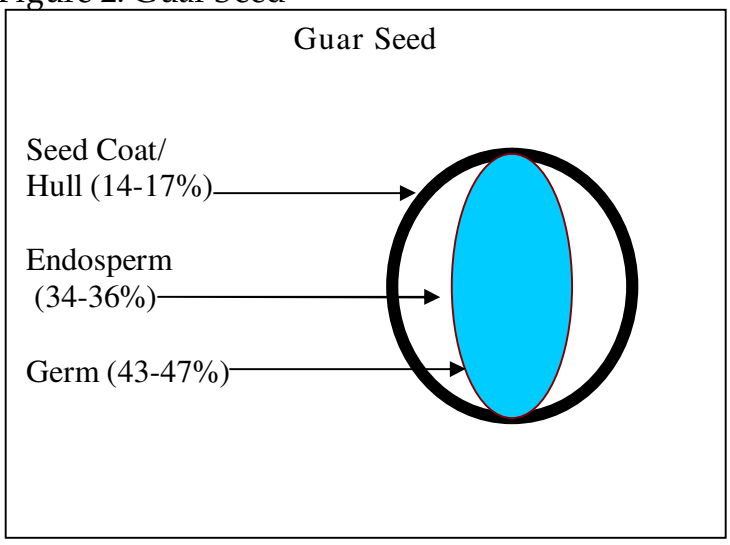


Table 3: Specification of Guar Seed

Part of seed %	Protein %	Ether Extract %	Ash %	Moisture %	Fibers %	Types of Sugar
Seed coat/Hull (14-17%)	5	0.3	4	10	36	D-Glucose
Endosperm (34-36%)	5	0.6	0.6	10	1.5	Galactomanon
Germ (43-47%)	55.3	5.2	4.6	10	18	Glucose

Description	Specification
Variety	Basis 98% whitish acceptance 1- Between 98% to 95% with a price deduction of 0.5% for every 1% 2- Between 95% to 90% with a price deduction of 2% for every 1% Rejected below 90%
Moisture	Basis 8% Acceptance 1- Between 8% to 10% with a price deduction of 1% for every 1% Rejected above 10%
Foreign Matter, Sand, Silica & damaged Seeds	Basis 1% Acceptance 1- Between 1% to 2% with a price deduction of 1% for every 1% fraction thereof 2- Between 2% to 3% with a price deduction of 2% for every 1% fraction thereof Rejected above 3%
Packing	Uniformly packed in clean, dry, sound, single, new or un mended B Twill Bags in merchantable condition and or any other

4.4 Refined Guar Gum Split

Guar Gum Split is obtained from guar seeds and refined to different purity levels as per buyer's requirements. This is the basic raw material for guar gum powder production. Guar gum refined split is refined endosperm derived from guar seed or cluster been. It is a non ionic polysaccharide galactomanon. The endosperm is mechanically separated from guar seed which yields 28% to 30% of dehusked refined split. With reserve estimates about 100kgs of seeds produces 28 to 30 kg of Guar Split.

Properties of Guar Gum

Chemical composition

Chemically, guar gum is a polysaccharide composed of the sugars, galactose, and mannose. The backbone is a linear chain of 1,4-linked mannose residues to which galactose residues are 1,6-linked at every second mannose, forming short side-branches.

Solubility and viscosity

Guar gum is more soluble than locust bean gum and is a better emulsifier as it has more galactose branch points. Unlike locust bean gum, it is not self-gelling. However, either borax or calcium can cross-link guar gum, causing it to gel. In water it is nonionic and hydrocolloidal. It is not affected by ionic strength or pH, but will degrade at pH extremes at temperature (e.g. pH 3 at 50°C). It remains stable in solution over pH range 5-7. Strong acids cause hydrolysis and loss of viscosity, and alkalies in strong concentration also tend to reduce viscosity. It is insoluble in most hydrocarbon solvents.

Guar gum shows high low-shear viscosity but is strongly shear-thinning. It is very thixotropic above concentration 1%, but below 0.3% the thixotropy is slight. It has much greater low-shear viscosity than that of locust bean gum, and also generally greater than that of other hydrocolloids. Guar gum shows viscosity synergy with xanthan gum. Guar gum and micellar casein mixtures can be slightly thixotropic if a biphase system forms.

Thickening

Guar gum is economical because it has almost 8 times the water-thickening potency of cornstarch - only a very small quantity is needed for producing sufficient viscosity. Thus it can be used in various multi-phase formulations: as an emulsifier because it helps to prevent oil droplets from coalescing, and/or as a stabilizer because it helps to prevent solid particles from settling.

Ice-crystal growth

Guar gum retards ice crystal growth non-specifically by slowing mass transfer across the solid/liquid interface. It shows good stability during freeze-thaw cycles.

4.5 Guar Gum Powder

The Guar Gum powder is a white to yellowish odorless powder. It is extracted by the wet milling of the refined splits. The powder is graded by granulation and quality. The products are re-blended according to specification.

The guar gum powder has more thickening ability than cornstarch. It not only works as a thickener but also works as binder and plasticizer as well. Guar Gum is easily soluble in water and has a natural ability to bind with water molecules. Without a binder like guar gum, different ingredients might separate into watery mess as far as creamy processed foods are concerned.

4.6 Guar Gum Derivatives

Guar split and gum powder is further processed to make various derivatives as per requirements of end user industry such as petroleum, textile, paper, food and pharmaceuticals etc.

4.7 Guar Meal (By products)

Guar meal is a by product of guar processing. It is (a mixture of husks and germ) a potential source of protein, and used for cattle as well as poultry feeding. To improve its nutritive value, the guar meal is toasted. It can be used up to 10% in poultry and can replace up to 100% protein supplements such as ground nut oil cakes and ruminants.

Guar meal typically comes in different forms: a guar meal *Churi*, which is in powder form used as poultry feed, and guar meal *Korma* in granular form used for cattle feed. Processed guar meal can be used either in conjunction with other feed stuffs, or by itself, as it is a complete nutritional feed.

Figure 3: Guar meal (by products)

