

*APPENDIX N2 : POST-HARVEST PROCESSING*

**APPENDIX- N2 : POST-HARVEST PROCESSING**

**TABLE OF CONTENTS**

	<u>Page</u>
N2.1 General Condition of Feasibility Study Area.....	N2 - 1
N2.2 Local Manufacturing Machinery and Equipment.....	N2 - 2
N2.3 Model Cooperative Project.....	N2 - 4
N2.4 Improvement Project of Training / Extension System.....	N2 - 7

## N2.1 General Condition of Feasibility Study Area

The present post-harvest practice in the study area is as follows.

### 1) Post-harvest processing of farmers

The current post-harvest processing practice of farmers is summarized in the table below:

#### Current Condition of Post-harvest Processing

Field	Phu Tho	Gao Giong
Threshing	Using mobile thresher. Existing No. in the Area: 15 sets (9 sets in coop. Area). Hiring charge (wage): 250 kg paddy or equivalent Dong /ha.	Using mobile thresher. Existing No. in the Area: Unknown but total capacity is enough for processing. Hiring charge (wage): 150 kg paddy or equivalent Dong /ha.
Drying	Mainly drying on field (only for w-s crop by av. two days), backyards and public places such as road. No. of drying yards made by tile or concrete: no places Av. drying hours: 2 days in a field before threshing for w-s crop only and 1-2 days around residence. Av. rotation period for sun drying: no rotation for w-s crop and av. every a half hour for s-a crop. Judging method of moisture content: Biting by experience. Existing mechanical dryer: none Introduction plan of mechanical dryer: exist*	Mainly drying on field (only for w-s crop by 1-2 days), backyards and public places such as road. No. of drying yards made by tile or concrete: no places Av. drying hours: 1-2 days in a field before threshing for w-s crop only and 1-2 days around residence after threshing. 3-5 days around residence for s-a crop. Av. rotation period for sun drying: av. every 1-2 hour. Judging method of moisture content: Biting by experience. Existing mechanical dryer: none Introduction plan of mechanical dryer: 2 flat bed dryers (cap.: 8 ton) in 2001
Storage	Almost all farmers sell their product to collectors soon after harvesting. Storage: They store paddy in plastic bags in a house or small shed.	Almost all farmers sell their product of s-a crop to collectors soon after harvesting to avoid deterioration of quality and keep their products w-s crop for a while to wait market price rising. Storage: Most popular mean for storing paddy is in cylindrical container made by bamboo net.
Milling for self-consumption	The most of them ask mobile rice mills coming from outside of commune. Milling charge: 2,000 VND / 20kg Farmers have all by-products such as bran and husk together with milled rice. Price of by-products: 1,500 VND / kg for small bran, 400 VND / kg for big bran containing husk and 60 VND / kg for husk.	They ask village millers. Milling charge: 1,800-2,000 VND / 20kg Farmers have all by-products such as bran and husk together with milled rice. Price of by-products: 1,500 VND / kg for bran.

\*Introduction plan of mechanical dryer:

Phu Tho Coop. is planning to introduce two units of flat bed dryer.

Expected time for installation: July 2000

Type: a flat bed dryer made by bricks, same as a type of dryers introduced in DANIDA Project.

Holding capacity: 8 tons / unit

Planned processing amount: 960 tons / 30 days for S-A crop, which will cover 45% of total products.

Investment: Cooperative's fund

## 2) Condition of rice mill

The general condition of rice mills existing in the Area is as follows:

### Condition of Existing Rice Mills in the Area

	Phu Tho	Gao Giong
No.	4 rice mills in the commune	3 (One owed by a coop. member) + 1 mobile mill.
No. of R/M surveyed	2	2
Type and Capacity of machinery	Almost a combination of a under-runner type husker and a corn type whitener.	Almost a combination of a under-runner type husker and a corn type whitener.
Processing wage	1,500VND / 20 kg	1,800-2,000 VND/20kg
Moisture content	w-s crop: 16-16.5 % s-a crop: more than 17 %	w-s crop: 14-15 % s-a crop: 15-16 %
Recovery rate	w-s crop: approx. 70 % s-a crop: approx. 60 %	w-s crop: approx. 55-70 % s-a crop: approx. 50-65 %

## N2.2 Local Manufacturing Machinery and Equipment

The Study Team visited local manufacturers and met specialists to collect useful information for designing of equipment and facilities to be introduced in the Model Cooperative Project and the Improvement Project of Training / Extension System.

