Online Appendix to Chapter 28, Planning and Appraising Development Projects

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INTRODUCTION

This online appendix is provided to elaborate on some of the details that are not included in Chapter 28. In particular there is a more extended discussion of shadow pricing, cost effectiveness analysis and sensitivity and risk analysis. The tables in this appendix are numbered as continuations of the numbering in Chapter 28 but the detailed tables at the end are numbered in logical order in relation to the process of calculation from Table 1 to Table 17 since the main text and the online appendix do not include all the tables required to undertake the analysis. In this respect Tables 28.1 to 28.5 are the same as Tables 5, 9, 12, 15 and 17 in the spreadsheet.

SHADOW PRICING

In the case of foreign exchange, estimates of the shadow exchange rate (SER) are made on the basis of the domestic market value of traded goods in relation to their border price value. Given the relative importance of taxes on trade in many developing countries, particularly for imports, approaches for estimating the value of the SER are usually made on the basis of the ratio of prices, including taxes on trade, to the prices at the border (Curry and Weiss, 2000: 138–42; Potts, 2002: 223–6). Estimates for these values for some countries were very high in the 1970s and 1980s but have fallen significantly with the liberalization of trade. In our

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BOX 28.4 | Estimating a Shadow Exchange Rate (SER)

The SER can be determined on the basis of the ratio of the border price of traded goods to their domestic market price. A simple estimate can be based on the values of imports and exports and the taxes imposed on them. So, in an economy with average export taxes (T_x) of 3 per cent and average import duties (T_m) of 12 per cent, and with 60 per cent of total trade being imports and 40 per cent exports, the SER could be estimated as:

$$SER = \frac{(X + T_x) + (M + T_m)}{(X + M)} = \frac{(40 - 1.2) + (60 + 7.2)}{(40 + 60)} = 1.06$$

However, in most developing countries, additional foreign exchange is more likely to be spent on extra imports rather than on consuming export products, so the value of foreign exchange is likely to be closer to the value taking only imports into account (60 + 7.2)/60 = 1.12. On this basis an SER of 1.1 is assumed for our example.

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BOX 28.5 | Estimating a Shadow Wage Rate (SWR) for Formal Sector Unskilled Labour

If the financial cost of an unskilled worker in the formal sector is $12.50 per day and the alternative wage the worker could earn in the informal sector is $10 per day (his/her opportunity cost), then the conversion factor (SP/MP) for unskilled labour $CF_{UL} = 10/12.5 = 0.80$. More sophisticated estimates might take account of the economic value of the output in the alternative occupation, potential seasonal variations in wages due to potential underemployment at certain times of year, and differences in the cost of living if employment implies migration.

example we will use a value of 1.10, a fairly typical value for the SER in a partially liberalized economy.

If the alternative activity for unskilled workers in the formal sector is some form of casual labour in small-scale agriculture or the urban informal sector, then the cost to the economy of employing extra unskilled labour in the formal sector is represented by the alternative income forgone, not the wage paid by the project to those workers. In a country with a minimum wage for formal sector employees it is likely that the opportunity cost of unskilled labour would be lower than the wage paid. Liberalization of formal sector labour markets has taken place in many countries, but it is still likely that the opportunity cost of formal sector labour will be lower than the wage paid. In our example we will use a value of 0.80 for formal sector unskilled labour

Once the basic parameters have been determined, it is possible to work out shadow prices for individual cost and benefit items. This can be done to varying levels of sophistication depending on available data. The normal approach to estimate shadow prices for any item is to break the market price value down on a percentage basis into what can be described as *primary factors*, namely foreign exchange, local costs, various categories of labour, and taxes. These breakdown percentages are then multiplied by the economic value of the primary factors to derive *conversion factors* (CFs) that can be used to convert market price costs and benefits into economic values. To follow this procedure it is necessary to decide what units to count in since one of the primary factors must have a value of 1. This is known as the *numéraire* of the system. In our example we use average domestic expenditure as the numéraire.[1] This is because it is equivalent to the units already used in the financial analysis and it is easier to trace distributional impact (Fujimura, 2012). A widely known alternative is what has been described as a "world price numéraire." This approach was originally developed by Little and Mirrlees (1969, 1974), and was also adopted by Squire and van der Tak (1975) and used by a number of international agencies including the World Bank. It had the advantage that it avoided direct measurement of a shadow exchange rate, which was politically sensitive in the 1970s and 1980s when overvaluation of exchange rates in developing countries was a major issue. The main disadvantage is that it makes it quite difficult to measure distributional impact because the units used in the economic analysis do not correspond to the units that project stakeholders receive.

