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THE PRIVATE AND SOCIAL PROFITABILITY OF MECHANICAL THRESHING

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by

Fleurdeliz S. Juarez
The International Rice Research Institute
Los Baños, Laguna

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Fleurdeliz S. Juarez**

Abstract

This paper provides a private and social cost-benefit analysis of thresher adoption and use in the Philippines. Private profitability was assessed using the net present value, breakeven point, payback period ad benefit-cost criteria. Social profitability measured the net social cost savings of mechanical thresher compared with traditional method. The results indicate a slight negative benefit to society. A sensitivity analysis was conducted to examine the impact of increases in fuel and oil prices on contract rates and costs.

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**Research Assistant, Economics Section, Agricultural Engineering Department, International Rice Research Institute, Los Banos, Laguna.

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 the advent of continuous cropping and increased yields from 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 manhours per ton using traditional techniques to 11 manhours per ton (Toquero, et al, 1977). In a rice-rice cropping pattern, threshers can shorten turnaround period by 5 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% (Toquero, et al, 1977).

Threshing is an important component of the rice production system as it accounts for 42% of the total labor input when using traditional methods (Toquero, et al, 1977). Opponents of mechanical threshing argue since rice threshing represents a 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 Fig. 1). This figure is an underestimate because it refers only to IRRI-designed and does not include other designs on those produced outside the IRRI agreement threshers. Compared to 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% of the market for all the years under review(Fig. 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 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 (3 irrigated and 3 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 owner	7	11	5
Thresher non-owner users	12	14	16
Thresher non-users	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, are farmers. Farmers were categorized according 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 hp engine or the small portable thresher with a 5-10 hp engine. Traditional threshing involves the use of either hand beating which is popular in Laguna and a foot treading found in Iloilo.

Analyses and Results

Private Profitability

In a private profitability analysis, one is interested in the return to the equity capital the individual entity contributes (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 non-owner users. The methodologies that will be used to measure these profits or benefits include 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)

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

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 non-owner thresher users in the Philippines using 1974-1979 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 non-owners 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 non-owner 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 thresher are 6-10 times faster than traditional methods. A comparison of opeational costs between traditional and mechanical threshing indicates 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 ranged 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 (Iloilo and Laguna irrigated) and high investment costs (Iloilo irrigated), 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 grain loss savings 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 showed 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%, 15% and 25% discount rates, sensitivity analyses 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, a number of rates of increase were simulated 10%, 30% and 50% per annum. For maintenance costs, 10% and 40% were chosen. 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 the machine. To compute the NPV from thresher adoption using 1983 data is not possible because of incomplete information. We must use other measures.

The Breakeven Point (BEP)

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

	tons/yr	hours/yr
Large thresher		
1) Th8, 16 hp	114.9	126.4
2) Th8, 10 hp	78.7	86.6
Portable thresher		
1) Th7, 7 hp	46.7	74.8
2) Th6, 5 hp	26.3	42.1

The hours needed to breakeven, (126.4 and 86.6 hours per year) for the large threshers compared with 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 higher 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 hp	3.7
Th8, 10 hp	2.1
Portable thresher	
Th7, 7 hp	9.2
Th6, 5 hp	3.0

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

Benefit-Cost Ratio (BCR)

The benefit-cost ratio is the relationship of the present worth of gross bebefits divided by the present worth of gross costs. The stream of costs and benefits are calculated over the life of the machine. A discount rate of 15% 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 are the following : (Table 10)

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

Social Profitability

In social profitability analysis, we are 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 buyers. Hence, use of market prices may introduce errors into 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 to the country.

The Net Social Profitability Approach

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 material 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 the case of mechanical threshing, net social profitability will be measured in terms of net social cost savings per unit of output threshed compared with manual threshing. This measure of profitability will assume that the cost 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: $NSCS_{ij}$ = the net social cost saving (or loss) for one unit of rice threshed using method i compared to method j.

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

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

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

E_j = 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 components used and valuing them at their social prices (or shadow

price). These inputs are classified into two categories: tradable and non-tradable.