Major equipment and facility to be considered are as follows:

### Major Equipment and Facility to be considered

Project	Intended Field	Equipment and facility
Model Cooperative Project	Improvement of P/H practice of farmers	Dryer and storage
	Model processing activity for farmer's group	Dryer, rice mill, and equipment for quality control and inspection
Improvement Project of Training / Extension System	Improvement of P/H processing technology	Dryer, rice mill, and equipment for quality control and inspection

As the conclusion of the above study, the following points were identified for consideration in design works for equipment and facility.

**Issues to be considered in Designing of Equipment and Facility**

Project	Field / Equipment	Issues to be considered
Model Project  Cooperative	P/H Processing equipment for farmers	<p>1) Dryer Based on the good result in DANIDA Project, the flat-bed dryer of same type for the Project will be considered. Floating type and/or mobile type dryer to cope with flooding condition will be also considered but the ordinary type will be introduced as much as possible in view of economy.</p> <p>2) Warehouse The cylindrical container made of a bamboo net is judged practical and economical, and as the price is not high farmers can procure by themselves. Therefore, this will not be included in the Project.</p>
	Rice mill	The plant with a combination of a rubber roll type husker and a vertical and abrasive type whitener will be considered among all combination types existing locally, because it can expect higher recovery rate and reduction of losses especially for uniform and high quality paddy.
	Equipment for recovery rate control	The introduction of weighing equipment in the processing line will be considered to ensure an operation practice for recovery rate control.
	Equipment for quality inspection and control	The equipment with reliable quality has not been manufactured locally yet. The introduction of a series of Japanese equipment for quality inspection and control will be considered.
Improvement Project of Training / Extension System	General	The demonstration of actual effects and results performed by the improved technology and equipment comparing to the existing practice in order to make trainees to learn and acquire the improved technology effectively. Introduction of the facilities will be considered based on these objectives.
	Drying	The extension of improved technology on sun drying and operational technology for a flat-bed type dryer which is expected to be spread more in future will be considered.
	Husking and whitening	The extension of improved technology on management and operation of the most popular type of mill. These include a combination of an under-runner type husker and a corn type whitener. The mill with rubber-roll type husker and vertical and abrasive type whitener is increasing in number gradually, for high quality rice production. Therefore, two types of the above will be considered.
	Recovery control	The extension for recovery control technology for evaluation and judgment to operation effectiveness will be considered.
N2-3		

Project	Field / Equipment	Issues to be considered
	Quality control	The extension of quality control technology for evaluation of quality of paddy, brown rice and milled rice and for their application to various transactions will be considered. The equipment with reliable quality has not been manufactured locally yet, the introduction of a series of Japanese equipment for training will be considered.

### **N2.3 Model Cooperative Project**

The all descriptions below are considered and treated as a component concerning the field of post-harvest processing in the integrated “Model Cooperative Project”.

#### 1) The Area

The two models of Phu Tho Cooperative and Gao Giong Cooperative were selected for the Project.

#### 2) Basic condition

The basic condition related to the post-harvest processing in the Project is shown in the table below.

#### **Basic Condition**

Objectives		Activities	
Production of high quality rice Reduction of P/H losses Adding value		Improvement of drying Emphasizing of quality control Establishment of rice mill business	
Input	Implementation Org.	Requirement	
Supply of necessary equipment and facility Supply of necessary training programs	Phu Tho Cooperative Gao Giong Cooperative Supported and supervised by Provincial and Divisional P.C.	Collaboration with SOEs concerned. Application of proper training programs by AEC.	

#### 3) Equipment and facility

The following equipment and facility will be introduced in two sites for the Project.

