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COMPARATIVE ADVANTAGE, MECHANIZATION AND RICE PRODUCTION IN WEST JAVA, INDONESIA

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By

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THE COMPARATIVE ADVANTAGE OF MECHANIZED RICE PRODUCTION IN WEST JAVA, INDONESIA*

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INTRODUCTION

In spite of increases in rice production averaging four percent a year over the 10 years of the first two development plans (1968/69 - 1978/79), Indonesia's rice imports continue to increase.

The third 5-year development plan (1978/79-1983/84) still gives high priority to the agricultural sector, including agro-industries. The general aims of agricultural development are: (1) to increase farmers' income, (2) increase labor and land productivity, (3) increase food production, (4) increase rural employment, and (5) support regional development. To achieve these goals, agricultural

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* The complete analysis on which this report is based is: Yusuf Saefudin, "The Domestic Resource Cost of Mechanization in West Java, Indonesia", Unpublished M.S. thesis, University of the Philippines at Los Banos, 1983.

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intensification, diversification, extensification and rehabilitation programs are being continued. Mechanization is intended to complement other inputs such as irrigation, fertilizer and other chemicals. However, as in other developing countries, the introduction of tractors in densely populated area, like West Java, created a continuing controversy.

Analysis of the impact of technological change on income can be financial or economic in nature. In financial analysis problems are solved using actual market prices. For economic analysis, the problem of choosing the correct prices is more complex. This results from the fact that: (1) markets, especially in developing countries are quite often distorted and prevailing market prices fail to reflect the social value of inputs and outputs and (2) the benefits and costs are not limited to those internal to the operation of the project but also include relevant externalities, intangible effects and indirect benefits and costs. For these reasons the analysts may need to adjust (impute) market prices when evaluating new technology using economic criteria.

Four characteristics of rice production in Asia are of special interest in analyzing comparative advantage (Pearson, et al., 1976). First, production technology is not uniform across the region. Second, because much rice production is carried out by family units that consume part of the output, profit maximization may not be a good behavioural rule for decision making. Third, political and social decisions generally affect production decisions as a result of

the overriding importance of rice in the food economy of Asian countries. Finally, the international price of rice is difficult to define and interpret because of the thinness of the international market, the existence of protective policies in many countries, and the variability of special trading arrangements.

Accordingly, it is of considerable interest to know which regions or which technology have a strong comparative advantage in rice production and how specific government policies have influenced patterns of rice production and trade.

This study is designed to compare social profitability between mechanized and non-mechanized farms using the domestic resource cost approach.

SAMPLING PROCEDURE

Research sites in West Java were selected using a combination of random and purposeful sampling procedures. Secondary data on farm area, production and the number of tractors in each of 20 districts in West Java were collected and assessed to determine their distribution in the province.

Subang and Indramayu districts were chosen because they each had a large rice production area and because 34 percent of all tractors in West Java are found there.

A stratified two stage sampling procedure was applied to draw village and farm samples.

Selection of villages. A random sample of six sub-districts (within the two districts) with the greatest number of hand tractors was first selected. Secondly, four villages with four or more tractors each were randomly selected from each district.

Selection of farmers. First, a block census of the eight villages was conducted covering 1600 households. Next, a stratified random sample was obtained for the survey. Census respondents were stratified according to the power used for land preparation in the 1978/79 wet season. The six groups used for sample stratification were: (1) tractor owners, (2) tractor hirers, (3) animal users, (4) animal-manual combined, (5) manual and, (6) landless labor. A total of sixty farmers was selected from each group so there were 300 sample farmers (excluding landless labor) in the study. Since some of the samples gave incomplete information, only 254 farmers were eventually used.

Data were collected during the following seasons: 1979 dry season (second crop), 1979 dry season (third crop), 1979/80 wet season, 1980 dry season (second crop) and 1980 dry season (third crop).