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

$$GSC_i = SPL_i \cdot SPP$$

where: GSC_i = the gross social cost of threshing using the traditional method (i) (pesos/ton)

SPL_i = the shadow price of labor in threshing using the traditional method paid in kind as percentage of gross production (%)

SPP = 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) in pesos/ton

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

I = an interest cost on investment of 15% 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)

Ma = the repair and maintenance costs of operating the rice thresher valued at 10% of the initial shadow investment cost. Fifty percent is alloted to foreign costs and 50% to domestic costs for repairs and maintenance (pesos/ton)

Tradable and non-Tradable 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 non-tradable (Little and Mirrless, 1974). In a some instances, an imported commodity can also be treated as non-tradable. 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 arise and this demand is met by domestic production, no change in trade would result and this commodity would be treated as non-tradable. In contrast, suppose there exists domestic production capacity for a certain good which is not being traded. Assume further there are grounds for believing domestic production of this good is undesirable. The good may be treated as traded or non-traded depending on whether the government will pursue rational policies or not.

The non-tradable inputs further consist of tradable (foreign) components and non-tradable (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 non-tradable inputs such as machine services, which include fuel, lubricants and spare parts.

The non-tradable 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 C.I.F. price for imports and F.O.B. price for exports (Squire and van der Tak, 1981). Likewise, the inputs or outputs of a project, even when produced domestically but being an import substitute, is measured at its C.I.F. price. Conversely, input or output that is directly exported or, though physically sold in the home market leads to additional export because the domestic demand is fully met from existing supplies, has a value to the economy measured at the F.O.B. export price. In all such cases the C.I.F. or F.O.B. 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 the 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 Mirrless, 1974; Squire and von der Tak, 1981). Border prices are to be converted into domestic currency using the shadow exchange rate. For non-tradable components of the non-tradable 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 manufacture of threshers is primarily intended for domestic consumption, two manufacturers in 1978 have tried exporting (together with engines) and around 5 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 its shadow price is valued at F.O.B. price. In 1978, prices (less 3% tax) are P28,615/unit for large threshers in Laguna and P9,990 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% government support. In social profitability analysis, subsidy is a cost to the government. In 1978, total oil imports amounted to P844,8M C.I.F. value (about 72.1 M barrels) and the bulk of these imports, about 79% of total C.I.F. value, comes from the Middle East Nations. (Philippine Yearbook 1981). The other 21% comes from Indonesia, Malaysia, Brunei and China. This is equivalent to $11.7/bbl, approximately P86/bbl or P0.54/li. PNOC distributes the imported crude oil to different local refineries who 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 non-tradable 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 C.I.F. 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 sub-cost components. 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 cost 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.

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 non-traded goods and resources due to the present protection structure.

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 x adjustment factor.

In 1978, the official exchange rate was P7.35 per US$. The SER is P7.35 multiplied by 1.34 equals P9.85 per US$.

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 WorldBank and other financing agencies. The current rate of interest or the cost of capital charged by banks is 15% while those of private moneylenders in the survey areas ranged from 25% to 50% per annum. The National Economic and Development Authority (NEDA) uses 15% as the opportunity cost of capital in their 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 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% of the gross threshed paddy paid in kind while in traditional threshing, a cost of 5.5% 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. Reasons for this assumption are: any labor displacement effect of the machine is difficult to measure; second, 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 non-farm activities. Some laborers may also prefer unemployment to the ardous work of manual threshing. Fourth, the threshing share of the laborers is not always sold but it 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 includes fixed and variable costs, are the following: using a large thresher in Laguna, the social cost is P78.31/ton of paddy threshed (Table 15). Using the small portable thresher, the social cost is P97.60 per ton (Table 16). In Iloilo, using the portable thresher, the gross social cost is P42.46/ton of paddy threshed (Table 17).

The gross social costs of traditional threshing includes only labor and, at 5.6% of the gross paddy threshed in Laguna, costs around P54.75/ton (Table 18). At 5.5% of the gross threshed paddy in Iloilo, it costs P49.36/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 -P23.56 per ton if a large thresher is compared to hand threshing and -P42.85 per ton if a small thresher is used. The cost savings are negative for the machine because of its high investment cost but with low annual output levels. It means the machine is not being

fully utilized. Thresher owners in Laguna indicated a desire to do more custom work if these were available.

In the computation, the thresher was regarded as being used for rice threshing only which includes on-farm and off-farm rice threshed. The engine of thresher is, however, 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 P6.90/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.