Churi	Korma
	

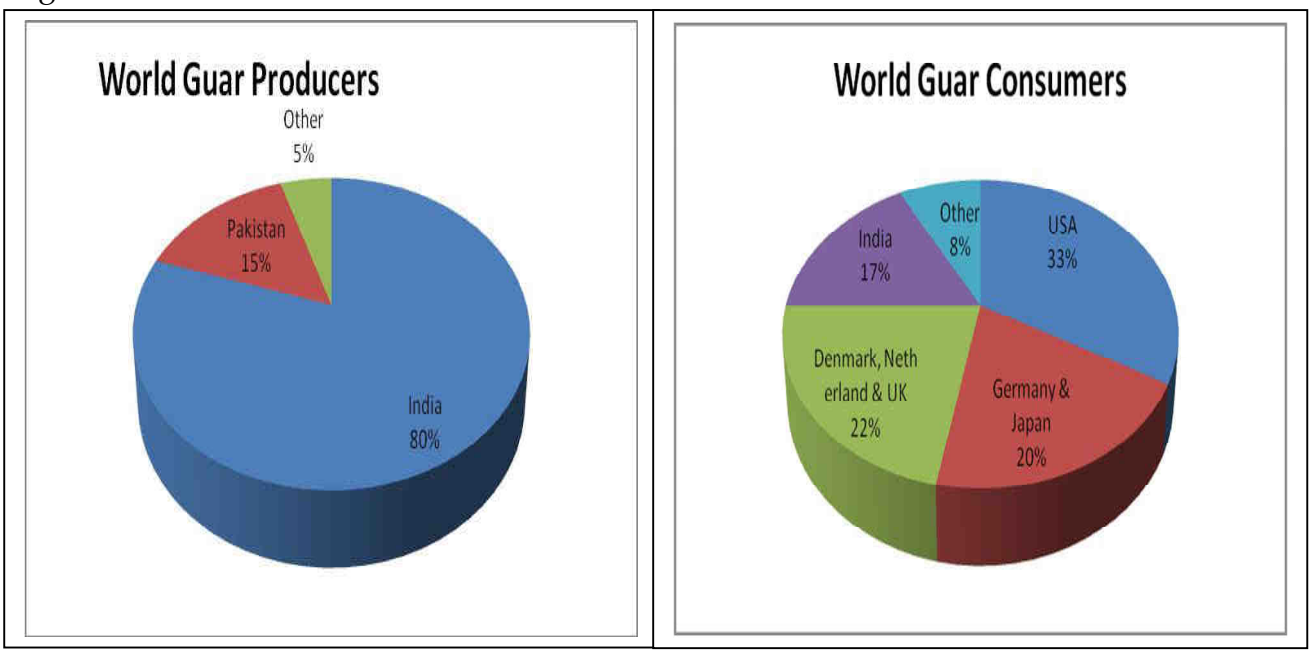
5 CURRENT INDUSTRY SITUATION

5.1 International Scenario

India is the largest producer of Guar seed in the world, constitute about 80% of the total production. Pakistan, USA, South Africa, Malawi, Zaire and Sudan are other major producing countries. World market for guar gum is estimated to be around 150000 tons/year, 70% of which is produced by India and Pakistan. The USA is the largest consumer of guar gum with an annual consumption of 45,000 tones which represents 25% of world trade. Germany & Japan consume another 23% between them with the UK, Denmark and the Netherlands combining take further 22% of world trade. The world guar market is a mature one and increasing steadily (>2% per year). The area of growth is in Asia and South America as standards of living increase resulting in the increased consumption of processed food[1]. Whereas the world demand for guar gum is estimated to be 1.5 Lakh tones per year[2].

Figure 4 represents the major world importers by percentage of their contribution as follows:

Figure 4: World Guar Producers & Consumers



[1] www.nmce.com/files/study/guarseed.pdf

[2] http://www.guargum.biz/guargum_global_market.html

5.2 Scenario of Pakistan

Pakistan is 2nd major guar seed producing country. Though its production and trade is comparatively very less than India but still it is one of the main competitors for India. If weather remains conducive for crop, Pakistan produces nearly 130,000 Tons per annum.

Following are details of Guar seed production statistics with respective to cultivated area, production and yield per hectare.

Table 4: Pakistan Guar Seed Production

Year	Punjab		Sindh		KPK		Balochistan		Pakistan	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
2005-06	109.1	81.7	16.5	12.9	2.0	2.5	3.2	1.9	130.8	99.0
2006-07	104.2	81.4	51.1	33.0	1.5	2.0	7.0	4.5	163.8	120.9
2007-08	94.4	74.7	60.3	40.0	1.6	2.1	6.9	3.8	163.2	120.6
2008-09	93.2	60.3	51.4	34.5	1.6	2.3	8.6	5.3	154.8	102.4
Area = 000 hectares Production = 000 tons										
Source: Pakistan Statistical Year Book 2010										

Pakistan's Trade

The trade statistics for the years from 2006 to 2009 with major trading partners is as follows:

Table 5: Exports to major trade partners

Country	Trade Unit	2006	2007	2008	2009
USA	Value ($)	5,242,922	7,903,949	9,971,856	5,763,341
	Quantity (kg)	4,569,059	6,356,942	7,920,311	5,468,832
Japan	Value ($)	3,089,558	3,609,632	4,480,447	2,870,068
	Quantity (kg)	2,393,100	2,807,500	3,458,000	2,560,100
Netherland	Value ($)	1,412,419	2,170,813	2,688,406	1,298,583
	Quantity (kg)	1,171,000	1,842,632	2,357,000	1,275,000
Denmark	Value ($)	857,244	1,172,201	1,275,546	758,791
	Quantity (kg)	684,000	905,281	1,081,000	736,000
Germany	Value ($)	374,239	648,418	1,737,457	724,543
	Quantity (kg)	320,000	546,868	1,440,400	560,000
UK	Value ($)	499,425	661,074	886,075	542,188
	Quantity (kg)	420,000	540,170	740,405	520,120
Source: Comtrade					

5.2.1 Price

The year 2011 guar observed highest increase in its price with a gain of 54% on Guar seed and 105% increase on guar gum. The prices soared at lifetime high during May 2011, touching Rs. 3,351 and Rs. 10,538 for guar seed and gum respectively.

5.2.2 Guar Processing Units in Pakistan

There are around 13 units in Pakistan that process the Refined Guar Split and Guar Gum Powder. Some of them have imported plants while others have installed local machinery. All of them export the Refined Guar Split and Guar Gum Powder whereas the Churi and Korma are sold in the local market.

Table 6: Guar Processing Units in Pakistan

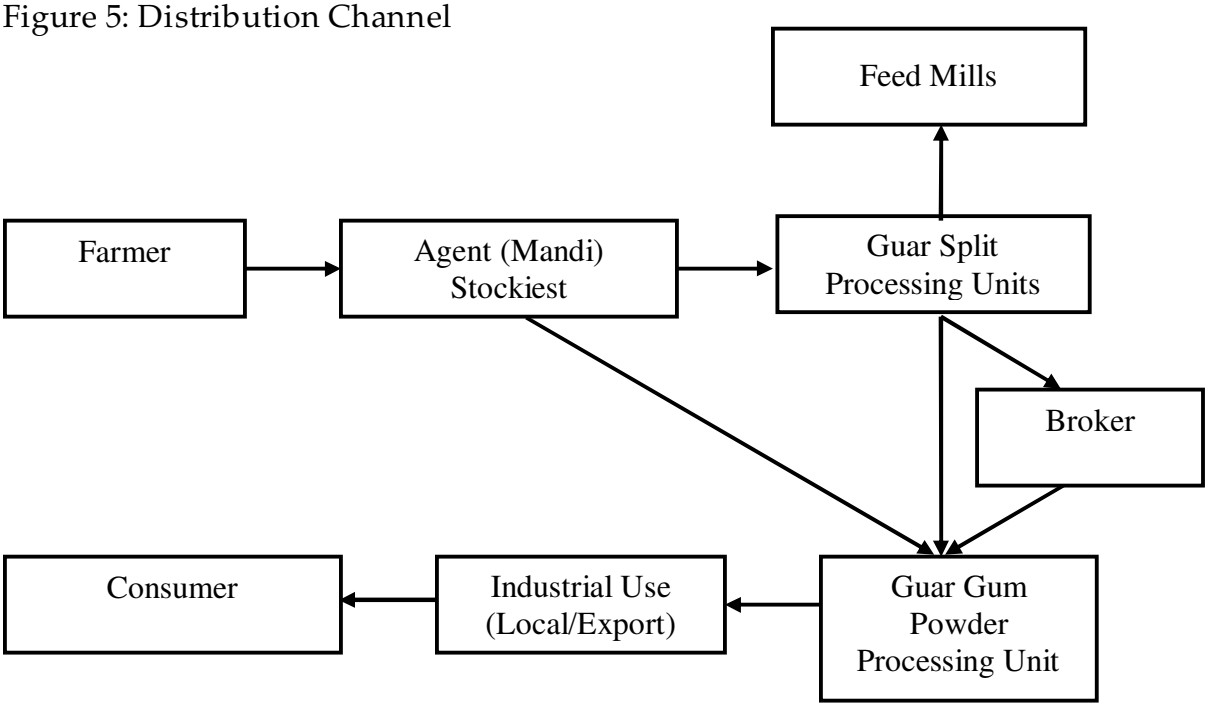
S#	Organization Name	Location
1	Abdullah Associate	Lahore, Punjab
2	Anabia Gum & Chemicals	Karachi, Sindh
3	Ghaziani Industries (Pvt) Ltd.	H.I.T.E, Lasbella, Baloochistan
4	Haidery Traders	H.I.T.E, Lasbella, Baloochistan
5	Kohsar Gums	Jhang, Punjab
6	National Colloid Industry (NCI)	Karachi, Sindh
7	Natural Polymer Industries (Pvt) Ltd.	Karachi, Sindh
8	Pakistan Gums and Chemicals	Karachi, Sindh
9	Pakistan Gum Industries (Pvt) Ltd.	Karachi, Sindh
10	Pakistan Guar Gum Manufacturing	Karachi, Sindh
11	Rabnawaz Enterprises	D.G.Khan, Punjab
12	Shazil Pakistan (Pvt) Ltd.	Karachi, Sindh
13	Supreme Gums Ltd.	Jhang, Punjab
Source :SMEDA Research and alibaba.com		