In principle, it is best to have a comprehensive study covering all the major sectors of the economy as well as a range of categories of labour. This would allow consistency in the application of shadow prices. Such studies have been undertaken in a number of economies, usually using an approach known as *semi-input-output analysis* (Potts, 2012a). The main problem is that such studies are conducted relatively infrequently and become out of date when economic conditions and policies change. In our example it is assumed that information is available to estimate shadow prices for the some of the most important items but not for everything. Where no

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BOX 28.6 | The Conversion Factor for Tomato Concentrate

The market price of $10 per kg can be decomposed on the following basis:

- The import cost of tomato concentrate is $8 per kg, so for each kg of output produced there is a foreign exchange saving of $8.
- Import duty is 25 per cent of the import price ($1.6) but this is a transfer payment so it does not represent an economic benefit, just a transfer of income from the consumers to the government.
- Transport per kg from the factory to the main market is, on average, $0.4 less than transport and port charges for the imported product.

On this basis:

- 80 per cent of the price represents a foreign exchange saving (80% F).
- 16 per cent of the price is a saving in import duty. This is a gain for the producer but a loss for the government.
- 4 per cent of the price is a saving in local distribution costs.

Therefore, the shadow price is $(8 \times 1.1) + (0.16 \times 0) + (0.4 \times 1) = 9.2$, and the conversion factor is $9.2/10 = 0.92$.

information is available it is assumed that the market price is equal to the shadow price.

The most important item for our project is the economic value of the output of tomato concentrate, assumed to be an import substitute.

A number of other adjustments have been made to some of the costs for which it might be expected that information would be available. Transport, construction, and utilities (energy and water) are used in many projects so any country that makes use of shadow prices should have some information on these sectors. Information on imported vehicles and machinery should not be difficult to collect if the project has been properly costed. Likewise, information on fertilizer costs is usually available in countries where agriculture is important, as would be information on rice if it is a major crop in the region. For other sectors, where information might not be available, shadow prices have been assumed to be the same as market prices. Table 28.4 illustrates the results for our example.

It can be seen that the project still appears to be viable, but both the *net present value* (NPV) and *internal rate of return* (IRR) have gone down. The main reason is that the conversion factor for the benefits is less than one and the conversion factors for some of the costs have gone up.

The conversion factor for the benefits is less than one because tomato concentrate production is protected by an import duty. The conversion factor for rice suggests that it is an export crop so the foreign exchange value is greater than the price paid to the farmers. Fertilizer is an import but, unlike for tomato concentrate, there is no import duty, presumably because the government wants to encourage farmers to use fertilizer. The conversion factor for utilities suggests that the price paid for water and electricity does not cover the full cost, perhaps because the utilities are in the public sector and the government wishes to keep costs down for producers. This is useful information, but we do not yet know who the losers are. Clearly, if the economic NPV is less than the NPV at market prices, someone has lost. This can be investigated through distribution analysis. This is rarely done in practice, partly because it can be quite complicated, especially for projects more

TABLE 28.4 | Distribution of Costs and Benefits ($ D '000 Shadow Prices)

Year	1	2	3	4	5	6	7	8	9	10
Shareholders	–1550	–237.2	–23.1	361.9	378.6	270.1	361	351.1	1253.1	1150
Bank	–2500	0	518.6	518.6	518.6	518.6	518.6	518.6	518.6	
Net Creditors		163.2	185	18.5	0	0	0	0	–366.7	
Farmers		21.5	428	428	428	428	428	428	385.2	
Government										
– Company Tax			34.5	145	152.8	161.3	170.4	180.3	191	
– Other Taxes	275	–401.7	–882	–930	–930	–915	–930	–930	–933.4	
– Foreign Exchange Premium	–245	119.2	312.1	336.1	336.1	328.6	336.1	336.1	350.1	
Total Government	30	–282.5	–535.5	–449	–441.1	–425.2	–423.5	–413.6	–392.3	
Unskilled Workers	45	86.4	161.6	161.6	161.6	162	161.6	161.6	146.5	
Net Benefits	–3975	–248.6	734.7	1039.7	1045.7	953.6	1045.7	1045.7	1544.4	1150
Present Values										
Shareholders	596.9									
Bank	0									
Net Creditors	116.9									
Farmers	1907.6									
Government	–2204.5									
Unskilled Workers	829.8									
NPV	1246.7									

complex than our case. However, it is not impossible and it does provide a check to ensure that the analysis is internally consistent.