##### a) Equipment and facility (for each area)

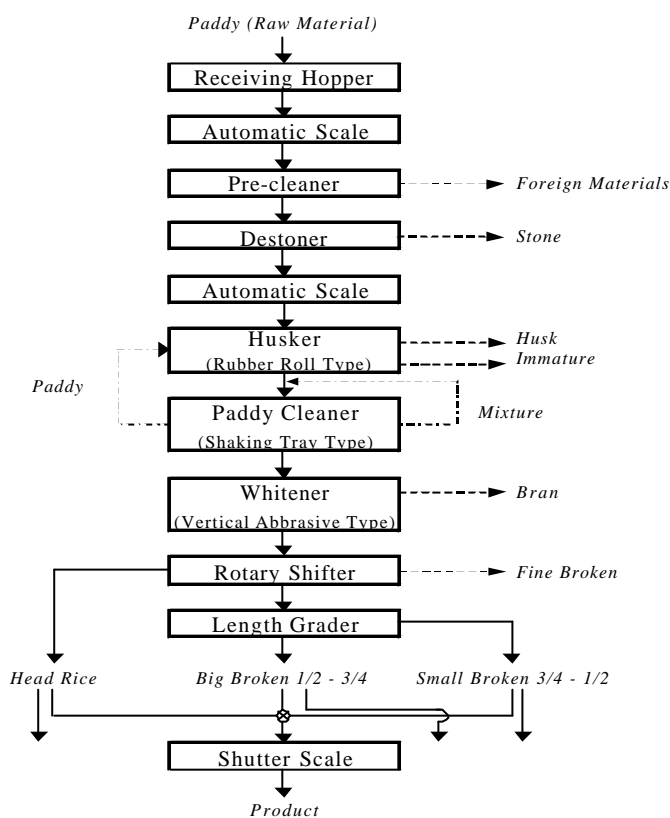
#### **Equipment and Facility Plan**

No.	Equipment and facility	Q'ty	Capacity
1	Rice mill	1 set	4t / hr.
2	Flat bed dryer	2 sets	8t / batch x 2
3	Drying yard	1 place	
4	Quality inspection and control equipment	2 sets	

- The machinery combination of the rice mill is designed in consideration of high and

effective performance of processing suitable to a uniform and high quality raw material.

The flow diagram is shown below:



**Flow Diagram of Rice Mill**

b) Building

The whole building and layout plan for the Project including other facilities such as warehouse and office are shown in the section of “N3 Marketing”.

**Building Plan**

No.	Function	Area (m <sup>2</sup> )		Remarks
		Phu Tho	Gao Giong	
1	Rice mill	600	600	
2	Flat bed dryer*	100	100	Outside

\*One unit between two dryers will be installed in the convenient place in the farmer’s residence area for collective use.

4) Construction site

The construction sites for the facility above are planned by the both Cooperatives as follows:

a) Phu Tho Cooperative

The land of approximately 2,000 m<sup>2</sup> located between the Cooperative office and Tien River.

b) Gao Giong Cooperative

The land of approximately 2,500 m<sup>2</sup> located on the corner of canals cross point in the opposite side of District P.C. Office.

5) Initial investment

The initial investment cost is estimated as follows:

**Initial Investment**

<Major component>	No.	Cost (US\$)
1.Rice mill unit	1 unit	65,000
2.Flat bed dryer	2 set	6,000
3.Inspection and quality control equipment	1 sets	12,200
(Total)		83,200

\* Building cost is estimated after integration of concerned sector's plan and shown in "N3 Marketing".

6) Operational cost

The annual operational cost is estimated as follows:

**Annual Operation Cost**

<b>- Rice mill</b>	
Operational hours	According to the handling plan designed by the marketing sector, annual operation hours are as follow: <Pho Tho Coop.> 180 days / year x 16 hrs. / 2 shifts = <u>2,880 hrs.</u> <Gao Giong coop.> 190 days / year x 16 hrs. / 2 shifts = <u>3,040 hrs.</u>
Cost	1) Power consumption: 120KWh <Pho Tho Coop.> @ 1,000 VND x 120KWh x 2,880 hrs = 345,600,000VND <Gap Giong Coop.> @ 1,000 VND x 120KWh x 3,040 hrs = 364,800,000VND 2) Consumables: 60,000,000VND / 2,000hrs <Pho Tho Coop.> 60,000,000VND x 2,880 / 2,000 hrs. = 86,400,000VND <Gao Giong Coop.> 60,000,000VND x 3,040 / 2,000 hrs. = 91,200,000VND 3) Other maintenance cost: 65,000US\$ x 3% = 1,950US\$ = 27,300,000VND 4) Total <Phu Tho Coop.> <u>459,300,000VND</u> <Gao Giong Coop.> <u>483,300,000VND</u>



<b>- Dryer</b>	
Operational amount	30 days x 2 times / day x 8 tons / batch = 480 ton
Cost	@ 37VND / kg incl. Depreciation, repair, diesel oil and labor. 37VND x 480,000 kg = 17,760,000VND / year Annual land rent charge 4,000VND is added for the dryer installed in the Farmer's residence area. 17,760,000VND + 4,000VND = 17,764,000VND Total cost for two unit in each Coop. <span style="float: right;">35,524,000VND</span>
<b>- Total operational cost</b>	<Phu Tho Coop.> <span style="float: right;">494,824,000VND</span> <Gao Giong Coop.> <span style="float: right;">518,824,000VND</span>

\*Total financial analysis including other activities for the Project is estimated in "N3 Marketing" after integration of each sector's cost estimation.

## **N2.4 Improvement Project of Training / Extension System**

The all descriptions below are considered and treated for a department or section concerning the field of post-harvest processing in the Project.

### 1) Basic condition

The basic condition for the department / section in charge of the post-harvest processing of rice in the Project is shown in the table below.

#### **Basic Condition**

Objectives		Activities	
1) Improvement of farmer's practice for P/H processing		1) Training of farmers	
2) Improvement of management and operational technology in rice mills		2) Retraining of manager and operator in rice mills	
3) Extension of quality inspection and control technology		3) Training of farmers, traders, rice millers and officials concerned	
Input	Implementing Org.	Requirement	
Equipment and facility necessary for training and extension Support for course design and curriculum preparation	Agricultural extension center, Dong Thap PC Support Agency: PHTI for activity planning, recruit and dispatching of trainers.	Support by PHTI	

### 2) Training subjects

Training subjects and schedule are planed as follows:

#### **Training Subject Plan**

**THE STUDY ON INTEGRATED AGRICULTURAL DEVELOPMENT PLAN  
IN THE DONG THAP MUOI AREA VIET NAM FINAL REPORT**

Subject	Trainee	Content
Post-harvest Processing Technology	Farmers, farmer's groups, traders, processors and extension officers	Technology such as drying and storage
Quality Inspection and Control Technology	Farmers, farmer's groups, traders, processors and officers	Inspection and control technology for paddy, brown rice and white rice quality
Factory Management Technology	Farmer's groups and processors	Factory management and profit control technology
Rice Processing Technology	Farmer's groups and processors	Milling, recovery control and machinery maintenance technology

(Monitoring of post-harvest losses)

The P/H loss assessment technology is trained among the above training programs through the demonstration and the assessment data is collected timely by the cooperation of trainees to learn the actual loss generating condition in the Area.

### Training Schedule Plan

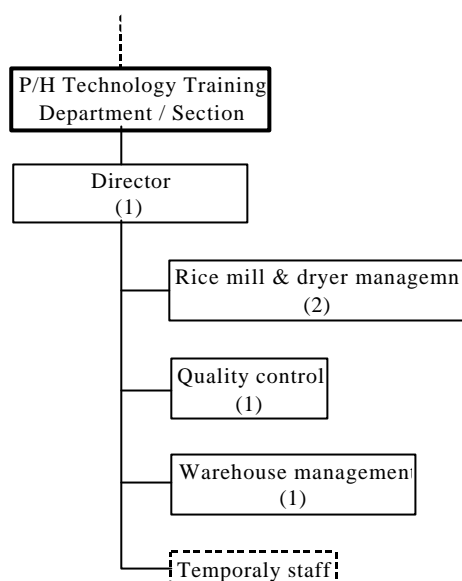
Program	Capacity (Trainee)	Period (Day)	Time / Year	Total (Day)	Total Trainees / Year
Post-harvest Processing Technology	10	3	20	60	200
Quality Inspection and Control Technology	10	3	30	90	300
Factory Management Technology	10	5	5	25	50
Rice Processing Technology	10	10	5	50	50
Total			60	225	600