5.2.3 Distribution Channels

Like other products Guar Seed has the similar marketing mechanism through intervention of middlemen "Arhti", who sells the seeds to processors. These units process the guar seed to obtain the refined split (guar gum), and during process Churi and Korma are obtained as byproducts of guar split. The refined split is directly sold to respective industrial users. The high protein byproducts are used for poultry and animal feeds with in the country.

In Pakistan at large Guar seeds are processed to initial level for producing Guar split, and only two units in the country are further processing Guar split into Guar Gum powder. Guar Gum powder with respect to their grade and specification is sold to their respective industries.

Figure 5: Distribution Channel



6 PRODUCTION PROCESS

6.1 Process Flow of Guar Gum

The following is elaborating the complete procedure of a Guar Gum Unit:

Three Screen Shifter 1 is made up of wood, and steel. A pit is dig in the soil below the ground level about 1 Square meters depth. It is covered with a net of 15 mm round steel duly welded. We can put about 500 Kg. weights in this pit at a time.

There is a controlled mechanical system for opening the gate of Shifter to 1st Elevator. 1st wooden Bucket Elevator lifts the material vertically and feeds it in the shifter 1. It is a sieving machine which can separate out the fine dust by aspiration system developed by negative pressure whereas thrash, jute sutli, lumps etc. separated out by sieving. The impurities, which are bigger or smaller

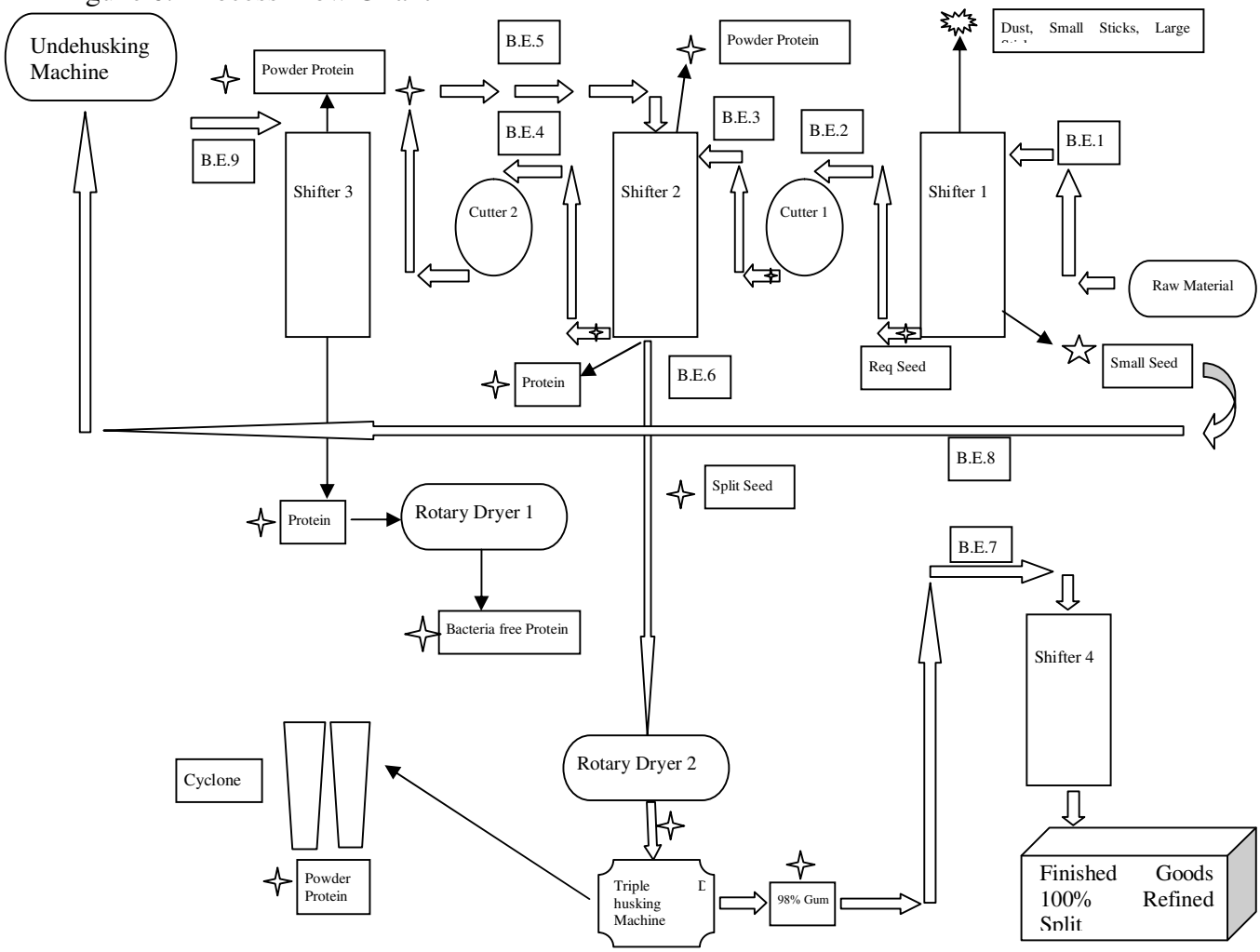
than the size of grain, is separated out by sieving with the help of different size sieves and the light impurities separated out by Aspiration System. These light impurities are collected in the Dust Chamber. Also, the small sized grain is separated at this stage.

