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THE PRIVATE AND SOCIAL PROFITABILITY OF MECHANICAL THRESHING

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INTRODUCTION

The use of mechanical threshers in small-scale traditional rice production systems raises several issues. The positive view equates machines with modernization and makes improved mechanical devices a requirement for development. With continuous cropping and increased yields from the use of modern rice varieties and controlled irrigation, the harvest of the first crop closely coincides with land preparation for a second crop. Since labor shortages usually accompany the first harvest, thresher use helps relieve labor bottlenecks which constrain sequential cropping. Threshers reduce labor input from 39 man-hours per ton using traditional techniques to 11 man-hours per ton (Toquero et al. 1977). In a rice-rice cropping pattern, threshers can shorten turnaround period by five days (McMennamy and Zandstra 1978) compared to 23 to 29 days with traditional threshing (Roxas et al. 1977). A long turnaround can result in lower yields and cropping intensity. Threshers have also evidenced a reduction in quantitative grain losses compared with traditional methods (hand beating) and have increased head rice recovery by 4.7 per cent (Toquero et al. 1977).

Threshing is an important component of the rice production system as it accounts for 42 per cent of the total labor input when using traditional methods (Toquero et al. 1977). Opponents of mechanical threshing argue that since rice threshing represents a

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major employment opportunity for the landless rural labor, machines will result in exploitation of the rural poor and is therefore not socially desirable.

The production and sale of threshers has continued to rise since 1975, reaching a peak in 1979 with 4,100 units (Table 1 and Figure 1). This figure is an underestimation because it refers only to IRRI-designed threshers and does not include other designs produced outside the IRRI. Compared with 1979 figures, production apparently declined in 1980-83 due to the economic recession, but the precise trend is not known because of incomplete data. Table 1, however, shows that thresher utilization remains high, and based on an expected life of 5-6 years, a minimum of 14,800 units were in use as of 1982. Both production and utilization seem to be highly regionalized, with Laguna and Iloilo holding an average of 62 per cent of the market for all the years under review (Figure 2).

In the face of declining real wage rates, rising fuel prices and a growing supply of farm labor, a careful evaluation of the advantages and disadvantages of machine threshing over the traditional methods is important. A critical issue raised by a leading economist during the 1981 consequences workshop in the Philippines is the private and

TABLE 1
IRRI THRESHER PRODUCTION STATISTICS, PHILIPPINES, 1974-81.

Year	*Large axial flow*	*Portable*	*Total*
	No. of units		
1974	120		120
1975	275		275
1976	552		552
1977	494	827	1,321
1978	689	1,746	2,435
1979	1,850	2,290	4,140
1980	1,059	1,218	2,277
1981	1,417	1,275	2,692
1982	1,689	1,113	2,802

Sources: IRRI Engineering Semiannual Report Nos. 21-29 (1974-79): Reports of Industrial Extension Engineers (1980-82).

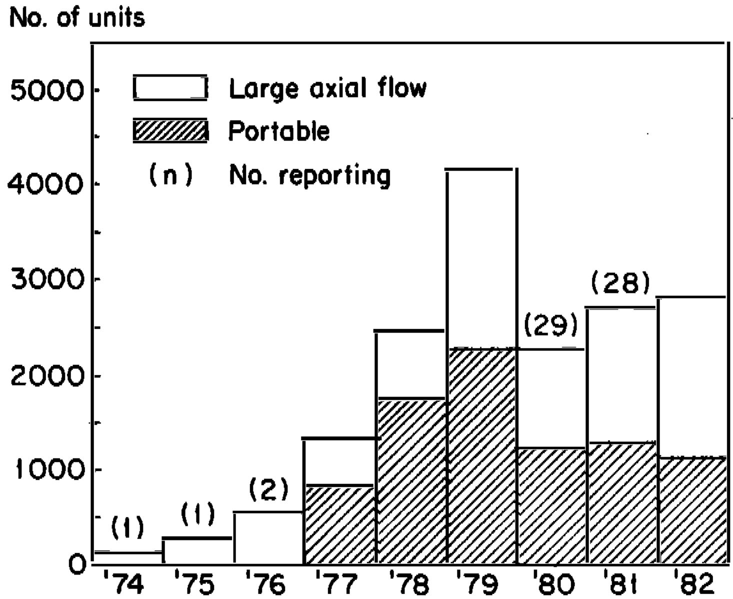

FIGURE 1
PRODUCTION OF IRRI DESIGNED MECHANICAL THRESHERS IN ILOILO AND LAGUNA BY COOPERATING MANUFACTURERS, 1974-82

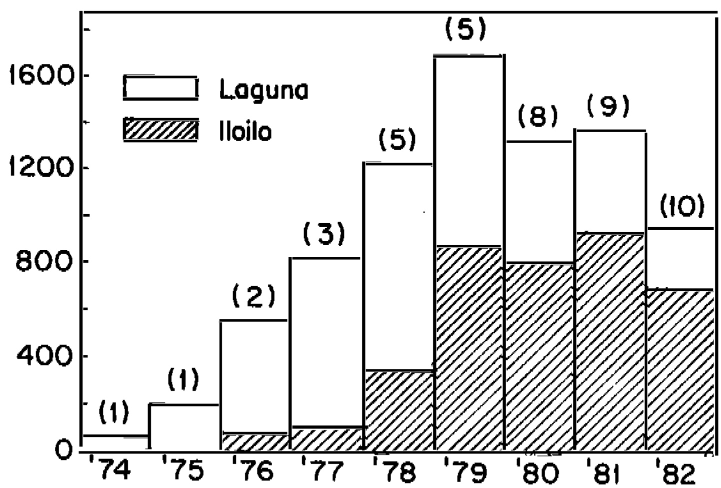

FIGURE 2
PRODUCTION OF IRRI DESIGNED MECHANICAL THRESHERS IN ILOILO AND LAGUNA BY COOPERATING MANUFACTURERS, 1974-82

social profitability of threshing machine: "Is there a substantial economic incentive to adopt the machine as judged on a private cost and returns basis? Would that incentive change if all inputs were priced at their shadow prices? Is there a significant net social benefit associated with using the machine? " (Herdt 1981).

OBJECTIVES

The general goal of this paper is to present both the private and social profitability of thresher adoption and use. Specifically, the objectives are:

1. To determine the private profitability of thresher adoption using different methods of investment appraisal such as net present value, breakeven point, payback period, and benefit-cost ratio;
2. To determine the social profitability of thresher adoption and use; and
3. To present the current status of thresher adoption and use and show the effects of fuel and oil price and contract cost increases on utilization.

SCOPE AND RESEARCH DESIGN

The study uses survey data from six villages (three irrigated and three rainfed) of Iloilo province and seven villages of Laguna in 1978-79 when sales of IRRI threshers were highest (Figure 3). These two provinces were chosen because of their high degree of thresher adoption. In the 1978 survey, respondents included the following categories:

Sample respondents	Laguna irrigated	Iloilo irrigated	Iloilo rainfed
Thresher owners	7	11	5
Thresher nonowner users	12	14	16
Thresher nonusers	7	14	15
Thresher manufacturers	1	6	

Some landless workers were also included but are not examined in this paper. All respondents, except the manufacturers and two thresher owners, were farmers. Farmers were categorized according

