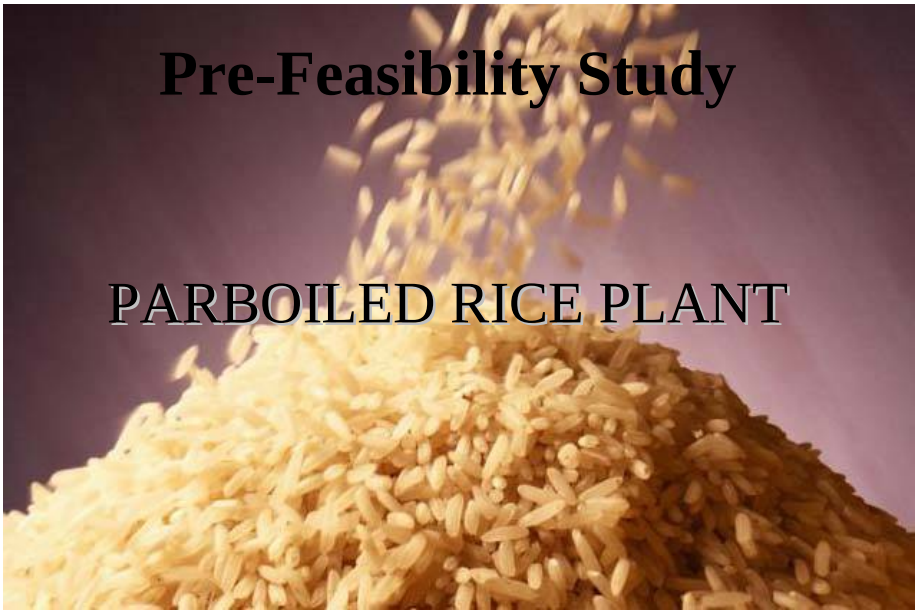

Pre-Feasibility Study

PARBOILED RICE PLANT

Small and Medium Enterprise Development Authority

Government of Pakistan

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May 2005

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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 sectoral 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 sectoral development strategy involved overhauling of the regulatory environment by taking into consideration other important aspects including finance, marketing, technology 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, 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 sectoral 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 help desk services as well as development of project specific documents. These documents consist of information required to make well researched investment decisions. Sectoral research studies, 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.

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, production, marketing, finance, capital budgeting and business management. The document also provides sectoral information, brief on government policies and international scenario, which have some bearing on the project itself.

This particular pre-feasibility is regarding rice parboiling and rice milling which comes under Food sector. Before studying the whole document one must consider following critical aspects, which forms the basis of any investment decision.

3 CRUCIAL FACTORS & STEPS IN DECISION MAKING FOR INVESTMENT IN THE PROJECT

Crucial factors in a plant of this size and purpose would be several;

- To obtain the required stream of raw material to process the targeted amount of rice. The breakeven level of sales is quite high and any shortage in raw material would make the project more risky. Since the product is dependent on environmental conditions the risk of a shortfall in raw rice procurement is there.
- Another critical factor would be the level of export sales. Since these are more profitable, the greater the proportion of the exports, the greater would be the level of profitability of the plant.
- Maintenance and following of international standards and grading of the rice according to the criteria followed in the global markets.
- Making sure that the rice produced is marketed properly internationally and a brand awareness is established about Pakistani par-boiled rice would be beneficial too, since Pakistan is traditionally know for its basmati rice and par-boiled rice has not been a strong sector for Pakistan so far.

4 PROJECT PROFILE

4.1 Opportunity Rationale

Parboiled rice is one of the most popular rice products in Europe, Saudi Arabia, South Africa and other regions of the world. It has become more important not only by the fact of improved nutritional value but also by the improved cooking and processing properties which are desired from the industrial standpoint. Par-boiled rice has shown the following advantages.

- The endosperm structure is changed due to starch gelatinization, so that the grain becomes harder. This increases the yield of whole head rice.

- Depending on the respective process which is being applied, vitamins and minerals from the bran are more or less shifted into the endosperm, so that they will not be removed during whitening the rice.
- Due to the fact that par-boiled rice is harder, it has a higher resistance against insects and has therefore a longer storage life.
- Paddy which has first been exposed to hydrothermal treatment has better cooking properties. The grains are loose and will not stick together after cooking.
- Due to inactivation of the fat splitting enzymes of lipase, par-boiled rice has a longer storage life.
- Longer storage life of rice bran due to partial stabilization of bran.

According to one study, 70% of the total rice demand from Saudi Arabia is that of par-boiled rice. Saudi Arabian market is a big market for Basmati par-boiled rice. South African market is non basmati par-boiled rice market. US market carry par-boiled rice and white rice on the same shelf.

According to one study the rice consumption has been expanding in Europe. The estimated consumption of rice in the European Union is estimated to be 1.5 Tons of white rice. There is an excess production of round and medium grain rice, which are traditional crops and represent 83% of the over all European production. There is also a marked deficit of slender long grain indica rice, generally grown in the tropics, due to high domestic demand. The European Union imports about 600,000 tons of white rice. USA has highest share of rice imports of Europe. USA exports 53%, Thailand exports 15% and India / Pakistan export 14% of the total rice. The estimated demand of other three countries (Austria, Finland and Sweden) which joined EU in 1997 and of Norway is around 140,000 tons of rice. This will further increase the EU deficit of rice and collectively, the import of long grain rice of Europe will increase. Consumption of rice has been increasing and is evident from the following table.

Kg/person/year

Country	1970	1980	1990
United Kingdom	1.4	3.3	3.7
Germany	1.6	2.0	3.4
Ireland	1.0	2.1	1.8
Belgium + Luxemburg	1.6	4.2	3.5
Netherlands	3.0	5.1	5.1
Denmark	1.6	2.1	2.7
France	2.5	3.7	3.2
Italy	3.9	4.6	5.7
Spain	-	6.3	6.3
Portugal	-	15.1	15.1
Greece	-	5.1	5.1

European regions have been showing increasing demand for rice imports. Czech Republic does not produce any rice and the main supplying countries are Viet Nam, Italy,

and Thailand. USA is also competing in this market and trying for bigger share. The total annual rice consumption is between 50,000 and 60,000 metric tons. Rice is a well established food and according to the foreign agriculture service "GAIN Report" the per capita consumption is 4.5 Kg per year. The most popular variety is non par-boiled long grain rice. Bosnia Herzegovina may also offer opportunities for Pakistani rice exporters. There are 3.75 million people in Bosnia Herzegovina and the annual per capita consumption is below 2Kg. Bosnia Herzegovina does not produce any rice. Rice is imported mainly from three countries Italy, Slovenia and China. However, the rice sometimes does not originate from the country of export-Slovenian and Austrian rice are actually processed Italian, Chinese and Pakistani rice. Total share of par-boiled rice in total rice imports of Bosnia Herzegovina is around 7.6% which is second most demanded type of rice.

Saudi Arabian rice imports for the calendar year 2002 were estimated around 824,000 metric ton. Rice demand and consumption is expected to increase mainly because of high population growth rate and increasing number of pilgrims that come to Mecca and Madina for Hajj and Ummra. Demand for Parboiled rice has been increasing from Saudi Arabian market and it has been estimated that the total demand for par-boiled rice is around 75% of the total rice. India is the main exporter of rice to Saudi Arabian market. Pakistan is the third largest exporter of rice for Saudi market.

4.2 Project Brief Description

Rice is consumed as a major food item after wheat. Rice, which is grown on a large irrigated area in Pakistan, is an important Kharif crop. Rice par-boiling is a process that adds more value to the rice. After par-boiling the ordinary milling process is applied to the paddy. Parboiling of rice is a process in which rice paddy is pre-cooked before milling. The usual steps involved are Soaking, Cooking, Drying and Milling. During husking the rice is removed from the husk, while the rice is further refined through different machines, during the polishing process. The objective of this document is to provide information about an investment opportunity for setting up a Par-boiledRice processing unit. In Pakistan, the area under rice cultivation is the third largest after the area under wheat and cotton crops. Total area under rice cultivation was 2.5 million-hectare (6.175 million acres) during the year 1999-2000.

Rice is grown in all four provinces of Pakistan. The rice crop is sown in the months of June/July and harvested in September/October. Rice is a high water-intensive crop. It needs flood irrigation during the entire season. There are different varieties of rice grown in Pakistan, which differ in tastes and aromas. Two main variety of rice, i.e. Basmati and Irri, are most commonly grown in Pakistan. The average yield of rice is 14 maunds (40 kg) per acre for Basmati and 29 maunds (83 kg) per acre for Irri rice. Basmati is considered to be the superior variety of rice.

4.3 Market Entry Timing

While there is no particular time period that would be especially suitable for the start up of the rice parboiling plant, it is advisable to start production with a steady supply or store of rice guaranteed. Agreements and deals with exporters and local dealers should also be established so that there is minimum lapse between the start of production and the selling of the product in the markets.

4.4 Proposed Business Legal Status

An enterprise can be a proprietorship or a partnership and even it can be registered under company law with corporate law authority. Selection totally depends upon the choice of the entrepreneur. This section will provide appropriate business structure (proprietorship/partnership/company) and will give rationale for its selection.

4.5 Project Capacity and Rationale

The proposed project would have the capacity to process 40 tones of rice per day. This means that the proposed annual capacity of the project would be to take in 11,550 tones per annum of raw materials. The output from this would be estimated to be 8,924 tonnes.

4.6 Total Project Investment

Financial Summary				
Project Cost	**IRR**	**NPV**	**Payback Period**	**Cost of Capital (WACC)**
61,048,692	56%	49,221,527	2.38 years	17%

4.7 Proposed Product Mix

This will include the proposed products, which will be produced by the project.

