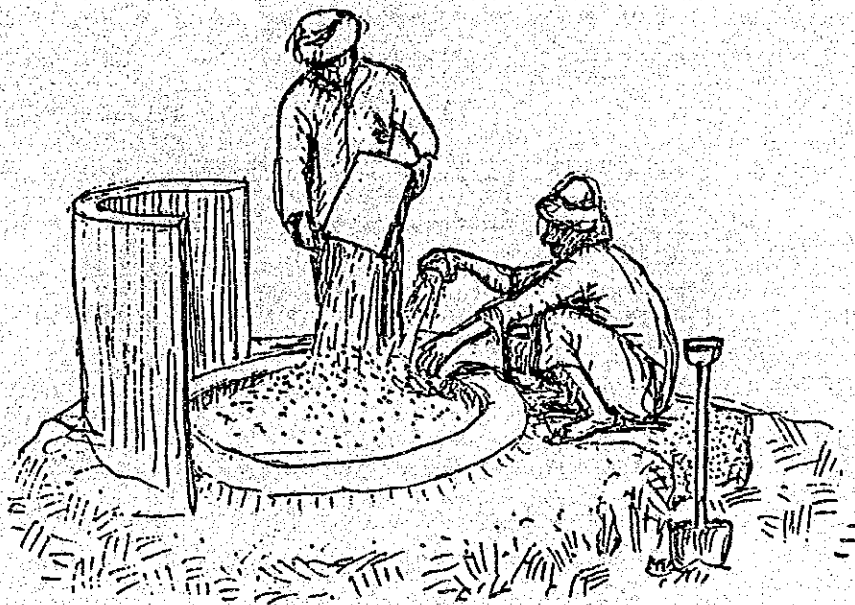


## CHAPTER 7 IMPLEMENTATION PLANS





## CHAPTER 7 IMPLEMENTATION PLANS

The four plans finally proposed for improvement are detailed as follows regarding their operational procedures. These four plans are mutually complementary and would initiate the first step toward post-harvest operation improvements.

### 7.1 Rental Operation of Harvesting Machines

#### (1) Purpose of operation

The purpose is to minimize losses which occur in traditional practices of harvesting and produce high quality paddy through well mechanized harvesting operations, and simultaneously to increase farmers' income.

#### (2) Executing agencies

A government organization or public corporation related to rice production and marketing in Punjab and Sind Provinces.

#### (3) Plan of operation

The executing agencies lease harvesting machines to farmers directly and/or to private sector to harvest paddy and wheat.

#### (4) Area of operation

The following six main rice-producing districts in Punjab and Sind Provinces are selected as operational areas.

Punjab Province ... Sialkot, Gujranwala, Sheikhpura

Sind Province .... Larkana, Jacobabad, Shikarpur

#### (5) Period of operation

This is to be implemented to eliminate various restrictive elements in the initial period of mechanization by government organizations themselves in order to open up the way for sound development and extension. Under this plan, machines will be introduced in only five years, and an additional five years will be allocated for operation. The extent of mechanization should be continued by farmers themselves or by the private

sector. For these reasons, the rice growing areas to be covered by this plan are targeted to be 5% of the total rice growing area in Pakistan, or approximately 50,000 hectares.

(6) Machines to be introduced

Taking into consideration of the conditions of paddy fields in the two provinces, the following machines are to be introduced and operated, at the ratios mentioned below;

	Harvesting Capacity	Punjab (%)	Sind (%)
Reapers Threshers	1.60 ha/8h	20	40
Combines	2.24 ha/8h	80	60

To ensure safe and steady progress of the plan, the number of machines to be introduced in the first year should be approximately 5% of the total number, followed by 20% in the second year, and approximately 25% each in the third, fourth, and fifth years.

Number of Machines to be Introduced

Year	(Units)			
	Punjab		Sind	
	Reapers, Threshers	Combines	Reapers, Threshers	Combines
First year	3	8	5	5
2	13	34	17	18
3	14	41	21	24
4	14	41	24	25
5	14	41	24	25
Total	58	165	91	97

## SPECIFICATION FOR THE HARVESTING MACHINES

### 1. Reaper

<u>Item</u>	
Engine	: 4-cycle air-cooled Gasoline 2.4 H.P/1700 R.P.M./144 CC
Speed Change (Forward)	: 2
(Reverse)	: 1
Cutting Width (mm)	: 1200
Height of Cutting (mm)	: 50 - 300
Applicable Plant Height (mm)	: 600 - 1200
Turning Method	: Side Clutch
Capacity	: 1.5 hr./acre

### 2. Thresher

<u>Item</u>	
Threshing Drum (Width x Diameter) (mm)	: 570 x 1,530
Horse Power Required (HP)	: 18
Capacity per Hour (kg)	: 3,000
Separating Method	: Winnower and seive
Threshing Type	: Axle-Flow

### 3. Combine

<u>Item</u>	
Width of Cutting Device	: 2.6 M
Speed of Cutting Device	: 1.1 M/S
Method of Conveyer	: Slat Conveyer
Diameter and Length of Threshing Rorator	: 650 x 2,170 MM
Capacity of Separating Section	: 4 - 6 Ton/Hr
Travelling Method	: Half track
Travelling Speed	: Forward 0.3 - 2.3 M/S Reverse 0.4 - 1.5 M/T
Horse Power	: About 50 Hp
Average Capacity	: 0.7 hr./acre (For Indica type rice)

(7) Financial analysis

1) Unit price of machine

(Unit: Rsl,000)

	Foreign Currency (CIF Karachi)	Local Currency (Duties and other cost)	Total
Combine	504	151	655
Reaper	24	7	31
Thresher	15	49	64

Notes 1: 5% is added on the combine price as an after-care fee for the combine manufacturer.