Current status of thresher ownership and use

A recent visit to the thresher owners (respondent in the 1978 survey) in Laguna provided some current information regarding thresher ownership and use. In the villages of Dita and Dila, where 5 out of the 7 thresher owner respondents reside, no thresher 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 down in 1980, another is still operating and the 2 others are operable but because of a lack of customers, are not being employed. 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 our earlier estimate of life of 5-6 years may be an underestimate. The engine, however, lasts only 3 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% 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 for other purposes. Figure 4 is a graphical presentation of these values and compares 1978 data with the current findings. Figure 5 shows total hours of use for all portable threshers in Laguna, total for Iloilo, and for large threshers in Laguna. Custom work accounts for 96% of total hours used for large threshers and 44% for small threshers. Hours used on the machine owners farm decreased because of two of the respondents (having 4 threshers) were non-farmers. Production had also decreased, since some respondents did not harvest during the 1983 dry season because of lack of water.

This is also another reason utilization decreased compared with 1978. Rates of payment also changed with an increase from 7-8% in 1978 to 9-10% 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 it was hard to find customers for threshing because some farmers requested loans from the machine owner before harvest. The thresher owner generally accedes to this request because if refused, the farmer will not patronize his thresher. Use of "gama" system of harvesting is declining in Laguna 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 farmers increased contract rates from 7-8% in 1978 to 9-10% in 1983 is due the increased cost of fuel and oil and spare parts. One manufacturer indicated devaluation may increase his selling price 60% or more. A sensitivity analysis was conducted to examine the effects of price changes on thresher utilization. Increases of 25, 50 and 100% in fuel, oil and grease prices and in custom rates of 10, 11 and 12% were examined. The large thresher was used to illustrate the effects.

The results in Table 21 show that increase in fuel and oil prices decrease profitability of threshers but can 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.

Summary

Use of farm machines in the Philippines has created controversy. While the search for evidence on profitability continue, adoption of machines continues to increase. There is also a growing number of manufacturers producing the machines. The results of a private profitability analysis on thresher showed that threshers are generally profitable if investment cost are excessive and if coupled with high levels of utilization. The social profitability analysis using shadow prices indicated the machine as 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 net cost savings of up to ₱13.68/ton if meals were not provided and positive savings of ₱33.66 to ₱36.60/ton if meals were included as payment in the traditional technique. A large part of the benefit, however, comes from custom threshing, the traditional technique, constituting an average of 69% 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 investments are less certain because of limited opportunities 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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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	1321
1978	689	1746	2435
1979	1850	2290	4140
1980	1059	1218	2277
1981	1417	1275	2692
1982	1689	1113	2802

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

Table 2. Labor requirement and time consumed in threshing by different methods, Laguna and Iloilo, 1978-79.

Method	Area	Hr/t	No. 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
Net cost saving	0 (36.60)

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

Table 4. Net present value in 1978 at different discount rates by investment year, Laguna and Iloilo.

Site	Discount rate (%)	Net present value by investment year (1978 ₱)				
		1974	1975	1976	1977	1978
Laguna						
	12	-12730	- 3675	9974		
	15	-15200	- 5013	9474		
	25	-24924	- 9974	7725		
	50	-61887	-26534	2499		
	12		8482			1051
	15		8710			1051
	25		9533			1051
	50		11687			1051
Iloilo						
	12				2176 (3352) a/	3205 (3653)
	15				2058 (3256)	3205 (3653)
	25				1705 (2955)	3205 (3653)
	50				801 (2205)	3205 (3653)
Iloilo rainfed						
	12				3638 (4175)	1389 (1815)
	15				3572 (4116)	1389 (1815)
	25				3337 (3903)	1389 (1815)
	50				2756 (3388)	1389 (1815)

a/ Numbers in parentheses are NPVs if 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 methods	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 (118)	9 (118)	11 (154)
Iloilo rainfed			
Foot treading	7 (103)	7 (103)	11 (154)

[a] 3.0 hectares and above

[b] 1.0 - 3.0 hectares

[c] below 1.0 hectare

Table 7. Benefit-cost ratios based on various sets of assumptions at various discount rates with project life of 20 years.

