**Chapter 4**

**Cost Theories**

Decision-making is essentially a process of selecting the best alternative given the available information for comparison of strengths and weaknesses of each alternative. If there exists no alternative to the current course of action, then there is no decision to be made. However, it is rare regarding any course of action for there not be alternatives. In personal decision-making, factors other than income and expenses such as qualitative factors may be more important than cost in deciding. However, in business decisions are generally made by identifying the alternative with the most revenue or the least cost.

Incremental analysis is a decision-making tool in which the relevant costs and revenues of one alternative are compared to the relevant costs and revenues of another alternative. Relevant costs may be defined as those future costs that are different between alternatives. Costs that are the same are considered irrelevant. Incremental analysis is sometimes called differential costing, marginal costing, or relevant costing.

Incremental analysis is basically a worksheet technique in which the relevant costs of one alternative are listed in one column and the relevant costs of another alternative are listed in an adjacent column. Frequently, an optional third column is used to show the difference in the costs. The differences in relevant costs are called incremental costs. Technically, incremental cost may be defined as the difference between the sums of the relevant costs of two alternatives. In short, it is a tool for choosing between two alternatives. The best decision is the one with the least amount of relevant costs or the greatest relevant revenue.

Under appropriate circumstances, incremental analysis is a tool for evaluating decision alternatives such as:

• Keep or replace

• Make or buy

• Sell now or process further

• Lease space or continue operations

• Continue or discontinue product line

• Accept or reject special offer

• Change credit terms

• Open new territory

• Buy or lease

The objective in using incremental analysis is to identify the alternative with the least relevant cost or the most relevant revenue. The difference in the sum of relevant costs is either called incremental cost or net benefit. Consequently, the alternative with a favorable incremental cost (sometimes called net benefit) is the desirable alternative.

**Relevant and Irrelevant Costs**

The most important concept to understand in using incremental analysis is relevant costs. In any decision involving two alternatives, the irrelevant cost may always be ignored. Only relevant costs must be identified and included in the analysis. Relevant costs are often defined as follows:

1. Those future costs that will be different under available alternatives.

2. Those costs that would be changed by making the decision.

3. Costs that will be different between two alternatives.

The decision criterion when using incremental analysis is simply this: the alternative should be chosen that has the least total relevant cost or the greatest total relevant revenue. The key to using incremental analysis correctly is the ability to distinguish between relevant costs and revenues. Examples of relevant and irrelevant costs are the following:

**Relevant Irrelevant**

Future costs that are not the same Allocated fixed cost

Opportunity costs (e.g., depreciation)

Trade-in allowance Future costs that are the same

Cost of new assets Historical costs (Sunk costs)

**Sunk Costs -** Two costs that are often misunderstood or used incorrectly in incremental analysis are sunk costs and opportunity costs. Sunk costs are, first of all, always irrelevant costs. They may be excluded in any analysis or cost comparison review. Sunk costs are historical costs; that is, past expenditures. Because they are expenditures already made the expenditure cannot be changed. To incur or not incur is not an option now. Examples of a sunk cost are cost of fixed assets such as buildings or equipment. By the same token, depreciation is also a sunk cost. The book value of a fixed asset (cost - accumulated depreciation) is also a sunk cost.

To illustrate, assume that an asset currently in use (old asset) has a book value of SR 1,000 and that this piece of equipment is tentatively under review for replacement. The purchase price of the new asset is SR 5,000 and is estimated to have a useful life of 10 years. The old asset can also last 10 years with some repairs now and then. The operating expenses of the old asset is now SR 800 per year but the new asset is projected to have only an operating expenses of SR 200 per year. The old asset has no trade-in value. The alternatives are to keep the old asset or to replace it. The replacement should take place if the relevant costs of replacing is less than the relevant costs of keeping.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **10 Years Basis** | | |
| **Keep Old Asset** | **Purchase New Asset** | **Difference** |
| Cost of new asset  Book value of old asset  Operating expenses | -  SR 1,000  SR 8,000  SR 9,000 | SR 5,000  1,000  2,000  SR 8,000 | (SR5,000)  0  6,000  SR1,000 |

The difference of SR 1,000 is a net benefit of purchasing and replacing the old asset with the new asset. However, since the book value of the old asset is shown in both columns and is, therefore, the same between both alternatives, the book value of the old asset is irrelevant. You may wonder how this is so? If the old asset is kept, then the book value of SR 1,000 will be shown on the books as depreciation cost over the remaining life of the old asset. If the new asset is purchased, then the book value of the old asset will be recorded as a SR 1,000 loss. In either event, an expense of SR 1,000 during the next 10 years will be recorded. Whether the old asset is replaced or not, the cost of the old asset results in a deduction from revenue in the same amount either as depreciation or a loss from the trade-in.

**Opportunity Costs -** Opportunity costs are always relevant to making decisions; however, the concept of opportunity cost is somewhat abstract and difficult to understand because it is not an out-of-pocket cost. Following are some commonly used definitions of opportunity cost:

1. Earnings that would be realized if the available resources would be put to some other use.

2. Alternative earnings that might have been obtained if the productive good, service, or capacity had been applied to some other alternative use.