During the period of the study, however, many farmers changed power sources from season to season. For the analysis therefore, sample farms were reclassified into mechanized and non-mechanized

farmers. The data from the 1979-80 wet season and 1980 dry season (I) were used in the study.[1]

In the wet season, there were 126 mechanized farms (consisting of 114 pure mechanized farms and 12 respondents who used combinations of tractor and manual methods)[2], and 126 non-mechanized farms (consisting of 60, 47, and 21 respondents who used animal, manual and combinations of animal and manual, respectively).

In the dry season, there were 106 mechanized farms (consisting of 91 ano 15 respondents who used only tractor and combinations of tractor and manual), and 148 non-mechanized farms (all used manual/hoe in land preparation).

METHODOLOGY

Domestic Resource Cost (DRC) like Net Social Profitability (NSP), is a statement of comparative advantage. Export promotion or

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[1] There are usually two dry seasons in West Java. The second dry season uses residual moisture from the wet season plus supplemental irrigation. The second dry season must rely exclusively on residual moisture. Few farmers presently plant a crop during the second dry season.

[2] Land preparation is usually a two stage operation. Combination of tractor and manual means the farmer used tractors in the first operation and used manual/hoe in the second. Similarly for the other combinations.

import substitution is socially profitable or has a comparative advantage only if the social opportunity cost of domestic resources used to produce an increment of output expressed as a unit of foreign exchange earned is less than the shadow price of foreign exchange. If the DRC ratio of the activity is less than the shadow price, the country has a comparative advantage in producing the incremental output of the product.

The DRC concept used study is one developed by Pearson et al. (1976). Briefly, the DRC is derived from the Net Social Profitability (NSP) concept, which is defined as the net gain (or loss) associated with an economic activity when all commodity outputs produced and material inputs and factor 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. Given the technology, the NSP formula in rice production is:

$$NSP_i = O_i S_o - \sum_{j=1}^{n} F_{ij} S_j + E_i \qquad (1)$$

where:

O_i - is the quantity of the output produced by the ith technology/method.

S_o - is the shadow price of the output (in domestic currency)

F_{ij} - is the quantity of the jth factor of production use by the ith method.

S_j - is the shadow price of the jth factor of production (in domestic currency).

E_i - is a measure of the net external benefits or costs imparted by the ith method to the rest of the domestic economy.

Since we wish to compare the domestic resources used for each method of land preparation, inputs must first be classified into tradable and non-tradable inputs. In general, we shall say that if demand for an input will be satisfied from imports, or some supply is exported, it is a tradable input. Other inputs are referred to as non-tradable (Little and Mirrless, 1974). However, imported inputs subject to fixed quotas would have to be treated as non-tradable. In contrast, for a locally produced input which is not being traded, but where there exists grounds to believe domestic production is undesirable, it can be treated as tradable or non-tradable input depending on whether the government will be pursuing rational policies or not. Output is assumed to be tradable because Indonesia still imports rice.

Based on those concepts, tradable inputs in this analysis consists of fertilizer, insecticides, pesticides, and tradable components of non-tradable inputs (e.g. tractor services, transport and handling) such as tractor equipment, fuel, oil and spare part components. Non-tradable inputs are then decomposed into tradable components and primary domestic factors by moving backward through the

input-output chain. Non-tradable inputs are seed, land, labor, capital, irrigation and tractor/animal services.

Using those adjustments, the second formula in the NSP analysis is:

$$NSP_i = (U_i - \bar{M}_i - R_i)\ V - \sum_{j=1}^{n} \bar{F}_j S_j + E \qquad (2)$$

where:

U_i - is the total value of output at border price (in foreign currency)

$\bar{M}_i$ - is the total (direct plus indirect) value of tradable inputs (in foreign currency).

R_i - is the total value of repatriated earnings of foreign owned factors of production (in foreign currency).

V - is the shadow price of foreign exchange, expressed as a ratio of local currency to foreign currency

$\bar{F}_j$ - is the total quantity of the jth primary domestic factor.