Part of the information is available from Table 28.3 (p. 520 of the textbook). However, to work out which groups get the costs and benefits derived from the difference between market prices and shadow prices, we need to look at the difference between the shadow prices of the various primary factors and the market prices. Any change in taxes goes to the government. Most of any difference between the shadow wage rate and the market wage is likely to go to workers, and the difference between the shadow exchange rate and the official exchange rate is assumed to go to the government because any extra foreign exchange allows more imports and the government receives tax on imports. By breaking down the relevant costs and benefits at market prices we can derive the breakdown of resource costs and benefits into primary factors. In most years the project leads to a net gain in foreign exchange revenue. This will allow more imports, which will boost government tax revenue. There is significant expenditure on unskilled labour in each year and this will lead to income gains to workers. However, the government will lose a significant amount of revenue from forgone taxes on imported tomato concentrate so the government is the net loser.

The overall distribution effects can be determined by combining the information in Table 28.3 (p. 520 of the textbook) with the breakdown of resource costs and benefits. This is shown in Table 28.5. Overall, the main gainers are the shareholders, the farmers, and the factory workers and the main losers are the government. Does this project contribute to development? The answer is probably yes as long as the project works as planned, but it is not quite as good as it appeared to be before the economic analysis was conducted.

THE DISCOUNT RATE

So far the discount rate has been assumed to be 8 per cent. How is this rate determined? There are two approaches to deciding on the discount rate. The first relates to the opportunity cost of capital. If investment resources are constrained it can be argued that the IRR of any project should be at least as high as the IRR on the next best alternative project. From a financial viewpoint, if there are no alternative projects to consider, this could be represented by the rate of interest that could be obtained from depositing funds in a bank. However, if alternative projects are available, it could be represented by the return on the next best alternative project or the cost of borrowing funds from a bank.[2] This approach to the discount rate is the one normally taken by development banks and tends to result in relatively high discount rates, typically 12 per cent, although the empirical evidence to justify such a high real rate is open to question.

The alternative approach is to consider the discount rate on the basis of social time preference. Why should we regard consumption now to be more valuable than consumption in the future? There are two main reasons. The first is that the future is uncertain and we prefer certain consumption now to uncertain consumption in the future. It is usually argued that, while this is important for individuals, governments should take account of the interests of future generations so this element should not be given too much weight. Also, uncertainty works both ways and some argue that it should not influence governments with many projects since, if they are prepared on the basis of best estimates, as many projects should exceed the return indicated in the plan as those that fall short. Evidence on this issue suggests that planners tend to

TABLE 28.5 | Breakdown of Resource Costs and Benefits ($ D '000,)

Year	1	2	3	4	5	6	7	8	9	10
Foreign Exchange	–2450	1191.9	3120.9	3360.9	3360.9	3285.9	3360.9	3360.9	3501.4	
Domestic Resources	–850	–820.1	–1475.9	–1434.9	–1428.9	–1432.9	–1428.9	–1428.9	–1152.4	1150
Unskilled Labour	–225	–432	–808	–808	–808	–810	–808	–808	–732.4	
Skilled Labour	–250	–394	–576	–576	–576	–580	–576	–576	–568.8	
Taxes	–275	401.7	882	930	930	915	930	930	933.4	
Net Benefits	–4050	–52.5	1143	1472	1478	1378	1478	1478	1981.2	1150

be optimistic on average (FAO, 1989) but practice may be improving (IEG, 2010).

The second reason used for discounting on the basis of social time preference is that, in any country with positive per capita income growth, the average person is getting richer. If additional consumption is less important as we get richer, we should put a lower weight on the consumption of future generations based on a combination of the expected rate of growth of per capita income (*g*) and the rate at which the value of additional consumption declines as income rises (*e*). This social time preference approach to discounting is the approach used by countries in the European Union, where it is argued that the discount rate for economic analysis for the richer countries should be 3 per cent and for the poorer countries it should be 5 per cent (EC, 2014: 44). Similar rates have been estimated for nine Latin American countries (Lopez, 2008).

Clearly, the two approaches tend to lead to quite different views on the value of the discount rate. This is an important issue that has not been resolved. As a result, there are differences between different agencies on the appropriate rate of discount to use. A review of these issues can be found in Kula (2012).