Type of machine	Discount rate (%)	PV11	PV14	PV31	PV34	PV51	PV54
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 (1.05)[a]	0.22 (0.53)	0.31 (0.72)	0.19 (0.47)	0.22 (0.54)	0.16 (0.41)
	15	0.42 (0.91)	0.20 (0.50)	0.29 (0.66)	0.18 (0.45)	0.21 (0.51)	0.16 (0.39)
	25	0.23 (0.63)[a]	0.18 (0.41)	0.21 (0.51)	0.16 (0.37)	0.18 (0.41)	0.14 (0.33)
Assumptions: (annual increase)							
Fuel (%)		10	10	30	30	50	50
Maintenance (%)		10	40	10	40	10	40

[a] Values in parentheses are B/C ratios when traditional threshing includes meals.

Table 8. Cost analysis of large and portable threshers, Laguna, October 1983 (before devaluation).

Items	Large thresher				Portable thresher			
	TH8 16 hp		TH8 10 hp		TH7 7-8 hp		TH6 5 hp	
Initial cost (₱)[a]	27300		18700		10000		6000	
Fixed costs (₱/yr)								
Depreciation[b]	4095		2805		1800		1080	
Interest[c]	2252		1543		825		495	
Repair and maintenance[d]	2730		1870		1000		600	
Total fixed costs	9077		6218		3625		2175	
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. For the large thresher, two manufacturers gave different prices. The one worth ₱27,300 is common in the survey area.

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

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

d/ 10% of initial cost.

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

f/ .03 li/hr for all 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% of the gross paddy threshed. Price of paddy is ₱1.70/kg or ₱1700/ton.

Table 9. Benefits of large and portable thresher investment, 1983.

Benefits	TH8 16 hp	TH8 10 hp	TH7 7 hp	TH6 5 hp
		pesos/year		
Salvage value at end of life year	2730	1870	1000	600
Cost savings from hiring (at 9% custom rate)	949	949	2066	2066
Net income from custom work	11774	11774	1870	1992

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, ₱27300)								
0	27300		27300		27300	0		0
1		3189	3189	0.870	2774	12723	0.870	11069
2		3189	3189	0.756	2411	12723	0.756	9618
3		3189	3189	0.658	2098	12723	0.658	8372
4		3189	3189	0.572	1824	12723	0.572	7278
5		3189	3189	0.497	1585	12723	0.497	6323
6		3189	3189	0.432	1378	15453	0.432	6676
Total					39370			49336
Portable thresher (TH6)								
0	6000		6000		6000	0		0
1		1549	1549	0.870	1348	4058	0.870	3530
2		1549	1549	0.756	1171	4058	0.756	3068
3		1549	1549	0.658	1019	4058	0.658	2670
4		1549	1549	0.572	886	4058	0.572	2321
5		1549	1549	0.497	770	4058	0.497	2315
Total					11194			13904

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

Table 11. Refining cost of gasoline, oil and grease, 1978.

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

C.I.F. value of crude oil is $li.70 or ₱86.00 per barrel.
1 barrel = 159 liters.

Table 12. Refining cost components of gasoline, motor oil and grease, 1978.

Cost components	% 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).

Table 13. Shadow price of gasoline, motor oil and grease per liter, 1978.

ITEM	TOTAL COST	COMPOSED OF		
		Foreign	Domestic	Tax
GASOLINE		฿/l		
C.I.F. 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		
Salary and wage	0.05		0.05	
Depreciation	0.04	0.04		
Indirect tax	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				
C.I.F. 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		
Salary and wage	0.26		0.26	
Depreciation	0.19	0.19		
Indirect tax	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				
C.I.F. 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	
		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	-

Table 15. Social cost of rice threshing using large axial flow threshers, Laguna, 1978.

ITEM	TOTAL COST	Composed of Foreign	Domestic
Large thresher, F.O.B. 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% 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

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

[c] From Table 14.

[d] 2.8% of the gross paddy threshed. Price of paddy is ₱977.62/ton

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

Table 16. Social cost of rice threshing using portable thresher, Laguna, 1978.

ITEM	TOTAL COST	COMPOSED OF Foreign	Domestic
Portable thresher, F.O.B.Philippines (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% 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% 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% of gross paddy threshed. Price of paddy is ₱977.62/ton

[e/] 10% of investment cost. Fifty percent is alloted to material cost which are tradable and 50% to labor and other domestic costs.

Table 17. Social cost of rice threshing using portable thresher, Iloilo, 1978.