The ratio obtained by setting NSP in (2) to zero and solving for V (the shadow price of foreign exchange) has been termed the domestic resource cost of foreign exchange earned or saved (DRC). So,

$$DRC_i = \frac{\Sigma \bar{F}_{ij} S_j - E}{(U_i - M_i - R_i)} \qquad (3)$$

A direct relationship between DRC and NSP can be obtained by substituting equation (3) into equation (2).

$$NSP_i = (V - DRC_i)\ (U_i - \bar{M}_i - R_i) \qquad (4)$$

When NSP is zero, the DRC measure is equal to the shadow price of foreign exchange. Similarly, when NSP is positive, the DRC is less than V, and when NSP is negative, DRC is greater than V.

In other words, the DRC measure in rice production (given technology) is equivalent to an exchange rate, indicating how many domestic resources are required to earn a unit of foreign exchange in that activity, while V is the exchange rate for the entire economy, measuring how many domestic resources the country is willing to give up to obtain a unit of foreign exchange.

A country has a comparative advantage in rice production if the DRC < V, indicating that fewer domestic resources are required to earn a unit of foreign exchange than the country is willing to pay for it.

Within a single country, the DRC concept can be used to evaluate several alternative methods of production or technologies. The methods can be ranked according to their DRC ratios. The smaller the DRC of a particular method in relation to the shadow price of foreign exchange, the greater is that method's relative degree of comparative advantage within an economy.

DRC and NSP are based on a common set of basic assumptions (Pearson et al., 1976). Among the most crucial of these assumptions

are: (1) the world price of the output (rice) is given exogeneously or is estimatable, (2) incremental costs of production are constant (subject to sensitivity analysis to reflect changed assumptions), (3) shadow prices of input and output are calculable, and (4) the true foreign exchange cost of production can be calculated. The empirical application of any technique will yield results that are useful only to the extent that the assumptions underlying the analysis are realistic. As a cautionary note, Herdt (1976) emphasized that decision criteria other than DRC alone must be considered. Employment, distribution of income, concentration of economic power, and the implications for all participants in the rice sector are among the most important.

ESTIMATION OF SHADOW PRICES

In DRC analysis, we compute the cost of foreign exchange saved for imported competing goods and the cost of foreign exchange earned from exports. Tradable outputs and inputs are thus evaluated at border prices (Scandizzon and Bruce, 1980). If inputs are directly imported or, though bought locally lead to additional imports, the shadow price of such inputs is the c.i.f. price, representing the direct foreign exchange cost of the import. Similarly, the shadow price of outputs that substitute for imports (import substitution) is measured by the c.i.f. import price. Conversely, for any input or output that would otherwise have been exported, the shadow price is the f.o.b. price, representing the direct foreign exchange earning of the export.

These border prices should not be adjusted for import duties or export taxes. But they should be adjusted to reflect internal transport or other costs (revalued at shadow price) in order to arrive at the value of the commodities at their point of origin (for outputs) and of destination (for inputs) (Little and Mirrless, 1974; Squire and van der Tak, 1975). Non-tradable inputs are then decomposed into tradable components and primary domestic factors. The former are evaluated using border prices and the later evaluated using accounting prices.

Since the official documents on c.i.f. prices can be over or under valued, we derived c.i.f. prices of tradable inputs from the f.o.b. prices at the origin parts plus freight charges. The c.i.f. prices of rice, urea, TSP and tractors were derived from the f.o.b. prices in Bangkok (Thai 25% brokens), Western Europe, the US Gulf and Japan, respectively. For pesticides/insecticides, which are mostly formulated in Indonesia, had costs divided into intermediate inputs cost (raw materials) which are tradable and processing costs. The former are evaluated at border prices and the latter are decomposed into tradable components and primary domestic factors based on the National Input-Output table.

Internal marketing costs (transport and handling) of tradable inputs and output are approximately equal to market prices less taxes. Composition into foreign (tradable) and domestic costs are based on the National Input-Output table with the assumptions that intermediate inputs and depreciation are treated as foreign costs (because they are

tradable components). Wages, salaries and operating surplus (less business taxes) are treated as domestic costs.