2: 30% of the CIF prices of the machines are counted up for duties and other costs payable in Pakistan rupees.

3: The body of the thresher is manufactured in Pakistan is in Pakistani rupees, and the part of the engine is imported and is counted up in foreign currency.

2) Total value of machines to be introduced

(Unit: Rsl,000)

	Foreign Currency	Local Currency	Total
Combines (262 units)	132,008	39,602	171,610
Reaper, Thresher (149 sets)	5,845	8,335	14,180
Total	137,853	47,937	<u>185,790</u>

### 3) Construction costs of operational centers

A center is provided in each of the six districts designated as operational areas for management and storage of machines.

◦ Combine storage area	25 m <sup>2</sup> /unit
◦ Reaper and thresher storage area	25 m <sup>2</sup> /set
◦ Construction cost per m <sup>2</sup>	Rs1,538/m <sup>2</sup>
◦ Total area of 6 storage centers	10,275 m <sup>2</sup>

Construction costs (Unit: Rs1,000)

Foreign currency (30%)	4,742
Local currency (70%)	11,066

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Total 15,808

### 4) Annual income and expenditure

◦ The capital should be borrowed at an annual bank interest rate of 5% to be repaid in 10 years.

◦ Other integration conditions are as follows:

#### a) Personnel costs

##### ◦ Clerical staff

###### Headquarters:

Manager (Rs6,000/month)	1 person
Clerical (Rs3,000/month)	4 persons
Servant (Rs1,000/month)	1 person

###### For each center:

Manager (Rs4,000/month)	1 person x 6 locations
Clerical (Rs2,500/month)	2 persons x 6 locations
Servant (Rs1,000/month)	1 person x 6 locations
Guard (Rs1,000/month)	4 persons x 6 locations

° Operator

Combines:

To employ an operator with an assistant (Rs100/day) per combine, they are employed for 100 days/year.

Mechanical engineers (Rs3,000/month) are employed at a rate of one engineer per ten combines. The cost will be Rs300/month per combine.

Reaper:

One operator (Rs50/day) is employed 100 days/year per reaper. Mechanical engineers (Rs3,000/month) are employed at a rate of one engineer per 50 reapers. The cost will be Rs60/month per year.

Thresher:

An operator (Rs75/day) is employed 70 days/year for one thresher. Mechanical engineer (Rs3,000/month) are employed at a rate of one engineer per 50 units. The cost will be Rs60/month per thresher.

b) Operational costs

Fixed cost:

10% of all annual personnel cost should be allocated.

Variable expenses:

° 7% of machine price per year for combines and reapers and 5%/year for threshers.

° Fuel and oil costs

Combines:

Fuel 12ℓ/h, diesel oil 1ℓ = Rs4.25.

Operated 90 days per year

Rice 8 hours x 60 days

Wheat 12 hours x 30 days

Total 840 hours/year

12ℓ/h x 840 hours/year x Rs4.25ℓ =

Rs42,840/year



Oil, etc. = Rs42,480 x 13% = Rs5,569/year

Transportation cost =

Rs120/day x 90 days = Rs10,800/year

Reapers:

Fuel 1ℓ/h, Gasoline 1ℓ = Rs7.73.

The other conditions are the same as those for combines.

1ℓ/h x 840 hours/year x Rs7.73 =

Rs6,493/year

Oil, etc. = Rs6,493 x 1% = Rs649/year

Transportation cost =

Rs120/day x 90 days = Rs10,800/year

Threshers:

Fuel 4.4ℓ/h, Diesel oil 1ℓ = Rs4.25.

60 days operated/year (8 h x 60 days = 480 h/year)

4.4ℓ/h x 480 h/year x Rs4.25 =

Rs8,976/year

Oil, etc. = Rs8,976 x 13% = Rs1,167/year

Transportation cost

= Rs120/day x 60 days

= Rs7,200/year

c) Income

Annual income per machine is estimated as follows:

Combine:

° Annual harvesting area

(Capacity)

(operating ratio).