COST-EFFECTIVENESS ANALYSIS AND THE SOCIAL SECTORS

In either approach it is necessary to measure costs and to have an indicator of output. For effective use of cost-effectiveness analysis (CEA) it is important to have as specific a measure of the project outcome as possible. For example, a measure of "primary school children enrolled" is not very helpful since it does not say anything about the learning achievements of the children. A similar comment could be made about "hospital patients treated." The literature on CEA in the health sector has developed a number of indicators of health outcomes, of which the best known is the disability adjusted life year (DALY). This measure provides an indicator of health expenditure outcome in terms of savings of DALYs per unit of cost or maximum DALYs saved per unit of health expenditure (ADB, 2000; Weiss, 2012). CEA in the health and education sectors is also discussed in Belli et al. (1998: ch. 8).

In the education sector CBA has been used, mainly at the policy level, to estimate the benefits of education in terms of the additional income earned by people with different levels of education. A great deal of research has been done by Psacharopoulos and various associates (e.g., Psacharopoulos and Patrinos, 2004) to determine the returns to education at different levels. An example of such an approach for higher education is described in Belli et al. (1998: ch. 8). The CBA approach has been criticized on the basis of the data used and their comparability (Bennell, 1996). Part of the reason why CBA has primarily been used at the policy level is that educational planning is mostly done using a program approach. CEA has been used for individual projects. In such studies the main problem has been the measurement of project outcomes. How do we measure the quality of education? If it is based on test results, how do we know what students would have known without the education project? A summary of some of the issues is given in Potts (2012b).

SENSITIVITY AND RISK ANALYSIS

All forms of project analysis make assumptions about the future, which is inherently uncertain. It is therefore clear that any of the estimates that go into CBA or CEA have a margin of error. No analysis of a project is complete without testing some of the main assumptions. What percentage change in the value of the benefits reduces the NPV to zero? How sensitive is the project result to changes in the most important cost items? How sensitive is the project to delay? Sensitivity analysis should be conducted for all the most important variables. Some examples of possible tests are indicated in Box 28.7.

It can be seen that the project is very sensitive to the price of the output. The margin of error is less than 5 per cent for both the financial analysis and the economic analysis. In the case of the economic analysis the relevant price is the world price rather than the local market price because this is what determines economic viability. The project is also quite sensitive to assumptions about production, particularly the economic NPV. Financial profitability is quite sensitive to the price of tomatoes but this does not affect the economic analysis because any loss to the factory is an equal and opposite gain to the farmers. The project is

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BOX 28.7 | Sensitivity Analysis

	Factory NPV	Financial NPV	Economic NPV
Base Value	1228.9	596.9	1246.7
Sales Price –10%	–1641.0	–1412.3	–1408.3
Break Even	–4.3%	–3.0%	–4.7%
Production –10%	421.5	39.1	–181.9
Break Even	–15.2%	–10.7%	–8.7%
Tomato Costs +10%	444.4	44.8	1246.7
Break Even	15.7%	10.8%	n.a.
Machinery Costs +10%	978.9	394.3	998.1
Break Even	49.2%	29.5%	50.1%

not very sensitive to machinery costs so it is unlikely that an increase in machinery prices would have a major impact on the project. Sensitivity analysis can identify critical areas that are important for project success and can point to potential actions to reduce the possibility of failure.

A more sophisticated way to look at the possibility of project failure is to conduct a risk analysis. This involves constructing a frequency distribution for the critical parameters and running a number of simulations to determine the overall probability of failure and the potential cost of failure. This can be done using specialized software that can be attached to a spreadsheet, but its usefulness depends on the availability of reasonably accurate information for constructing the frequency distributions. The issue of sensitivity and risk analysis is discussed in more detail in Curry and Weiss (2000, ch. 9), Belli et al. (1998: ch. 12), and Potts (2002, ch. 15).

NOTES

1. The approach used in this chapter is derived from UNIDO (1972) and subsequent publications. Other relevant expositions of this general approach are Potts (1990, 1999) and Londero (1996).
2. It should be remembered that if the analysis is conducted in constant prices it is the real rate of interest that is relevant. This can be estimated as $(1 + r) / (1 + i) - 1$ where r is the nominal rate of interest and i is the rate of inflation.