After sieving the material from Shifter 1, the cleaned material goes into the 2nd Wooden Bucket Elevator by gravity. This Elevator lifts the material vertically and feeds it into the Cutter 1, which is fitted next to the shifter 1. Here the material is split into 2 Pieces. These pieces are again lifted by the 3rd Wooden Bucket Elevator and fed into the One Screen Shifter 2 designed for separating the split seeds, protein, and intact seeds. The powdered protein is sucked upward and sent to the protein chamber, whereas the large sized protein is sieved downwards, and manually shifted to the Rotary Dryer 1, which kills its bacteria through high heat treatment. The unbroken seeds are taken up by the 4th Wooden Bucket Elevator and pushed into Cutter 2 for recycling. After this, the recycled split is brought to Shifter 2 againd, via 5th Bucket Elevator. All of the split material is sieved down and through the 6th Bucket Elevator, elevated to the Rotary Dryer 2. It is then pushed down to the Triple Dehusking Machine, which extracts 98% fiber. Finally the 7th Bucket Elevator lifts it to the Shifter 4, where the remaining impurities are removed, and the finished product "100% refined split" is obtained. The powder protein is sucked upwards by the Cylcone.

The small sized seeds separated in Shifter 1, are sent to the Undehusking Machine through 8th Bucket Elevator. The undehsuking machine polishes these seeds and through 9th Bucket Elevator, transfers it to the Shifter 3, to obtain the powder and thick protein. The thick protein is freed from bacteria in the Rotary Dryer 1.

The final product obtained from the process is Guar split. The produce may further be processed to obtain Guar powder. The detail of Guar powder processing is enclosed in annexure I.

Figure 6: Process Flow Chart



6.2 Final Product

The product mix of the proposed project will be the refined guar split as main product, and Churi, and Korma as by products. 1 Ton of guar seed will produce 0.28 Ton of Refined Split/Gum, 0.3 Ton Churi, 0.37 Ton Korma, and 0.04 Ton other like waste. Table 7 describes the possible obtained products mix from the process while table 8 describes the recommend parameter of final products for selling.

Table 7: Final product mix

Products /by Products	Weight (%)
Refined Split	28 (+/-1 Variance)
Churi	30
Korma	37
Other	4

Table 8: Recommended Project Parameters of Final products

Guar Split	
Description	Accepted Standard
Color	Pale – White
Gum Contents	80-85%
Splits	90% Min
Minerals Matter (ASH)	1.5% Max
Fiber	1.5 – 2.0% Max
Protein	5% M
Moisture	10% Max
Ether Soluble Substances	0.6% Max
Acid Insoluble Ash (Sand/Silica)	Traces
Black Split	1% Max
Heavy Metals	Nil
Appearances	Bright Creamy Yellow
Air	2.5% Max
Churi	
Protein (0+A)	50% Min
Silica	2% Max
Fiber	10% Max
Moisture	10% Max
Korma	
Protein (0+A)	35% Min
Silica	2% Max
Fiber	10% Max
Moisture	10% Max

6.3 Packaging

Flexible HDPE circular woven bags of 25 Kg, 50 Kg, 800 Kg, and 900 Kg etc., depending upon the order can be used as final product packaging. Paper bags and HDPE Drums are also used for enclosing the final product for distribution only.

6.4 Target Customers

The Guar Gum/Powder Processing units abroad whereas the by products i.e. Churi and Korma will be sold to poultry and cattle feed mills.

6.5 Pricing

The F.O.B price range for the proposed project remains around $1,150 to $ 1,300 in the international market. Whereas the average price of Churi & Korma in the local market is around Rs. 25,000

7 PROJECT INPUTS

7.1 Land

Table 8: Land Cost

Area (Sq. Meter)	Rate/Sq Meter (Rs.)	Total Cost (Rs.)
1,356	1,350	1,830,600

7.2 Building

Table 9: Building Cost

Description	Area (Ft)	Total Area (Sq Ft)	Rate/Sq Ft (Rs.)	Cost (Rs.)
Production Area				
Ground Floor				
Production Hall	140 x 50	7,000	1,000	7,000,000
Store for Raw Material	100 x 30	3,000	1,000	3,000,000
Finished Goods Storage	100 x 30	3,000	1,000	3,000,000
Administration Area				
Ground Floor				
Wash Room for Labor	15 x 6	90	500	45,000
First Floor				
Room for Labor	30 x 30	900	800	720,000
Spare Parts' Store	20 x 20	400	800	320,000
Office	20 x 20	400	1000	400,000
Wash Room for Officers and Guests	10 x 6	60	800	48,000
Kitchen	6 x 5	30	800	24,000
Grounds				
Open Area	30 x 50	1,500	100	150,000
Overhead Water Tank	300 Gallon			30,000
U/G Water Tank	1,500 Gallon			150,000
Boundary Wall 10' High	460 RFT		70	315,000
Total Amount				15,202,000

7.3 Machinery

Table 10: Machinery Cost

S. No	Description	Units	Unit Price (Rs.)	Total Cost (Rs.)
1	Shifter (Wooden and Steel): Make : Local Three Screen with Blower Motor: 7.5 Hp	2	350,000.00	700,000.00
2	Shifter (Wooden & Steel): Make : Local One Screen Motor: 5 Hp	1	100,000.00	100,000.00
3	Shifter (Steel): Make : Local Four Screen Reducing Gear, Motor 7.5 Hp	1	600,000.00	600,000.00
4	Wooden Bucket Elevator Make : Local Motor: 2 Hp	3	125,000.00	375,000.00
5	Steel Bcuket Elevator Motor: 3 Hp	6	175,000.00	1,050,000.00
6	Guar Crushing/Cutter Machine Make : Local Motor : 15/10 Hp	3	300,000.00	900,000.00
7	Rotary Dryer/Oven Gas Fired Make : Local R. Gear, Motor 10 Hp Length: 14' Dia: 4' Burners : 5	2	1,500,000.00	3,000,000.00
8	Split Dehusking Machine Make : Local Blower Motor: 25 Hp	3	400,000.00	1,200,000.00

9	Twin Cyclone Make : Local Fan Airlock Valves : 2 Italian Motor: 35 Hp	1	500,000.00	500,000.00
10	100 Kva Generator Make : Dorman (England)	1	950,000.00	950,000.00
11	Used Fork Lifter of 1 Ton	1	400,000.00	400,000.00
12	Weigh Scale	1	50,000.00	50,000.00
13	Welding Plant	1	90,000.00	90,000.00
14	Gas Cutter with Cylinder	1	80,000.00	80,000.00
15	Stitching Machine	1	50,000.00	50,000.00
16	SPOCKET (Chain Cuppee)	1	45,000.00	45,000.00
17	Grinder	2	20,000.00	40,000.00
18	Spare Motors	8	10,000.00	80,000.00
19	Tarpolin (40' x 40')	1	15,000.00	15,000.00
20	Water Pump with Motor	1	10,000.00	10,000.00
21	Miscellaneous Tools		25,000.00	25,000.00
Total Amount				9,660,000.00