Rice: 0.4 ha/h x 8 hours x 60 days x 70% = 134.4 ha

Wheat: 0.6 ha/h x 12 hours x 30 days x 80% = 172.8 ha

---

≅ 308 ha

° Contract fee

Rs750/ha x 30 ha = Rs231,000/year

Reaper + thresher

° Annual harvesting area

0.25ha/h x 8 hours x 60 days x 80% = 96 ha

° Contract fee

$$\text{Rs}750/\text{ha} \times 96 \text{ ha} = \underline{\text{Rs}72,000/\text{year}}$$

Reaper

° Annual harvesting area (Wheat)

$$0.38\text{ha}/\text{h} \times 12 \text{ hours} \times 30 \text{ days} \times 90\% = 123 \text{ ha}$$

° Contract fee

$$\text{Rs}375/\text{ha} \times 123 \text{ ha} = \underline{\text{Rs}46,125/\text{year}}$$

Income that can be anticipated for each machine can be summarized as follows:

Annual Income by Machine Type per Machine

	(Rs)		
	Rice	Wheat	Total
Combine	101,250	129,750	231,000
Reaper	36,000	46,125	82,135
Thresher	36,000	-	36,000

d) Income and expenditure for ten years after the commencement of operations in accordance with the foregoing conditions are shown on the next page.

(8) Financial feasibility

According to the cost and benefits in the financial evaluation stated above, the plan is still considered to be sound and feasible from a financial point of view.

(9) Consideration for implementation

1) Technical considerations

a) Improvements are needed on machines to be used under various the conditions of paddy fields, in Pakistan. For example, stalks of Basmati varieties are long, and easily lodged and also shattering kernels.

Project Cash Flow (10 years)

(Rs. 1,000)

Year	Investment		Expenditure							Income				Benefit
	Building	Machinery	Personnel Expenses		O & M Cost		Inter-est	Repayment		Combine	Reaper + Thresher	Reaper (Wheat)		
			Office Worker	Operator	Fixed Cost	Variable Cost		Building	Machinery					
1	15,808	9,276	1,236	271	140	1,547	1,254	1,581	1,546	3,003	576	369	Δ3,626	
2		36,915	1,236	1,329	246	7,654	2,944	1,581	7,699	15,015	2,736	877	Δ7,686	
3		45,906	1,236	2,624	375	15,189	4,775	1,581	8,427	30,030	5,256	3,369	Δ3,237	
4		46,846	1,236	3,966	509	22,937	6,271	1,581	16,234	45,276	7,992	5,123	2,419	
5		46,846	1,236	5,309	644	30,686	7,376	1,581	24,042	60,522	10,728	6,877	9,672	
*	15,808	185,789	6,180	13,499	1,914	78,013	22,620	7,905	57,948	153,846	27,288	16,615	Δ2,458	
6			1,236	5,309	644	30,686	5,749	1,581	24,042	60,522	10,728	6,877	18,552	
7			1,236	5,039	617	29,139	4,122	1,581	22,496	57,519	10,152	6,508	28,501	
8			1,236	3,980	511	23,031	2,572	1,581	16,343	45,507	7,992	5,123	37,869	
9			1,236	2,686	381	15,497	1,329	1,581	15,616	30,492	5,472	3,508	39,015	
10			1,236	1,343	247	7,749	469	1,581	7,808	15,246	2,736	2,754	38,318	
**	15,808	185,789	12,360	31,856	4,314	184,115	36,861	15,810	144,253	363,132	64,368	41,385	159,797	

Remarks: 1. Round off a decimal fraction.

2. \* ... Sub Total \*\* ... Total

b) Threshers can be manufactured in Pakistan. However, appropriate guidance to manufactures is required for improvement.

c) This program is planned to continue for a certain period of time. Considerations should be made to allow the foreign suppliers of machines to provide technical support and assistance.

2) Operational considerations

a) Operators should be trained properly.

b) The machines should be well maintained and always kept in good performance and condition.

c) Machines should not be left idling as much as possible. Close contact with the borrowers of the machines will be necessary to increase the machine operating days to be as high as possible.

3) Institutional and considerations

The executing agency of this plan should meet the following conditions:

a) Undertaking by organizations having similar activities and a well experienced staff in these areas.

b) Ability to conduct the activities in Punjab and Sind under close cooperation with provincial governments, regional administrators, and farmers.

In the past, Agriculture Dept. of both provinces and PASSCO had similar services, such as leasing tractors, bulldozers etc. and these organizations have regional centers or offices in rice producing areas. Though these two organizations seem to have sufficient ability to accomplish the operation, PASSCO could carry out this operation more closely with farmers in competition with private sector since PASSCO have a good experience in servicing tractors directly to farmers.

## 7.2 Rental Operation of Rubber-roll Huskers

### (1) Purpose of operation

The purpose is to reduce quantitative and qualitative losses which occur in rice milling by replacing sheller type huskers with rubber-roll type huskers, and to produce high quality rice for both domestic and overseas markets.

### (2) Executing agency

A government organization or public corporation which is well-versed in the actual conditions of rice mills in Punjab and Sind Provinces and which can accomplish the foregoing purpose.

### (3) Applicable rice mills

Sheller-type mills located in Punjab and Sind Provinces and interested in participating in this improvement program

### (4) Period of operation

In the initial introduction period of rubber-roll huskers, restrictive conditions described in 4-2-3 (d) have to be eliminated, and this operation is limited to five years to lease machines by a public enterprise. After the first five years, efforts should be continued by the private sectors.

### (5) Study of alternative plans

The following alternative plans are considered prior to the introduction of rubber-roll huskers:

#### 1) Husker with rubber roll widths of 6 or 10 inches

The price of a 10" rubber roll husker is generally 6 to 7 times higher than that of 6" width. The 10" rubber-roll husker is durable for approximately 10 years, while that of 6" husker is 5 years. Therefore, it is economically advantageous to use two 6" huskers.