### Training Schedule Plan (Calendar)

Program	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Post-harvest Processing		***	****			***	****			***	***	
Quality Inspection and Control	*	**	***	***	***	***	***	**	**	**	***	***
Factory Management		—	—			—	—				—	
Rice Processing Technology		—	—			—	—				—	

### 3) Organization and staffing

Organization and staffing plan are prepared as follows:



**Organization Plan**

**Staffing Plan**

Class	Allocation	No.	Role	Remark
Permanent	Director	1	To manage the dept. or section and give a guidance on P/H processing technology for farmers.	To be recruited newly
	Rice mill & dryer	2	To maintain and give a guidance on milling plant and dryer	
	Quality control	1	To maintain and give a guidance on equipment for inspection and quality control	
	Warehouse	1	To maintain warehouse	
Temporary	Trainers	Unspecified	To give a guidance of factory management technology and loss assessment	PHTI will support to recruit and dispatch staffs.

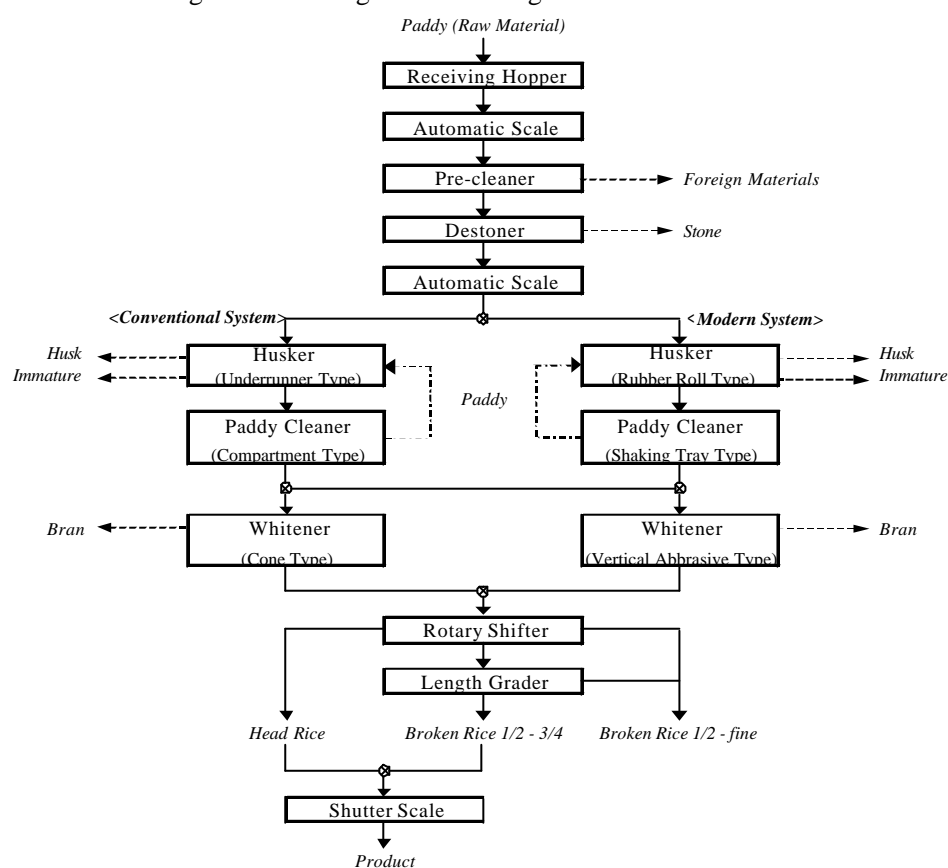
4) Facility and equipment

Theoretical training is carried out in the lecture room for multi-purpose use in the Center and the following facility and equipment will be introduced for practice training.

