

APPENDIX VI: INVESTMENT APPRAISAL

The following 10 steps give a suggested approach to investment appraisal. They are given only in outline form to illustrate the sequence – for more information the reader is referred to any standard text on cost-benefit analysis.

Step 1: Define the 'with' and 'without' technology situations.

A systematic description is needed of the technology to be appraised. How does it function? What does it do? What materials are needed to implement it? And so on.

⇒ In the example in Box 8.2 (Chapter 8), the 'with technology' situation is single-row *Gliricidia* hedgerows planted across the contour. The 'without technology' situation is steep-slope arable cropping without any direct measure of keeping soil on the slope. The materials for the technology are as described in the Box.

Step 2: Convert the data into common units.

Usually it is sensible to convert field areas into hectares, and yields into kilogrammes per hectare, although locally relevant measures may also be used. Money should be in local currency terms, with values reflecting real values and real costs to the land user. So, crop revenues should be calculated based on the price paid to farmers for their crops – the producer price – not the price at which they can be bought in the market – the market price. Inflation is a major problem in many countries, so a fixed date for valuation will usually need to be specified.

⇒ Farmers in Sri Lanka do not use field measurements of hectares and they measure their crops in the number of sacks taken from the field. Traders come to their farms to buy produce – so the crop revenues are valued according to the prices paid by traders.

Step 3: List the costs and benefits.

This is the first vital step in bringing the information into some common format – two columns representing costs to the land user and benefits. Field observations and data collected from farmers are vital in undertaking this listing. The list should include only costs and benefits that occur as a result of adopting the technology. Any cost or benefit that would also occur if the farmer did not adopt the technology should not be included. Double-counting of benefits must be avoided.

⇒ Costs and benefits are derived from checklists developed from these *Guidelines*, but adapted for the specific circumstances of Hill Land farmers. The by-products of conservation technologies are especially important, such as the leaves of *Gliricidia* hedgerows used as a mulch on the fields. Labour constraints are also a major consideration, since farmers have to balance their steep slope farming with their rice paddies. If the season is difficult, they may even abandon steep slope farming altogether. To avoid double-counting, the impact of erosion on yields and the value of the increased soil quality cannot both be taken – they represent different facets of the same process of improvement.

Step 4: List the monetary values for each costs and benefit

The monetary values must be based on the costs and benefits to the land user, expressed usually in local currency (such as Rupees) per hectare. Costs and benefits for which there are no monetary values are usually excluded.

⇒ The production benefits and the costs due to foregone opportunities are the principal monetary values, which can be relatively easily priced by the farmer. For example, *Gliricidia* hedges take up land space that cannot then be used for cropping. This cost (or production opportunity foregone) may be valued as the value of the crop less a percentage that reflects the proportion of land taken up by the hedgerow.

Step 5: Identify the ranges in data to be used in the appraisal

One of the commonest mistakes is to assume that rural society is homogeneous and that all farmers have the same perspectives. Different farmers have different values and they give responses accordingly. This variation needs to be reflected in terms of minima and maxima – i.e. ranges in value that encompass the spread. These ranges are then used for further calculation, and they will identify especially where some farmers may gain a net benefit and others a net cost because of their different circumstances.

⇒ In the Sri Lankan hills, yields of vegetables can be very different, with some farmers growing very sizeable surpluses for sale, while others have barely enough on which to subsist. Yields were found to vary according to status of land degradation, but also according to management, soil type and responsiveness of farm practices to crop needs (e.g. supplementary irrigation). These factors determine a large range in value of produce, and only the more productive farmers may get a net benefit through implementing the conservation technology. In other words, the investment is only worthwhile for good farmers on good soils.

Step 6: Identify the time period for the appraisal

The time period may be the life of the technology itself, as recognised by farmers, or it may be the number of years over which farmers assess it as an investment in improving their land. Time period has important implications because improvement in land quality happens slowly, so some benefits may only be realised after the life of the technology.

⇒ The *Gliricidia* hedgerows are typically replaced every 7 to 20 years, depending on the vigour and growth of the trees, and the accumulation of soil. Commonly farmers uproot their hedgerows and plant new lines on the old terraces. They reason that the soil accumulated behind the old *Gliricidia* is fertile and should be used productively. The time-period of the appraisal in this instance should be the life of the hedge and could safely be taken as the upper limit of 20 years.