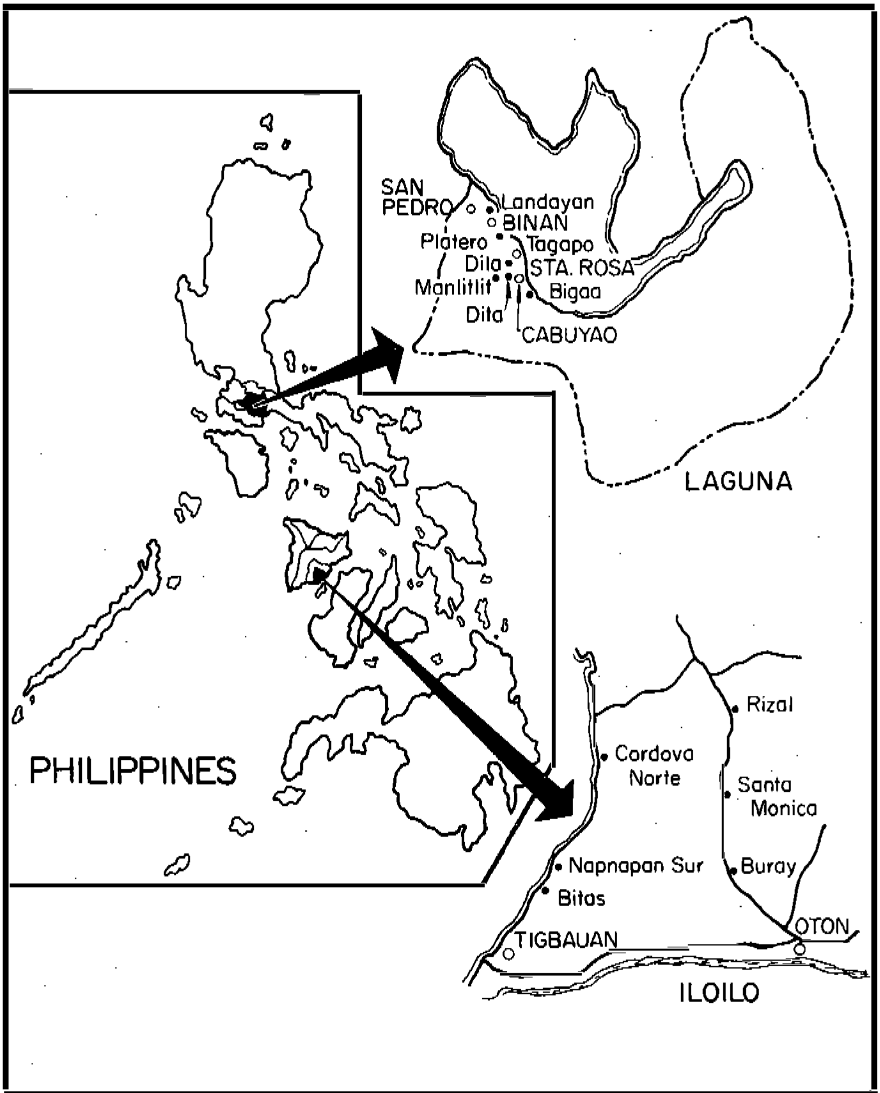

FIGURE 3
MAP OF STUDY AREAS IN LAGUNA AND ILOILO, PHILIPPINES, 1978-79

to farm size (with small farms below 1.0 hectare and large farms above 3.0 hectares). From each category, respondents were selected by simple random sampling. Since there were few thresher owners, a complete enumeration of this group was carried out.

Mechanical threshing includes use of either the large axial flow thresher with a 16 h.p. engine or the small portable thresher with a 5-10 h.p. engine. Traditional threshing involves the use of either hand beating which is popular in Laguna or foot treading which is practised in Iloilo.

ANALYSES AND RESULTS

Private Profitability

In a private profitability analysis, one is interested in the return to the equity capital contributed by the individual entity. (Gittinger 1974). In this paper we are concerned with the impact that thresher adoption has had on some groups in society such as thresher owners and nonowner users. The methodologies that will be used to measure these profits or benefits include the Net Present Value (NPV), the Breakeven Point (BEP), the Payback Period (PBP), and the Benefit-Cost Ratio (BCR).

The Net Present Value Approach

Since investments incur future costs and benefits at different points in time, the time value of money is an important consideration in investment appraisal. For comparison, costs and benefits need to be reduced to a comparable *present worth,* using the process of discounting. The *net present value* is defined as the difference between the present worth of the benefit stream minus the present worth of the cost stream. The annual cash flows (R_t), defined as the difference between gross benefits from an investment and all input costs — such as fuel, labor and operating materials — are obtained for each investment. The NPV formula is (Branson 1975):

$$\text{NPV} = -C + \sum_{t=1}^{n} \frac{R_t}{(l+i)^t} + \frac{S_n}{(1+i)^n}$$

where

C is investment cost of the thresher and its complements;
R_t is net income in period t;

S_n is the resale value at the end of the period n and,
i is the discount rate

Using this approach, an analysis was carried out for owners and nonowner thresher users in the Philippines using 1974-79 data (Juarez and Pathnopas 1983). For owners, the analyses were made of (1) past investments for those who had purchased their machines from 1974 through 1978, and (2) investments which are at the decision making stage. A sensitivity analysis showing the effects of increased fuel and oil prices and maintenance costs on profitability was also included.

For *owners,* benefits were assessed as gains from ownership and/or rental, whereas for *nonowners* they were gains from utilization. The formula for estimating these gains is:

$$R_t = NRF_t + NROF_t - MA_t + LS_t$$

where

R_t is the gain in period t from thresher use as compared to traditional methods;
NRF_t is the net income obtained from on-farm use of a rice thresher in period t which is equal to the net cost savings per unit multiplied by the quantity threshed. Net cost savings is equal to the operating cost of the traditional method minus the operating cost of the mechanical method;
$NROF_t$ is the net income obtained from hiring out a thresher in period t which is equal to the quantity threshed on a contract basis multiplied by the net thresher charge;
MA_t is the repair and maintenance expense for period t and,
LS_t is the benefit in terms of losses avoided as a result of using mechanical as opposed to traditional threshing in period t.

The terms $NROF_t$ and MA_t are zero (0) for nonowner users since they cannot provide contract services and were not directly required to cover repair and maintenance costs.

The private profitability from thresher ownership and/or rental and utilization is equal to the NPV. Where NPV is positive, the investment is profitable.

Labor requirement and net cost savings. The labor requirement and time consumed in threshing by different methods in Laguna and Iloilo given in Table 2 show that mechanical threshers are 6-10 times faster than traditional methods. A comparison of operational cost between traditional and mechanical threshing indicates that the machines were more expensive. If, however, traditional threshing includes meals, as in the case of Iloilo, traditional threshing becomes more expensive and net cost savings achieved by the machine range from ₱34 to ₱37 per ton of rice threshed (Table 3).

Purchase of a thresher before 1978. With the exception of early adopters of large threshers in Laguna, NPVs were positive at all discount rates (Table 4). There appeared to be a declining NPV with later adoption. The pattern resulted from many of the earliest adopters threshing rice with very low yields and high investment costs followed by a decline in benefits in more recent years as machines became more widespread and competition increased (Laguna irrigated and Iloilo rainfed).

Use of contractor services in 1978. Farmers who do not own a thresher can gain from net cost savings and a reduction in grain loss by switching from traditional to contract use of mechanical threshers. In Table 5, gains per farm appeared to be higher in irrigated areas, where threshers substitute for manual methods and where traditional threshing includes meals. Gains according to farm size in Table 6 show that in Iloilo small farms gained relatively more per hectare, by switching from traditional to mechanical threshing than either the small or large farms. This was because net cost saving plus reduced losses and the yields were all greater on small than large farms.

Purchase of a thresher after 1978. For machine life, 20 years was chosen arbitrarily as the cut-off point. Although the machine might still be functional after 20 years, a newer model with a better performance would doubtless be available. A number of variables, such as labor cost, the future price of petroleum products, and maintenance costs affect the present value of thresher investments. At 12 per cent, 15 per cent and 25 per cent discount rates, sensitivity analysis were undertaken on these variables to determine the degree to which changes in their costs would affect profitability (Table 7). It is difficult to estimate future real prices for petroleum products although they will almost inevitably rise. Hence, several rates of increase were simulated at 10 per cent, 30 per cent and 40 per cent per annum. For maintenance costs, 10 per cent and 40 per cent were

TABLE 2
LABOR REQUIREMENT AND TIME CONSUMED IN THRESHING BY DIFFERENT METHODS, LAGUNA AND ILOILO, 1978-79.

Method	*Area*	*Hr/t*	*No. of persons*	*M-hrs/t*	*M-days/t*	*M-days/ha.*[a]
Hand beating	Laguna (14)[b]	1.6	27.2	43.92	5.49	19.2
Foot treading	Iloilo (24)	6.6	9.0	59.44	7.43	26.0
	Iloilo rainfed (20)	6.2	10.4	64.64	8.08	21.0
Large thresher	Laguna (5)	1.1	6.8	7.48	0.94	3.29
Portable thresher	Laguna (5)	1.6	4.4	7.04	0.88	3.08
	Iloilo (13)	1.7	4.0	6.80	0.85	2.98
	Iloilo rainfed (5)	1.6	4.0	6.40	0.80	2.08

a. Based on average rice yield of 3.5 tons per hectare for Laguna and Iloilo irrigated and 2.6 tons per hectare for Iloilo rainfed.
b. Numbers in parentheses refer to number of observations.