7.4 Office Equipment

Table 11: Office Equipment Cost

S. No	Description	Cost/Unit (Rs.)	Qty	Total Cost (Rs.)
1	Computer Server	150,000	1	150,000
2	Computers	25,000	2	50,000
3	Laptop	60,000	1	60,000
4	Computer UPS	30,000	3	90,000
5	Computer Printer	20,000	1	20,000
6	Telephone	2,500	2	5,000
7	Fax Machine	15,000	1	150,000
8	Vacuum Cleaner	19,000	1	19,000
9	Misc (Water Cooler/ Dispenser Unit etc.)	40,000		40,000
Total Amount				449,000

7.5 Furniture & Fixture

Table 12: Furniture & Fixture Cost

S. No	Description	Cost/Unit (Rs.)	Qty	Total Cost (Rs.)
1	Chairs	2,000	8	16,000
2	Tables	7,000	3	21,000
3	File Cabinets	4,000	2	8,000
4	Electric Fans & Lighting	25,000		25,000
5	Split A/C (1.5 Tons)	36,000	1	36,000
Total Amount				106,000

7.6 Office Vehicles

Table 13: Office Vehicles Cost

S. No	Description	Cost/Unit (Rs.)	Qty	Total Cost (Rs.)
1	Car	889,000	1	889,000
2	Motorcycle	45,000	1	45,000
Total Amount				934,000

7.7 Human Resource requirement

Table 14: HR Cost

S. No	Description	No	Salary/Person (Rs.)	Total Salary (Rs.)
1	CEO	1	60,000	60,000
2	Accountant	1	20,000	20,000
3	Labor	30	7,000	210,000
4	Security Guard	2	7,000	14,000
5	Sweeper	1	7,000	7,000
Total Amount				311,000

7.8 Electrification

The Cost associated with the electrification is based upon the load of 50 Kva and the Electrification Charges covering the Security Deposits and Installations is around Rs. 1500,000.

7.9 Gas

The cost related to gas is in the form of Security Deposit. For the proposed project it is around Rs. 85,000.

7.10 Water

Security Deposit and initial pipe lying though varies but supposed to be around Rs. 45,000 for the line of 1", within an industrial area.

8 FINANCIAL ANALYSIS

Financial Evaluation — SMEDA

Key Variables			
Type of Machinery			…
Cost of One Machine		…	
Number of Machines		…	
Total Investment in Project			30,614,368
Equity	60%		18,220,043
Debt	40%		12,394,325
Lease	0%		-
Export-refinance	0%		-
Interest Rate			16%
Debt Tenure			5
Debt Payments per year			1
Total Number of Employees		…	

Rs. in actuals

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Free Cash Flow to Equity (FCFE)	(1,081,773)	1,909,656	6,197,687	6,108,962	7,450,226	14,931,580	18,655,069	22,902,897	27,742,174	34,988,885
Free Cash Flow to Firm (FCFF)	1,657,908	5,474,781	9,313,428	9,378,274	10,897,682	14,931,580	18,655,069	22,902,897	27,742,174	45,816,906
Profit margin on sales	-2%	1%	3%	4%	5%	6%	7%	8%	9%	10%
ROE	-12%	11%	21%	30%	39%	47%	53%	60%	65%	71%
Times interest earned	0.01	2.18	6.45	13.42	34.77	-	-	-	-	-

		Equity		Project
Internal Rate of Return (IRR)		35%		29%
Modified Internal Rate of Return (MIRR)*		26%		21%
Payback Period (yrs)		4.54		4.44
Net Present Value (NPV)	@ 25%	11,430,862	@ 18%	23,755,592

**Re-investment rate has been taken to be the interest on cash in bank, which in this case is 9%*

Capital Investment	Rs. in actuals
Land	1,830,600
Building/Infrastructure	15,202,000
Machinery & equipment	9,660,000
Furniture & fixtures	106,000
Office vehicles	934,000
Office equipment	449,000
Pre-operating costs	1,000,353
Training costs	-
Total Capital Costs	29,181,953

Working Capital	Rs. in actuals
Equipment spare part inventory	22,969
Raw material inventory	379,747
Upfront land lease rental	-
Upfront building rent	-
Upfront machinery & equipment lease rental *	-
Upfront office equipment lease rental *	-
Upfront office vehicles lease rental *	-
Upfront insurance payment	529,700
Cash	500,000
Total Working Capital	1,432,416

Total Investment	30,614,368

Initial Financing	Rs. in actuals
Debt	12,394,325
Equity	18,220,043
Lease	-
Export re-finance facility	-

** Provisioning for the first year installments*

Statement Summaries — SMEDA

Income Statement

Rs. in actuals

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenue	104,966,820	130,858,636	160,879,146	176,967,061	194,663,767	214,130,143	235,543,158	259,097,474	285,007,221	313,507,943
Cost of goods sold	96,448,590	117,765,932	141,887,428	153,336,617	165,712,577	179,090,575	193,552,019	209,184,951	226,084,596	244,353,951
Gross Profit	8,518,230	13,092,703	18,991,718	23,630,443	28,951,190	35,039,568	41,991,139	49,912,523	58,922,624	69,153,992
General administration & selling expenses										
Administration expense	1,212,000	1,330,002	1,459,493	1,601,591	1,757,524	1,928,639	2,116,415	2,322,472	2,548,591	2,796,725
Rental expense	-	-	-	-	-	-	-	-	-	-
Utilities expense	-	-	-	-	-	-	-	-	-	-
Travelling & Comm. expense (phone, fax, etc.)	484,800	532,001	583,797	640,636	703,010	771,456	846,566	928,989	1,019,436	1,118,690
Office vehicles running expense	186,800	205,480	226,028	248,631	273,494	300,843	330,928	364,020	400,422	440,465
Office expenses (stationary, etc.)	60,600	66,500	72,975	80,080	87,876	96,432	105,821	116,124	127,430	139,836
Promotional expense	209,934	261,717	321,758	353,934	389,328	428,260	471,086	518,195	570,014	627,016
Insurance expense	529,700	472,060	414,420	356,780	299,140	316,711	253,369	190,026	126,684	63,342
Professional fees (legal, audit, etc.)	524,834	654,293	804,396	884,835	973,319	1,070,651	1,177,716	1,295,487	1,425,036	1,567,540
Depreciation expense	1,968,400	1,968,400	1,968,400	1,968,400	1,968,400	2,082,443	2,082,443	2,082,443	2,082,443	2,082,443
Amortization expense	200,071	200,071	200,071	200,071	200,071	-	-	-	-	-
Property tax expense	-	-	-	-	-	-	-	-	-	-
Miscellaneous expense	3,149,005	3,925,759	4,826,374	5,309,012	5,839,913	6,423,904	7,066,295	7,772,924	8,550,217	9,405,238
Subtotal	8,526,143	9,616,283	10,877,712	11,643,970	12,492,074	13,419,340	14,450,637	15,590,680	16,850,274	18,241,295
Operating Income	(7,913)	3,476,420	8,114,006	11,986,474	16,459,116	21,620,228	27,540,501	34,321,842	42,072,351	50,912,697
Other income	22,500	85,935	355,911	612,634	693,496	910,955	1,344,937	1,813,190	2,322,260	2,955,737
Gain / (loss) on sale of assets	-	-	-	-	373,600	-	-	-	-	-
Earnings Before Interest & Taxes	14,587	3,562,355	8,469,917	12,599,108	17,526,212	22,531,183	28,885,439	36,135,033	44,394,611	53,868,433
Interest expense	1,952,483	1,635,974	1,313,073	938,509	504,014	-	-	-	-	-
Earnings Before Tax	(1,937,896)	1,926,381	7,156,843	11,660,599	17,022,198	22,531,183	28,885,439	36,135,033	44,394,611	53,868,433
Tax	-	-	2,929,585	4,780,846	6,979,101	9,237,785	11,843,030	14,815,363	18,201,790	22,086,058
NET PROFIT/(LOSS) AFTER TAX	(1,937,896)	1,926,381	4,227,259	6,879,753	10,043,097	13,293,398	17,042,409	21,319,669	26,192,820	31,782,376
Balance brought forward		(1,937,896)	(11,514)	2,107,872	4,493,813	7,268,455	10,280,926	13,661,668	17,490,668	21,841,744
Total profit available for appropriation	(1,937,896)	(11,514)	4,215,744	8,987,625	14,536,909	20,561,853	27,323,335	34,981,337	43,683,489	53,624,120
Dividend	-	-	2,107,872	4,493,813	7,268,455	10,280,926	13,661,668	17,490,668	21,841,744	26,812,060
Balance carried forward	(1,937,896)	(11,514)	2,107,872	4,493,813	7,268,455	10,280,926	13,661,668	17,490,668	21,841,744	26,812,060