4.8 Recommended Project Parameters

Capacity	Human Resource	Technology/Machinery	Location
Installed Husking Capacity (tons)	No. of employees	Local/Foreign	Suitable Locations
25,200	70	Both	Sind Rice Belt (Larkana, Dadu etc)

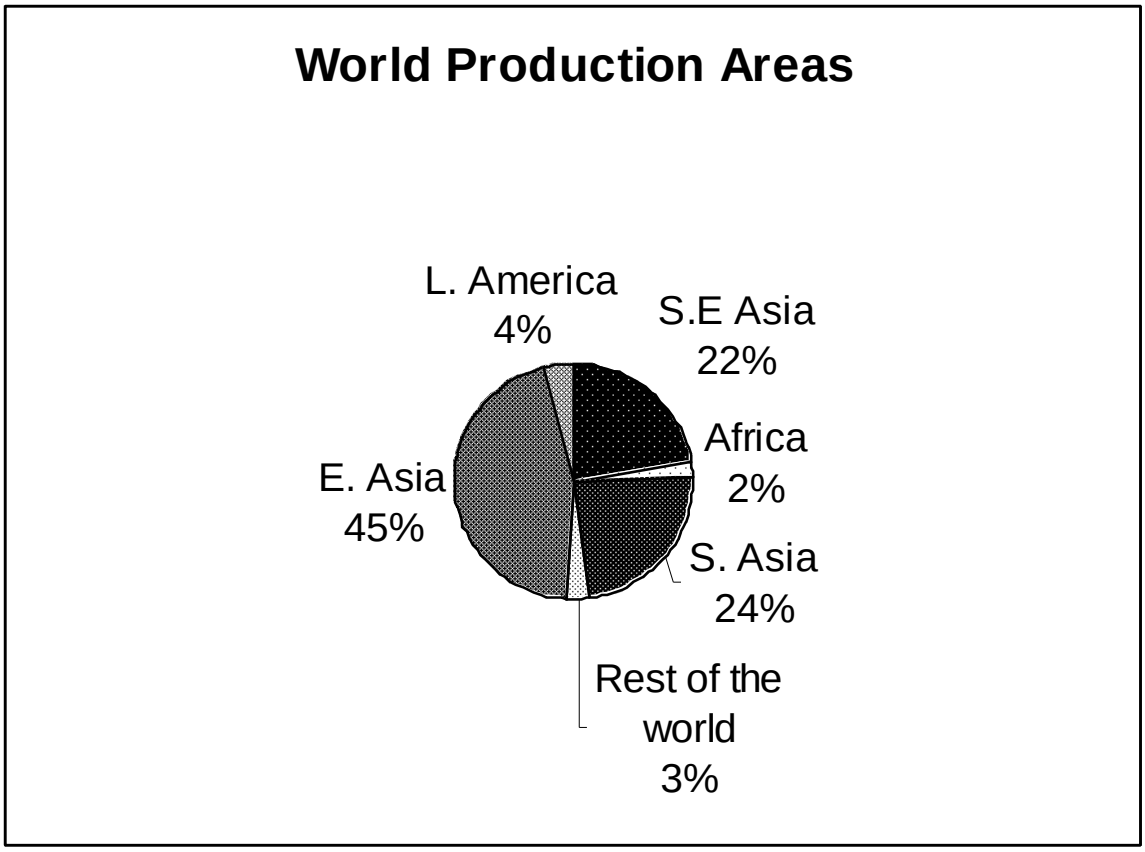
4.9 Proposed Location

The most feasible location for the plant would be in or near the rice producing regions of Sind. This is advisable as transportation costs would be reduced and contact with growers/farmers directly can be made. It is usually the case that the farmers are willing to approach the manufacturing plant directly if it is located near to their lands.
However, the availability of trained personnel in the locality has to be kept in mind as well as the availability of suitable residences because costs could rise if there was a problem in the accessibility of the location from other urban areas.

5 SECTOR & INDUSTRY ANALYSIS

5.1 World Rice Production Areas

Asian farmers are producing about 91 % of the total world rice production, with two countries, China (including Taiwan) and India. These two countries are producing about 55% of the total crop.



5.2 Rice & its Varieties

Rice (Oryza Sativa L.) is a short-lived plant related to the grass family, with a life cycle of 3-7 months. The span of one cycle varies, depending on its type and the growing environment. Rice growing requires an extensive irrigation system and properly leveled fields. A uniformly leveled field enables each rice kernel to absorb the same amount of moisture from the field. This uniform moisture level will maintain a consistency in the rice quality. If the moisture level runs too high, the rice may spoil faster.

In general, the rice family could be broken down into three main categories:

1. Indica (long grain) - grown in the warm climate region, such as Thailand, India, Pakistan, Brazil, and Southern USA

2. Japonica (round grain) - grown in the cold weather area, such as Japan, Korea, Northern China and California.

3. Javanica (medium grain) - only grown in Indonesia

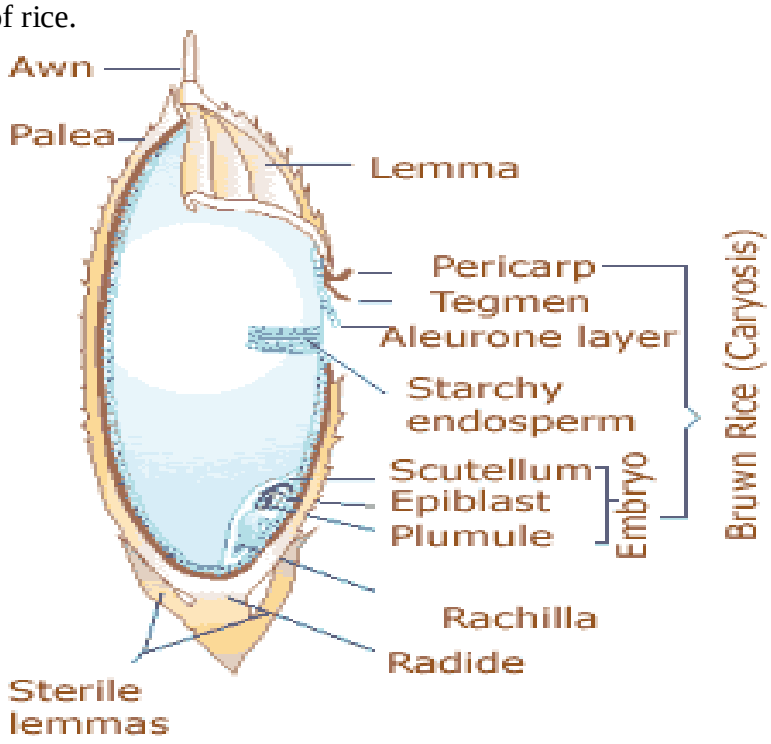
5.3 Rice Grain

A kernel of rice consists of several layers. In the figure below is an example of a rice grain called true fruit or brown rice (Caryosis). In general, each rice kernel is composed of the following layers.

- Rice shell or Husk: encloses the brown rice, consists mainly of embryo and endosperm.

- Bran layer: a very thin layer of differentiated tissues. This layer contains fiber, vitamin B, protein and fat. The most nutritious part of rice resides in this layer.

- Embryo: the innermost part of rice consisting mainly of starch called amylose and amylopactin. The mixture of these two starches determines the cooking texture of rice.



5.4 Types of Rice

5.4.1 White Rice

White rice belongs to the Indica (long grain) category. It is also known as polished rice or fully milled rice because most of the outer layers- the husk and the bran layer are removed from the kernel, through the milling process.

5.4.2 Jasmine Rice

Jasmine rice, also called fragrant rice or “Hom Mali” rice, is recognized world wide as Thailand’s specialty. Thai Jasmine rice belongs to the Indica (long-grain) category and could be divided into 4 sub categories: Kao Dok Mali, Go Kho 15, Klongluang, and Suphan. The grains of Jasmine rice appear silky, smooth, and shiny. When cooked, Jasmine rice produces an elegant aroma.

5.4.3 Brown Rice

Similar to White rice, Brown rice belongs to the Indica (long-grain) category. The only difference between these two varieties is the milling; milling removes both the husk and the bran layer of the kernal. Through the milling process, Brown rice becomes White rice. As a result, in Brown rice, only the husk is removed while the bran layer remains. Because of the brand layer, Brown rice contains more nutrients than White rice. In particular, Brown rice is very high in fiber and vitamin B.

5.4.4 Glutinous Rice

Glutinous rice, also called sticky rice or sweet rice, consists of amylose and amylopectin starch. With a chalky white texture, glutinous rice is often used in producing starch and flour.

5.4.5 Broken Rice

During the milling process, broken rice is separated from the White rice, whose shape remains intact. In other words, broken rice is the damaged White rice and is normally used in animal feeding or other food & beverage processing, such as beer brewing and flour processing. A grain of broken rice gives a low fiber texture and low nutrient level, while retaining its high energy content.

5.4.6 Short Grained Rice

Short-Grained rice belongs to the Japonica (Short Grained) category and has a short, round, and plumpy kernel. When cooked, short-Grained rice stick together, although not as much as glutinous rice.

5.4.7 Paddy

Paddy is the most original form of a rice kernel. After the harvest, rice is separated from the ear into individual grains. After drying, the end result is the Paddy, whose kernel is still inside the hull. After the milling process, the out hull is removed, along with the bran layer. And the end product becomes White rice.

5.4.8 Black Rice

Black rice could be either medium or long grain. Precooked black rice has white kernels inside the black bran. Once cooked, the rice becomes deep dark purple with a nutty flavor and a whole grain texture. Black rice gives a particularly cohesive characteristic and is made into various stir fry, stuffing, casseroles, and side dishes.

5.4.9 Red Rice

Red Rice has a shorter and wider seed than long-grain rice. A typical red rice plant has an unusually hard grain, which retains its shape after an hour of cooking. Red rice has a distinctive chewy texture and a nutty flavor. Cooking intensifies its red color.

6 SECTOR CHARACTERISTICS

6.1 International Rice Market

One of the major agriculture based businesses; the rice market is currently 20 million tones, which amounts to $6 Billion annually. The largest exporter of rice is Thailand, while Vietnam, USA, India and Pakistan follow in the same order. These countries exchange places at times when the production of one country is affected due to environmental or other reasons.

6.1.1 Demand Analysis.

The world rice consumption has increased for the last three years. This upward trend was predicted to continue in 2001/02, when the world demand was expected to touch 405.856 million metric tons of rice. This increase is significant, comparing to a mere 388.792 million metric tons in 1998/99. China, the world's most populous country, consumes the most rice. In general, rice consumption has increased in every country from year to year. In conjunction with the world's rising consumption level, the world's rice production will also expand in order to meet this higher demand.

6.1.2 Consumption Pattern of Rice

World rice consumption in 1999/2000 - 2002/2003 (milled basis)

Units in thousand metric tons

Country	1999/2000	2000/2001	2001/2002	2002/2003
China	133,763	134,356	134,595	134,800
India	82,670	75,851	82,251	84,000
Indonesia	35,400	35,877	36,358	36,790
Bangladesh	23,766	25,790	26,250	26,250
Vietnam	16,771	17,275	17,400	17,700
Thailand	9,300	9,400	9,500	9,600
Burma	9,330	9,350	9,400	9,475
Philippines	8,400	8,750	8,900	9,105
Japan	9,450	9,000	9,000	9,000
Brazil	7,956	7,956	7,958	8,000
Korea, South	4,986	5,000	5,100	5,100
United States	3,846	3,676	3,889	3,969
Egypt	2,856	3,015	3,150	3,275
Iran	3,019	3,050	3,075	3,100
EU	2,190	2,207	2,215	2,190
Korea, North	2,000	1,837	1,500	1,950
Taiwan	1,315	1,265	1,150	1,150
South Africa	531	525	550	600
Others	40,788	42,168	41,696	42,607
WORLD TOTAL	**398,337**	**396,348**	**403,937**	**408,661**

The above table reveals that during the last four years the rice consumption has been increasing and this increase will result into more production.