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DETAILED TABLES

TABLE 1 | Investment Costs ($D '000 constant market prices)

Year	1	2	3	4	5	6	7	8	9	10
Land	50.0									–50.0
Buildings	1000.0									–500.0
Machinery	3000.0									–600.0
Vehicles		100.0				100.0				
Total Investment Costs	4050.0	100.0				100.0				–1150.0

TABLE 2 | Revenue ($D '000 constant market prices)

Year	1	2	3	4	5	6	7	8	9
Production (tonnes)		300.0	600.0	600.0	600.0	600.0	600.0	600.0	540.0
Stock (tonnes)		30.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0
Increase in Stock		30.0	30.0						–60.0
Sales (tonnes)		270.0	570.0	600.0	600.0	600.0	600.0	600.0	600.0
Unit Price ($D/kg)	10.0								
Sales ($D '000)		2700.0	5700.0	6000.0	6000.0	6000.0	6000.0	6000.0	6000.0

TABLE 3 | Operating Costs ($D '000 constant market prices)

Year	1	2	3	4	5	6	7	8	9
Tomatoes		729.0	1539.0	1620.0	1620.0	1620.0	1620.0	1620.0	1620.0
Transport		162.0	342.0	360.0	360.0	360.0	360.0	360.0	360.0
Packing Materials		540.0	1140.0	1200.0	1200.0	1200.0	1200.0	1200.0	1200.0
Utilities		202.0	382.0	400.0	400.0	400.0	400.0	400.0	400.0
Maintenance Materials		50.0	75.0	100.0	100.0	100.0	100.0	100.0	100.0
Unskilled Labour		374.0	734.0	770.0	770.0	770.0	770.0	770.0	770.0
Skilled Labour		350.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0
Total Operating Costs		2407.0	4712.0	4950.0	4950.0	4950.0	4950.0	4950.0	4950.0

TABLE 4 | Working Capital ($D '000 constant market prices)

Year	1	2	3	4	5	6	7	8	9
Stocks of Packing Materials		54.0	114.0	120.0	120.0	120.0	120.0	120.0	0.0
Finished Goods		213.0	426.0	426.0	426.0	426.0	426.0	426.0	0.0
Accounts Receivable		225.0	475.0	500.0	500.0	500.0	500.0	500.0	0.0
Accounts Payable		61.8	126.8	133.3	133.3	133.3	133.3	133.3	0.0
Total Working Capital		430.2	888.2	912.7	912.7	912.7	912.7	912.7	0.0
Incremental Working Capital		430.2	458.0	24.5	0.0	0.0	0.0	0.0	–912.7

TABLE 5 | Annual Statement of Costs and Benefits ($D '000 constant market prices)

Year	1	2	3	4	5	6	7	8	9	10
Investment Costs	4050.0	100.0				100.0				–1150.0
Operating Costs		2407.0	4712.0	4950.0	4950.0	4950.0	4950.0	4950.0	4950.0	
Incremental Working Capital		430.2	458.0	24.5	0.0	0.0	0.0	0.0	–912.7	
Total Costs	4050.0	2937.2	5170.0	4974.5	4950.0	5050.0	4950.0	4950.0	4037.3	–1150.0
Revenue		2700.0	5700.0	6000.0	6000.0	6000.0	6000.0	6000.0	6000.0	
Net Revenue	–4050.0	–237.2	530.0	1025.5	1050.0	950.0	1050.0	1050.0	1962.7	1150.0
NPV at 8%	1228.9									
IRR	13.5%									
PV of costs	27629.5									
PV of benefits	28858.4									
B/C Ratio	1.04									

TABLE 6 | Loan Interest and Repayment Schedule ($D '000)

Year	1	2	3	4	5	6	7	8	9
Interest Rate	8%								
Loan Principal	2500.0								
Total Payment			518.6	518.6	518.6	518.6	518.6	518.6	518.6
Unpaid Interest		200.0							
Interest Paid			216	191.8	165.6	137.4	106.9	74.0	38.4
Loan Repayment			302.6	326.8	352.9	381.2	411.7	444.6	480.2
Balance Outstanding	2500.0	2700.0	2397.4	2070.6	1717.7	1336.5	924.8	480.2	0.0

TABLE 7 | Depreciation Schedule ($D '000)

Year	1	2	3	4	5	6	7	8	9
Buildings		50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Machinery		300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
Vehicles		25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Total Depreciation		375.0	375.0	375.0	375.0	375.0	375.0	375.0	375.0

TABLE 8 | Profit and Loss Account ($D '000)