TABLE 3
THE NET PRIVATE COST SAVING OF SWITCHING FROM TRADITIONAL TO MECHANICAL THRESHING, LAGUNA AND ILOILO, 1978-79

Area and method	*Net cost saving (₱/ton)*
Laguna	
Cost of hand beating	54.75
Cost of using portable/large thresher	68.43
Net cost saving	–13.68
Iloilo	
Cost of foot treading	49.36
	(83.02)[a]
Cost of using portable thresher	49.36
Net cost saving	0
	(33.66)
Iloilo rainfed	
Cost of foot treading	49.36
	(85.96)
Cost of using portable thresher	49.36
	0
Net cost saving	(36.60)

a. Figures in parentheses are those when traditional threshing includes meals. Meals cost ₱4.53/day/person x 7.43 m-days/ton (Iloilo) = ₱33.66/ton; 8.08 m-days/ton (Iloilo rainfed) = ₱36.60/ton.

chose. Results show that, where threshers replace foot treading and hand beating, an increase in petroleum costs decreased the profitability of threshers. Similarly, increased maintenance costs decrease the profitability of of the machine. To compute the NPV and BCR from thresher adoption using 1983 data is not possible because of incomplete information.

The Breakeven Point (BEP)

The breakeven point is the annual use level at which the machine

TABLE 4
NET PRESENT VALUE IN 1978 AT DIFFERENT DISCOUNT RATES BY INVESTMENT YEAR, LAGUNA AND ILOILO

Site	*Discount rate (in percent)*	*Net present value by investment year (1978 ₱)*						
		1974	*1975*	*1976*	*1977*		*1978*	
Laguna								
							Large thresher	
	12	–12,730	–3,675	9,974				
	15	–15,200	–5,013	9,474				
	25	–24,924	–9,974	7,725				
	50	–61,887	26,534	2,499				
					Portable thresher			
	12		8,482				1,051	
	15		8,710				1,051	
	25		9,533				1,051	
	50		11,687				1,051	
Iloilo								
	12				2,176	(3,352)[a]	3,205	(3,653)
	15				2,058	(3,256)	3,205	(3,653)
	25				1,705	(2,955)	3,205	(3,653)
	50				801	(2,205)	3,205	(3,653)
Iloilo rainfed								
	12				3,638	(4,175)	1,389	(1,815)
	15				3,572	(4,116)	1,389	(1,815)
	25				3,337	(3,903)	1,389	(1,815)
	50				2,756	(3,388)	1,389	(1,815)

a. Numbers in parentheses are NPVs when traditional threshing includes meals.

TABLE 5
MAXIMUM, MINIMUM AND AVERAGE GAINS OF USING A THRESHER AS COMPARED TO TRADITIONAL METHODS OF THRESHING, LAGUNA AND ILOILO, 1978

Threshing method	*Average net cost saving (₱)*	*Average gains from losses saved (₱)*	*Total gains (₱/farm)*		
			ave.	*max.*	*min.*
Laguna		*Large thresher*			
Hand beating	–265	1095	831	1926	59
		Portable thresher			
Hand beating	–610	1147	882	2043	66
Iloilo					
Foot treading	–2.2 (294)[a]	24	22 (316)	68 (948)	8 (118)
Iloilo rainfed					
Foot treading	–0.7 (309)	24	22 (331)	44 (632)	9 (125)

a. Numbers in parentheses are values if traditional threshing includes meals.

TABLE 6
GAINS FROM USING A THRESHER COMPARED TO TRADITIONAL METHODS BY FARM SIZE, LAGUNA AND ILOILO, 1978

Threshing method	*Total gains (₱/ha)*		
	Large[a]	*Medium*[b]	*Small*[c]
Laguna			
Hand beating	250	198	132
Hand beating	265	206	140
Iloilo			
Foot treading	8	9	11
	(118)	(118)	(154)
Iloilo rainfed			
Foot treading	7	7	11
	(103)	(103)	(154)

a. 3.0 hectares and over.
b. 1.0-3.0 hectares.
c. Below 1.0 hectare.

must be operated to make investment profitable. The breakeven formula is: Fixed cost + variable cost $(x) = B(x)$

where x = the breakeven point (can be in hectares, tons, or hours per year, depending on the unit used), and
B = the benefits (or the custom fee).

Using the BEP measure of investment appraisal, the machine can only be profitable if the annual use level is at or above the breakeven point.

Table 8 shows the fixed and variable costs of owning and operating portable IRRI threshers in 1983. Table 9 gives the benefits.

Using these data, the breakeven points for the two types of threshers are the following:

Large thresher	tons/yr.	hours/yr.
1) Th8, 16 h.p.	114.9	126.4
2) Th8, 10 h.p.	78.7	86.6

TABLE 7
BENEFIT-COST RATIOS BASED ON VARIOUS ASSUMPTIONS AND DISCOUNT RATES WITH PROJECTED LIFE OF 20 YEARS'

Type of machine	*Discount rate (in percent)*	*BCR 1*	*BCR 2*	*BCR 3*	*BCR 4*	*BCR 5*	*BCR 6*
Laguna							
Large thresher	12	0.61	0.23	0.45	0.21	0.33	0.19
	15	0.54	0.21	0.41	0.20	0.31	0.18
	25	0.37	0.18	0.31	0.17	0.25	0.15
Portable thresher	12	0.64	0.29	0.45	0.26	0.34	0.24
	15	0.56	0.27	0.42	0.25	0.32	0.22
	25	0.40	0.23	0.33	0.21	0.27	0.19
Iloilo							
Portable thresher	12	0.46	0.22	0.31	0.19	0.22	0.16
		(1.05)[a]	(0.53)	(0.72)	(0.47)	(0.54)	(0.41)
	15	0.42	0.20	0.29	0.18	0.21	0.16
		(0.91)	(0.50)	(0.66)	(0.45)	(0.51)	(0.39)
	25	0.23	0.18	0.21	0.16	0.18	0.14
		(0.63)[a]	(0.41)	(0.51)	(0.37)	(0.41)	(0.33)
Alternative Assumptions: (Annual increase in percent)[b]							
Fuel cost		10	10	30	30	50	50
Maintenance cost		10	40	10	40	10	40

a. Values in parentheses are B/C ratios when traditional threshing includes meals.
b. Refers to annual increase in percent of original cost (1978 cost) of fuel and maintenance.

TABLE 8

COST ANALYSIS OF LARGE AND PORTABLE THRESHERS, LAGUNA, OCTOBER 1983 (BEFORE DEVALUATION)

Item	*Large thresher*				*Portable thresher*			
	TH8 *16 h.p.*		*TH8* *10 h.p.*		*TH7* *7-8 h.p.*		*TH6* *5 h.p.*	
Initial cost (₱)[a]	27,300		18,700		10,000		6,000	
Fixed costs (₱/yr)								
Depreciation[b]	4,095		2,805		1,800		1,080	
Interest[c]	2,252		1,543		825		495	
Repair and maintenance[d]	2,730		1,870		1,000		600	
Total fixed costs	9,077		6,218		3,625		2,175	
Variable Costs:	₱/hr	₱/ton	₱/hr	₱/ton	₱/hr	₱/ton	₱/hr	₱/ton
Gasoline[e]	11.13	12.24	11.13	12.24	8.48	13.57	5.30	8.48
Oil[f]	0.39	0.43	0.39	0.43	0.39	0.62	0.39	0.62
Grease[g]	0.10	0.11	0.10	0.11	0.01	0.02	0.01	0.02
Labor[h]	55.64	61.20	55.64	61.20	38.25	61.20	38.25	61.20
Total variable costs	67.26	73.98	67.26	73.98	47.13	75.41	43.95	70.32

a. Includes cost of body and engine. Price obtained from manufacturers but adjusted with 10% discount to reflect price purchased by farmers.

b. Caculated on a straight-line basis with 10 percent salvage value over 6-year life for large thresher and 5-year life for portable thresher

c. 15 percent on average balance over life of machine. Formula: $\frac{\text{initial cost} + \text{salvage value}}{2} \times i \text{ rate.}$

d. 10 percent of initial cost.

e. 2.1 li/hr. for large thresher, 1.6 li/hr. for portable thresher (7-8 h.p.) and 1.0 li/hr. (5 h.p.). Price of gasoline is ₱5.30 li/hr.

f. .03 li/hr. for all thresher types. Price of oil is ₱13.00/li.

g. .01 lb/hr. for large thresher and .001 lb/hr. for portable. Price of grease is ₱12.50/qt. or .50 kg. 1 lb = ₱10.45.

h. 3.6 percent of the gross paddy threshed. Price of paddy is ₱1.70/kg or ₱1,700/ton.

TABLE 9
BENEFITS OF LARGE AND PORTABLE THRESHER INVESTMENT, 1983.