- 2) Normally, rubber-roll huskers have an aspirator, which is expensive. It will be easier for rice mills to use the rubber-roll type husking section only. Therefore, it will be reasonable to use two 6" husking without an aspirator.
- 3) Rubber rolls can be special or ordinary quality rolls. The performance and durability of ordinary quality rubber rolls are slightly inferior compared with those of special quality rubber rolls. However, the price of special quality rubber rolls is high even with these factors considered.

(6) Plan of operation

- 1) The executing agency leases rubber-roll huskers to the rice mills participating in this program under the condition of including a rental that should be decided separately.

2) Rental plan

There are many rice mill owners that only marginally recognize the advantages of rubber-roll huskers. Therefore, the huskers should be rented gradually under the following plan:

No. of Rubber Roll Huskers by Year

Year	No. of Huskers	No. of Rice Mills
1	100	50
2	900	450
3	1,000	500
Total	2,000	1,000

- 3) Two 6" rubber-roll huskers per mill should be installed.
- 4) Rubber rolls could be purchased from the domestic market.

(7) Calculations of annual income and expenditures of a rice mill with a husker installed.

1) Annual expenditure

a) Unit price of husker

- ° Purchase cost of one husker

$$17,500 + 5,100 + 5,000 = \underline{\text{Rs}27,100}$$

Breakdown Huskers price (CIF Karachi) = Rs17,000

Sales tax, etc.  $17,000 \times 30\%$  = Rs5,100

Transportation cost = Rs5,000  
(Karachi to rice mill)

- ° The purchase cost is calculated based on obtaining a loan with a 3.5%-p.a. bank interest repaying it in equal installments in five years. This cost will be recovered as a lease rental.

- ° The lease rental includes 3%/year of the husker price as an insurance premium, clerical administration cost, etc., in addition to the repayment money mentioned above.

b) Breakdown of expenditure (One rice mill, two huskers installed)

- ° Lease rental  $(27,100/5 \text{ years} + 17,000 \times 3\%)$

$\times 2 \text{ machines} = \text{Rs}11,860$

Bank interest  $27,100 \times 3.5\% \times 2 \text{ units} = \text{Rs}1,897$

Total  $\text{Rs}13,757$

- ° Repair cost  $\text{Rs} 17,000 \times 5\% \times 2 \text{ units} = \text{Rs}1,700$

- ° Rubber-roll  $\text{Rs} 500 \times 50 \text{ pairs} \times 2 \text{ units} = \text{Rs}50,000$

Total  $\underline{\text{Rs}65,457}$

2) Annual profit

The operating conditions for a standard type of rice mill were set as follows:

Annual milling amount	:	4,000 tons
Breakdown		
Basmati varieties		1,340 tons
Other varieties		2,660 tons

a) Generated profit by quantitative loss improvements

According to test results conducted by the study team, the milling recovery can be improved by at least 1% by using rubber-roll huskers compared with conventional disc shellers.

° Milled rice price

Basmati Rs4,375/ton  
Other varieties Rs2,162.5/ton

° Loss reductions

Basmati 1,340 ton x 1% = 13.4 ton  
Other varieties 2,660 ton x 1% = 26.6 ton

° Annual profit

$$(4,275 \times 13.4) + (2,162.5 \times 26.6) = \underline{\text{Rs}16,147.5}$$

b) Profit by qualitative loss improvements

According to test results conducted by the study team, the broken kernel generation ratio can be reduced by at least 5%, compared with conventional disc shellers by using rubber-roll huskers.

° The differences in price and broken kernel allowable limit of special and FAQ rice are as follows:

Milled Rice Price and Broken Kernel Generation Ratio

	Basmati			Other Varieties		
	SPECIAL	FAQ	Difference	SPECIAL	FAQ	Difference
Price (Rs/40 kg)	181	175	6	95	86.5	8.5
Broken Kernel Generation Ratio (%)	7	15	8	20	40	20



- ° Grading items for quality differences between special and FAQ rice are broken kernels, damaged kernels, under-milled kernels, foreign matter, and paddy with Basmati, and red kernels, under-milled kernels, chalky kernels, and other varieties.

Therefore, only milled rice whose quality elements with other items correspond to higher grades had a possibility for being up-graded, even if the broken kernel generation ratio was reduced.

- °  $5\%/8\% = 62.5\%$  of the volume of Basmati, traded in FAQ in the past, had a possibility for being up-graded to a special grade. However, only milled rice with other inspection items such as damaged kernels corresponding to special had a possibility for being up-graded.

Similarly, in other varieties,  $5\%/2\% = 25\%$  had a possibility for being up-graded.

- ° The foregoing profit cannot be quantified based on data gathered in Pakistan during the study. Therefore, it can only be said that profit generates by improving qualitative losses.