Statement Summaries
Balance Sheet

SMEDA

Rs. in actuals

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Assets											
Current assets											
Cash & Bank	500,000	-	1,909,656	5,999,471	7,614,620	7,796,392	12,447,045	17,440,447	22,852,675	28,753,105	36,929,930
Accounts receivable	-	2,875,803	3,230,486	3,996,408	4,628,030	5,090,833	5,599,917	6,159,908	6,775,899	7,453,489	8,198,838
Finished goods inventory	-	-	-	-	-	-	-	-	-	-	-
Equipment spare part inventory	22,969	28,699	35,364	38,988	42,985	47,391	52,248	57,604	63,508	70,018	-
Raw material inventory	379,747	488,051	618,561	701,448	795,443	902,032	1,022,904	1,159,973	1,315,410	1,491,675	-
Pre-paid annual land lease	-	-	-	-	-	-	-	-	-	-	-
Pre-paid building rent	-	-	-	-	-	-	-	-	-	-	-
Pre-paid lease interest	-	-	-	-	-	-	-	-	-	-	-
Pre-paid insurance	529,700	472,060	414,420	356,780	299,140	316,711	253,369	190,026	126,684	63,342	-
Total Current Assets	1,432,416	3,864,614	6,208,487	11,093,096	13,380,217	14,153,358	19,375,482	25,007,958	31,134,176	37,831,628	45,128,768
Fixed assets											
Land	1,830,600	1,830,600	1,830,600	1,830,600	1,830,600	1,830,600	1,830,600	1,830,600	1,830,600	1,830,600	1,830,600
Building/Infrastructure	15,202,000	14,441,900	13,681,800	12,921,700	12,161,600	11,401,500	10,641,400	9,881,300	9,121,200	8,361,100	7,601,000
Machinery & equipment	9,660,000	8,694,000	7,728,000	6,762,000	5,796,000	4,830,000	3,864,000	2,898,000	1,932,000	966,000	-
Furniture & fixtures	106,000	95,400	84,800	74,200	63,600	53,000	42,400	31,800	21,200	10,600	-
Office vehicles	934,000	747,200	560,400	373,600	186,800	1,504,216	1,203,373	902,530	601,687	300,843	-
Office equipment	449,000	404,100	359,200	314,300	269,400	224,500	179,600	134,700	89,800	44,900	-
Total Fixed Assets	28,181,600	26,213,200	24,244,800	22,276,400	20,308,000	19,843,816	17,761,373	15,678,930	13,596,487	11,514,043	9,431,600
Intangible assets											
Pre-operation costs	1,000,353	800,282	600,212	400,141	200,071	-	-	-	-	-	-
Legal, licensing, & training costs	-	-	-	-	-	-	-	-	-	-	-
Total Intangible Assets	1,000,353	800,282	600,212	400,141	200,071	-	-	-	-	-	-
TOTAL ASSETS	30,614,368	30,878,096	31,053,498	33,769,637	33,888,288	33,997,175	37,136,856	40,686,888	44,730,663	49,345,672	54,560,368
Liabilities & Shareholders' Equity											
Current liabilities											
Accounts payable	-	3,789,340	4,638,262	5,595,742	6,044,045	6,528,377	7,051,646	7,616,998	8,227,831	8,887,824	9,528,265
Export re-finance facility	-	-	-	-	-	-	-	-	-	-	-
Short term debt	-	581,773	-	-	-	-	-	-	-	-	-
Other liabilities	-	-	-	-	-	-	-	-	-	-	-
Total Current Liabilities	-	4,371,113	4,638,262	5,595,742	6,044,045	6,528,377	7,051,646	7,616,998	8,227,831	8,887,824	9,528,265
Other liabilities											
Lease payable	-	-	-	-	-	-	-	-	-	-	-
Deferred tax	-	-	-	1,980,300	1,980,300	1,980,300	1,584,240	1,188,180	792,120	396,060	-
Long term debt	12,394,325	10,224,835	8,206,708	5,865,680	3,150,087	-	-	-	-	-	-
Total Long Term Liabilities	12,394,325	10,224,835	8,206,708	7,845,980	5,130,387	1,980,300	1,584,240	1,188,180	792,120	396,060	-
Shareholders' equity											
Paid-up capital	18,220,043	18,220,043	18,220,043	18,220,043	18,220,043	18,220,043	18,220,043	18,220,043	18,220,043	18,220,043	18,220,043
Retained earnings	-	(1,937,896)	(11,514)	2,107,872	4,493,813	7,268,455	10,280,926	13,661,668	17,490,668	21,841,744	26,812,060
Total Equity	18,220,043	16,282,147	18,208,529	20,327,915	22,713,856	25,488,498	28,500,969	31,881,711	35,710,711	40,061,787	45,032,103
TOTAL CAPITAL AND LIABILITIE	30,614,368	30,878,096	31,053,498	33,769,637	33,888,288	33,997,175	37,136,856	40,686,888	44,730,663	49,345,672	54,560,368

Note: Total assets value will differ from project cost due to first installment of leases paid at the start of year 0