ITEM	TOTAL COST	COMPOSED OF Foreign	Domestic
Portable thresher, FOB Philippines (₱)	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% after 4 years.

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

Average total tons threshed per year (average for irrigated rainfed = 123 tons.

[b] 15% on average balance over life machine

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

[c] From Table 14.

[d] 1.8% of gross paddy threshed. Price of paddy is ₱897.44/ton.

[e] 10% of investment cost. Fifty percent is alloted for material which are tradable and 50% to labor and other domestic costs.

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% of gross output[a])	54.75
Iloilo	
Foot treading (5.5% 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] Number in parenthesis in 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 those when traditional threshing includes meals.

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.

Table 21. Effects of fuel and oil price increases and changes in contract rates on private profitability of large threshers (Th8, ₱18,700), using the breakeven point measure, Laguna, 1983.

Contract rates (%)	Fuel and oil price increases (%)			
	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

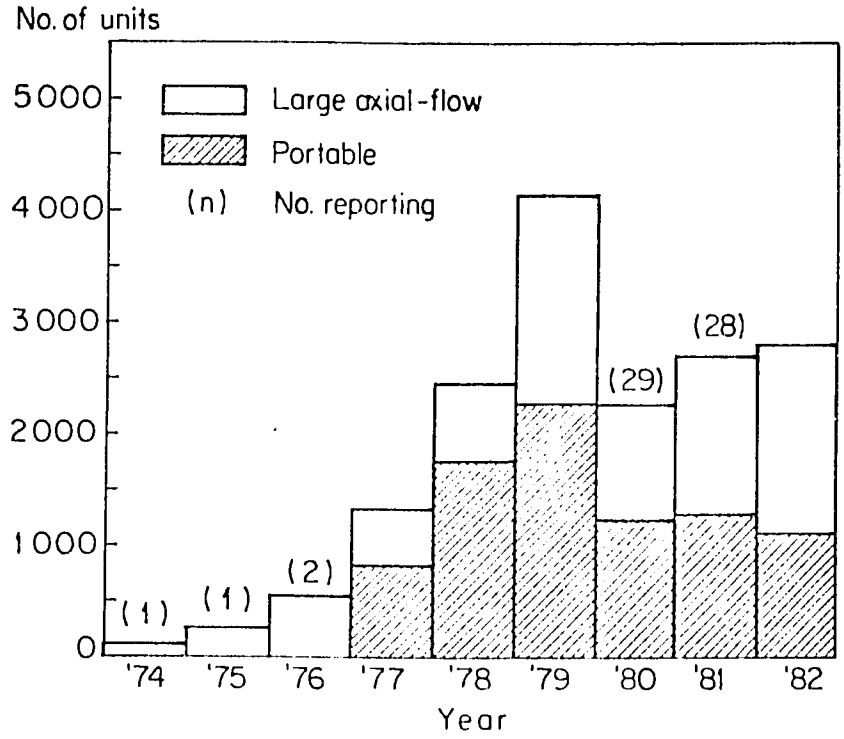

Fig.1. Production of IRRI designed mechanical threshers in the Philippines by cooperating manufacturers, 1974-'82.