6.1.3 Supply Analysis

The share of par-boiled rice in the global sales of rice is 60% and this share is growing on an annual basis. Middle East and European countries are the major consumers of par-boiled rice and their proportion of par-boiled rice is growing. Pakistan has surplus white rice available for export which is becoming redundant due to the decreasing demand of white rice and increasing demand of par-boiled rice.

6.1.4 Rice Production and Composition of Production

With the greatest populations to feed, China and India remain the world's top two rice producers in 2002/2003. However, production of Indian rice in 2002/2003 was forecast at 80 million tons, down from approximately 90 million tons in the previous year, on account of poor monsoon rains during the middle of 2002, when developing crops rely heavily on rainfall. The subsequent drought condition was reported to be the worst over the past decade.
Thailand ranks sixth in the world in terms of rice production volume in 2002/2003, trailing behind China, India, Indonesia, Bangladesh, and Vietnam.

World rice production in 1999/2000 - 2002/2003 (milled basis)

Unit: thousand metric tons

Country	1999/2000	2000/01	2001/02	2002/03
China	138,936	131,536	124,320	123,200
India	89,700	84,871	91,600	80,000
Indonesia	33,445	32,548	32,422	32,500
Bangladesh	23,066	25,086	25,500	26,000
Vietnam	20,926	20,473	20,670	20,500
Thailand	16,500	16,901	16,500	16,500
Burma	9,860	10,771	10,440	10,440
Philippines	7,772	8,135	8,450	8,300
Japan	8,350	8,636	8,242	8,200
Brazil	7,768	7,062	7,480	7,600
United States	6,502	5,941	6,764	6,457
Korea, South	5,263	5,291	5,515	5,300
Egypt	3,787	3,965	3,575	3,800
Pakistan	5,156	4,700	3,740	3,500
EU	1,751	1,567	1,620	1,792
Taiwan	1,349	1,342	1,245	1,197
Australia	787	1,259	930	965
Others	28,282	27,270	27,575	28,156
WORLD TOTAL	**409,200**	**397,354**	**396,588**	**384,407**

Source: USDA, Foreign Agricultural Services (FAS), Aug 20021
Source: http://www.foodmarketexchange.com

After a record 409.2 million metric tons in 1999/2000, world rice production has shown a general decline in production year-on-year, with 397.35, 396.59 and 384.4 million metric tons in 2000/01, 2001/02 and 2002/03, respectively. Rice output in 2002/03 was expected to fall by 3 percent from 2001/02, with lower output in major producing nations like India, Pakistan, Vietnam and the US, as well in other nations including the Philippines, South Korea, Japan and Taiwan.

6.2 World Price for Rice

Historical Price Trends of Rice

Average (C&F) Price of Rice US $ PMT

Year	Basmati Rice	American Rice	Thai Rice	Australian Rice
1986	722	455	223	352
1987	688	416	215	329
1988	736	519	287	472
1989	710	510	377	477

1990	675	519	319	474
1991	662	521	360	457
1992	725	555	346	484
1993	582	511	338	497
1994	546	565	365	514
1995	572	509	368	526
1996	503	536	436	571
1997	629	538	438	556
1998	674	617	393	520
1999	641	556	355	527
2000	529	569	363	551

Global Rice Price Trends and projections (1996-2003)

Units: USD/metric ton

Type	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Long Grain Rice, High Quality										
Thai 100% B (FOB)	338	306	296	300	300	309	310	317	319	323
Thai 5% (FOB)	331	295	285	289	289	297	299	305	307	311
US No. 2, (FOB Houston)	450	418	413	409	414	424	428	435	438	443
US No. 2 - Thai 5%	119	123	128	121	125	127	129	129	131	132
Long Grain Rice, Low Quality										
Thai 35% (FOB)	259	254	244	248	253	260	261	267	270	275
US Wheat No.2 (FOB Gulf)	184	155	150	151	157	159	160	162	164	166
Thai 35% - US Wheat	75	99	95	97	96	101	101	105	106	106
Medium Grain Rice										
US No. 2 MG Rice(FOB CA)	415	396	409	406	407	411	412	415	417	420

Source: Division of Agriculture, University of Arkansas, Aug 1998

The global rice price for major long and medium grain rice is currently lower than in previous years. This drop in the global price is due to a slight decrease in rice production in major rice producing countries, beginning in 1998. According to the USDA, nominal price quotes for milled rice have declined over the past twelve months. Price for Thailand's 100% grade B are 25 % below that of a year earlier. Similarly price for Vietnam's 5 % broken and Pakistan's 15/20 % are also lower. Prices are currently reported below US $ 190 per metric ton for both of these grades. Overall rice prices are still more than 20% below levels reported a year ago.

However, the reports state an upward price trend beginning from 2000. These reports predicts that the trend will continue to increase until the year 2005.

An overview of the Global Rice Prices

Thailand	USD/ton (FOB)	USA	USD/ton (FOB)	Pakistan	USD/ton	India	USD/ton	Vietnam	USD/ton
FWR 100% A	520	Long (AR)	236.2-275.6	IRRI-6 10%	200	PR 106 5%	196	5%	183
WR 100% B	197	Medium (AR)	275.6-374	IRRI-6 15%	196	PR 106 5% PB	195	10%	178
5%	191	Medium (CA)	315-472.4	IRRI-6 25%	189	PR 106 25%	175	15%	171
25%	174	Short (CA)	403.54-472.4	IRRI-6 5%	210	Basmati	850	25%	163

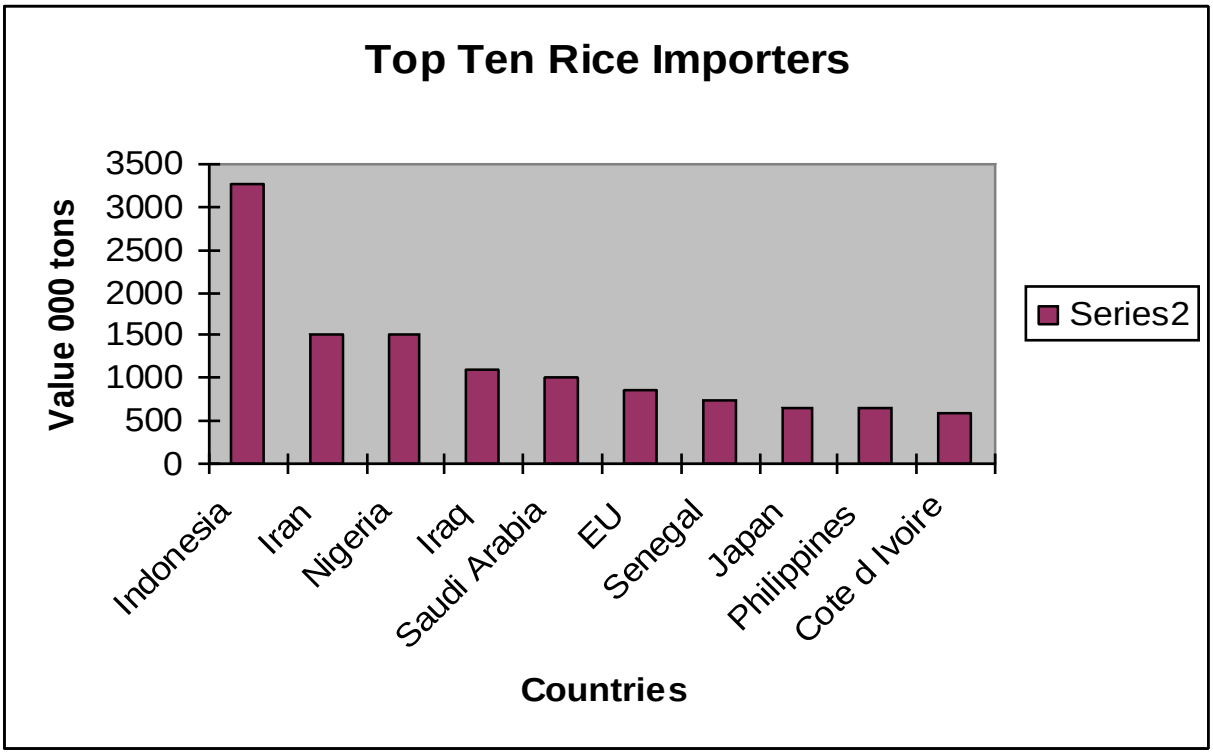
*** All prices are FOB*

6.2.1 Top Ten Importing & Exporting Countries of Rice

Top Ten Importing Countries

Unit: Thousand Metric Tons

Countries	1999	2000	2001	2002 August	2003 August
Indonesia	3729	1500	1500	3250	3250
Iran	1313	1100	735	1250	1500
Nigeria	950	1250	1738	1500	1500
Iraq	779	1274	959	1000	1100
Saudi Arabia	750	992	1053	900	1000
EU	784	852	800	800	850
Senegal	700	502	863	900	750
Japan	633	656	680	650	650
Philippines	1000	900	1175	1200	650
Cote d' Ivoire	600	450	654	575	600



Import

Indonesia is likely to remain the world's number one rice importer in 2003, with approximately 3.25 million tons, unchanged from this year's estimate. The country needs to import this much because its rice production is considerably limited by El Nino-induced drought. Trailing behind are Iran and Nigeria, with 1.5 million tons each next year. Iran's projected imports next year will top those in the past few years, when figures mostly exceeded one million tons each year, while import growth in Nigeria has been steady at over one million tons each year as well.

Other prominent importers in 2003 will include Iraq (1.1 million tons), Saudi Arabia (1 million tons), the EU (0.85 million tons), Senegal (0.75 million tons) and the Philippines and Japan (0.65 million tons each). On the whole, rice imports in these countries will remain steady next year, either equal to 2002 figures or surpassing them. This robust import demand could be attributed to rising consumption worldwide, especially in the face of El Nino-induced drought affecting rice production in some countries, particularly Indonesia.