Step 7: Construct a summary table

The table should have years listed in the first column, with a row assigned to each year of the appraisal. The body of the table is then devoted to two main sections for costs and benefits, with two columns for each type of cost or benefit to accommodate the range of values from the minimum to the maximum. If actual and relatively unchangeable costs are known for some items, then these are used.

⇒ An example of a summary table for *Gliricidia* hedgerows is given here. Costs and benefits are specified in local currency at prevailing prices to the farmer. So fertilizer 'benefit' is priced at the price delivered at the farm gate. The values a to k will be used in the next step.

Year	COSTS (and resources required)					BENEFITS					
	labour		Tools	Loss in crop area		Increase in crop yield		Saving on fertilizer		Pole production	
	Min	Max	Actual	Min	Max	Min	Max	Min	Max	Min	Max
1											
2	a	b	c	d	e	f	g	h	i	j	k
3											
etc.											

Step 8: Calculate total costs and benefits, and net cash flow for each year

The minimum and maximum data are kept separately. So for both total cost and total benefit, a minimum and maximum value is calculated for each year. The net cash flow is then calculated for each year by subtracting total costs from total benefits.

⇒ From the summary table for *Gliricidia* hedgerows, total costs, benefits and net cash flow are entered. The items a to k at Step 7 show how the data are ordered. Note especially that minimum net cash flow equals

minimum total benefits minus maximum total costs. Similarly, maximum net cash flow equals maximum total benefits minus minimum total costs.

Year	TOTAL COSTS		TOTAL BENEFITS		NET CASH FLOW	
	Min	Max	Min	Max	Min	Max
1						
2	a + c + d = r	b + c + e = s	f + h + j = t	g + i + k = u	t - s	u - r
3						
etc.						

Step 9: Adjust the net cash flow for the time value of money

The time-value of money is involved in investment appraisal because sums of money are received (benefits) and spent (costs) at different points in time. The sums of money are multiplied by a factor that is related to 'discount rate', which expresses how the value of money diminishes over time. The appraisal reflects only the value now – or 'net present value'. So a benefit in the future is worth less than a benefit now. A cost in the future is worth less at the present time than a cost now. Because discount rates are often difficult to fix and depend upon external factors such as the cost of borrowing money, it is good practice to set a lower and upper discount rate and to use both of these in the calculations – see final step 10

⇒ *Gliricidia* hedgerows and their associated terraces demand a lot of labour to plant and to construct initially. Then there are some maintenance costs in pruning the hedges and replanting trees that have died, but this is relatively small in cost. Benefits, however, come only slowly. The soil improves in quality only after a long time, having to recover from the initial earth movement in making the terraces. So, with the costs coming early and the benefits coming late, the adjustment for net cash flow for the time value of money means that very few farmers will find investing in these hedgerows financially worthwhile. Maybe only farmers who are retired employees with other sources of income can afford them.

Step 10: Calculate the net present value of the technology

The net present value (NPV) is calculated by adding the present values of the net cash flow for each year of the appraisal. The upper and lower discount rates and the minimum and maximum discounted cash flows should be kept separate. The discount factor is derived from standard tables – the further into the future, the smaller is the factor to account for the lower net present value of money as time progresses. NPV then is the sum of discounted net cash flows over the period of the appraisal. If NPV is positive it indicates that at that discount rate, the benefits of the investment exceed the costs. So the investment is economically worthwhile at that discount rate. Alternatively, if NPV is negative, the investment is not economically viable. Conservation technologies with negative NPV are very unlikely to be acceptable to land users because, to implement them, the land user would be poorer. Because the whole appraisal has been carried out with ranges of data (minimum/maximum; upper/lower discount rate) there will be several answers, ranging from a best to a worst case scenario.

⇒ The final table brings all the calculations together. Note the several different values for NPV ranging from best case scenario (maximum discounted net cash flow at the lower discount rate) to worst case scenario (minimum discounted net cash flow at upper discount rate)

Year	Lower discount rate			Upper discount rate		
	Discount factor	Minimum discounted net cash flow	Maximum discounted net cash flow	Discount factor	Minimum discounted net cash flow	Maximum discounted net cash flow
1						
2						
3						
etc.						
NPV Total	-			-		