Benefit	*TH8 16 h.p.*	*TH8 10 h.p.*	*TH7 7 h.p.*	*TH6 5 h.p.*
Salvage value at end of life year	2,730	1,870	1,000	6,000
Cost savings from hiring (at 9 percent custom rate)	949	949	2,066	2,066
Net income from custom work	11,774	11,774	1,870	1,992

Portable thresher		
1) Th7, 7 h.p.	46.7	74.8
2) Th6, 5 h.p.	26.3	42.1

A comparison of the hours needed to break even (126.4 and 86.6 hours per year) for the large threshers and actual use of the machine at 169 hours per year reported by thresher owners implies that use of the large thresher in Laguna is economical on the basis of private costing criteria. Actual use of the Th6 model portable thresher is approximately 72 hours per year and above the breakeven point. Use of the Th7, however, appears uneconomical because of low utilization combined with high initial cost.

The Payback Period (PBP)

The payback period is an estimate of the length of time required to repay the original investment.

$$\text{Payback period} = \frac{\text{Initial cost}}{\text{Average annual net benefit}}$$

When ranking investments, the technique having the shortest payback period is the most desirable.

The payback periods for the large and portable threshers are:

Large thresher	*Years*
Th8, 16 h.p.	3.7
Th8, 10 h.p.	2.1

Portable thresher	
Th7, 7 h.p.	9.2
Th6, 5 h.p.	3.0

Investment in a large thresher can be recovered in 2 to 4 years and that in a Th6 portable thresher in 3 years. For the Th7, however, high initial cost and low levels of output make recovery of the investment improbable.

Benefit-Cost Ratio (BCR)

The benefit-cost ratio is the relationship of the present worth of gross benefits divided by the present worth of gross costs. The stream of costs and benefits is calculated over the life of the machine. A discount rate of 15 per cent is chosen to obtain the present worth. If, at the assumed rate, the present worth of benefits is less than the present value of costs, a ratio of less than 1.0 is obtained, which means that an investor cannot recover his investment.

The discounted benefit-cost ratios for the different thresher investments as computed from Table 10 are the following:

Large thresher	B/C ratios
Th8 16 h.p.	1.25
Th8 10 h.p.	1.78
Portable thresher	
Th7	0.82
Th6	1.24

SOCIAL PROFITABILITY

In social profitability analysis one is interested in the total return or productivity of an investment to society regardless of who contributes to the cost or who receives the benefits (Gittinger 1974). For this type of analysis, "shadow prices" instead of market prices are used to reflect the true value of the commodity. For various reasons, markets are imperfect. There may be institutional rigidities, price controls or imperfect information offered by competing sellers and

TABLE 10
EXAMPLE OF DISCOUNTED COSTS AND BENEFITS OF LARGE AND PORTABLE THRESHER INVESTMENT OVER 5-6 YEAR MACHINE LIFE

Year	*Initial cost*	*Operation & maintenance costs*[a]	*Gross costs*	*Discount factor 15%*	*Present worth of costs*	*Gross benefits*	*Discount factor 15%*	*Present worth of benefits*
				Pesos/year				
Large thresher (TH8)								
0	27,300		27,300		27,300	0		0
1		3,189	3,189	0.870	2,774	12,723	0.870	11,069
2		3,189	3,189	0.756	2,411	12,723	0.756	9,618
3		3,189	3,189	0.658	2,098	12,723	0.658	8,372
4		3,189	3,189	0.572	1,824	12,723	0.572	7,278
5		3,189	3,189	0.497	1,585	12,723	0.497	6,323
6		3,189	3,189	0.432	1,378	15,453	0.432	6,676
Total					39,370			49,336
Portable thresher (TH6)								
0	6,000		6,000		6,000	0		0
1		1,549	1,549	0.870	1,348	4,058	0.870	3,530
2		1,549	1,549	0.756	1,171	4,058	0.756	3,068
3		1,549	1,549	0.658	1,019	4,058	0.658	2,670
4		1,549	1,549	0.572	886	4,058	0.572	2,321
5		1,549	1,549	0.497	770	4,658	0.497	2,315
Total					11,194			13,904

a. Depreciation and interest costs are not included when using discounted techniques.

buyers. Hence, the use of market prices may introduce errors into the analysis of investments. A shadow price is defined as that price which would prevail in the economy if it were in perfect equilibrium under conditions of perfect competition (Gittinger 1974). In this paper, the net social profitability approach is used to determine the profitability of rice thresher adoption in the country.

The Net Social Profitability Approach

The net social profitability (NSP) concept is defined as the net gain (or loss) associated with an economic activity when all commodity outputs are produced and material inputs and factors of production employed are evaluated at their social opportunity costs (through the use of shadow prices) and when all external effects on the domestic economy are given a social valuation and included in the analysis (Pearson et al. 1976). Based on the NSP concept, the costs in producing an output would generally include land, labor and capital and, in the case of agricultural crops, additional materials inputs like fertilizer and chemicals. Benefits would include the output produced and other direct benefits. To the degree possible, account should also be taken of externalities such as pollution, congestion, price effects, labor displacement effects, and others. When the NSP is positive for a certain project or economic activity, then it is profitable to engage in that activity. The economy also has a comparative advantage in undertaking that activity (Saefuddin 1978). In general, the higher the NSP, the greater the comparative advantage.

In this paper, net social profitability will be measured only in terms of net social cost savings per unit of output threshed by machine compared with manual threshing. This measure of profitability will assume that the costs of all inputs in producing rice are the same for both methods, except for threshing labor.

Social Gain from Rice Thresher

The social gain (or loss) from machine threshing can be determined by noting the difference in the social cost using a thresher and the cost using the best alternative methods, which in this study are: the traditional hand beating and foot treading. The unit social cost saving from using the rice thresher compared with alternative methods can be stated in the following formula:

$$NSCS_{ij} = GSC_i - GSC_j + (E_i - E_j)$$

where

$NSCS_{ij}$ is the net social cost saving (or loss) for one unit of rice threshed using method *i* compared with method *j*.

GSC_i is the gross social cost for one unit of rice threshed using the traditional method (*i*).

GSC_j is the gross social cost for one unit of rice threshed using a machine (*j*).

E_i is the net external benefit (or cost) for one unit of rice threshed by an alternative method (*i*), and

E_j is the net external benefit (or cost) for one unit of rice threshed by machine (*j*).

Externalities are those benefits (or costs) outside the immediate confines of a project but which result from implementation of the project.

The externalities of rice threshing are difficult to identify and measure. An example is the labor displacement effect. It is, however, very difficult to calculate a true shadow price for manual labor. In terms of price effects, the tradable inputs used in rice threshing would have a minimal impact on the world price elasticity of any input. Hence, if we assume that $(E_i - E_j)$ is equal to zero, then the social gain (or loss) of using a thresher can be determined by examining only the social cost saving ($NSCS_{ij}$) realized from its use.

Social Cost of Rice Threshing

The social cost of rice threshing using either the mechanical thresher or alternative methods can be measured by decomposing all input cómponents used and valuing them at their social prices (or shadow price). These inputs are classified into two categories: tradable and nontradable.

Determination of the gross social cost of threshing using traditional methods, GSC_i, is expressed as:

$$GSC_i = SPL_i \cdot \text{SPP}$$

where

GSC_i is the gross social cost of threshing using the traditional method (pesos/ton)

SPL_i is the shadow price of labor in threshing using the traditional method paid in kind as percentage of gross production (in per cent)

SPP is the shadow price of paddy (pesos/ton)

Determination of the gross social cost of threshing using the rice thresher, GSC_j is expressed as:

$$GSC_j = D + I + M + L + Ma$$

where

GSC_j = the gross social cost of threshing with the rice thresher j (pesos/ton)

D = depreciation calculated using a book value for the machine of 70 per cent after 5 years using shadow prices (pesos/ton)

I = an interest cost on investment of 15 per cent on the average balance over the life of the machine (pesos/ton)

M = the material costs of operating the rice thresher which includes fuel (gasoline), engine oil and grease, calculated at shadow prices (pesos/ton)

L = the labor costs of operating the rice thresher valued at shadow wages (pesos/ton)

$M\ Ma$ = the repair and maintenance costs of operating the rice thresher valued at 10 per cent of the initial shadow investment cost. Fifty per cent is allotted to foreign costs and 50 per cent to domestic costs for repairs and maintenance (pesos/ton)

Tradable and Nontradable Inputs

In general, an input is tradable if some of the demand for such input will be satisfied from imports, or some of the supply exported. Other inputs are referred to as nontradable (Little and Mirrless 1974). In some instances, an imported commodity can also be treated as nontradable. For example, suppose there is no domestic production of a particular commodity and demand is met by imports provided this import has been subjected for a long time to a fixed quota. Even if additional demand arises and this demand is met by domestic production, no change in trade would result and this commodity would be treated as nontradable. In contrast, suppose there exists domestic production capacity for a certain good which is not being traded. Assume further that there are grounds for believing that domestic production of this good is undesirable. The good may be treated as traded or nontraded depending on whether the government will pursue rational policies or not.