Year	1	2	3	4	5	6	7	8	9
Sales Revenue		2700.0	5700.0	6000.0	6000.0	6000.0	6000.0	6000.0	6000.0
Operating Costs		2407.0	4712.0	4950.0	4950.0	4950.0	4950.0	4950.0	4950.0
Less Depreciation		375.0	375.0	375.0	375.0	375.0	375.0	375.0	375.0
Less Loan Interest		200.0	216.0	191.8	165.6	137.4	106.9	74.0	38.4
Net Pre-Tax Profit		–282.0	397.0	483.2	509.4	537.6	568.1	601.0	636.6
Cumulative Taxable Profit		–282.0	115.0	598.2	1107.6	1645.1	2213.2	2814.2	3450.8
Tax @ 30%		0.0	34.5	145.0	152.8	161.3	170.4	180.3	191.0
Net Profit after Tax		–282.0	362.5	338.2	356.5	376.3	397.7	420.7	445.6
Cumulative Net Profit after Tax		–282.0	80.5	418.7	775.3	1151.6	1549.3	1970.0	2415.6

TABLE 9 | Cash Flow ($D '000)

Year	1	2	3	4	5	6	7	8	9	10
Cash Inflow										
Equity Capital	1600.0	400.0								
Loan	2500.0									
Sales		2700.0	5700.0	6000.0	6000.0	6000.0	6000.0	6000.0	6000.0	
Total Annual Cash Inflow	4100.0	3100.0	5700.0	6000.0	6000.0	6000.0	6000.0	6000.0	6000.0	
Cash Outflow										
Investment	4050.0	100.0				100.0				–1150.0
Incremental Working Capital		430.2	458.0	24.5					–912.7	
Operating Costs		2407.0	4712.0	4950.0	4950.0	4950.0	4950.0	4950.0	4950.0	
Loan Interest			216.0	191.8	165.6	137.4	106.9	74.0	38.4	
Loan Repayment			302.6	326.8	352.9	381.2	411.7	444.6	480.2	
Tax			34.5	145.0	152.8	161.3	170.4	180.3	191.0	
Total Annual Cash Outflow	4050.0	2937.2	5723.1	5638.1	5621.4	5729.9	5639.0	5648.9	4746.9	–1150.0
Annual Net Cash Flow	50.0	162.8	–23.1	361.9	378.6	270.1	361.0	351.1	1253.1	1150.0
Cumulative Balance C/F	50.0	212.8	189.7	551.7	930.3	1200.4	1561.4	1912.5	3165.6	4315.6
Return to Equity	–1550.0	–237.2	–23.1	361.9	378.6	270.1	361.0	351.1	1253.1	1150.0
NPV to Equity at 8%	596.9									
IRR to Equity	13.3%									

TABLE 10 | Hectare Budgets for Alternative Crops

	Paddy	Tomatoes (standard)	Tomatoes (improved)
Production (kg.)	4000	18000	25000
Price ($D Per kg.)	1.00	0.45	0.45
Revenue	4000	8100	11250
Incremental Revenue		4100	7250
Inputs			
Fertilizer	135	645	690
Chemicals		1290	1385
Other Costs	155	1260	1430
Total Input Costs	290	3195	3505
Incremental Costs		2905	3215
Gross Margin	3710	4905	7745
Net Incrementa Revenue		1195	4035
Total Labour Days	282	380	435
Return per Day	13.2	12.9	17.8
Incremental Labour Days		98	153
Incremental Return per Day		12.2	26.4

TABLE 11 | Aggregate Income and Costs to Farmers

Year	1	2	3	4	5	6	7	8	9
Revenue									
Without the Project									
Rice	576.0	576.0	576.0	576.0	576.0	576.0	576.0	576.0	576.0
With the Project									
Rice	576.0	176.0							57.6
Tomatoes		810.0	1620.0	1620.0	1620.0	1620.0	1620.0	1620.0	1458.0
Incremental Revenue		410.0	1044.0	1044.0	1044.0	1044.0	1044.0	1044.0	939.6
Rice		–400.0	–576.0	–576.0	–576.0	–576.0	–576.0	–576.0	–518.4
Tomatoes		810.0	1620.0	1620.0	1620.0	1620.0	1620.0	1620.0	1458.0
Inputs (Incremental)									
Fertilizer		51.0	79.9	79.9	79.9	79.9	79.9	79.9	71.9
Chemicals		129.0	199.4	199.4	199.4	199.4	199.4	199.4	179.5
Other Costs		110.5	183.6	183.6	183.6	183.6	183.6	183.6	165.2
Incremental Costs		290.5	463.0	463.0	463.0	463.0	463.0	463.0	416.7
Incremental Net Revenue		119.5	581.0	581.0	581.0	581.0	581.0	581.0	522.9
Labour Days ('000 incremental)		9.8	15.3	15.3	15.3	15.3	15.3	15.3	13.8
Opportunity Cost		98.0	153.0	153.0	153.0	153.0	153.0	153.0	137.7
Incremental Net Benefit		21.5	428.0	428.0	428.0	428.0	428.0	428.0	385.2