World rice import trends (1999-2003)

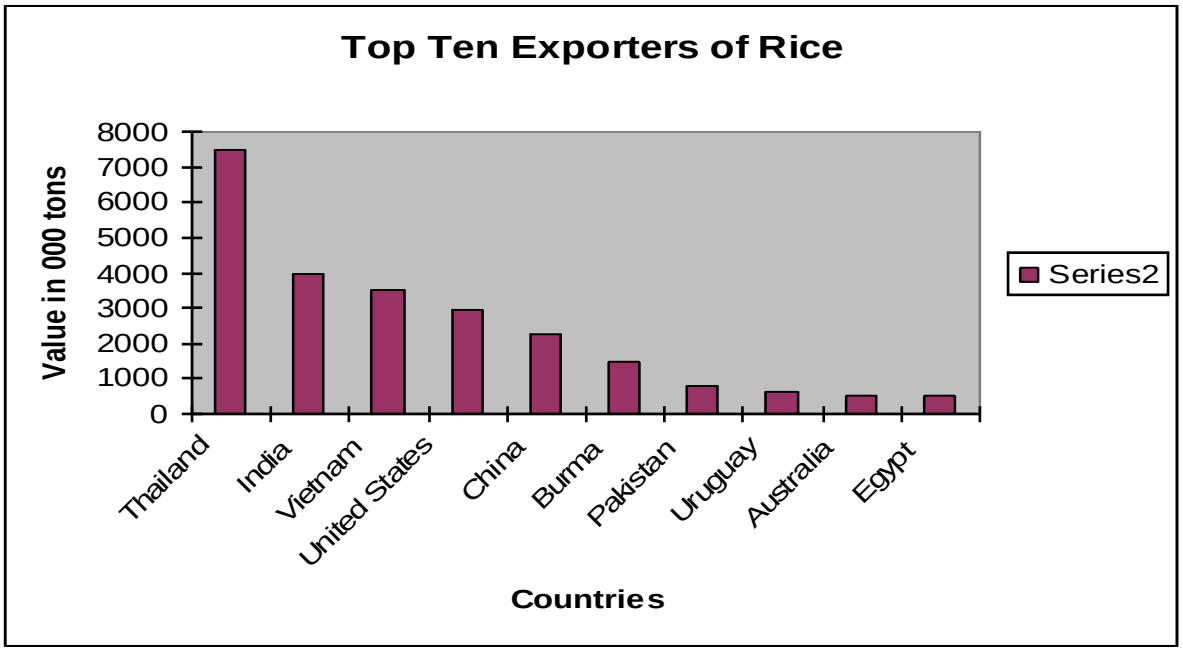
Unit: Thousand Metric Ton

Country	1999	2000	2001	2002 (August 12)	2003 (August 12)
Indonesia	3,729	1,500	1,500	3,250	3,250
Iran	1,313	1,100	735	1,250	1,500
Nigeria	950	1,250	1,738	1,500	1,500

Iraq	779	1,274	959	1,000	1,100
Saudi Arabia	750	992	1,053	900	1,000
EU	784	852	800	800	850
Senegal	700	502	863	900	750
Japan	633	656	680	650	650
Philippines	1,000	900	1,175	1,200	650
Cote d'Ivoire	600	450	654	575	600
Malaysia	617	596	633	600	600
South Africa	514	523	572	550	550
Bangladesh	1,220	638	402	300	500
Mexico	342	415	388	500	500
Cuba	431	415	481	455	475
Korea, North	159	400	537	150	450
United States	358	308	413	420	430
Brazil	781	700	673	600	400
China	178	278	267	200	400
Eastern Europe	361	343	381	357	358
Russia	580	400	247	275	350
Singapore	421	354	444	325	325
Turkey	321	309	231	250	325
Guinea	300	275	325	275	300
Canada	248	250	262	265	270
Haiti	235	245	250	260	265
Yemen	217	210	202	200	250
Ghana	125	186	211	210	225
Syria	200	150	172	180	180
Uzbekistan	40	30	142	175	175
Korea, South	137	151	99	150	150
Taiwan	5	3	23	125	130
Colombia	38	60	163	75	100
Nicaragua	88	60	117	100	100
Sri Lanka	205	18	35	80	100
Honduras	75	80	96	75	80
UAE	75	75	75	80	80
El Salvador	28	30	76	75	75
Jamaica & Dep	71	75	75	75	75
Costa Rica	56	48	41	65	70
Peru	116	86	62	55	60
O.W. Europe	50	50	55	50	50
Other Countries	3,458	3,841	4,175	4,245	4,130
Unaccounted	1,653	1,768	1,971	1,127	1,186
WORLD TOTAL	**24,941**	**22,846**	**24,453**	**24,949**	**25,564**

Unit: thousand metric tons

Source: USDA, Foreign Agricultural Service (FAS), August 12, 2002



Export

Total world rice exports in 2003 have recently been projected at 25,564,000 metric tons, higher than the 24,949,000 tons estimated for 2002, according to the USDA. Thailand will maintain its top position, with 7.5 millions tons estimated to be shipped in 2002 and 2003, unchanged from 2001. India and Vietnam will continue to trade places in 2003, as the former is expected to become the world's second biggest rice exporter with 4 million tons, followed by Vietnam with 3.5 million tons. Traditionally, Vietnam has exported more rice than India, but Vietnam is very likely to lose its position to India this year. India has huge stockpiles, which keep prices very competitive, whereas low production in Vietnam pushes prices up. In fourth place comes the US, which will export 2.95 million tons next year. US rice exports have been steadily growing since 1999, thanks to increasing crops and more competitive prices. China will be fifth, with 2.25 million tons projected for export.

Burma (1.5 million tons) is expected to outdo Pakistan (0.8 million tons) in exporting rice. As a matter of fact, the latter had exported more rice than Burma until 2001, but will likely lose its place this year on account of poor production triggered by irrigation water shortages. Pakistan's 2002 exports are projected at 1.25 million tons, against 1.5 million tons from Burma.

Trends in world rice exports (1999-2003)

Unit: Thousand Metric Ton

Country	1999	2000	2001	2002 (Aug 12)	2003 (Aug 12)
Thailand	6,679	6,549	7,521	7,500	7,500
India	2,752	1,449	1,936	4,500	4,000
Vietnam	4,555	3,370	3,528	2,800	3,500

United States	2,644	2,847	2,541	2,950	2,950
China	2,708	2,951	1,847	1,500	2,250
Burma	57	159	670	1,500	1,500
Pakistan	1,838	2,026	2,417	1,250	800
Uruguay	681	642	806	650	650
Australia	667	617	618	400	500
Egypt	320	500	705	500	500
EU	348	308	275	275	325
Argentina	674	332	363	350	300
Guyana	252	167	175	150	175
Others	766	929	1,051	624	614
World Total	**24, 941**	**22, 846**	**24, 453**	**24, 949**	**25, 564**

Units Thousand Metric Tons

Source: USDA, Foreign Agricultural Service (FAS), August 12, 2002

6.3 Pakistan Market

6.3.1 Basmati Rice from Pakistan

The finest rice is from Pakistan whatever the brand name. Pakistan is the producer of the world's finest long grained aromatic basmati rice. Basmati, the king of rice, is held in the highest regard world over. Among all the other varieties of rice, none have the distinctive long grains or the subtle aroma for which this grain is considered so special. This also justifies the premium this rice commands against all other rice of the world. It takes birth in the most fertile valleys and plains of Pakistan. It is harvested by hand with delicate care, aged to perfection and then processed. The result is an extra long, pearly white, delicate grain with an irresistible aroma and delectable taste bringing alive an age of nawabs and emperors, glittering courts and legendary chefs. The name basmati originated from a Sanskrit word "BASH", which means smell. This rice has special features, which make it's naturally long grain fragrant and delicious in taste. The legend says that this rice was meant to be consumed by maharajas (kings), maharanis (queens), princes and royal families. This unique rice is just one crop a year grown only in northern India and Pakistan, the region known as old Punjab - the land of five rivers originating from Himalayas.

6.3.2 Types and Forms of Rice

6.3.2.1 Super Kernel

Super Kernel is a long grain rice with a slender kernel, four to five times longer that it's width. The grains are separate, light and fluffy when cooked, and mostly used for recipes such as biryani, which require rice of a distinct shape and texture.

6.3.2.2 Basmati Rice 385

Basmati Rice 385 is dry and separate when cooked, resulting in long, thin grains, since the long grain increases only in length when cooked.

6.3.2.3 Brown Rice

Brown Rice is the least processed form of rice, as the kernels of rice have had only the hull removed. The light brown color of brown rice is caused by the presence of bran layers which are rich in minerals and vitamins, especially the B-complex group. With a natural aroma and flavor similar to that of roasted nuts or popcorn, it is chewier than white rice, and slightly more nutritious, but takes longer to cook. Brown rice may be eaten as is or milled into regular-milled white rice.

6.3.2.4 Par-boiled Rice

Par-boiled is rough rice that has gone through a steam-pressure process before milling. It is soaked, steamed, dried, and then milled to remove the outer hull. This procedure gelatinizes the starch in the grain, and is adopted at the mill in order to harden the grain, resulting in less breakage, thus ensuring a firmer, more separate grain. Parboiled rice is favored by consumers and chefs who desire extra fluffy and separate cooked rice.

6.3.3 Production of Rice (Supply Side Analysis)

Pakistan's second major crop is rice. The following table shows that the rice production has been on a rise from year 1988 to 1997 with production declines in year 1992 and 1994.

Historical Rice Production Statistics

Year	Production ('000 Metric Tons)	Milled Production ('000 Metric Tons)
1988	4,800	3,200
1989	4,830	3,220
1990	4,898	3,265
1991	4,865	3,243
1992	4,674	3,116
1993	5,993	3,995
1994	5,171	3,447
1995	5,951	3,967
1996	6,461	4,307
1997	6,500	4,333

Source: http://www.usda.gov

Year wise Rice Production Comparison

Thousand Tons

Year	1998-99	1999-00	2000-01	2001-02	2002-03
Rice	4674	5156	4803	3882	4478

Source: Federal Bureau of Statistics

Different verities of rice are produced in all four provinces of the country. Major varieties are IRRI and BASMATI. The variety wise production of rice in the following ten year period is as

Variety wise Rice Production

Year	Basmati	Irri	Others	Total (000 tons)
1992-93	1,124	1,798	194	3,116
1993-94	1,267	2,524	204	3,995
1994-95	1,352	1,927	168	3,447
1995-96	1,488	2,284	195	3,967
1996-97	1,538	2,494	273	4,305
1997-98	1,439	2,468	426	4,333
1998-99	1,552	2,662	460	4,674
1999-00	1,713	2,936	507	5,156
2000-01	1,596	2,735	522	4,803
2001-02	1,416	2,173	185	3,774

The maximum production was recorded during the year of 1999-00. During this year production of rice was 5,156,000 Tons. Variety wise Punjab province is prominent in Basmati rice and Sindh province in Irri. The share of these two varieties in overall production is estimated to be more than 95%.