The nontradable inputs further consist of tradable (foreign) components and nontradable (domestic) components. The Input-Output Table (NEDA 1979) is used to trace these components and in assigning proper valuation.

Based on these concepts, tradable inputs used in machine threshing consist of the rice thresher unit, the engine and tradable components of nontradable inputs such as machine services, which include fuel, lubricants and spare parts.

The nontradable inputs include domestic capital, labor and machine services.

Derivation of Shadow Prices

Tradable inputs are to be valued at their border prices, that is, the CIF price for imports and the FOB price for exports (Squire and van der Tak 1981). Likewise, the inputs or outputs of a project, even when produced domestically but which constitute an import substitute, are measured at their CIF price. Conversely, inputs or outputs that are directly exported or, though physically sold in the home market lead to additional export because the domestic demand is fully met from existing supplies, has a value to the economy measured at the FOB export price. In all such cases the CIF or FOB prices would not be adjusted for import duties or export taxes which may be levied. These border prices, however, should be adjusted to reflect internal transport and other costs in order to arrive at the value of the commodities at their point of origin (for outputs) and destination (for inputs).

It must be understood, however, that border prices can be used as shadow prices as long as the supply of imports or demand for exports is assumed to be perfectly elastic so that the investment decision does not affect import or export prices. Border prices should not be adjusted for import duties or export taxes that may be levied.

If import prices rise, however, or the export prices fall on account of the project, the value to the economy of additional imports or exports is not measured by the old or new border price but is better approximated by the marginal import cost or export revenue (Little and Mirrlees 1974; Squire and von der Tak 1981). Border prices are to be converted into domestic currency using the shadow exchange rate. For nontradable components of the nontradable inputs, the market price is used as the shadow price.

The derivation and estimates of shadow prices of the variables included in the estimation of the social profitability of thresher ownership and use are the following:

1. Shadow Price of Rice Thresher and Engine

In the Philippines, the rice thresher is produced domestically while the engine is imported. Although the manufacture of threshers is primarily intended for domestic consumption, two manufacturers in 1978 have tried exporting (together with engines) and around five manufacturers are reported to have the capability to export. In 1983, ten manufacturers reportedly exported machines. Exportable goods and goods that exceeded domestic consumption and have potentials for export are considered tradable. Hence, threshers in the Philippines are considered tradable and their shadow price is valued at FOB price. In 1978, prices (less 3 per cent tax) are ₱28,615/unit for large threshers in Laguna and ₱9,990 for portable threshers in Laguna and Iloilo.

2. Shadow Price of Oil

The Philippines, through the Philippine National Oil Corporation (PNOC), imports crude oil. PNOC imports with about 90 per cent government support. In social profitability analysis, subsidy is a cost to the government. In 1978, total oil imports amounted to ₱844,8M CIF value (about 72.1 million barrels) and the bulk of these imports, about 79 per cent of total CIF value, comes from the Middle East Nations (Philippine Yearbook 1981). The other 21 per cent comes from Indonesia, Malaysia, Brunei and China. This is equivalent to \$11.7/bbl, approximately ₱86/bbl or ₱0.54/l. PNOC distributes the imported crude oil to different local refineries which process it into gasoline, motor oil, grease, and other desired oil products. These products are then distributed to local dealers for sale to the public. During the refining and distribution process, foreign, domestic and tax expenses are incurred.

Oil is a tradable component of a nontradable good such as machine service and transport. Hence, to estimate the shadow price of oil products, the CIF value of crude oil is used plus the refining cost (less tax), all valued in domestic currency. The refining cost is obtained by subtracting the CIF price from the buyer's price. This is shown in Table 11 on a per liter basis. To arrive at the shadow price of refining cost, it is necessary to determine its subcost components.

TABLE 11
REFINING COST OF GASOLINE, OIL AND GREASE, 1978.

GASOLINE		₱/li
Buyer price in 1978[a]		1.67
CIF price of crude oil[b]		0.54
	Refining cost	1.13
MOTOR OIL		
Buyer price in 1978[a]		5.90
CIF price of crude oil[b]		0.54
	Refining	5.36
GREASE		
Buyer price in 1978[a] (at ₱5.50) x 2 lbs/1		11.00
CIF price of crude oil[b]		0.54
	Refining cost	10.46

a. Prices obtained from local gasoline dealers.
b. *Philippine Yearbook 1981.* National Census and Statistics Office, NEDA, p. 377.
Note: CIF value of crude oil is $11.70 or ₱86.00 per barrel; 1 barrel = 159 liters.

Based on the Input-Output Table, these include intermediate inputs, salaries and wages, depreciation, indirect taxes and operating surplus (NEDA 1979). The percentage equivalents are given in Table 12. These cost components are then allocated to foreign, domestic and tax costs.

The shadow price of oil is assumed equal to its market price minus taxes (indirect and corporation tax). The per liter shadow costs of gasoline, oil and grease are shown in Table 13. In Table 14, these costs are converted to a per ton of paddy basis by threshing method and by province for 1978.

TABLE 12
REFINING COST COMPONENTS OF GASOLINE, MOTOR OIL AND GREASE, 1978

Cost component	Percent allocation (a)	Refining cost (₱/li) Total (b)	Distribution (c) = (a) (b)
GASOLINE			
Intermediate input	63.84	1.13	0.72
Salaries and wages	4.84	1.13	0.05
Depreciation	3.62	1.13	0.04
Indirect taxes	21.84	1.13	0.25
Operating surplus	5.86	1.13	0.07
MOTOR OIL			
Intermediate input	63.84	5.36	3.42
Salaries and wages	4.84	5.36	0.26
Depreciation	3.62	5.36	1.17
Indirect taxes	21.84	5.36	1.17
Operating surplus	5.86	5.36	0.32
GREASE			
Intermediate input	63.84	10.46	6.68
Salaries and wages	4.84	10.46	0.51
Depreciation	3.62	10.46	0.38
Indirect taxes	21.84	10.46	2.28
Operating surplus	5.86	10.46	0.61

Source: 1974 Interindustry (Input-Output) Accounts of the Philippines, NCSO, NEDA, Manila, 1979, p. 101, Col. 66 (Petroleum Refineries and Other Petroleum Products).

3. Shadow Exchange Rate

The exchange rate is necessary to convert cost values in different terms to a common base. The result may be expressed in domestic or in foreign values. The official exchange rate (OER) which exists with trade restrictions and under distorted prices is not considered the appropriate rate. The shadow exchange rate (SER) is used to correct distortions in relative prices between traded and nontraded goods and resources due to the present protection structure.

TABLE 13
SHADOW PRICE OF GASOLINE, MOTOR OIL AND GREASE PER LITER, 1978.

Item	*Total costs*	*Composed of*		
		Foreign	*Domestic*	*Tax*
GASOLINE			₱/l	
CIF price of crude oil	0.54	0.54		
Refining cost[a]	1.13	0.76	0.12	0.25
Intermediate input	0.72	0.72		
Salaries and wages	0.05		0.05	
Depreciation	0.04	0.04		
Indirect taxes	0.25			0.25
Operating surplus	0.07		0.07	
Total market price	1.67	1.30	0.12	0.25
Adjustment factor		1.34	1.10	0
Shadow price of gasoline	1.86	1.74	0.12	0
MOTOR OIL				
CIF price of crude oil	0.54	0.54		
Refining cost[a]	5.36	3.61	0.58	1.17
Intermediate input	3.42	3.42		
Salaries and wages	0.26		0.26	
Depreciation	0.19	0.19		
Indirect taxes	1.17			1.17
Operating surplus	0.32		0.32	
Total market price	5.90	4.15	0.58	1.17
Adjustment factor		1.34	1.0	0
Shadow price of motor oil	6.14	5.56	0.58	0
GREASE				
CIF price of crude oil	0.54	0.54		
Refining cost[a]	10.46	7.06	1.11	2.29
Intermediate input	6.68	6.68		
Salary and wage	0.51		0.50	0.01
Depreciation	0.38	0.38		
Indirect tax	2.28			2.28
Operating surplus	0.61		0.61	
Total market price	11.00	7.60	1.11	2.29
Adjustment factor		1.34	1.00	0
Shadow price of grease	11.29	10.18	1.11	0

a. Data obtained from Tables 11 and 12.