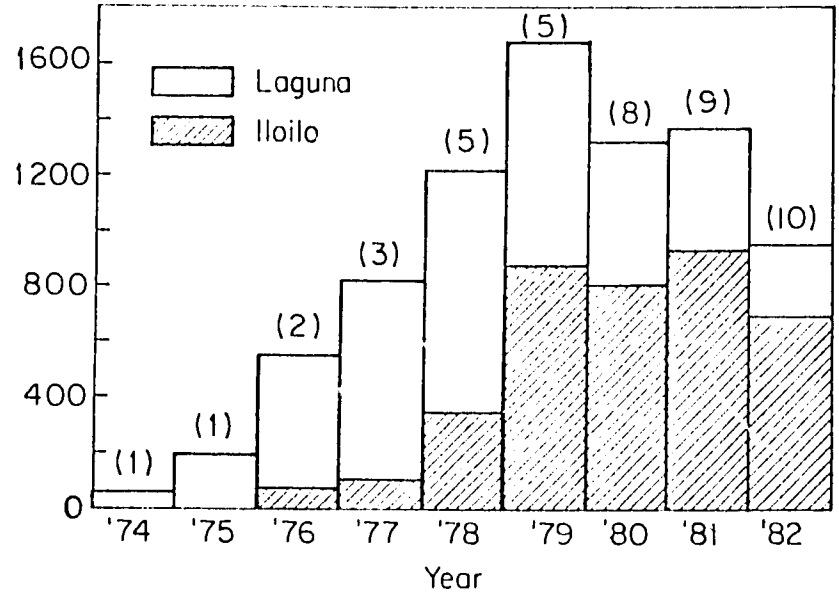

Fig.2. Production of IRRI designed mechanical threshers in Iloilo and Laguna by cooperating manufacturers, 1974-'82

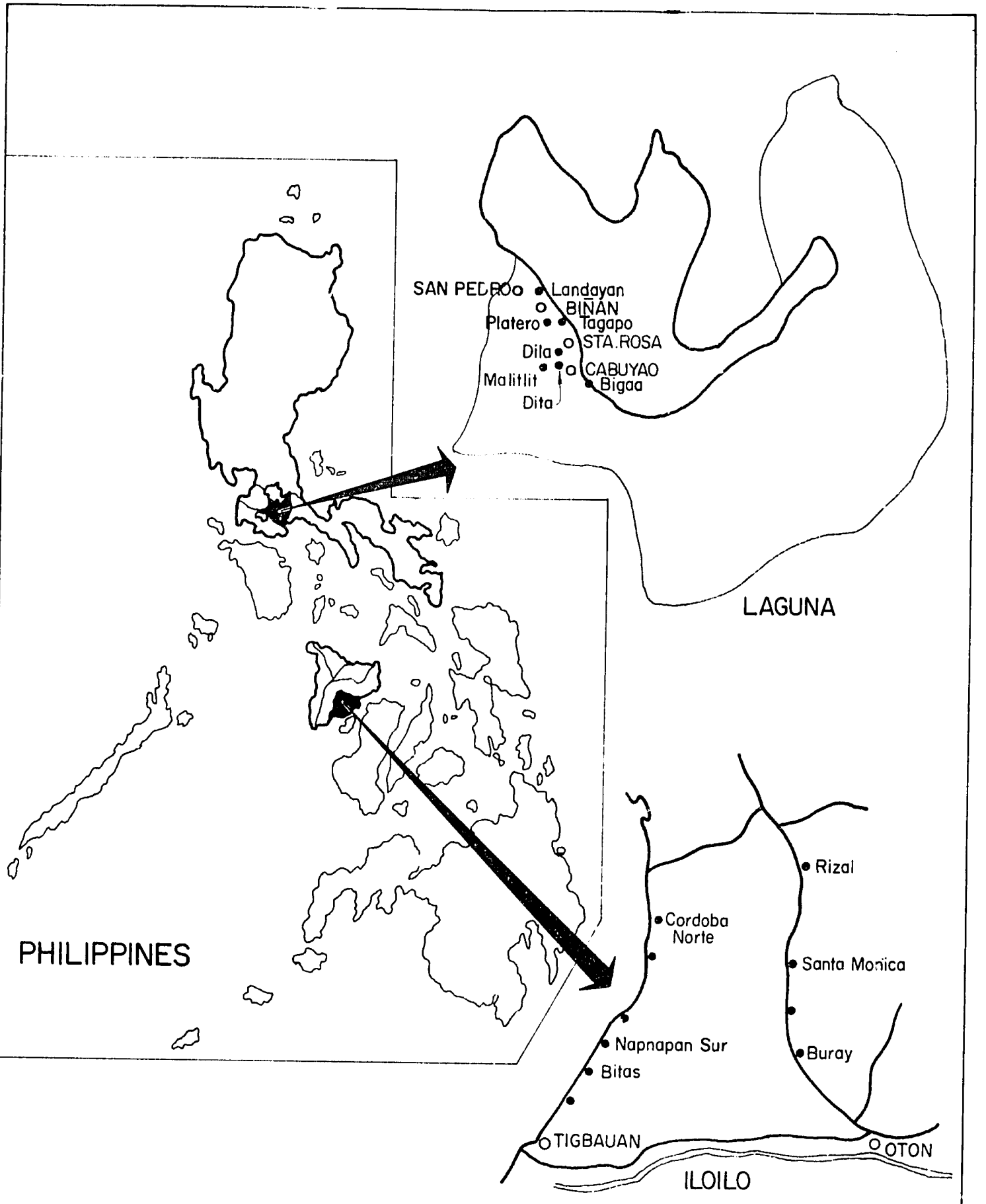

Fig.3. Map of study areas in Laguna and Iloilo, Philippines, 1978-79.