The shadow price of tractor services was estimated using a two step procedure. First, we estimated the shadow price of the tractor which was derived from the f.o.b. price in Japan plus freight charges (in order to arrive at the c.i.f. price Jakarta) plus internal marketing costs. Second, we estimated the cost of depreciation using a straight line method. This cost together with the operational costs and interest charges (revalued at shadow prices) set the shadow price of tractor services. The calculated shadow prices of tradable and non-tradable inputs are shown in Table 1.

The shadow wage rate is approximated by the prevailing wage rate for a given job since small rice farm production activities belong to the unprotected sector (informal sector) in which wages are freely determined in the market. There are no labor unions in the rural areas and minimum wage regulation exists only in the urban sectors (and is applicable only in government offices). Occupational mobility does exist between regions with different irrigation schedules or to Jakarta. The wage rates for unskilled labor in Jakarta are however, approximately the same as those in the agriculture sector.

Family labor was valued at the same wage rate as hired labor on the assumption that family labor had the same opportunity to get jobs as hired labor. The common system in West Java, especially among small farmers, is that farmers are employed by other farmers. So even if family labor income on their own farm is reduced by payments to

neighbors, the reduction would be compensated for by family's wage earnings from neighbors.

The shadow price of land was approximated by the return to land and management from growing the best alternative crop valued at social prices. For sensitivity analysis, we also used the market rental rate paid by tenant farmers. Among possible alternative crops, returns to land was highest in soybean production (Table 2). We, therefore, selected soybeans as the best alternative crop.

The shadow price of capital or shadow rate of interest was estimated by considering interest rates charged by private banks in the public sector. Since the current rate of interest in private banks ranged from 18-24 per annum, we selected 20 percent as the best estimate of capital cost. Two more alternatives, i.e. 12 and 30 percent were also employed as the lowest and high estimates. The low rate (12%) is the official interest rate in the BIMAS National Production Program. It is also the official rate for Small Investors' credit (Kredit Investasi Kecil) and Permanent Working Capital Credit (Kredit Modal Kerja Permanen), two popular programs for small business, especially in the non-agricultural sectors. The high rate (30%) is the estimated average rate for informal credit in the rural areas. In fact, informal credit rates ranged widely from zero charged on loans from family members to a moderate level charged by input suppliers or traders, to a very high rate charged by moneylenders for consumption loans.

The shadow exchange rate was estimated by using the "purchasing power parity" concept, which is based on differences between consumer

price indices in Indonesia and in the trading countries. Using time series data on the consumer price index (1971 as the base year), the average shadow exchange rate from mid-1979 to mid-1980 should be Rp 725/US$1. At the same time, the official exchange rate was Rp 625/US$1. Therefore, the adjustment factor for foreign costs (shadow exchange rate) is 1.16.

RESULT

Tables 3 and 4 show the private and social costs of production for mechanized and non-mechanized farms for the wet and dry seasons. The social cost[3] was higher than the private cost for all methods and seasons. On mechanized farms, these differences were 14 and 16 per cent for the wet and dry seasons. On non-mechanized farms, the figures were 8 and 9 per cent, respectively.

The difference between social and private costs was mainly due to high subsidies on inputs such as fertilizer and pesticides. The subsidy rate for urea, TSP fertilizer and pesticides was about 62, 58 and 79 per cent in 1979-1980.

The foreign cost[4] on mechanized farms was higher than on non-mechanized farms in both seasons. This was due to the higher

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[3] Social cost = [foreign cost x adjustment factor (1.6)] + Domestic cost.

[4] Foreign cost is the total value of tradable inputs and tradable components, evaluated at their border prices.

capital cost on mechanized farms in the form of tractor services. On the other hand, the domestic cost[5] on mechanized farms was slightly lower than on non-mechanized farms for both wet and dry seasons. Although mechanized farms spent more for harvesting and material input costs, this was more than offset by lower pre-harvest labor costs by substituting the tractor for human labor. The domestic cost difference was much lower in the dry season because non-mechanized farms used a minimum tillage system (walik jerami), a technique widely practiced in the dry season. This system requires only 50-60 per cent of the labor used in wet season for land preparation.