### Facility and Equipment Plan

<Major component>	No.	
1.Rice mill unit*	1 unit	1-2 t / hr
2.Inspection and quality control equipment	3 sets	
3.Drying yard	1 place	
4.Flat bed dryer	1 set	Husk fed 4t / batch
5.Warehouse of processing material and product for training	1	
6.Tools and equipment for maintenance	2 sets	

The Rice Mill is designed especially for comparison training between the conventional processing and the modern one on husking and whitening. The flow diagram is shown below:



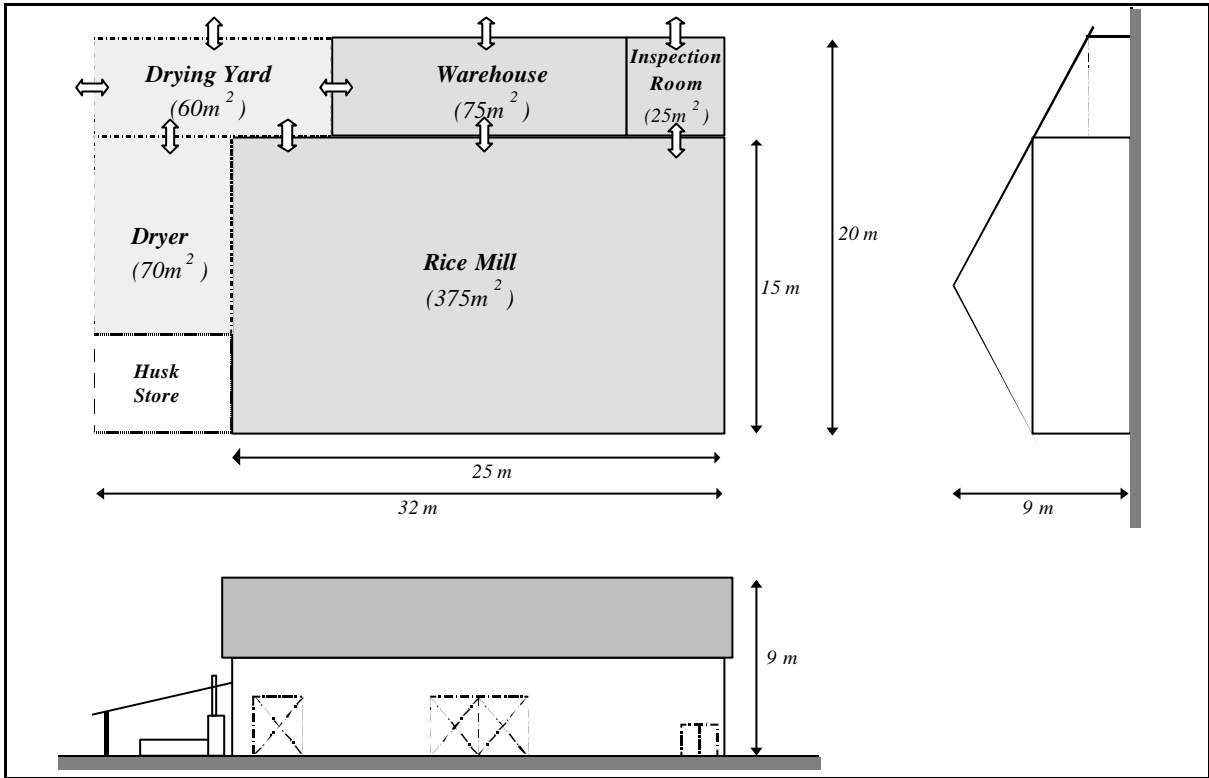
Flow Diagram of Rice Mill for Training

### Building Plan

<Building>	m <sup>2</sup>		
1. Rice mill	375	15 x 25m	475 m <sup>2</sup>
2. Warehouse	75	5 x 15m	
3. Inspection Room	25	5 x 5m	
4. Flat bed dryer	70	7 x 10m	130 m <sup>2</sup> in the open
5. Drying yard	60	5 x 12m	
(Total)	630		

5) Construction site and layout plan

The construction sites for the facility above are planned in the area of the existing “Agricultural Extension Center” in Cao Lanh Town. The layout plan of the building is shown in the drawing below.