6.3.4 Local Consumption pattern

The per capita local consumption may be calculated by local consumption. Ministry of Agriculture has calculated the per capita consumption of rice, which is as following.

Year	Population (000 Nos)	Production (000 Tons)	Local Consumption (000 tons)	Surplus for Export (000 tons)	Per capita consumption (Kg)
1991-92	117,320	3,243	1,407	1,834	11.99
1992-93	120,465	3,116	1,772	1,344	14.70
1993-94	124,465	3,994	2,000	1,315	16.06
1994-95	128,199	3,446	2,064	1,464	16.09
1995-96	132,045	3,966	2,130	1,623	16.13
1996-97	136,006	4,304	2,199	1,795	16.16
1997-98	140,087	4,333	2,269	1,980	16.19
1998-99	143,726	4,673	2,340	2,071	16.28

1999-00	147,466	5,155	2,413	2,165	16.36
2000-01	151,300	4,802	2,488	2,264	16.44
Average		**4103**	**2108**	**1785**	**15.64**
Growth	**2.6 %**	**4.0 %**	**5.87 %**	**2.11 %**	

Source: Ministry of Agriculture

The production for the period 1991-92 to 2000-01 has shown 4.0 % growth, local consumption has shown 5.87 % and surplus for export has shown a growth of 2.11%.

6.3.5 Price Pattern

Local prices of finished and raw rice are as following

Table 6-1 Wholesale prices of different varieties from January 2001 to January 2002

Rice Variety	Market	Unit (Kg)	Prices (Rs. 40 Kg)		
			Jan-2001	**Dec-2001**	**Jan-2002**
Rice Irri Sindh av. Quality	Quetta	40	390	440	440
Rice Irri Sindh av. Quality	Sukkur	40	310	350	320
Rice Irri Sindh av. Quality	Larkana	40	400	300	330
Rice Irri Sindh broken av. Quality	Karachi	40	380	310	322.50
Rice Irri Sindh broken av. Quality	Hyderabad	40	282.50	300	329.00
Rice Irri Sindh broken av. Quality	Sukkur	40	305	320	320
Rice Irri Sindh broken av. Quality	Larkana	40	300	280	280

Table 6-2 Prices of Different Varieties of Rice Paddy-2002

Variety	Unit	Rs.
Irri-6	40 Kg	210
Irri-9	40 Kg	240
Basmati-385	40 Kg	370
Basmati-Super	40 Kg	380

The above table gives the prices of different varieties of raw rice (paddy) for year 2002. The price of Irri-6 was recorded lowest and the price of Basmati Super was recorded highest. The Ex-Factory prices of different varieties of (Parboiled) Reprocess Rice are given as under.

Product Mix	Varieties /Price per 40 Kg bag (Rs.)			
	Irri-6	**Irri-9**	**Basmati-385**	**Basmati-Super**
Rice Broken Small	325	365	425	465
Rice Broken Large	300	340	400	440
Bran	180	180	180	180
Nikko	280	280	280	280
Choba	210	210	210	210
Dust	150	150	150	150
Husk	40	40	40	40

The table indicates that the highest Ex-factory price for processed rice is that for Basmati Super and the lowest is that for Irr-6. The prices of other by products is also given in the above table.

Rice Exports from Pakistan

Pakistan is a major rice exporter and rice is one of the top ten commodities being exported from Pakistan to more than 70 destinations. Pakistani rice is broadly classified into Irri and Basmati. Quantity wise bulk quantities go under Irri Varieties, but value wise Basmati has the major share. Pakistan has been exporting rice of all varieties i.e. Basmati, Irri and others. The share of Basmati and others is estimated in terms of quantity at 30:70.

Table 6-3 Yearly comparison of Exports of Basmati and other Varieties

(US $million)

Year	Basmati		Other Varieties		Total	
	Qty. (mil. Tons)	Value	Qty. (mil. Tons)	Value	Qty. (mil. Tons)	Value
1990-91	446	218	738	128	1,205	346
1991-92	558	230	954	185	1,512	416
1992-93	462	199	570	118	1,032	317
1993-94	306	126	679	116	984	242
1994-95	452	184	1,400	271	1,852	454
1995-96	716	295	884	209	1,601	504
1996-97	457	205	1,310	264	1,767	469
1997-98	552	253	1,539	309	2,091	562
1998-99	559	283	1,200	250	1,789	534
1999-00	570	290	1,346	249	1,916	540

Source: FBS

Table 6-4 Historical Rice Export Comparison

Year	Quantity (M.T)	Value 000 Dollars	A. U. Price per M.T	% share in total exports	% change in Value

1987-88	1,210,199	363,105	300.04	8.2	21.2
1988-89	854,320	303,391	355.36,	6.5	(16.4)
1989-90	743,889	231,211	321.57	4.8	(21.2)
1990-91	1,204,575	346,222	287.42	5.6	44.7
1991-92	1,511,844	415,680	274.95	6	20.1
1992-93	1,032,132	317,110	307.24	4.7	23.7
1993-94	984,325	242,167	246.02	3.6	23.6
1994-95	1,852,267	454,244	245.24	5.6	87.6
1995-96	1,600,524	503,957	314.87	5.8	10.9
1996-97	1,767,206	468,563	265.14	5.6	(7.0)
1997-98	2,091,243	562,424	268.94	6.5	20.0
1998-99	1,788,774	533,573	298.29	6.9	(5.1)
1999-00	1,916,054	539,670	281.66	6.3	1.1
2000-01	2,456,023	525,548	213.98	5.7	(2.6)

Source : EPB

Table 6-5 Top Ten Exporting Partners with Pakistan from 1997-98 to 2000-01

Quantity in M.T.
Value in '000' Dollars

Countries	1997-98 July June		1998-99 July June		1999-00 July June		2000-01 July June	
	Quantity	**Value**	**Quantity**	**Value**	**Quantity**	**Value**	**Quantity**	**Value**
Dubai	185,128	77,850	255,925	106,016	258,302	105,475	267,313	99,458
African Countries N	287,933	50,092	322,435	65,536	361,709	65,093	482,471	71,456
Afghanistan	38,413	4,821	50,798	7,932	193,203	29,524	297,129	42,279
Saudi Arabia	60,119	28,906	85,141	39,972	91,315	39,530	80,045	30,358
Oman	84,200	34,087	63,262	28,171	75,229	33,474	49,376	20,313
Qatar	26,628	12,220	27,234	12,161	58,876	25,288	43,935	16,512
Ivory Cost	4,200	858	6,030	1,348	10,000	1,730	105,629	14,911
U.K	18,818	13,503	30,627	20,000	30,474	18,200	31,677	14,776
Kenya	288,799	64,040	81908	20,270	15,126	2,978	76,282	13,248
Kuwait	20,958	9,399	36,063	15,134	30,465	14,704	29,469	12,930

Source : EPB

Table 6-6 Total Exports of Rice from 1996-97 to 2000-2001

Year	Quantity	Value
1996-97	**1,767,206**	**468,563**
1997-98	2,091,243	562,424
1998-99	1,788,774	533,573

1999-2000	1,916,054	539,670
2000-2001	2,456,023	525,548

Source: EPB

6.4 Legal Issues Regarding Industry

The Pakistan's new investment policy has long been characterized by steady moves to liberalization, deregulation, and privatization. All industries are open to investment without government permission except for the following four specified industries.

- Arms & Ammunitions
- High Explosives
- Radio Active Substances
- Security Printing, currency or Mint

Rice par boiling comes under Category C & D which is priority industries and agro based industries. Custom duty leviable on import of plant, machinery and equipment (which is not manufactured locally) for industries falling under category "C" and "D" is 10%.

Pakistan has been considering various measures to encourage exporters to invest more in production of par-boiled rice for its subsequent exports to Saudi Arabia and different other countries where there is considerable demand for par-boiled rice. Saudi Arabia imports a total of approximately 600,000 tons of rice per annum. Consortium based approach came into focus for the export of par-boiled rice to Saudi Arabia when chairman EPB visited Saudi Arabia in late 2003. According to this approach, the importers would guarantee a quantity of 20,000 to 50,000 tons per annum and would import par-boiled rice from the consortium of five to ten exporters, to be put together by the EPB. The exporters would guarantee quality and price for a year or a period of time mutually agreed between the importer and the consortium, irrespective of any local price fluctuations.

7 PROCESSING PLAN

7.1 Par Boiling

Par-boiling is the hydrothermal treatment of paddy before milling. The three steps of parboiling are:

1. Vacuum
2. Soaking (sometimes called steeping) paddy in water to increase its moisture content to about 30%.
3. Heat-treating wet paddy, usually by steaming, to complete the physical-chemical changes.
4. Drying paddy to a safe moisture level for milling.

7.1.1 Vacuum

Vacuum is used in some machines for soaking and drying. The benefits are

- Reduced heat and electricity consumption.
- Making recycled-husk as the only fuel employed in the par boiling system, with no other needs of fuel.
- Even moistening of all rice verities.
- Reduced soaking and drying time (keeping rice warm and wet for too long destroys its good smell and taste due to fermentation.

7.1.2 Soaking

Before soaking, the paddy is de-aerated. Soaking in some cases is done at 6 Kg/ cm2. For this hot water is pumped in the soaking pressure vessel and cushion of compressed air at 6 Kg/cm2 is maintained, at the top of the vessel, by means of an air compressor.

Hot water is generated in a special heater in which heat is provided to the cool water by (a) the hot steam condensate returning back to the boiler's hot well and (b) the direct injection of the steam. The soaking dwell time (for water uptake) and temperature of hot water differs from variety to variety. The higher the soaking temperature, the lesser the time required for saturated uptake of the grain. However, higher temperature and soaking time have their own disadvantages. Higher temperature of soaking increases the concentration of salts and vitamins in the water. This reduces the nutrient value of the rice. Secondly the color of the Kernel changes to brown, due to the dissolving of the color pigment in the kernel.

Lengthy and low water temperature soaking of rice will create fermentation which gives a bad smell and taste to the rice. Also certain biological changes take place which are also harmful for the rice grain. The harmful effects on rice as mentioned above could be avoided by soaking rice under pressure and de-aerating rice prior to soaking. The outcome is better product with good grain color and water soluble nutritious substances.

7.1.3 Heating and Drying of Soaked Rice

Rotating and pressure resistant vessel is also used for heating because it allows high heating temperatures of more than 100 degrees, even exposure to heat/steam and condensate to be removed continuously. The rice grains break when they are moist and handled mechanically. Hence mechanical handling of moist grain is avoided and its conveyance by gravity is adopted. Also hot and wet rice creates blockages in mechanical handling. Such blockage may cause serious problems of unblocking, cleaning and maintenance.