Table 5 shows the comparison of net social profitability (NSP), domestic resource cost (DRC), and comparative advantage measures between mechanized and non-mechanized farms. Comparative advantage is calculated as the ratio of the DRC measure to the shadow exchange rate. It measures the degree of efficiency of an activity in using domestic resources.

The net social profitabilities in the wet season were higher than those in the dry season. Hence, DRC values and comparative advantage in the wet season were lower than those in the dry season. This means the wet season crop costs the economy much less than the dry season crop. Again, this results from the higher yields in the wet season on both mechanized and non-mechanized farms.

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[5] Domestic cost is the total value of primary domestic factors such as labor, land and domestic capital, evaluated at shadow prices.

DRC measures in the wet and dry seasons were lower than shadow exchange rates for both mechanized and non-mechanized farms, indicating fewer domestic resources are required to save or earn a unit of foreign exchange than the country is willing to pay for it. Thus both methods had an international comparative advantage in producing rice.

Although the foreign cost on mechanized farms was higher than on non-mechanized farms, it was more than offset by the higher value of output on mechanized farms (due to higher yields resulting from higher fertilizer use) so net foreign exchange saved (or value added in world prices) on mechanized farms was slightly higher than on non-mechanized farms. Hence, mechanized farms had slightly lower DRC values, indicating mechanization had a greater comparative advantage than traditional methods. In this sense mechanization was economically more efficient in growing and marketing incremental amounts of rice. The differences were, however, small as indicated by the similarity of values for comparative advantage for all groups.

Table 6 shows DRC measures using alternative shadow prices for land and capital. By using higher estimates of the opportunity cost for land and capital, the DRC measures were still lower than the shadow exchange rate, indicating both methods maintained a strong comparative advantage in rice production.

The extent of comparative advantage as given by the DRC values depends upon the price of rice, yield per hectare and various cost components. We analyzed the elasticity of the DRC with respect to some important parameters such as capital, land and labor cost, yield,

c.i.f. price and shadow exchange rate, by assuming a 10 per cent increase in the specified parameters. The elasticity of the DRC depends upon the significance of that parameter in determining the value of the DRC. Table 7 reveals that the DRCs are relatively insensitive to shadow exchange rates and the shadow price of land, but highly sensitive to the shadow price of capital and the c.i.f. price of imported rice. The sensitivity of the DRC to the world price of imported rice has very serious policy implications in light of the extreme fluctuations in world rice prices. These have ranged from $210 to $421 ton during the past five years. At a price less than $190 per ton and with input prices and yields at their 1979-80 wet season levels, all methods are inefficient, and the country would be able to obtain its additional rice requirements at lower resource expenditures through direct imports of rice.

CONCLUSION

This study shows that both mechanical and traditional methods were economically profitable and had a strong comparative advantage in rice production as indicated by positive NSP and DRC values, which were much lower than the shadow exchange rate. In the wet season, the cost of domestic resources used by both methods were 42-47 per cent lower than the country is willing to give up to save a unit of foreign exchange. Although the dry season yield was much lower than the wet season, the cultivation of the dry season crop was still efficient. DRC values in the dry season were still lower than the shadow exchange rate.

The variation in DRC values between mechanized and non-mechanized farms was negligible, with mechanized farms having a slightly lower DRC value, indicating mechanization was more efficient in rice production. This result was not suprising because, although the foreign cost on mechanized farms was higher than non-mechanized farms, it was more than offset by the higher value of output so that the net foreign exchange (or value added in world prices) was higher on mechanized farms. Conversely, the domestic cost on mechanized farms was lower than on non-mechanized farms due to substitution of tractor for human labor. These component differences resulted in DRC values on mechanized farms slightly lower than on non-mechanized farms.