### 3) Annual income and expenditure

Annual income and expenditure of a rice mill that has introduced a rubber-roll husker are roughly as follows:

$$\text{Rs}116,147.5 - \text{Rs}65,457 = \underline{\text{Rs}50,690.5}$$

### (8) Calculations of annual income and expenditures of the entire program

Calculations of annual income and expenditures of the entire business in the past seven years, based on the foregoing results, are as follows:

Calculations of Annual Operational Income and Expenditure

(Rs)

Year	No. of huskers	No. of mills with husked rice mill	Profit
1	100	50	2,543,525
2	1,000	500	25,345,250
3	2,000	1,000	50,690,500
4	2,000	1,000	50,690,500
5	1,900	950	50,690,500
6	1,900	950	48,155,975
7	1,000	500	25,345,250

(9) Financial feasibility

The plan is justified to be soundly feasible from a financial viewpoint based on the careful study and evaluation stated above. The plan would also certainly have economical impact and improve rice quality which is supplied to domestic and foreign markets.

(10) Considerations for business implementation

- 1) Rubber-roll huskers are not developed at present. High-performance rubber-roll huskers have been difficult to obtain because rubber rolls that can be procured locally are not high quality. Furthermore, imported rubber rolls are expensive not only due to the high F.O.13 price but to an import duty is levied.

Therefore, rubber roll manufacturing plants should be established in Pakistan when rubber-roll huskers become popular in Pakistan to some extent (after 2,000 huskers are introduced) to allow rubber rolls made in Pakistan to be used. This will be a condition to fix rubber-roll huskers. If possible, the executing agency to implement these improvement measures should establish the plant.

2) Institutional considerations

Sheller-type mills in Punjab are obligated to sell milled rice to the Food Dept. of the provincial government in accordance with the monopoly rice procurement scheme of the province. In Sind, most sheller-type mills sell milled rice to the Food Dept. of the provincial government by contract. Therefore, the rice mills in these two provinces are under the jurisdiction of the Food Dept. in the sense of rice procurement.

However, the provincial Food Dept. also manages food items such as wheat and sugar, not only milled rice, and is considered to be too busy to implement this business.

For example, government corporations such as PASSCO are also related to rice mills, and their employees have the proper capabilities to perform this business. Furthermore, PASSCO has been operating by themselves the rice mill and giving guidance to the contracted rice mills in several years. Therefore, it seems to be the appropriate choice as the executing agency of the plan.

### 7.3 Operations of Producing Edible Oil from Rice Bran

#### (1) Purpose of operation

The purpose is to promote high utilization of rice bran by introducing technology and equipment to extract and refine edible oil from rice bran and to use it also in extracting oil from other oil seeds in order to improve the traditional way of extraction, and to save foreign exchange which is used to import edible oil.

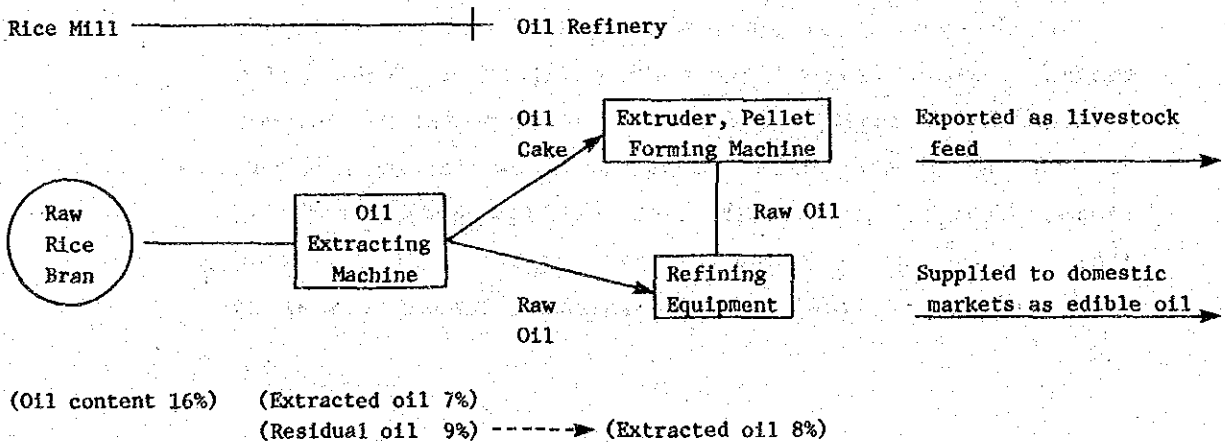
#### (2) Executing agencies

A public corporation that is related to rice processing and marketing in rice growing areas of Punjab and Sind Provinces.

#### (3) Plan of operation

The executing agency will lease oil extracting machines to 40 main rice mills. Rice mills installed with oil extracting machines will extract oil from rice bran. Raw oil and oil cake, after extraction, will be gathered in an oil refinery which is established in a nearby port in Karachi. Raw oil is refined as edible oil and supplied to domestic markets, and oil cake is processed to obtain residual oil and is formed into pellets for export as livestock feed.

The process to obtain edible oil and feed pellet is illustrated below.



(4) Rice mills and oil refineries

The number of rice mills to participate should be approximately 200, located in nearby Gujranwala City in Punjab Province and Larkana City in Sind Province, where the largest volume of paddy is marketed in these provinces. 40 extruders are installed out of 200 mills. An oil refinery is established in a nearby Karachi port as the entire volume of oil cake produced in the refinery will be exported.