Par-boiled paddy should be dried to 14% moisture for safe storage or milling. Parboiled paddy is more difficult to dry and requires more energy than field paddy because its moisture content is much higher. However, higher air temperatures help reduce the drying time. If drying is done too fast, internal stresses develop in the grain and cause breakage during milling. After drying is completed, the paddy should be allowed to stand

for at least several hours - preferably for 1 or 2 days - before it is milled, to permit internal moisture differences and stresses to equalize.

Moisture reduction takes place rapidly during the first part of drying from 36 to 18% moisture level, but is slow from 18 to 14%. The drying process should be stopped at about 18% moisture to allow the paddy to temper or equalize for several hours before continuing the drying to 14%. Most par-boiled paddy is sun-dried on large drying floors close to the rice mill. A large number of workers are needed to constantly turn and mix the paddy to achieve rapid, uniform drying. For best results, paddy should be spread about 2.5 cm thick over the floor. At this thickness 500 square meters of drying floor can handle 6 tons of paddy. Depending on drying air temperature and relative humidity, sun-drying usually takes 1 or 2 days.

Sun-drying paddy from 36% to 14% moisture in a single stage causes considerable damage to its milled quality. The problem is overcome by dividing the drying periods and tempering the paddy in between.

Mechanical equipment for drying par-boiled paddy is the same as for drying field paddy. But the operation of the equipment differs. The continuous-flow dryer (LSU type) is used as a re-circulating batch dryer. Wet paddy is re-circulated in the dryer until it reaches 14% moisture.

In contrast with field paddy, par-boiled paddy requires air temperatures of up to 100°C during the first drying period. During the second period air temperature should be kept below 75°C. Maintaining higher air temperature will not decrease the drying time but will result in increased drying cost and more damage to milled rice quality. The first drying period takes about 3 hours including dryer loading and unloading time. After tempering, the second drying period takes about 2 hours. Continuous-flow dryers are available in many sizes to match the capacity of the parboiling system. A 24-5/day parboiling plant needs an 8-ton (holding capacity) dryer. In some cases, rotary dryers are used to pre-dry par-boiled paddy before it is loaded into the continuous-flow dryer. That removes large quantities of surface moisture quickly. Many parboiling plants use husk-fired boilers to supply steam and hot water for parboiling. These same boilers can supply steam to heat exchangers that are used to supply the heated air for drying. In some cases, oil-fired burners and direct husk-fired furnaces have supplied the heated air for drying.

Parboiling causes physical and chemical changes and modifies the appearance of rice. To learn more about these changes, refer to the following table:

Change	Description
Taste and Texture	Change in taste and texture of the rice, preferred by some consumers and disliked by others.
Gelatinization of Starch	Gelatinization of starch making the grain translucent, hard, and resistant to breakage during milling which increases milling recovery for head rice and total white rice yields.
Enzyme Inactivation	Inactivation of all enzymes which stops biological processes and

	fungus growth.
Milling	Easier removal of the hull during milling but more difficult bran removal.
Cooking	More rice swelling during cooking and less starch in the cooking water.

7.2 Rice Milling

Paddy is processed to convert it into white rice which is ready for consumption. The different stages of rice processing are described below.
The process of removing husk, the top layer of the kernel grain is done in this unit. The process is called husking or hulling or shelling. After this process, the final product is "*brown or cargo rice*".

7.2.1 Reception & Storage

It is essential to have a system which can receive, clean and store paddy within a very short time, particularly during the harvest season. Paddy supplied in bulk is weighed and discharged into large intake pits. Paddy is cleaned from coarse impurities. Paddy is then dried to reduce the moisture content to 14% making it suitable for storage. This is achieved through several passes in vertical driers, with intervals of 8-12 hours.

7.2.2 Husking Unit

In the husking unit generally there are two separate lines provided. One for intake of raw paddy from the paddy storage area and the other, for the intake of par-boiled paddy from the par-boiled unit. The major components / equipments in this unit and its operations are explained as following.

7.2.3 Pre-cleaner

The pre-cleaner removes the large, medium and small size impurities, including ferrous metal from the incoming metal. The large impurities such as straw, strings and stones are removed in the first stage of scapling. Then in the second stage, more impurities are removed which are of the size of the product to be cleaned. Finally in the third stage, through the lower sieve, fine impurities like weeds etc. are removed. Magnets are provided to remove ferrous metal from the clean stock. Dust is removed by an aspiration system, which is installed on the top of the cleaner. The aspirated air is led to cyclones for separation of solids from the exhaust air.

7.2.4 Cleaning

Paddy is cleaned from dust and foreign particles. Classifiers are used to remove straw, sand, stone and paper etc. from the paddy, while destoners remove heavy impurities such as stones and glass.

7.2.5 Husking

The husking machine does two things; it dehusks the paddy and then separates the kernels into fractions of large, light and mixed kernels. Husking generally cannot be done 100% and hence, will still be having the unhusked kernels. These are separated in a later process and recycled.

Dehusking is achieved in this machine by passing paddy through rubber rollers and by friction. Parboiling makes the paddy lesser tough and easier to remove, with lesser broken grains. Exhaust fans (or aspiration) suck out the husk from the machine. The resulting output is brown or cargo rice.

7.2.6 Phak Grader

This grader separates the brown rice into grades of large, medium and small sizes. It delivers them into separate bins provided for interim storage.

7.2.7 Husk Separator

This machine separates husk from the kernels by application of rubber roller friction to husk.

7.2.8 Paddy Separator

In the dehuller, some part of the paddy (about 15%) will escape dehulling. This dehulled paddy is separated in this machine and recycled to the dehuller.

7.2.9 Destoner

This is a pre-cleaning machine which removes stones from the paddy through the principle of oscillating to and fro, the particles of different material densities. Pre-cleaned paddy is spread on a to and fro oscillating horizontal sieve with air blown from under the sieve. The stones of higher density descend own the sieves and are discharged as waste.

7.2.10 Reprocessing Unit

In this unit the brown rice, an output from the husking unit, is processed to give the final product of polished white rice or Parboiled rice fit for consumption. The reprocessing unit comprises of the following parts.

- Separator
- Grader
- Polisher
- Color Sorter (if provided)

7.2.11 Separator

This separator is the same as the separator in the husking unit except that the finer sieves are provided for removal of impurities remaining in the product after husking.

7.2.12 Combi- Cleaner:

The combi-cleaner is the combination of three separate individual units i.e.

1. Scalping Cylinder (optional)
2. Double Stage Sieves Frame
3. Strong air Flow Aspirator

This machine is capable of fulfilling the requirements of cleaning of grains and similar products.

7.2.12.1 Scalping Cylinder

Through a vertical pipe equipped with an adjusting valve & gravity flap, adjustable by counter weight to ensure a uniform distribution of the stock. The scalping cylinder separates the large impurities like straw, string and stones etc. Cylinder is equipped with a rotary wiper to remove the sticked impurities. The rejections are thrown in a straw box and the stock is fed to the double screen tray.

7.2.12.2 Double Stage Sieves Cleaner

After cleaning through scalping cylinder, the stock is fed to the flat sieves. Mesh sieves are used for cleaning of rice in double stage with suitable sizes according to the grains. The sieves are operated through vibrating electric motor.

The upper sieve screens off impurities which exceed the size of the material to be cleared. These impurities are discharged through the outlet provided.

The bottom sieve separates fine impurities such as sand, weeds etc. and the impurities are discharged through the outlet provided. Rubber balls are provided to prevent clogging of sieves.

7.2.12.3 Air Aspirator

A strong fan is provided on the top of the air aspirator with the volume of of 4 cu-m of air/min suction. Four air regulatory channels with the control of shutters on the top are provided for efficient blow of light particles.

7.2.13 Magnetic Cleaning

The magnets attract iron particles in the stock. Permanent type magnets are provided at the discharge of cleaned stock.

7.2.14 Silky Polisher

Shelling is the process of removing husk from the paddy. This is achieved by the gentle action of rubber rolls applied to the paddy. Next, the husk aspirator separates the husk from the rice by means of air aspiration. The brown rice then passes into the paddy separator which separates any unshelled kernels from the brown rice. The unshelled paddy is recycled back in to the sheller while the shelled rice (brown or cargo rice) passes onto the whitener and polisher.

7.2.15 Whitening & Polishing

During whitening and polishing bran layers are removed from the brown rice. This not only enhances the appearance of the rice but also increases its shelf life, since the lipids contained in the embryo and the bran layers are highly susceptible to enzymatic and non enzymatic oxidation. The bran removal is best achieved in several steps to ensure evenly milled rice grains with minimum brokens and optimum whiteness. The number of passes required depends upon the desired finish and variety of rice. In the whitening process bran is removed by abrasive action. Bran is removed by creating high friction forces between the rice grains. Whitening process results in smooth rice with an opaque appearance.

7.2.16 Grading

Grading removes brokens from head rice and sorts rice into fractions of different length. Head rice, brokens and tips are further separated by a sequence of indent cylinders into fractions of different broken sizes and head rice.

7.2.17 Color Sorting

Optical inspection is the final quality control and enhancement step in the rice mill. Discolored grains and optionally chalky kernels are removed to yield a first grade product.

8 MARKET INFORMATION

8.1 Market Potential

The par-boiled variety of rice is the fastest growing rice product in the global market. It is preferred in Africa, Europe and the US due to its longer shelf life and ease of cooking. Pakistan is lagging on the exports of par-boiled rice due to the lack of processing facilities. Meanwhile India has been successful in exporting both par-boiled rice and has developed expertise in the manufacturing of parboiling plants as well.

8.2 Target Customers

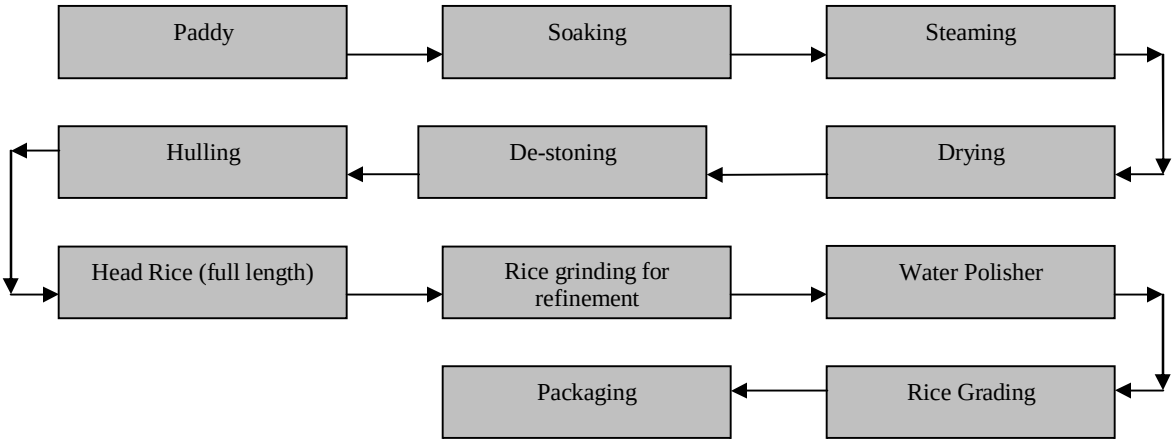
The main market for the par-boiled rice would be Europe, UK and the US, where the demand for par-boiled rice is growing steadily.