We need, however, to remind ourselves that the DRC approach used in this study does not consider the employment and income distribution effects of mechanization. Therefore, considerations other than the DRC alone must be considered to further justify development of mechanization in the West Java.

Table 1. Allocation of rice production input costs to foreign, domestic and tax sources (percentage), using the best estimate of capital cost, West Java.[a]

	Foreign cost	Domestic cost	Taxes, tariff
Urea fertilizer	86.8	11.6	1.6
TSP fertilizer	85.4	12.8	1.8
Insecticides/pesticides	57.4	37.7	4.8
Hand tractor services	46.7	39.2	14.2
Irrigation cost	61.5	35.0	3.5
Marketing cost	23.0	66.9	10.1
Hand tractor	57.7	23.2	19.1
Fuel and lubricants	64.4	24.6	10.1

[a] For detailed budgets of costs, see Saefudin, Y. "The Domestic Resource Cost of Mechanization in West Java, Indonesia", Unpublished M.S. thesis, University of the Philippines at Los Banos.

Table 2. Returns to land and management in alternative crops with opportunity cost for capital (Rp/ha).

Item	Maize		Soybean	
	Private	Social	Private	Social
Cost of production:				
1. Seed	7,000	7,000	14,000	14,000
2. Urea fertilizer[a]	5,250	12,223	5,250	12,223
3. TSP fertilizer[b]	3,500	7,336	1,750	3,668
4. Pesticides[c]	3,750	16,120	10,000	42,985
5. Irrigation[d]	1,650	12,951	1,650	12,951
6. Preharvest labor	51,975	51,975	60,000	60,200
7. Harvest labor	10,500	10,500	13,000	13,000
8. Family labor	22,275	22,275	26,000	26,000
9. Total	105,900	140,380	131,850	185,027
Value of production[e]	256,000	188,830	360,000	246,907
Return to land, management and capital	150,100	48,450	228,150	61,880
Depreciation	2,277	2,277	2,277	2,277
Return to non land capital[f]	2,925	4,304	3,714	5,841
Return to land and management				
- at 12% a year	144,898	41,869	222,159	53,762
- at 20% a year		39,000		49,868
- at 30% a year		35,413		45,000

[a] 75 kg per hectare.

[b] 50 kg/ha for maize and 25 kg/ha for soybean

[c] 3 l/ha for maize and 8 l/ha for soybean

[d] Social cost of irrigation from Djamaluddin, op cit., under Jatiluhur Multipurpose Project.

[e] The average f.o.b. price US Gulf 1979-80 was $142 and $250 per m-ton for maize and soybean. Freight cost was $55/m-ton. Handling cost assumed 5% of c.i.f. price and transport cost Rp 5,600/m. ton.

[f] At 12% a year, for 4 months.

Table 3. Production cost using best estimates of opportunity cost for capital and land, wet season, 1979-80, West Java (Rp/ha)[a]

Item	Mechanized			Non-mechanized		
	Private cost	Social cost		Private cost	Social cost	
		Foreign	Domestic		Foreign	Domestic
1. Seed	4,565	-	4,565	5,614	-	5,614
2. Hand tractor service	20,640	17,397	8,540	-	-	-
3. Urea fertilizer	17,210	33,492	4,455	14,734	30,638	4,076
4. TSP fertilizer	5,575	10,204	1,530	4,666	8,514	1,277
5. Pesticides	4,013	10,417	6,840	5,028	13,042	8,564
6. Pre-harvest hired labor	50,429	-	50,429	65,084	-	65,084
7. Irrigation	2,452	12,376	7,050	2,429	12,376	7,050
8. Total pre-harvest cost	104,884	83,886	83,409	97,555	64,569	91,665
9. Interest on pre-harvest cost	6,293	8,388	8,341	5,853	6,457	9,167
10. Harvest labor	61,586	-	61,586	53,822	-	53,852
11. Family labor	7,354	-	7,354	26,414	-	26,414
12. Land cost	104,174	-	49,868	106,489	-	49,868
13. Total production cost	284,291	92,274	210,558	290,113	70,026	230,935

Table 4. Production cost using best estimates of opportunity cost for capital and land, dry season 1980, West Java (Rp/ha)[a].