Statement Summaries — SMEDA

Cash Flow Statement

Rs. in actuals

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating activities											
Net profit	-	(1,937,896)	1,926,381	4,227,259	6,879,753	10,043,097	13,293,398	17,042,409	21,319,669	26,192,820	31,782,376
Add: depreciation expense	-	1,968,400	1,968,400	1,968,400	1,968,400	1,968,400	2,082,443	2,082,443	2,082,443	2,082,443	2,082,443
amortization expense	-	200,071	200,071	200,071	200,071	200,071	-	-	-	-	-
Deferred income tax	-	-	-	1,980,300	-	-	(396,060)	(396,060)	(396,060)	(396,060)	(396,060)
Accounts receivable	-	(2,875,803)	(354,682)	(765,922)	(631,622)	(462,803)	(509,083)	(559,992)	(615,991)	(677,590)	(745,349)
Finished good inventory	-	-	-	-	-	-	-	-	-	-	-
Equipment inventory	(22,969)	(5,731)	(6,664)	(3,625)	(3,996)	(4,406)	(4,858)	(5,355)	(5,904)	(6,510)	70,018
Raw material inventory	(379,747)	(108,304)	(130,511)	(82,887)	(93,994)	(106,589)	(120,872)	(137,069)	(155,436)	(176,265)	1,491,675
Pre-paid building rent	-	-	-	-	-	-	-	-	-	-	-
Pre-paid lease interest	-	-	-	-	-	-	-	-	-	-	-
Advance insurance premium	(529,700)	57,640	57,640	57,640	57,640	(17,571)	63,342	63,342	63,342	63,342	63,342
Accounts payable	-	3,789,340	848,922	957,480	448,303	484,332	523,269	565,351	610,834	659,993	640,441
Other liabilities	-	-	-	-	-	-	-	-	-	-	-
Cash provided by operations	(932,416)	1,087,717	4,509,557	8,538,715	8,824,554	12,104,530	14,931,580	18,655,069	22,902,897	27,742,174	34,988,885
Financing activities											
Change in long term debt	12,394,325	(2,169,490)	(2,018,128)	(2,341,028)	(2,715,592)	(3,150,087)	-	-	-	-	-
Change in short term debt	-	581,773	(581,773)	-	-	-	-	-	-	-	-
Change in export re-finance facility	-	-	-	-	-	-	-	-	-	-	-
Add: land lease expense	-	-	-	-	-	-	-	-	-	-	-
Land lease payment	-	-	-	-	-	-	-	-	-	-	-
Change in lease financing	-	-	-	-	-	-	-	-	-	-	-
Issuance of shares	18,220,043	-	-	-	-	-	-	-	-	-	-
Purchase of (treasury) shares	-	-	-	-	-	-	-	-	-	-	-
Cash provided by / (used for) financing a	30,614,368	(1,587,717)	(2,599,901)	(2,341,028)	(2,715,592)	(3,150,087)	-	-	-	-	-
Investing activities											
Capital expenditure	(29,181,953)	-	-	-	-	(1,504,216)	-	-	-	-	-
Acquisitions	-	-	-	-	-	-	-	-	-	-	-
Cash (used for) / provided by investing a	(29,181,953)	-	-	-	-	(1,504,216)	-	-	-	-	-
NET CASH	500,000	(500,000)	1,909,656	6,197,687	6,108,962	7,450,226	14,931,580	18,655,069	22,902,897	27,742,174	34,988,885
Cash balance brought forward		500,000	-	1,909,656	5,999,471	7,614,620	7,796,392	12,447,045	17,440,447	22,852,675	28,753,105
Cash available for appropriation	500,000	(0)	1,909,656	8,107,343	12,108,433	15,064,846	22,727,971	31,102,114	40,343,343	50,594,849	63,741,990
Dividend	-	-	-	2,107,872	4,493,813	7,268,455	10,280,926	13,661,668	17,490,668	21,841,744	26,812,060
Cash carried forward	500,000	-	1,909,656	5,999,471	7,614,620	7,796,392	12,447,045	17,440,447	22,852,675	28,753,105	36,929,930

9 KEY ASSUMPTIONS

9.1 Project Capacity

The project's Capacity utilization will be 60% in the first year. In the Second Year it will increase to 93% at a rate of 55% annually and will be capped at 95% maximum. The project will work on three shifts per 24 hour basis. It will process 10 Tons of Guar Seed per 24 Hours, with an output of 2.8 Tons Refined Guar Split and 7 Ton Guar Meal Protein.

Percentage of Output

As per the industry norms and processing standards, it is assumed that the proposed project will produce as per the following percentage:

Table 15: Percent Output

Product Output	Percentage
Refined Split	28%
Protein	70%
Wastage	2%

Quantity of Output at 95% Capacity

Table 16: Quantity of Output at 95% capacity

Daily Input (Tons of Guar Seed)	Daily Output of Guar Split (Tons/Day)	Daily Output of Protein (Tons/Day)	Days/year	Annual Output of Guar Split	Annual Output of Protein
10	2.8	7	300	840	2100

9.2 Revenue Assumptions

The per Ton Sale price of Refined Split in year 1, is estimated to be Rs 104,125/. The sales price is assumed to increase at 10% per annum, a fairly accurate assumption reflecting historic industry trends. The Average price of the protein is estimated to be around Rs. 25,000/Ton for the corresponding year.

Table 17: Individual Selling Prices

Sale price calculation of Refined Guar Split and Protein	Price/Ton (Rs.)	
	Min	Max
Price for Refined Split	97,750	110,500
Weighted Average Price for Refined Split	104,125	
Average Price of Protein	25,000	

Table 18: Revenues

Guar Split			Protein		
Price/Ton (Rs.)	Qty/Year (Tons)	Revenue/Year (Rs.)	Price/Ton (Rs.)	Qty/Year (Tons)	Revenue/Year (Rs.)
104,125	840	87,465,000	25,000	2,100	52,500,000
Total Revenue					139,965,000

Table 19: Average Selling Prices

Total Revenue/Year (Rs.)	Total Qty/Year (Rs.)	Average Price/Year (Rs.)
139,956,000	2,940	47,604

9.3 Cost of Goods Sold Assumptions

The per Ton cost of Guar Seed in year 1, is estimated to be Rs 41,333/. The buying cost is assumed to increase at 5% per annum, a fairly accurate assumption reflecting historic relevant trends.

Table 20: Cost of Goods Sold Growth Rate

Description	Rate
COGS Growth Rate	8%

Table 21: Cost of Guar Seed

Description	Procurement of Seed	
	Off-Season	Season
Time Available In Months	8 Months	4 Months
Cost (Rs./Ton)	42,000	40,000
Weighted Average Buying Cost (Rs./Ton)	41,333	
Total Cost (including Packaging & misc)	41,500	

9.4 Other Assumptions

Other assumptions pertaining to the Economy, Financing, Depreciation, Cash Flows, and Utility Costs are given as below:

Table 22: Economic Related assumptions

Description	Rate
Inflation rate	10%
Electricity growth rate	10%
Water price growth rate	10%
Gas price growth rate	10%
Wage growth rate	10%

Table 23: Financial Assumptions

Description	Rate
Interest rate	16%
Working Capital Loan	9%
Corporate tax rate	41%
Turnover tax rate	1%
Dividend rate	50%
Required rate of return on equity	25%
WACC	14%

Table 28: Depreciation Rates

Description	Rate
Machinery and Equipments	10%
Furniture and Fixture	20%

Table 29: Cash Flow Assumptions

Description	Days
Accounts Receiveables	15
Accounts Payables	15

ANNEXURE I

A-1: Project Description

The project is about setting up of a specialty grade guar gum powder manufacturing unit. The proposed project will manufacture Pharmaceutical, Cosmetic and Food grades, for domestic and export market.

A-2: Proposed Plant Capacity and Cost

The capacity for the proposed unit is - 20 ton /day input and considering 300 working days in a year the installed capacity of unit will be 5000 Tons per Annum. The estimated project cost for the proposed project is around US $ 1.8 million.

A-3: Technology /Process

A-3.1: The Plant

- Guar split is fed in the pneumatic system to feed in to the turbo screen that is suggested at the high of plant. After the initial screening which is done to remove any foreign matter, the monitored material is stored in a storage hopper. The material then is taken by gravity to double cone mixer as and when required for pre-hydrating of guar splits.