(5) Plan of operation

A) Total amount of rice bran

The rice bran amount obtained from 200 rice mills with an average paddy processing capacity of 4,000 tons per year:

$$4,000 \text{ tons} \times 200 \text{ rice mills} \times 0.06 = \underline{48,000 \text{ tons}}$$

This rice bran amount is about 1/5 of the total amount that can become raw material for edible oil at present, namely, 240,000 tons. The purpose of this program is for the Pakistani Government to lead the private sector to utilize resources effectively, and it is expected that the remaining rice bran would be developed by private business.

B) Oil extracting machines: 40 units

(Installed in rice mills)

One oil extracting machine should be able to process rice bran of 5 rice mills.

Oil extraction capacity per machine is 8 to 10 tons rice bran/day

No. of working days per year: 250 days (150 days for rice bran processing, 100 days to process other oil seed)

The annual processing amount per machine is as follows:

° Raw material

Rice bran ... 4,000 tons x 0.06 = 240 tons  
 (Amount of (Rice bran  
 paddy) ratio) (Rice bran amount  
 per rice mill)

... 240 tons x 5 = 1,200 tons  
 (Rice (No. of  
 bran/mill) mills) (Rice bran  
 processing amount  
 per oil extracting  
 unit)

° Products

Raw oil ..... 1,200 tons x 0.07 = 84 tons  
 (Rice bran) (Oil ex-  
 tracting (Raw oil amount)  
 ratio)

... 1,200 tons x 0.9 = 1,080 tons  
 (Rice bran) (Oil cake  
 yield) (Oil cake amount)

C) Oil refineries

(Installed in Karachi)

a) Extraction of raw oil from oil cake

° Raw material

Oil cake ..... 1,080 tons x 40 units = 43,200 tons  
 (Total collected  
 amount)

° Products

Export pellets 43,200 tons x 0.9 = 38,880 tons  
 Raw oil ..... 43,200 tons x 0.08 = 3,456 tons  
 (Oil extraction  
 ratio)

b) Oil refining

Raw oil collected from 40 mills

84 tons x 40 mills = 3,360 tons

Raw oil processed in oil refineries

3,456 tons

Products (Refined edible oil)

(3,360 tons + 3,456 tons) x 0.9 = 6,000 tons  
 (Recovery ratio)

(6) Financial analysis

- ° The profitability of the oil extracting business in rice mills is stated on a trial basis in section (7).
- ° 200 days are allocated for rice bran and additional 100 days are allocated to extract oil from other types of oil seeds on a contract basis.

1) Equipment cost

- a) Oil extracting machines  
(with rice bran pre-processing equipment)  
Capacity : 1 ton rice bran/h  
Rs2,462,000 x 40 machines = Rs98,480,000
- b) Oil cake processing equipment  
(with pellet former)  
Capacity : 200 tons/oil cake/day  
1 unit ..... Rs103,846,000
- c) Oil refining equipment  
(with equipment to fill cans and bottles for retail sale)  
Capacity: 30 tons/raw oil/day  
1 unit ..... Rs23,007,000
- d) Ancillary equipment  
Warehouse, storage tanks,  
lorries, etc. .... Rs11,538,000  
Total equipment cost ..... Rs236,941,000  
=====

2) Annual expenditure (working 300 days)

- a) Processing costs (7% of equipment cost)  
..... Rs9,692,000
- b) Wages (2% of equipment costs) ..... Rs2,769,000  
Total ..... Rs12,461,000
- c) Bank interest and depreciation costs  
Bank interest (5%) ..... Rs11,847,000  
Depreciation costs (10 years) ... Rs23,694,000  
Total ..... Rs35,541,000

d) Raw material costs	
Raw oil .....	Rs27,648,000
3,456 tons x Rs8,000	
Oil cake .....	Rs62,208,000
43,200 tons x Rs800	
Grand Total .....	Rs110,210,000
	=====

3) Annual income

a) Rental for 40 oil extraction units	
.....	Rs9,848,000
246,000RP x 40 units	
b) Edible oil sales .....	Rs78,000,000
6,000 tons x 13,000RP	
c) Processing costs for other	
types of oil seeds .....	Rs4,153,000
Extracting raw oil from cakes of other types of oil seeds and refining raw oil requires 100 days per year as a contract business. The actual cost for 100 days was calculated as income for the processing cost.	
12,461,000 x 100 days/300 days	
d) Oil cake (Pellets)	
Rice bran cake	
38,886 tons x Rs600 .....	Rs23,328,000
Total .....	<u>Rs115,329,000</u>

4) Annual net profit

4) = 3) - 2) = 115,329,000 - 110,210,000	
=	Rs5,119,000
	=====

(7) Cost and benefits of oil extraction business of rice mills

1) Annual expenditures

° Rice bran raw material costs .....	Rs1,200,000
240 ton x Rs1 x 1,000 kg x 5 mills	
° Mill expenditures (labor cost, electricity, etc.)	
Approx. 10% of equipment cost ....	Rs250,000