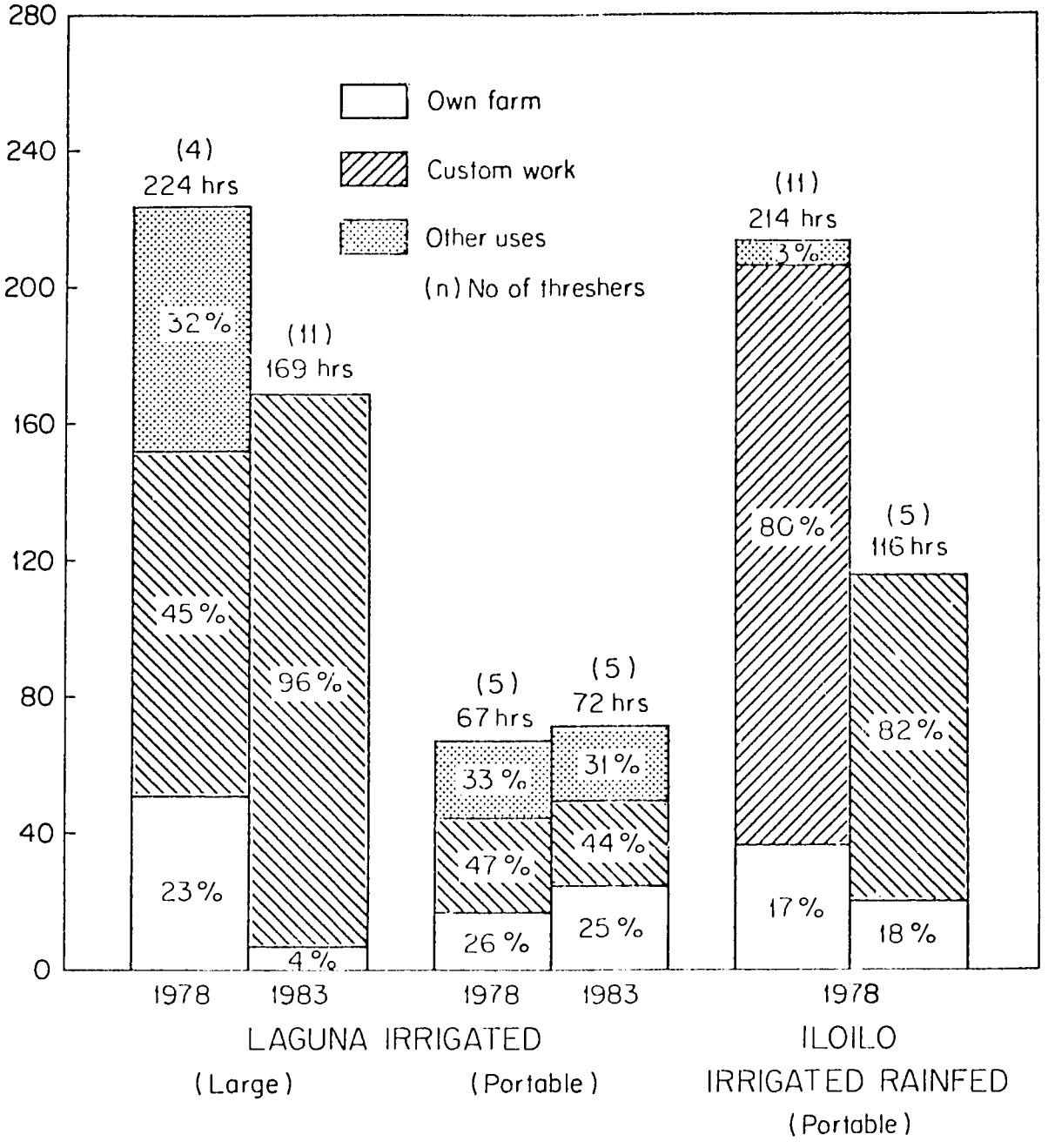

Fig. 4. Allocation of threshing time, 22 owners, Laguna and Iloilo, 1978-83.