- The pre hydrated guar splits are at a time sent by gravity to hopper of flacker that crushes the
- guar splits and uniformly moves it to the ultra fine grinder, which grinds the material without generating too much heat. The grinded material is then fed into a dryer.

- Centrifugal screen is used to screen the material, which is again passed through turbo screens for additional precautions, separating the oversize material in terms of grade and particle size. The oversized particle will be sent to the same grinder for recycling, and the process will be repeated.

- The material that passes from all the screens is sent to Nuta mixer separately by gravity for blending and assembling it to a uniform lot, which is then tested and packed.

A-3.2: The Required Machinery

Table: Machinery

S. No.	Description	Qty
1	Pneumatic Conveying System	1 Set
2	Split Cleaning Vibratory Screen	2
3	Split Washer	2
4	Double Cone Mixer	2
5	Water Tank	3
6	Double Chilled Roll Flakers Machine	3
7	Ultra Fine Pulverizer	3
8	Boiler with 1.0 M.T. Steam per hour with 15 Kg Pressure	1
9	Heat Exchanger	4
10	Pneumatic Dryer Line	2
11	Blower, Cyclone, Dust Collector	2 Lines
12	Rotary Siever (MS)	2
13	Nuta Mixer (Conical Blender)	4
14	Misc. Pipe Lines	Lot

A-3.3: The Manufacturing Process

- Guar seed pods are first sun dried and thrashed, to separate seeds from them. These seeds are then processed in industry. The by products of guar (Korma, Churi) are utilized for cattle feed.

- The seeds are then pulverized and the germ is separated from endosperm, which contains about 80% Galactomannan (gums), and polysaccharides. Two halves of the endosperm is obtained from each seed, known as Un-dehusked Guar Splits.

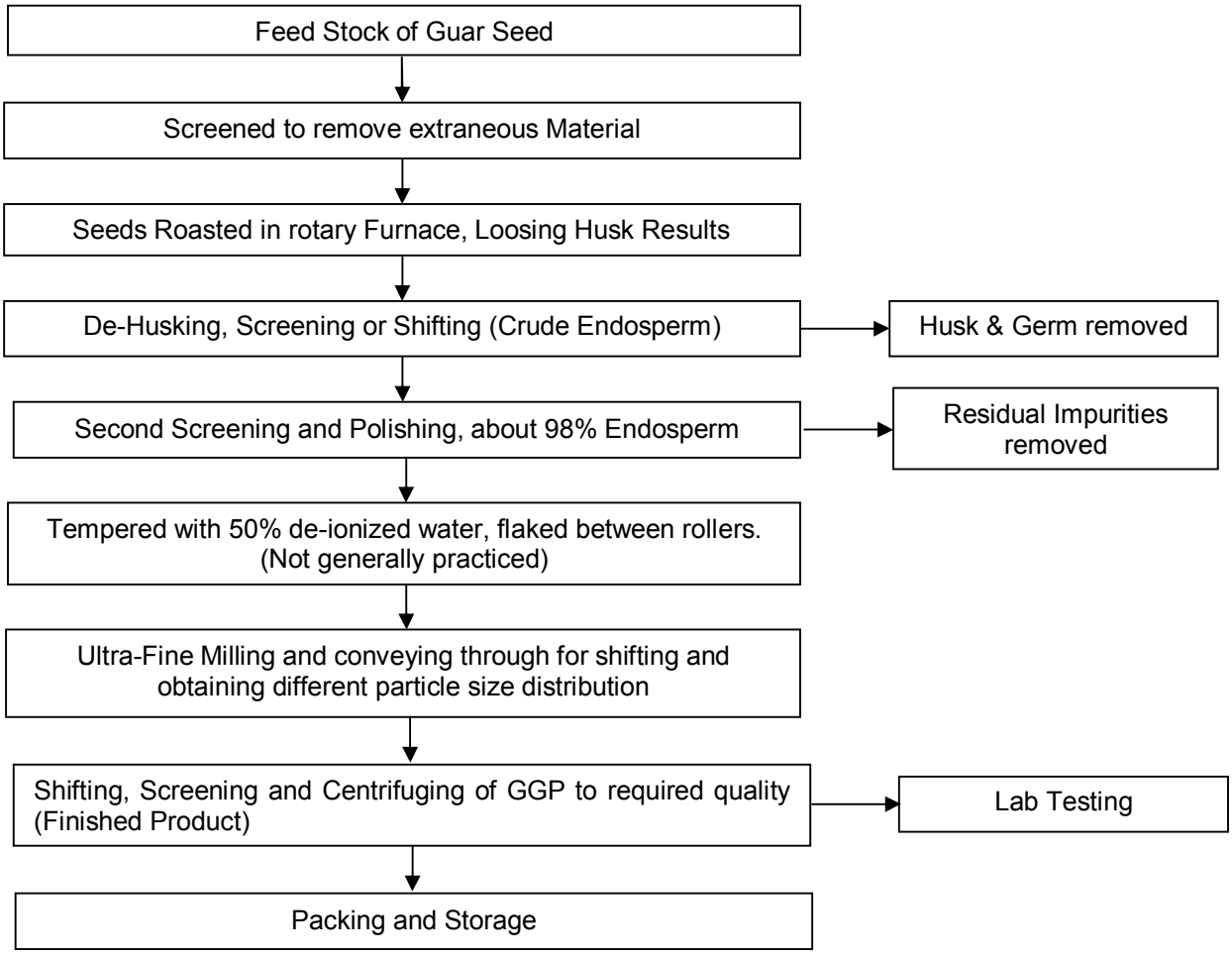
- When the polished endosperm are removed and separated from the fine layer of fibrous material a husk and refined Guar splits are obtained. These refined splits are then pulverized and treated and processed using tailor made technology for specialty grade products for usage in industries specified. After pulverization, sieving is done to get the required mesh size i.e. fine, coarse, etc.

- The Guar gum is mechanically extracted by roasting, differential attrition, sieving and polishing of Guar seeds. The sieved gum is then passed through the blenders to make it homogenous and later it is packed for marketing.

- The gum is refined to make yellowish white powder as per the quality specifications required by consuming industries and grades specified. It is consumed in this form world wide.

- The modern high technology units employ hammer /or Jet mills and other equipment's using the latest techniques to produce powders with higher fineness, finer colloid formation, higher water absorption and consistency, especially as per Pharmaceuticals, Cosmetics and Food processing industries' requirements.

Figure: Process Flow



A-4: MARKET RELATED GUAR GUM SPECIFICATIONS

Table: General Specification

Description	Required
Moisture	14% Max
Ash (Total)	1.5% Max
Acid Insoluble Residue	4% Max
Galctomannan	75% Min
Protein	7% Max
Arsenic	3 ppm Max
Lead	10 ppm Max
Zinc	25 ppm Max
Copper & Zinc	50 ppm Max

A-4.2 Specification regarding the application of Guar Gum

Table: Food Grade

Particle Size	Viscosity Range
200 Mesh	2000-7500
.-200 90% Min	
300 Mesh	3500-5000
.-200 99% Min	

Table: Industrial Grade

Particle Size	Viscosity Range
100 Mesh	3000-6000
-100 80% Min	

A-4.3 Packaging

As per current practices the guar gum powder is packed in paper bags of 25 Kg and the bags then filled in containers that consist of 800 packets.