° Rental of oil extraction machines  
 rental ..... Rs246,200  
 The equipment cost of oil extraction machines is to  
 be depreciated by 10-year.  
 $Rs2,462,000 \div 10 \text{ years} = Rs246,200$   
 Total expenditure ..... Rs1,696,200

2) Annual income

° Raw oil sales ..... Rs672,000  
 $1,200 \text{ tons} \times 0.07 \times Rs8,000$   
 ° Oil cake sales ..... Rs768,000  
 $8 \text{ tons} \times 0.8 \times 150 \text{ days} \times Rs800$   
 ° Oil extraction contract fee for  
 other types of oil seeds ..... Rs1,040,000  
 Assuming that contracts are received for a total of  
 100 days per year to extract oil from other types  
 of oil seeds, the processing fee of Rs2/kg  
 determined during the survey was applied.  
 $8 \text{ tons} \times 100 \text{ days} \times 0.65 \times Rs2 \times 1,000 \text{ kg}$   
 Total income ..... Rs2,480,000

3) Annual profit

$Rs2,480,000 - Rs1,696,200 = Rs783,800$   
 =====

(8) Financial feasibility

By means of a financial evaluation stated above, the plan has a high viability and soundness, and certainly would give economic benefits to the country by saving foreign currency used for the importing edible oil.

(9) Consideration for implementation

1) Requirements for implementation

At present, Pakistan imports more than 700,000 tons of edible oil per year, spending a large amount of foreign exchange for this purpose. Under such circumstances, the plan to introduce facilities and technology to produce edible oil from rice bran needs to be urgently started.

However, a detailed feasibility study should be undertaken to examine technical and operational aspects more carefully.

## 2) Technical considerations

- a) The reason why rice bran oil, which is a valuable edible oil resource, has not been utilized in Pakistan so far is that rice bran obtained after milling rapidly oxidizes, and this has not been overcome technically. Even if such high acid-value rice bran could be extracted to produce oil, nearly all had to be used only as an industrial raw material for soaps and detergent etc.

The important requirement in the implementation of the plan is to efficiently extract oil from rice bran before the acid value increases, that is, from fresh rice bran. This can be done by installing oil extraction machines directly at rice mill. The key to producing good-quality edible oil is to extract oil from fresh rice bran, within 4 to 8 hours after milling.

- b) An increase in oil seed crops is an emphasis in the agriculture policy as clearly mentioned in the Sixth Five-Year Plan. However, it is clear that losses would be still great if oil extraction and processing equipment is dependent on conventional methods.

The significance of installing efficient oil extraction facilities in rice mills is great in effectively utilizing other oil seeds which supports an increase in oil-seed production.

- c) Good quality of rice bran, that is, unmixed husk or broken kernels and uniform rice bran quality, are important to increase the oil extraction ratio.

## 3) Economic considerations

- a) There is a special demand in overseas markets for rice bran oil if the quality is good, and oil is

traded at considerably high prices. Raw oil obtained by extracting rice bran in rice mills could be exported after simple processing, such as degumming.

- b) This plan calls for export of the entire quantity of defatted rice bran pellets for feed. However, these pellets could be able to contribute greatly to the poultry industry which is presently rapidly growing in Pakistan.

4) Institutional and organizational considerations

- a) Rice bran oil is not used in Pakistan for cooking yet, and there is no specific public organization responsible for it. Ghee Corporation of Pakistan is a public corporation responsible only for importing and supplying vegetable oil and ghee.

PASSCO, which is a federal corporation responsible for building agro-based industries, is recommended to execute overall control of the plan for the following reasons:

- ° PASSCO maintains a close relation with rice mills through routine activities in both Sind and Punjab.

- ° PASSCO has proper departments to execute the plan such as;

Field Dept.:

to control field work

Engineering Dept.:

to supervise and support mechanical operations

Commercial Dept.:

to handle the supply of raw material and the sale of products

- b) The Pakistan Council for Scientific and Industries Research (PCSIR) Laboratories, which is a research organization of the federal government under the Ministry of Science and Technology, has researchers and research experience regarding rice bran oil

extracting and refining technologies. The executing agency should maintain a close relationship with this institution to receive technical assistance.

- c) The operation is planned with approximately 1/5 of the available rice bran amount, in Pakistan. The remaining portion is expected to be implemented by the efforts of the private sector. The executing agency should play a positive guidance role for private enterprises regarding technology, equipment, and operation.

## 7.4 Establishment of Facilities for Improving and Developing of Post-harvest Technology

### (1) Purpose of the plan

The purpose is to provide facilities which allow postharvest machines to be improved and developed to fit local conditions of paddy field in Pakistan, to promote the utilization of by-products, and to train farmers and concerned personnel how to operate, repair, maintain, and management of these machines.

### (2) Executing agencies

The Rice Research Institute (RRIs) belonging to Punjab and Sind Provinces.

### (3) Nature and organization of facilities

The following four sections are incorporated in the activity of RRIs:

- 1) Harvesting machinery
- 2) Rice milling
- 3) By-product utilization
- 4) Information and extension

Basic research is already done by some sections of the RRIs regarding 1) and 2) above, and this plan would strengthen and expand the existing sections, in a practical way. New sections should be established for 3) and 4). Expenditures for administrative activities should be streamlined in the existing organizational structures of the RRIs. Wide activities should be conducted with the cooperation of federal and provincial organizations, universities, research institutes, and also the private sector. A technical committee should be organized to obtain more practical advice and counselling.