**Layout Plan of Building**

6) Initial investment

The initial investment cost is estimated as follows:

**Initial Investment**

<Major component>	No.	Cost (US\$)
1.Rice mill unit	1 unit	50,000
2.Inspection and quality control equipment	3 sets	33,000
3.Flat bed dryer	1 set	2,000
(Total)		85,000
<Building>		
1. Building	475 m <sup>2</sup>	190,000
2. Drying yard	130 m <sup>2</sup>	
(Total)		190,000
(G. Total)		275,000

7) Operational cost

The annual operational cost is estimated as follows:

**Annual Operation Cost**

<b>- Rice mill</b>	
Operational hours:	<p>&lt;For training&gt;  3 hours x 5 times = 15 hrs / year  5 hours x 3 days x 5 times = 75 hrs / year  Total: 90 hrs / year  &lt;For commercial use&gt;  The rice mill will be used for processing service to traders and farmers during idle time.  Feb. – Apr. : 30 days  Jun. – Aug. : 30 days  Oct. – Nov. : 20 days  80 days x 12hrs = 960 hrs  Total : 1,050 hrs / year</p>
Cost:	<p>1) Power consumption: 65KWh  @ 1000 VND x 65KWh x 1,050 hrs = 68,250,000VND  2) Consumables: 20,000,000VND / 2,000hrs  20,000,000VND x 1,050 / 2,000 = 10,500,000VND  3) Other maintenance cost:  50,000US\$ x 2% = 1,000US\$ = 14,000,000VND  Total : 92,750,000VND / year</p>
<b>- Dryer</b>	
Operational hours:	20 days x 8 hrs / batch x 8 tons / batch = 160 ton / 160 hrs
Cost	<p>@ 45VND / kg incl. repair, husk, diesel oil and labor.  45VND x 160,000 kg = 7,200,000VND / year</p>
<b>- Total operational cost</b>	G. Total : 99,950,000VND / year

8) Management cost

The annual management cost is estimated as follows:

**Annual Management Cost**

<b>- Personal expenditures</b>	
Permanent staff	1) Director: @500,000VND / month x 12 = 6,000,000VND 2) Engineer for rice mill and dryer @400,000VND / month x 2 person x 12 = 9,600,000VND 3) Quality inspector @400,000VND / month x 12 = 4,800,000VND 4) Warehouse manager @300,000VND / month x 12 = 3,600,000VND Total : 24,000,000VND
Temporary staff	Trainer for factory management: @25,000 x 3 days x 5 times = 375,000VND Other trainers: @25,000 x 20 man / day = 500,000VND Total : 875,000VND
<b>- Miscellaneous</b>	@ 500,000VND / month x 12 = 6,000,000 VND
<b>- Total management cost</b>	G. Total : 30,875,000VND

9) Income

The annual income is estimated as follows:

**Annual Income**

<b>- Training fee</b>	Free for trainees of farmers. The rate is decided by reference to ones on the vocational training school. 1) P/H processing Technology : @30,000 x 50 trainees = 1,500,000VND 2) Quality inspection and control technology: @60,000 x 50 trainees = 3,000,000VND 3) Factory management technology: @200,000 x 25 trainees = 5,000,000VND 4) Rice processing technology: @300,000 x 50 trainees = 15,000,000VND Total : 24,500,000VND
<b>Te- Milling service charge</b>	The wage for processing service: @1,800VND / 20 kg 1,800VND / 20 kg x 1,050 hrs x 1,000 kg = 94,500,000VND Total : 94,500,000VND / year
<b>- Total income</b>	G. Total : 119,000,000VND / year

10) Balance

The annual financial balance is estimated as follows:

**Annual Financial Balance**

- Operational cost	99,950,000VND
- Management cost	30,875,000VND
- Income	119,000,000VND
<b>- Balance</b>	<b>-11,825,000VND</b>