8.3 Trade Statistics

This section of the report will provide trends and statistics of Pakistan as

9 PRODUCTION PROCESS

9.1 Production Process Flow



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9.2 Product Mix Offered

The business will process the two main varieties of rice that are produced in Pakistan. These are Irri-6 and Irri-9. Other by products would be from the processing which would yield full grain head rice, small broken rice, large broken rice, barn and husk. Husk can be sold off to husk board producers or can be used as fuel for the boiler. This pre-feasibility study would assume that the husk is being used as fuel for the boiler.

9.3 Raw Material Requirement

	Units(tonnes)	Cost	Total
Irri-6 paddy	12,600	8,750	110,250,000
Irri-9 paddy	12,600	10,750	135,450,000
Total	**25,200**		**245,700,000**

9.4 Technology and Processes

The plant for a rice parboiling unit is available from several countries like Germany, UK, India, Italy, Japan etc.
The main criterion for the selection of a production process is based on the ease of use, maintenance requirements, and overall costs. The lower these values are the more attractive the plant would be.

9.4.1 Technology/Process Options

Currently there are two forms of processing systems available; batch and continuous processing systems. Continuous processing is suitable for plants where there are huge quantities to be processed and it is difficult to switch between different types of raw material. Such a system would require a large amount of investment for storing raw materials as well as the finished goods.
Batch processing systems operate in small batches of material and can be controlled to adjust differing forms and types of raw materials.

9.4.2 Merits & demerits of a particular technology

The batch processing system would be more suitable for the Pakistani situation where the sales would be to individual traders and exporters which would be requiring relatively less quantities. Similarly, since there are at least four major types of raw materials to be processed, the batch system is more suitable.

9.5 Machinery Requirement

The machinery required would be for processing 2.5 tons/hour. There would be four separate types of machinery required.

1. Raw paddy processing unit
2. Parboiling unit
3. Husking unit
4. Processing unit (grading, sorting,
5. Bagging and packaging

9.6 Product/Project Standards And Compliance Issues

The plant would have to operate under the rules of the environmental protection act. Air, noise and water pollution should be prevented as much as possible. Since the nature of the plant is such, the impact on the environment is going to be minimal.
Similarly, the product should be graded according to the international standards of grading rice. This is of high importance because if these standards are not followed, the quality of the product will be lowered and the demand will fall significantly.

10 LAND & BUILDING REQUIREMENT

10.1 Total Land Requirement

Total land requirement is about 1.1 acres. This is done keeping in mind the future expansion of the project.

10.2 Covered Area Requirement

Approximately 30,000 sq. feet would be covered by the 2.5ton/hour plant and the accompanying infrastructure needs.

10.3 Construction Cost

Construction cost for the area would be Rs. 17,345,200 including the costs of electrical wiring, and the cost of the covered area would be Rs. 12,500,000.

10.4 Rent Cost

There would be no rent cost as the land is being assumed as being purchased outright.

10.5 Recommended Mode

The method of acquiring land is preferably purchase as both leasing and renting could prove to be inconvenient over the long term.

10.6 Suitable Location

Location should preferably be near the rice producing regions of Sind, which lie all along the river Indus, especially in Larkana, Dadu, etc.

11 HUMAN RESOURCE REQUIREMENT

The nature of the machinery is such that a mixture of unskilled and highly skilled labor force is required. Engineering staff would be needed to ensure the proper running and maintenance of the machinery. Both mechanical and electrical engineers would be required to look after electrical equipment (transformer, motors, wiring etc) and the machines respectively.
Technicians and maintenance staff, production supervisors, shift leaders etc would also be required. Managers for production, finance and administration, sales and marketing would also be needed.
The structure would be headed by the Director, CEO, and then the GM. The total staff would be about 145 out of which 104 would be direct labor. Skill level and standard of the staff and their training would be key factors for the plant as a ineffectiveness would affect both the quality and the level of output of the plant.

12 FINANCIAL ANALYSIS

In formulating a project, it is not only necessary to obtain clear cut answers of all technical aspects of the project but all the financial aspects assume great importance. A project can be technically and market wise feasible but can turn out to be a financial disaster. In order to provide information regarding financial aspects of the project, this section should include a detailed study of:

12.1 Initial Financing

Initial Financing	**Rs. in 000s**
Debt	30,524,346
Equity	30,524,346
Lease	0
Export re-finance facility	0

- Capital Costs

Capital Investment	**Rs. in 000s**
Land	3,028,638
Building/Infrastructure	17,345,200
Machinery & equipment	22,263,389
Furniture & fixtures	268,500
Office vehicles	974,650
Office equipment	221,500
Pre-operating costs	1,905,684
Training costs	50,000
Total Capital Costs	**46,057,561**

- Working Capital

Working Capital	**Rs. in 000s**
Equipment spare part inventory	50,649
Raw material inventory	14,669,115
Upfront office vehicles lease rental *	0
Upfront insurance payment	271,366
Cash	0
Total Working Capital	**14,991,131**

12.1 Projected Income Statement

12.2 Projected Balance Sheet

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	223,272,618	258,918,150	290,027,010	323,599,461	359,804,090	398,820,182	419,466,470	440,439,793	462,461,783	485,584,872
Cost of goods sold	185,626,893	209,226,602	234,542,618	261,934,436	291,554,118	323,564,628	340,617,223	358,581,872	377,537,233	397,542,004
Gross Profit	37,645,725	49,691,548	55,484,392	61,665,026	68,249,971	75,255,555	78,849,246	81,857,921	84,924,549	88,042,868
General administration & selling expenses										
Administration expense	1,297,800	1,424,156	1,562,813	1,714,971	1,881,943	2,065,172	2,266,240	2,486,884	2,729,011	2,994,711
Rental expense	-	-	-	-	-	-	-	-	-	-
Utilities expense	583,200	641,520	705,672	776,239	853,863	939,249	1,033,174	1,136,492	1,250,141	1,375,155
Travelling & Comm. expense (pl	100,800	110,614	121,384	133,202	146,170	160,402	176,019	193,156	211,962	232,599
Office vehicles running expense	97,465	107,212	117,933	129,726	142,699	156,968	172,665	189,932	208,925	229,817
Office expenses (stationary, etc	25,200	27,654	30,346	33,300	36,543	40,100	44,005	48,289	52,991	58,150
Promotional expense	223,273	258,918	290,027	323,599	359,804	398,820	419,466	440,440	462,462	485,585
Insurance expense	271,366	239,357	207,347	175,337	143,327	189,801	151,841	113,881	75,920	37,960
Professional fees (legal, audit, e	223,273	258,918	290,027	323,599	359,804	398,820	419,466	440,440	462,462	485,585
Depreciation expense	3,337,529	3,337,529	3,337,529	3,337,529	3,337,529	3,456,536	3,456,536	3,456,536	3,456,536	3,456,536
Amortization expense	386,137	386,137	386,137	386,137	386,137	5,000	5,000	5,000	5,000	5,000
Property tax expense	-	-	-	-	-	-	-	-	-	-
Miscellaneous expense	2,732,726	3,114,181	3,451,520	3,814,807	4,205,794	4,626,343	4,864,713	5,107,948	5,363,346	5,631,513
Subtotal	9,278,768	9,906,195	10,500,734	11,148,447	11,853,612	12,437,211	13,009,125	13,618,997	14,278,754	14,992,611
Operating Income	28,366,957	39,785,353	44,983,658	50,516,579	56,396,359	62,818,343	65,840,122	68,238,924	70,645,795	73,050,258
Other income	41,444	269,890	661,435	1,103,382	1,595,814	2,247,617	3,065,390	3,932,781	4,842,968	6,277,128
Gain / (loss) on sale of assets	-	-	-	-	389,860	-	-	-	-	-
Earnings Before Interest & Taxes	28,408,401	40,055,243	45,645,093	51,619,961	58,382,033	65,065,960	68,905,512	72,171,706	75,488,763	79,327,386
Interest expense	3,830,570	3,220,969	2,532,589	1,755,248	877,447	-	-	-	-	-
Earnings Before Tax	24,577,831	36,834,274	43,112,504	49,864,713	57,504,586	65,065,960	68,905,512	72,171,706	75,488,763	79,327,386
Tax	8,602,241	12,891,996	15,089,376	17,452,650	20,126,605	22,773,086	24,116,929	25,260,097	26,421,067	27,764,585
NET PROFIT/(LOSS) AFTER TAX	15,975,590	23,942,278	28,023,128	32,412,064	37,377,981	42,292,874	44,788,583	46,911,609	49,067,696	51,562,801
Balance brought forward		15,975,590	39,917,868	67,940,996	100,353,059	137,731,040	180,023,914	224,812,497	271,724,106	320,791,802
Total profit available for appropriati	15,975,590	39,917,868	67,940,996	100,353,059	137,731,040	180,023,914	224,812,497	271,724,106	320,791,802	372,354,602
Dividend	-	-	-	-	-	-	-	-	-	-
Balance carried forward	15,975,590	39,917,868	67,940,996	100,353,059	137,731,040	180,023,914	224,812,497	271,724,106	320,791,802	372,354,602