TABLE 14
SOCIAL COSTS OF GASOLINE, MOTOR OIL AND GREASE CONSUMPTION PER TON OF RICE THRESHED BY TYPE OF THRESHER, LAGUNA AND ILOILO, 1978.

Item	*Total cost*	*Composed of*	
		Foreign	*Domestic*
LARGE THRESHER, Laguna		₱/ton	
Gasoline (2.2 l/ton)	4.09	3.83	0.26
Engine oil (0.03 l/ton)	0.18	0.16	0.02
Grease (0.01 l/ton)	0.11	0.10	0.01
PORTABLE THRESHER, Laguna			
Gasoline (2.16 l/ton)	4.02	3.76	0.26
Engine oil (0.04 l/ton)	0.24	0.22	0.02
Grease (0.001 l/ton)	0.01	0.01	–
PORTABLE THRESHER, Iloilo			
Gasoline (2.73 l/ton)	5.08	4.75	0.33
Engine oil (0.05 l/ton)	0.31	0.28	0.03
Grease (0.001 l/ton)	0.01	0.01	–

Computations for the SER in the Philippines under the protective system have yielded a value of 1.34 of the OER (using the UNIDO "second-best" estimate cited by Bautista and Power (1979). The formula is: SER = OER × adjustment factor.

In 1978, the official exchange rate was ₱7.35 per U.S. dollar. The SER is ₱7.35 multiplied by 1.34 equals ₱9.85 per US$.

4. Shadow Rate of Interest

The shadow rate of interest is equal to the opportunity cost of capital. Expressed differently, it is the marginal productivity of additional investment in the best alternative use (Squire and Van der Tak 1981). This is the traditional procedure used by the World Bank and other financing agencies. The current rate of interest or the cost of capital charged by banks is 15 per cent while that of private moneylenders in the survey areas ranged from 25 to 50 per cent per annum. The National Economic and Development Authority (NEDA) uses 15 per cent as the opportunity cost of capital in its project evaluation studies (Herdt and Lacsina 1976). The same rate is used in this study.

5. Shadow Wage Rate

In its simplest sense, the shadow wage rate is measured by the opportunity cost of labor; i.e., the marginal output of labor which is foregone elsewhere because of its use in the project (Squire and Van der Tak 1981). In a perfectly competitive market, this wage is determined by the marginal value product which an extra hired laborer would produce. Hence, in cases where there is severe unemployment or widespread disguised unemployment, the shadow wage rate is considered zero or close to zero. In this situation, if laborers are still paid a wage, it is because of tradition or social pressure placed on the farmers to share their wealth with their less fortunate neighbors. Agricultural labor may also be valued at the wage it commands, which means that the marginal value product of agricultural labor is worth something near the value of the observed wage.

In this study, labor costs for mechanical threshing include the wage of the machine operator and helpers working with the machine. In the case of traditional threshing, labor costs are the wages paid to the persons who thresh the paddy. In machine threshing, the wage is equivalent to 1.8 per cent of the gross threshed paddy paid in kind, while in traditional threshing, a cost equivalent to 5.5 per cent of the gross paddy is used. This share multiplied by the market price of paddy will give the market wage.

The social wage in this study will be valued at market wage. The reasons for this assumption are the fact that any labor displacement effect of the machine is difficult to measure and the seasonal pattern of agricultural employment. Threshing operations are done when farm operations are at a peak — harvesting, threshing, planting — and under these circumstances, virtually every agricultural laborer is employed. In some cases, casual labor from urban areas may return to their villages to assist in the harvest. During this peak, the marginal productivity of labor is not zero. Third, it is assumed that the time saved using the thresher will be used for other productive purposes, such as building houses, digging irrigation canals, clearing farms or engaging in off-farm and nonfarm activities. Some laborers may also prefer unemployment to the arduous work of manual threshing. Fourth, the threshing share of the laborers is not always sold but is used for home consumption; hence, the market price of paddy is used for valuation purposes.

Net Social Cost Savings (NSCS) of Using Mechanical Thresher

Based on the above assumptions and estimation of shadow prices, the gross social costs of mechanical rice threshing, which include fixed and variable costs, are the following: using a large thresher in Laguna, the social cost is ₱78.31/ton of paddy threshed (Table 15). Using the small portable thresher, the social cost is ₱97.60 per ton (Table 16). In Iloilo, using the portable thresher, the gross social cost is ₱42.46/ton of paddy threshed (Table 17).

The gross social costs of traditional threshing include only labor and, at 5.6 per cent of the gross paddy threshed in Laguna costs around ₱54.75/ton (Table 18). At 5.5 per cent of the gross threshed paddy in Iloilo, it costs ₱49.36/ton.

The net social cost savings to society of using a mechanical thresher are shown in Table 19. In Laguna, the net social cost savings are negative at ₱23.56 per ton if a large thresher is compared to hand threshing and ₱42.85 per ton if a small thresher is used. The cost savings are negative for the machine because of its high investment cost but low annual output levels. It means that the machine is not being fully utilized. Thresher owners in Laguna indicated the desire to do more custom work if these were available.

In the computation, the thresher was regarded as having been used for rice threshing only (including on-farm and off-farm rice threshing). The engine of the thresher, however, is sometimes used for water pumping or for land preparation. The hours used in these activities were not included as these practices were not common.

In Iloilo province, the net social cost savings of using a portable thresher are positive. The savings are ₱6.90/ton of paddy threshed without meals comparing mechanical threshing with foot treading. These are the average net social cost savings for both irrigated and rainfed barrios. If treated separately, however, net social cost savings would be higher in irrigated barrios because of the higher annual output of the machines.

TABLE 15
SOCIAL COST OF RICE THRESHING USING LARGE AXIAL FLOW THRESHER, LAGUNA, 1978

Item	*Total cost*	*Composed of*	
		Foreign	*Domestic*
Large thresher, FOB Philippines less 3% tax	₱28,615	28,615	
Fixed cost (₱/ton)			
Depreciation[a]	11.52	11.52	
Interest on investment[b]	15.84	15.84	
Variable cost (₱/ton)			
Fuel[c]	4.09	3.83	0.26
Oil[c]	0.18	0.16	0.02
Grease[c]	0.11	0.10	0.01
Labor[d]	27.37	—	27.37
Repair and maintenance[e]	19.20	9.60	9.60
Total	78.31	41.05	37.26

a. Calculated using a book value of 70 percent after 5 years.
Average total tons threshed per year = 149 tons

$$\text{Fixed cost/ton} = \frac{\text{Cost/year}}{\text{No. of tons/year}}$$

b. 15% on average balance over life of machine.

$$\text{Formula: } \frac{\text{Investment cost + 10\% salvage value}}{2} \times \text{shadow rate of interest}$$

c. From Table 14.
d. 2.8 percent of the gross paddy threshed. Price of paddy is ₱977.62/ton.
e. 10 percent of investment cost. Fifty percent is alloted to material costs which are tradable and 50 percent to labor and other domestic costs.

Current Status of Thresher Ownership and Use

A recent visit to the thresher owners (respondents in the 1978 survey) in Laguna provided some current information regarding thresher ownership and use. In the villages of Dita and Dila, where five out of the seven thresher owner respondents reside, no thresher

TABLE 16
SOCIAL COST OF RICE THRESHING USING PORTABLE THRESHER, LAGUNA, 1978

Item	*Total cost*	*Composed of*	
		Foreign	*Domestic*
Portable thresher, FOB			
Philippines	9,990	9,990	–
Less 3% tax	₱9,990	9,990	
Fixed cost (₱/ton)			
Depreciation[a]	19.21	19.21	–
Interest on investment[b]	21.13	21.13	–
Variable cost (₱/ton)			
Fuel[c]	4.02	3.76	0.26
Oil[c]	0.245	0.22	0.02
Grease[c]	0.01	0.01	–
Labor[d]	27.37	–	27.37
Repair and maintenance[e]	25.62	12.81	12.81
Total	97.60	57.14	40.46

a. Calculated on its book value of 70 percent after 4 years.

$$\text{Fixed cost/ton} = \frac{\text{Cost/year}}{\text{No. of tons/year}}$$

Average total ton threshed per year = 39 tons.

b. 15 percent on average balance over life of machine.

$$\text{Formula: } \frac{\text{Investment cost + 10\% salvage value}}{2} \times \text{interest rate}$$

c. From Table 14.

d. 2.8 percent of gross paddy threshed. Price of paddy is ₱977.62/ton.

e. 10 percent of investment cost. Fifty percent is allotted to material costs which are tradable and 50 percent to labor and other domestic costs.

had been purchased in the 1981-83 period. The older thresher owners still continue to provide custom services in the area.