TABLE 12 | Distribution of Costs and Benefits (Market Prices)

Year	1	2	3	4	5	6	7	8	9	10
Shareholders	–1550.0	–237.2	–23.1	361.9	378.6	270.1	361.0	351.1	1253.1	1150.0
Bank	–2500.0		518.6	518.6	518.6	518.6	518.6	518.6	518.6	
Net Creditors		163.2	185.0	18.5					–366.7	
Government			34.5	145.0	152.8	161.3	170.4	180.3	191.0	
Farmers		21.5	428.0	428.0	428.0	428.0	428.0	428.0	385.2	
Total Benefits	–4050.0	–52.5	1143.0	1472.0	1478.0	1378.0	1478.0	1478.0	1981.2	1150.0
NPV at 8%	3253.4									
IRR	22.5%									
Share of Farmers	2024.6									
	62.2%									

TABLE 13 | Combined Annual Statement of Resource Costs and Benefits ($D '000 Constant Market Prices)

Year	1	2	3	4	5	6	7	8	9	10
Land	50.0									–50.0
Buildings	1000.0									–500.0
Machinery	3000.0									–600.0
Vehicles		100.0				100.0				
Transport		180.0	360.0	360.0	360.0	360.0	360.0	360.0	324.0	
Packing Materials		654.0	1260.0	1206.0	1200.0	1200.0	1200.0	1200.0	960.0	
Utilities		220.0	400.0	400.0	400.0	400.0	400.0	400.0	364.0	
Maintenance Materials		50.0	75.0	100.0	100.0	100.0	100.0	100.0	100.0	
Unskilled Labour		410.0	770.0	770.0	770.0	770.0	770.0	770.0	698.0	
Skilled Labour		350.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	
Factory Costs	4050.0	1964.0	3365.0	3336.0	3330.0	3430.0	3330.0	3330.0	2946.0	–1150.0
Rice		400.0	576.0	576.0	576.0	576.0	576.0	576.0	518.4	
Fertilizer		51.0	79.9	79.9	79.9	79.9	79.9	79.9	71.9	
Chemicals		129.0	199.4	199.4	199.4	199.4	199.4	199.4	179.5	
Other Costs		110.5	183.6	183.6	183.6	183.6	183.6	183.6	165.2	
Farmer Labour		98.0	153.0	153.0	153.0	153.0	153.0	153.0	137.7	
Farmer Costs		788.5	1192.0	1192.0	1192.0	1192.0	1192.0	1192.0	1072.8	
Sales		2700.0	5700.0	6000.0	6000.0	6000.0	6000.0	6000.0	6000.0	
Net Benefits	–4050.0	–52.5	1143.0	1472.0	1478.0	1378.0	1478.0	1478.0	1981.2	1150.0

TABLE 14 | Breakdown of Costs and Benefits (%)

	F	D	UL	SL	T
Primary Factor Values	1.10	1.00	0.80	1.00	0.00
Land		100.0%			
Buildings	20.0%	50.0%	15.0%	10.0%	5.0%
Machinery	75.0%	10.0%	2.5%	5.0%	7.5%
Vehicles	75.0%	4.0%	2.0%	4.0%	15.0%
Transport	65.0%	5.0%	5.0%	10.0%	15.0%
Packing Materials		100.0%			
Utilities	85.0%	10.0%	5.0%	10.0%	–10.0%
Maintenance Materials		100.0%			
Unskilled Labour			100.0%		
Skilled Labour				100.0%	
Rice	110.0%	–10.0%			
Fertilizer	90.0%	10.0%			
Chemicals	80.0%	12.0%			8.0%
Other Costs		100.0%			
Farmer Labour		100.0%			
Sales	80.0%	4.0%			16.0%