Statement Summaries **SMEDA**

Balance Sheet

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	-	4,144,400	22,844,580	43,298,909	67,039,316	92,542,101	132,219,601	174,319,425	218,958,713	265,338,094	362,374,705
Accounts receivabl	-	18,351,174	19,816,059	22,559,390	25,217,526	28,085,077	31,176,340	33,628,219	35,338,614	37,105,544	38,960,821
Finished goods inv	-	9,707,505	10,920,943	12,231,456	13,645,719	15,170,828	16,814,335	17,655,052	18,537,804	19,464,694	20,437,929
Equipment spare p	50,649	59,829	70,359	82,419	96,213	111,967	123,444	136,097	150,047	165,427	-
Raw material inven	14,669,115	17,327,892	20,377,602	23,870,450	27,865,240	32,428,173	35,752,060	39,416,647	43,456,853	47,911,180	-
Pre-paid annual lar	-	-	-	-	-	-	-	-	-	-	-
Pre-paid building re	-	-	-	-	-	-	-	-	-	-	-
Pre-paid lease inte	-	-	-	-	-	-	-	-	-	-	-
Pre-paid insurance	271,366	239,357	207,347	175,337	143,327	189,801	151,841	113,881	75,920	37,960	-
Total Current Assets	14,991,131	49,830,158	74,236,890	102,217,962	134,007,340	168,527,948	216,237,621	265,269,319	316,517,951	370,022,899	421,773,455
Fixed assets											
Land	3,028,638	3,028,638	3,028,638	3,028,638	3,028,638	3,028,638	3,028,638	3,028,638	3,028,638	3,028,638	3,028,638
Building/Infrastructu	17,345,200	16,477,940	15,610,680	14,743,420	13,876,160	13,008,900	12,141,640	11,274,380	10,407,120	9,539,860	8,672,600
Machinery & equip	22,263,389	20,037,050	17,810,711	15,584,372	13,358,033	11,131,695	8,905,356	6,679,017	4,452,678	2,226,339	-
Furniture & fixtures	268,500	241,650	214,800	187,950	161,100	134,250	107,400	80,550	53,700	26,850	-
Office vehicles	974,650	779,720	584,790	389,860	194,930	1,569,684	1,255,747	941,810	627,873	313,937	-
Office equipment	221,500	199,350	177,200	155,050	132,900	110,750	88,600	66,450	44,300	22,150	-
Total Fixed Assets	44,101,877	40,764,348	37,426,820	34,089,291	30,751,762	28,983,916	25,527,381	22,070,845	18,614,310	15,157,774	11,701,238
Intangible assets											
Pre-operation cost	1,905,684	1,524,547	1,143,410	762,273	381,137	-	-	-	-	-	-
Legal, licensing, &	50,000	45,000	40,000	35,000	30,000	25,000	20,000	15,000	10,000	5,000	-
Total Intangible Asse	1,955,684	1,569,547	1,183,410	797,273	411,137	25,000	20,000	15,000	10,000	5,000	-
TOTAL ASSETS	61,048,692	92,164,053	112,847,119	137,104,526	165,170,238	197,536,864	241,785,002	287,355,165	335,142,261	385,185,673	433,474,694
Liabilities & Shareholders' Equity											
Current liabilities											
Accounts payable	-	15,961,342	18,029,395	20,279,318	22,725,953	25,385,385	28,119,867	29,680,666	31,335,372	33,090,307	30,595,745
Export re-finance fa	-	-	-	-	-	-	-	-	-	-	-
Short term debt	-	-	-	-	-	-	-	-	-	-	-
Other liabilities	-	-	-	-	-	-	-	-	-	-	-
Total Current Liabiliti	-	15,961,342	18,029,395	20,279,318	22,725,953	25,385,385	28,119,867	29,680,666	31,335,372	33,090,307	30,595,745
Other liabilities											
Lease payable	-	-	-	-	-	-	-	-	-	-	-
Deferred tax	-	3,896,093	3,896,093	3,896,093	3,896,093	3,896,093	3,116,874	2,337,656	1,558,437	779,219	0
Long term debt	30,524,346	25,806,682	20,479,417	14,463,773	7,670,787	-	-	-	-	-	-
Total Long Term Liab	30,524,346	29,702,775	24,375,510	18,359,866	11,566,880	3,896,093	3,116,874	2,337,656	1,558,437	779,219	0
Shareholders' equity											
Paid-up capital	30,524,346	30,524,346	30,524,346	30,524,346	30,524,346	30,524,346	30,524,346	30,524,346	30,524,346	30,524,346	30,524,346
Retained earnings	-	15,975,590	39,917,868	67,940,996	100,353,059	137,731,040	180,023,914	224,812,497	271,724,106	320,791,802	372,354,602
Total Equity	30,524,346	46,499,936	70,442,214	98,465,342	130,877,405	168,255,386	210,548,260	255,336,843	302,248,452	351,316,148	402,878,948
TOTAL CAPITAL AN	61,048,692	92,164,053	112,847,119	137,104,526	165,170,238	197,536,864	241,785,002	287,355,165	335,142,261	385,185,673	433,474,694

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

12.3 Projected Cash Flow Statement

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	-	15,975,590	23,942,278	28,023,128	32,412,064	37,377,981	42,292,874	44,788,583	46,911,609	49,067,696	51,562,801
Add: depreciation expense	-	3,337,529	3,337,529	3,337,529	3,337,529	3,337,529	3,456,536	3,456,536	3,456,536	3,456,536	3,456,536
amortization expense	-	386,137	386,137	386,137	386,137	386,137	5,000	5,000	5,000	5,000	5,000
Deferred income tax	-	3,896,093	-	-	-	-	(779,219)	(779,219)	(779,219)	(779,219)	(779,219)
Accounts receivable	-	(18,351,174)	(1,464,885)	(2,743,331)	(2,658,136)	(2,867,551)	(3,091,263)	(2,451,879)	(1,710,395)	(1,766,931)	(1,855,277)
Finished good inventory	-	(9,707,505)	(1,213,438)	(1,310,513)	(1,414,262)	(1,525,110)	(1,643,506)	(840,717)	(882,753)	(926,890)	(973,235)
Equipment inventory	(50,649)	(9,180)	(10,530)	(12,060)	(13,793)	(15,755)	(11,477)	(12,653)	(13,950)	(15,380)	165,427
Raw material inventory	(14,669,115)	(2,658,777)	(3,049,709)	(3,492,848)	(3,994,790)	(4,562,933)	(3,323,888)	(3,664,586)	(4,040,206)	(4,454,327)	47,911,180
Pre-paid building rent	-	-	-	-	-	-	-	-	-	-	-
Pre-paid lease interest	-	-	-	-	-	-	-	-	-	-	-
Advance insurance premium	(271,366)	32,010	32,010	32,010	32,010	(46,474)	37,960	37,960	37,960	37,960	37,960
Accounts payable	-	15,961,342	2,068,053	2,249,924	2,446,634	2,659,432	2,734,482	1,560,799	1,654,706	1,754,935	(2,494,562)
Other liabilities	-	-	-	-	-	-	-	-	-	-	-
Cash provided by operations	(14,991,131)	8,862,064	24,027,445	26,469,974	30,533,392	34,743,255	39,677,500	42,099,824	44,639,288	46,379,380	97,036,611
Financing activities											
Change in long term debt	30,524,346	(4,717,664)	(5,327,265)	(6,015,645)	(6,792,986)	(7,670,787)	-	-	-	-	-
Change in short term debt	-	-	-	-	-	-	-	-	-	-	-
Change in export re-finance facilit	-	-	-	-	-	-	-	-	-	-	-
Add: land lease expense	-	-	-	-	-	-	-	-	-	-	-
Land lease payment	-	-	-	-	-	-	-	-	-	-	-
Change in lease financing	-	-	-	-	-	-	-	-	-	-	-
Issuance of shares	30,524,346	-	-	-	-	-	-	-	-	-	-
Purchase of (treasury) shares	-	-	-	-	-	-	-	-	-	-	-
Cash provided by / (used for) financ	61,048,692	(4,717,664)	(5,327,265)	(6,015,645)	(6,792,986)	(7,670,787)	-	-	-	-	-
Investing activities											
Capital expenditure	(46,057,561)	-	-	-	-	(1,569,684)	-	-	-	-	-
Acquisitions	-	-	-	-	-	-	-	-	-	-	-
Cash (used for) / provided by invest	(46,057,561)	-	-	-	-	(1,569,684)	-	-	-	-	-
NET CASH	-	4,144,400	18,700,180	20,454,329	23,740,406	25,502,785	39,677,500	42,099,824	44,639,288	46,379,380	97,036,611
Cash balance brought forward		-	4,144,400	22,844,580	43,298,909	67,039,316	92,542,101	132,219,601	174,319,425	218,958,713	265,338,094
Cash available for appropriation	-	4,144,400	22,844,580	43,298,909	67,039,316	92,542,101	132,219,601	174,319,425	218,958,713	265,338,094	362,374,705
Dividend	-	-	-	-	-	-	-	-	-	-	-
Cash carried forward	-	4,144,400	22,844,580	43,298,909	67,039,316	92,542,101	132,219,601	174,319,425	218,958,713	265,338,094	362,374,705

12.4 Ratio Analysis

Calculations **SMEDA**

Ratio Analysis

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Profitability ratios											
Profit margin on sales		7%	9%	10%	10%	10%	11%	11%	11%	11%	11%
ROI (same as ROA)		17%	21%	20%	20%	19%	17%	16%	14%	13%	12%
ROE		34%	34%	28%	25%	22%	20%	18%	16%	14%	13%
Liquidity ratios											
Current ratio		3	4	5	6	7	8	9	10	11	14
Quick ratio		2	3	4	5	5	6	8	9	10	14
Asset management ratios											
Inventory turnover ratio		13	13	12	12	11	11	11	10	10	
Days sales outstanding		30	28	28	28	28	28	29	29	29	29
Fixed assets turnover ratio		5	7	9	11	12	16	19	24	31	41
Total assets turnover ratio		2	2	2	2	2	2	1	1	1	1
Debt management ratios											
Debt ratio	30%	28%	18%	11%	5%	0%	0%	0%	0%	0%	0%
Times interest earned		7	12	18	29	67	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

13 KEY ASSUMPTIONS

13.1 Operating assumptions

Operating Assumptions	
Hours operational / day	16
Shift length (hours)	8
Days operational / year	300

13.2 Economy-Related assumptions

Economy 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%
Office equipment price growth rate	5%
Office vehicles price growth rate	10%

13.3 Cash flow assumptions

Cash Flow Assumptions	
Accounts receivable cycle (in days)	30
Accounts payable cycle (in days)	30

13.4 Revenue assumptions

Revenue Assumptions	
Description	**Rate**
Processing capacity	25,200
Sale price per unit in year 1 (Irri-6)	18,000
Sale price per unit in year 1 (Irri-9)	24,000
Sale price growth rate	5%
Production capacity utilization	70%
Production capacity utilization growth rate	5%
Maximum capacity utilization	95%

13.5 Expenses assumptions

Expense Assumptions	
Description	**Cost / Unit**
Cost of goods sold 1 (Irri-6)	8,750
Cost of goods sold 2 (Irri-9)	10,750
Cost of goods sold growth rate	5.0%
Operating costs 2 (machinery maintenance)	44
Operating costs 3 (direct electricity)	357
Operating costs 4 (direct water)	11

Sources of Information (documents, references)