Item	Mechanized			Non-mechanized		
	Private cost	Social cost		Private cost	Social cost	
		Foreign	Domestic		Foreign	Domestic
1. Seed	4,814	-	4,814	5,456	-	5,456
2. Hand tractor service	16,496	17,397	8,540	-	-	-
3. Urea fertilizer	15,164	31,500	4,190	14,204	31,942	4,249
4. TSP fertilizer	5,426	9,906	1,485	5,118	8,844	1,326
5. Pesticides	4,861	12,614	8,283	5,088	13,200	8,668
6. Pre-harvest hired labor	64,069	-	64,069	61,336	-	61,336
7. Irrigation	2,567	12,376	7,050	2,579	12,376	7,050
8. Total pre-harvest cost	113,397	83,793	98,431	93,781	66,362	88,085
9. Interest on pre-harvest cost	6,804	8,379	9,843	5,627	6,636	8,809
10. Harvest labor	47,399	-	47,399	42,514	-	42,514
11. Family labor	6,963	-	6,963	25,010	-	25,010
12. Land	106,491	-	49,868	106,222	-	49,868
13. Total production cost	281,054	92,173	212,504	273,154	72,998	214,286

[a] For notes, see Table 2.

Table 5. Summary of domestic resource cost components using best estimate of opportunity cost for land and capital, West Java.[a]

Item	Wet Season 1979-80		Dry Season 1980	
	Mechanized	Non-mechanized	Mechanized	Non-mechanized
1. Yield, milled rice (kg/ha)[b]	3.20	3.06	2.31	2.26
Value ($/ha)[c]	1,176	1,125	849	831
2. Production cost				
a. Foreign cost (Rp/ha)	92,274	71,026	92,173	72,998
($/ha)	127.27	497.967	127.135	100.687
b. Domestic cost (Rp/ha)	210,559	230,935	212,505	214,286
3. Marketing cost				
a. Foreign cost (Rp/ha)	35,683	34,141	25,759	25,218
($/ha)	49.218	47.091	35.530	34.783
b. Domestic cost (Rp/ha)	104,015	99,518	75,086	73,510
4. Net Social Profitability (Rp/ha)	409,779	379,796	209,658	216,253
5. Domestic Resource Cost (DRC)	315	338	419	414
6. Comparative advantage	0.43	0.46	0.58	0.57

[a] The opportunity cost for capital is 20% a year for six months. Land valued in the best alternative crop. Shadow exchange rate of Rp 725 = US$1, and official exchange rate of Rp 625 = US$1.

[b] Conversion factor of 65% from paddy to milled rice.

[c] C.I.F. price of $367.95/m-ton.

Table 6. Domestic Resource Costs with alternative shadow prices for land and capital, West Java.

Shadow price of land at	Shadow price of capital (%/year)	Wet Season 1979-80		Dry Season 1980	
		Mecha-nized	Non-mechanized	Mecha-nized	Non-mechanized
1. Best alternative Crop	12	290	314	387	387
	20	315	338	419	414
	30	348	368	463	451
2. Market rental rate	12	337	363	463	463
	20	367	391	503	497
	30	406	428	557	543

Table 7. Elasticity of domestic resource cost with respect to stated parameters.[a]

Parameters	Mechanized	Non-mechanized
1. Capital opportunity cost	0.104	0.090
2. Land opportunity cost	0.015	0.015
3. Labor cost	0.039	0.044
4. Rice yield	0.055	0.057
5. C.I.F. price of rice	0.105	0.103
6. Shadow exchange rate	0.016	0.013
Basic calculation[b]	315	338

[a] Indicating change in DRC value with respect to 10% change (increase in specified parameter.

[b] Values of DRC based on the opportunity cost of capital at 20% a year and land valued at the best alternative crop.