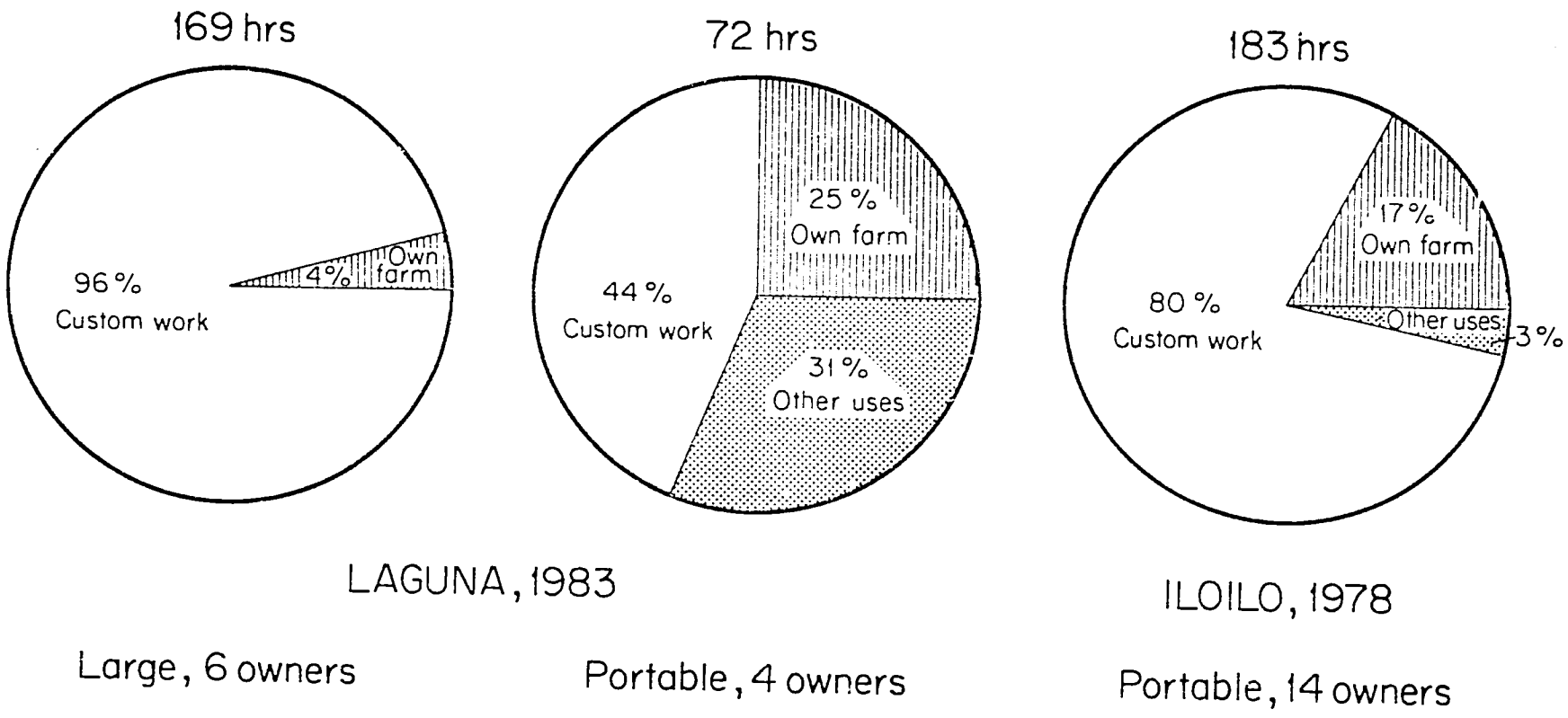

Fig. 5. Allocation of threshing time, 22 owners, Laguna and Iloilo, 1978-83.

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

1983

HTC = 19 % of gross*
- H = 10 %
- TC = 9 %
  - 60 % (5.4 % of gross) — to machine owner
  - 40 % (3.6 % of gross) — to operators + helpers

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

H[a/] - Harvesting

T - Threshing

C - Cleaning

Fig. 6. Rates of payment for harvesting, threshing and cleaning in Laguna, 1978-83.