TABLE 15 | Annual Statement of Economic Costs and Benefits ($ D '000 Shadow Prices)

Year	CF	1	2	3	4	5	6	7	8	9	10
Land	1.00	50.0									–50.0
Buildings	0.94	940.0									–500.0
Machinery	1.00	2985.0									–600.0
Vehicles	0.92		92.1				92.1				
Transport	0.91		162.9	325.8	325.8	325.8	325.8	325.8	325.8	293.2	
Packing Materials	1.00		654.0	1260.0	1206.0	1200.0	1200.0	1200.0	1200.0	960.0	
Utilities	1.18		258.5	470.0	470.0	470.0	470.0	470.0	470.0	427.7	
Maintenance Materials	1.00		50.0	75.0	100.0	100.0	100.0	100.0	100.0	100.0	
Unskilled Labour	0.80		328.0	616.0	616.0	616.0	616.0	616.0	616.0	558.4	
Skilled Labour	1.00		350.0	500.0	500.0	500.0	500.0	500.0	500.0	500.0	
Rice	1.11		444.0	639.4	639.4	639.4	639.4	639.4	639.4	575.4	
Fertilizer	1.09		55.6	87.1	87.1	87.1	87.1	87.1	87.1	78.4	
Chemicals	1.00		129.0	199.4	199.4	199.4	199.4	199.4	199.4	179.5	
Other Costs	1.00		110.5	183.6	183.6	183.6	183.6	183.6	183.6	165.2	
Farmer Labour	1.00		98.0	153.0	153.0	153.0	153.0	153.0	153.0	137.7	
Sales	0.92		2484.0	5244.0	5520.0	5520.0	5520.0	5520.0	5520.0	5520.0	
Net Benefits		–3975.0	–248.6	734.7	1039.7	1045.7	953.6	1045.7	1045.7	1544.4	1150.0
NPV		1246.7									
IRR		13.9%									

TABLE 16 | Breakdown of Resource Costs and Benefits ($ D '000,)

Year	1	2	3	4	5	6	7	8	9	10
Foreign Exchange	–2450.0	1191.9	3120.9	3360.9	3360.9	3285.9	3360.9	3360.9	3501.4	
Domestic Resources	–850.0	–820.1	–1475.9	–1434.9	–1428.9	–1432.9	–1428.9	–1428.9	–1152.4	1150.0
Unskilled Labour	–225.0	–432.0	–808.0	–808.0	–808.0	–810.0	–808.0	–808.0	–732.4	
Skilled Labour	–250.0	–394.0	–576.0	–576.0	–576.0	–580.0	–576.0	–576.0	–568.8	
Taxes	–275.0	401.7	882.0	930.0	930.0	915.0	930.0	930.0	933.4	
Net Benefits	–4050.0	–52.5	1143.0	1472.0	1478.0	1378.0	1478.0	1478.0	1981.2	1150.0

TABLE 17 | Distribution of Costs and Benefits ($ D '000 Shadow Prices)

Year	1	2	3	4	5	6	7	8	9	10
Shareholders	–1550.0	–237.2	–23.1	361.9	378.6	270.1	361.0	351.1	1253.1	1150.0
Bank	–2500.0	0.0	518.6	518.6	518.6	518.6	518.6	518.6	518.6	
Net Creditors		163.2	185.0	18.5	0.0	0.0	0.0	0.0	–366.7	
Farmers		21.5	428.0	428.0	428.0	428.0	428.0	428.0	385.2	
Government										
– Company Tax			34.5	145.0	152.8	161.3	170.4	180.3	191.0	
– Other Taxes	275.0	–401.7	–882.0	–930.0	–930.0	–915.0	–930.0	–930.0	–933.4	
– Foreign Exchange Premium	–245.0	119.2	312.1	336.1	336.1	328.6	336.1	336.1	350.1	
Total Government	30.0	–282.5	–535.5	–449.0	–441.1	–425.2	–423.5	–413.6	–392.3	
Unskilled Workers	45.0	86.4	161.6	161.6	161.6	162.0	161.6	161.6	146.5	
Net Benefits	–3975.0	–248.6	734.7	1039.7	1045.7	953.6	1045.7	1045.7	1544.4	1150.0
Present Values										
Shareholders	596.9									
Bank	0.0									
Net Creditors	116.9									
Farmers	1907.6									
Government	–2204.5									
Unskilled Workers	829.8									
NPV	1246.7									