Thresher Utilization

The large threshers bought in the 1974 to 1980 period are still being utilized efficiently. One portable thresher bought in 1975 broke

TABLE 17
SOCIAL COST OF RICE THRESHING USING PORTABLE THRESHER, ILOILO, 1978.

Item	*Total cost*	*Composed of*	
		Foreign	*Domestic*
Portable thresher, FOB Philippines 3% tax (₱)	9,990	9,990	–
Fixed cost (₱/ton)			
Depreciation[a]	6.09	6.09	–
Interest on investment[b]	6.70	6.70	–
Variable cost (₱/ton)			
Fuel[c]	5.08	4.75	0.33
Oil[c]	0.31	0.28	0.03
Grease[c]	0.01	0.01	–
Labor[d]	16.15	–	16.15
Repair and maintenance[e]	8.12	4.06	4.06
Total	42.46	21.89	20.57

a. Calculated on its book value of 70 percent after 4 years.

$$\text{Fixed cost/ton} = \frac{\text{Cost/year}}{\text{No. of tons threshed/year}}$$

Average total tons threshed per year = 123 tons.

b. 15 percent on average balance over life of machine.

$$\text{Formula: } \frac{\text{Investment cost + 10\% salvage value}}{2} \times \text{interest rate}$$

c. From Table 14.

d. 1.8 percent of gross paddy threshed. Price of paddy is ₱897.44/ton.

e. 10 percent of investment cost. Fifty percent is allotted to material costs which are tradable and 50 percent to labor and other domestic costs which are nontradable.

down in 1980, another is still operating, and the two others are operable but are not being employed for lack of customers. Large threshers are preferred because of their built-in cleaning mechanism. Thresher owners indicated that the body of the machines will last beyond 10 years provided repair and maintenance is provided. The life of the machine may mean that an earlier estimate of life of 5-6 years may be an underestimation. The engine, however, lasts only 3

TABLE 18
GROSS SOCIAL COST OF RICE THRESHING USING TRADITIONAL METHOD, LAGUNA AND ILOILO, 1978

Area and method	*Wage rate (₱/ton)*
Laguna	
Hand beating (5.6 percent of gross output[a])	54.75
Iloilo	
Foot treading (5.5 percent of gross output)	49.36 (83.02)[b]

a. Based on the price of paddy at ₱977.62/ton in Laguna and ₱897.44 in Iloilo.
b. This figure in parentheses is for the wage rate including meals.

TABLE 19
THE NET SOCIAL COST SAVING OF SWITCHING FROM TRADITIONAL TO MECHANICAL THRESHING, 1978

Area and method	*Pesos/ton*
Laguna	
Cost of hand beating	54.75
Cost of using large thresher	78.31
Net social cost saving	–23.56
Cost of hand beating	54.75
Cost of using portable thresher	97.60
Net social cost saving	–42.85
Iloilo	
Cost of foot treading	49.36 (83.02)[a]
Cost of using portable thresher	42.46
Net social cost saving	6.90 (40.56)

a. Figures in parentheses are cost of traditional threshing which include meals.

to 5 years. Owners interviewed in the most recent round of the survey placed a high salvage value on their machines after 5 years of use. Some indicated a value of 70 per cent of the initial cost cited in the 1978 survey. Supplemental information on the annual use patterns of thresher owners in Laguna showed an average total use of 169 hours for large threshers and 72 hours for portable machines (Table 20). These are further broken down into hours used on own farm, custom work, and other purposes. Figure 4 is a graphical presentation of these values and compares 1978 data with current findings. Figure 5 shows total hours of use for all portable and large threshers in Laguna and for portable threshers in Iloilo, for the period 1978-83. Custom work accounts for 96 per cent of total hours used for large threshers and 44 per cent for small threshers. Hours used on the machine owners' farms decreased because two of the respondents (having four threshers) were nonfarmers. Production also decreased, since some respondents did not harvest during the 1983 dry season because of lack of water. This is also another reason why utilization decreased compared with 1978. Rates of payment also changed with an increase from 7-8 per cent in 1978 to 9-10 per cent in 1983 as shown in Figure 6. Rates increased most markedly after 1982 due to increased prices for fuel, oil and spare parts. One thresher owner mentioned that it was hard to find customers for threshing because some farmers requested loans from the machine owner before harvest. The thresher owner generally accede to this request because refusal would have meant that the farmers would no longer patronize his thresher. The use of the "gama" system of harvesting in Laguna has seemed to decline and some farmers have already returned to direct hiring. In addition, some landless workers have been absorbed by industry in the areas while others are busy digging subdivision canals and a few have gone to Saudi Arabia.

The current devaluation has resulted in price increases for most items. Increased prices for oil and oil products will cause some changes in the profitability of thresher adoption and use. In fact, one reason why farmers increased contract rates from 7-8 per cent in 1978 to 9-10 per cent in 1983 is the increased cost of fuel and oil and spare parts. One manufacturer indicated that devaluation may increase his selling price to 60 per cent or more. A sensitivity analysis was conducted to examine the effects of price changes on thresher utilization. Increases of 25, 50 and 100 per cent in fuel, oil and grease