(4) Activities

1) Harvesting machines

- Improvements of various types of harvesting machines
- Practical modifications such as threshers and other harvesting machines manufactured in Pakistan
- Education and training operators and mechanics

2) Rice milling

- Improvements in various processes of milling machines
- Improvements in producing technologies and equipment of par-boiled rice
- Education and training rice milling engineers

3) By-products utilization

- High utilization of rice straw, husk, rice bran, and broken rice
- Public display and demonstration

4) Information management and retrieval systems and publicity and dissemination of results

- Filing, updating, and retrieval systems for documents, books, magazines, data, reports, etc.
- Copying, drafting, printing, and storage systems
- Photographing, projection, education and training

(5) Buildings

- |   |                    |
|---|--------------------|
| 1) Workshop .....                                 | 150 m <sup>2</sup> |
| 2) Equipment display and public demonstrations .. | 400 m <sup>2</sup> |

(6) Equipment and apparatus

- Various types of harvesting machines  
Reapers, binders, threshers, combines, etc.

- ° Milling machine  
Drying, husking, milling, cleaning par-boiling, and handling equipment like packing and weighing
- ° Various types of by-product utilization facilities  
Rice straw, husk, and rice bran processing equipment
- ° Machines and tools for remodeling  
Lathes, boring machines, press brakes, benders, small presses, boring tools, welding machines, compressors, hand tools, measuring instruments, etc.
- ° Testing and measuring instruments  
Measuring instruments, testers, motive power meters, recorders, photographing equipment, data processing equipment etc.
- ° Analysis instruments for testing physical and chemical characteristics of products.  
Physiochemical analyzers, and chemical apparatus etc.
- ° Information management and retrieval systems and education and publicity equipment  
Data compiling and perusal facilities, personal computer and software, VTR, copier, printer, OHP, slide projector, business machines, etc.

(7) Expenditure needed for the facilities

(Unit: Rsl,000)

1) Buildings	550 x Rs7,693	4,230
	<u>Contingencies (15%)</u>	640
	Subtotal	4,870
2) Equipment		23,077
	<u>Contingencies (10%)</u>	2,308
	Subtotal	25,385
3) Total expenditure	Punjab Province RRI	30,255
	<u>Sind Province RRI</u>	30,255
	Subtotal	60,510
4) Others		4,840
5) Grand total		65,350
		=====

(8) Profitability of facilities

The activities of the facilities would play an important role not only in technical support for proposed improvement plans, but also in improving postharvest operations of paddy/rice which would be conducted widely and diversely in the future. The activities would make a great contribution in increasing production, crop diversification, upgrading farmers' income, supplying high-quality rice to both domestic and overseas markets, earning foreign exchange, and fostering village industries. However, because of the purposes and natures of the facilities, direct earnings cannot be expected. The Government of Pakistan should take financially feasible countermeasures and implement them as soon as possible.

(9) Considerations for implementation

1) Requirements for implementation

Various activities in the facilities would perform not only an important role in this program, but also perform integral element toward the modernization of rice cultivation in Pakistan. The plan requires to be implemented urgently, and the basic study for implementation should be undertaken as early as possible.

2) Technical considerations

a) Harvesting machines should be modified to fit local conditions of Pakistan. Complaints and requests for improvements made in the field should be studied actively and executed quickly. The plan should be made as a mechanism that allows the field and R&D organizations to work as one unit.

b) Operators should be trained to permit and equipment to function effectively and soundly. These operators should also be versed in maintenance, management, and repairs, as well as operational technology. Education and training should be provided periodically under appropriate curriculum.



c) Technical assistance by foreign countries to support the above-mentioned R&D, education and training activities is not necessarily required for the following reasons.

- ° Pakistan has reached a certain level of post-harvest technology, and Pakistani engineers can autonomously perform related activities.
- ° It would be more effective to train Pakistani engineers in foreign countries and transfer technology to many Pakistanis after their return from foreign study.

### 3) Institutional considerations

a) The official organization that has administrative responsibilities for the manufacture, remodeling, and testing of agricultural machinery is the Farm Mechanization Institute (AFMI). However, the RRIs in Punjab and Sind Provinces were finally selected as the executing agencies for the following reasons:

- ° Agricultural mechanization of Pakistan has mainly evolved around wheat, and mechanization of rice has just started.
- ° Compared with other agricultural crops, rice harvest mechanization has some peculiarities in operation. Furthermore, in the case of Pakistan, soil and farming conditions differ from one region to another. In fact, FMI activities in Sind and Punjab Province regarding rice harvest have been conducted by engineers belonging to the FMI in the agricultural machinery section of the RRI with its cooperation.
- ° RRIs are the institutions which concentrate to research and study on only rice.

° The RRI's have performed their activities mainly for basic reserach, and it is necessary for the RRI's to strenghen their capacities in undertaking practical development and extension as much as possible.







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