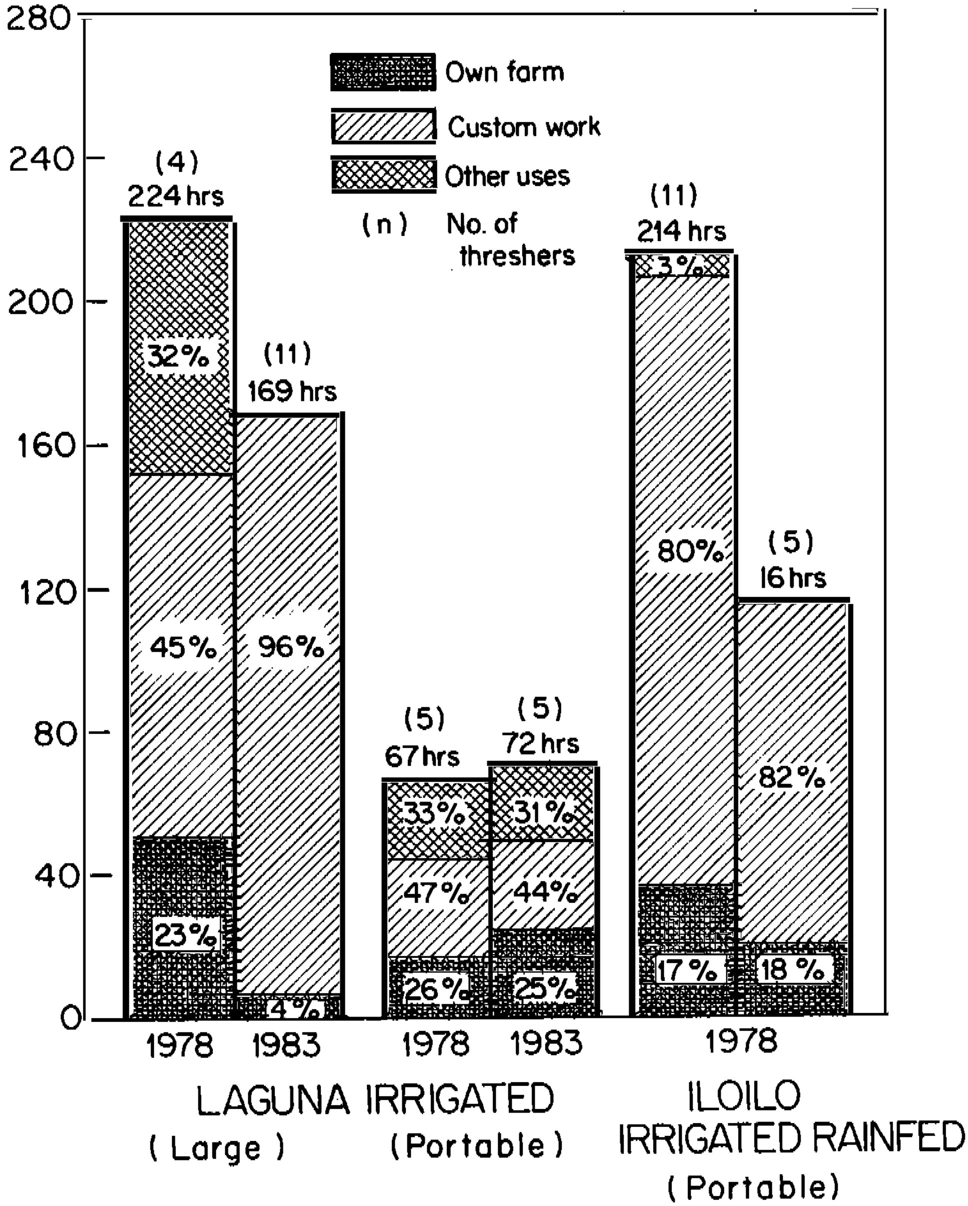

FIGURE 4
ALLOCATION OF THRESHING TIME, 22 OWNERS, LAGUNA AND ILOILO, 1978-83

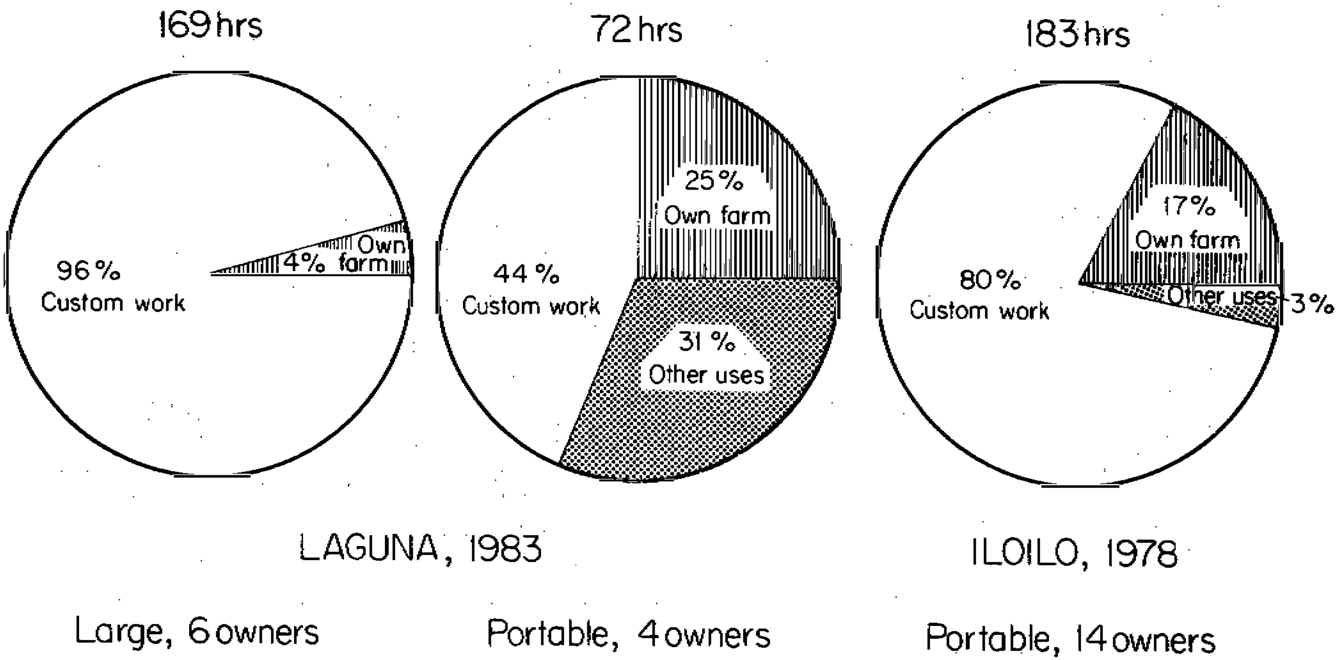

FIGURE 5
ALLOCATION OF THRESHING TIME, 22 OWNERS, LAGUNA AND ILOILO, 1978-83

1978

HTC[a] = 17 % of gross* { H = 10 %; TC = 7 % { 60 % (4.2 % of gross) to machine owner; 40 % (2.8 % of gross) to operators + helpers } }

*Sometimes 18 % of gross : 10 % to harvesters and 8 % to threshers.
or 19.4 % of gross : 12 % to harvesters and 7.4 % to threshers.

1983

HTC = 19 % of gross** { H = 10 %; TC = 9 % { 60 % (5.4 % of gross) to machine owner; 40 % (3.6 % of gross) to operator + helpers } }

**Sometimes 20 % of gross : 10 % to harvesters and 10 % to threshers.

[a] H = Harvesting
T = Threshing
C = Cleaning

FIGURE 6
RATES OF PAYMENT FOR HARVESTING, THRESHING AND CLEANING IN LAGUNA, 1978-83

TABLE 20
ANNUAL USE PATTERN FOR 8 THRESHER OWNERS,[a] LAGUNA, 1983

Thresher no.	*Threshing capacity (t/hr.)*	*Own farm*	*Custom work*	*Other uses*	*Total*	*Total threshed (t/yr.)*
			Operating hours per year			
			Large thresher			
1	0.92	16	225	0	241	222
2	0.92	16	225	0	241	222
3	0.55	13	10	0	23	13
4	0.92	8	6	0	14	13
5	0.92	–	182	0	182	167
6	0.92	–	182	0	182	167
7	0.92	–	182	0	182	167
8	1.15	2	160	0	162	187
9	0.92	10	150	0	160	148
10	0.92	10	100	0	110	102
11	0.83	–	361	0	361	299
Average	0.90	6.8	162.1	0	168.9	155.2
			Portable thresher			
1	0.46	0	0	0	0	0
2	0.37	0	0	0	0	0
3	0.92	48	35	0	83	76
4	0.69	20	62	0	82	56
5	0.69	20	62	112[b]	194	56
Average	0.62	17.6	31.8	22.4	71.8	37.6

a. Five owners own 2-3 threshers.
b. Includes use of engine for land preparation.

prices and in custom rates of 10,11 and 12 per cent were examined. The large thresher was used to illustrate the effects.

The results in Table 21 show that increases in fuel and oil prices decrease the profitability of threshers but that this could be offset by increases in custom rates. The problem, however, is that thresher owners cannot easily increase custom rates because of widespread competition from large numbers of threshers operating in the field.

TABLE 21
EFFECTS OF FUEL AND OIL PRICE INCREASES AND CHANGES IN CONTRACT RATES ON PRIVATE PROFITABILITY OF LARGE THRESHER (TH8, ₱18,700, USING THE BREAKEVEN POINT MEASURE, LAGUNA, 1983

Contract rate (%)	*Fuel and oil price increase (in percent)*			
	0	*25*	*50*	*100*
		tons/year		
9	78.7	82.0	85.6	93.9
10	69.7	72.3	75.1	81.3
11	62.5	64.6	66.8	71.8
12	56.7	58.4	60.2	64.2

SUMMARY

The use of farm machines in the Philippines has created a controversy. While the search for evidence of profitability continues, the adoption of machines continues to increase. There is also a growing number of manufacturers producing the machines. The results of a private profitability analysis of threshers showed that they are generally profitable if investment costs are not excessive and if levels of utilization are high. A social profitability analysis using shadow prices on the other hand, indicated that the machines are slightly more expensive than the traditional method.

Thresher owners gain from thresher ownership through both on-farm and off-farm use. For on-farm use, gains are obtained through reduced losses in addition to net cost savings. Switching from traditional to mechanical threshing gave a negative net cost savings of up to ₱13.68/ton if meals were not provided and positive savings of ₱36.66 to ₱36.50/ton if meals were included as payment in the traditional technique. A large part of the benefit, however, comes from custom threshing, constituting an average of 69 per cent of total threshing hours for large and portable threshers. The estimated net present values indicated a high degree of profitability from past investments. In the survey areas, future investment are less certain because of limited oppurtunities for custom work due to competition from the large number of threshers in use. In Laguna, only large axial flow threshers are popular. Portable threshers are not patronized. The results of the breakeven point analysis, payback period and the benefit-cost ratio were all positive.

For thresher users, gains were obtained only through net cost savings and reduced losses. The gains are highest in irrigated areas. In some areas small farms gain proportionately more by switching from traditional to mechanical methods.

Increased fuel costs will make thresher investment less profitable compared to traditional threshing. As maintenance costs increase, investment will also look less attractive. Even though the net benefits of investing in threshers are positive, further adoption of the machine may be constrained by institutional factors such as availability of customers for contract services.

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