The definition preferred in this chapter is the following: opportunity cost is the amount of revenue forgone (given up) by not choosing one alternative over another.

The key word for understanding opportunity cost is not “cost” but “revenue forgone”. For example if you decide to take a vacation rather than invest SR 5,000 in a savings account that earns 6% per annum, then the opportunity cost is the interest you could have earned. At 6% interest you could have earned SR 300 for a full year. Therefore, the decision to take a vacation should include as a cost the interest that was not earned.

Other examples of opportunity cost may be given. If you have been given a choice of two jobs and job A pays SR 60,000 per year and job B pays SR 55,000 per year, then the opportunity cost of accepting job A is SR 55,000. Other things equal, you are only SR 5,000 better off financially with job A.

If you own land that could be sold for SR 100,000 and the land is not now earning any income other than appreciation in value, then there is an opportunity cost of not earning interest. Assuming you could earn at a minimum 6% interest in a CD, the opportunity cost of keeping the land and not selling is SR 6,000 per year. Interest in the amount of SR 6,000 is being forgone each year in favor of the land appreciating in value.

You own a building that you can easily rent for SR 10,000 a month. If you decide to use the building to open a business for yourself, then you incur an opportunity cost in the amount of SR 10,000, (rent given up, forgone, or sacrificed) by going into business. If you are a student and you spend 30 hours a week in class and in studying, there is an opportunity cost of being a student. The opportunity cost is the income you could be earning by working rather than attending class or studying.

**Fixed and Variable Costs -** Costs in management accounting are often assumed to be either fixed or variable. The classification of a cost as either fixed or variable does not necessarily mean the cost is relevant or irrelevant. Whether a fixed cost or a variable cost is relevant or irrelevant depends on the whether the cost is different between the two alternatives. However, variable costs are always relevant, if there is a different in volume between the two alternatives. For example, assume that machine B is being considered to replace machine A and that the purchase of machine B would increase production capacity and also sales by 50%. If current production and sales is 1,000 units (full capacity) and selling price is SR 100, then production and sales would increase to 1,500 units. Currently, cost of goods sold is SR 80 per unit. Based on these assumptions, the following analysis may be prepared:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Machine A**  **(Volume = 1,000)** | **Machine B**  **(Volume = 500)** | **Difference**  **(500)** |
| Sales  Cost of goods sold | (SR10,000)  SR 8,000  (SR 2,000) | (SR15,000)  SR12,000  (SR 3,000) | SR5,000  ( SR4,000)  SR1,000 |

**Note:** For simplistic purposes, the cost of machine B was ignored. However, in order to make the decision, the cost of machine B must be included as a relevant cost.

In this particular case, both sales and cost of goods sold are relevant. However, had volume not been greater with the machine B, then sales and cost of goods sold would have been the same and, therefore, irrelevant. Then other cost or revenue factors would have had to be found to make the decision. Whether a fixed cost or variable cost is relevant then depends more on the circumstances than the nature of the cost.

**Incremental Analysis Model**

The basic incremental analysis model used in this program may be mathematically summarized as follows:

IC = ∑RCia - ∑RCib

i = 1, n

RCia - relevant costs of alternative A

RCib - relevant costs of alternative B

n - number of relevant cost items

Incremental analysis is a flexible tool. Data may computed and presented for the life of a decision alternative on a per period basis such as a month or year. This procedure would require the relevant cost items to be divided either by the number of years of the number of months in the life of the assets under consideration. Incremental analysis does not require that irrelevant data be included. However, at the option of the analyst irrelevant costs may be included. The inclusion of irrelevant data will in no way affect the ultimate decision.

The action of classifying an expense as irrelevant or relevant does not mean that the irrelevant cost is not important. In fact, in the execution of the decision, it may be very important. To illustrate, assume that you are about to go to a movie and you are in the midst of choosing which movie theater to attend. You have narrowed your choices to movie A and movie B and you want to see the movie which will cost the least. You have made the following cost analysis:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Movie A** | **Movie B** | **Difference** |
| Cost of popcorn  Large drink  Transportation cost | SR 3.00  SR 3.50  SR 1.00  SR 7.50 | SR 3.50  SR 4.25  .75  SR 8.50 | (SR .50)  (SR .75)  SR .25  (SR 1.00) |

The net benefit of attending movie A is SR 1.00. The cost of tickets is SR 8.00, the same at each movie theater. Therefore, since the ticket cost is the same, you have correctly omitted this irrelevant cost from your analysis. Consequently, you decide in favor of movie A and you put SR 7.50 in your pocket. However, at this point taking only SR 7.50 would be a mistake since the total cost of attending movie A would be SR 15.50. The execution of the decision requires this amount. The cost of the tickets is only irrelevant in making the decision but not irrelevant in the execution of the decision.

**The Keep or Replace Decision**

The keep or replace decision is very common in most businesses. Some examples of the keep or replace decision are the following:

1. Keep old car or replace with a new car

2. Keep old computer or buy a new computer

3. Keep old copy machine or buy a new copy machine

4. Keep old factory equipment or replace with new

If replacements results in a substantial increase in net income immediately or within a few years, then replacement should be seriously considered and most likely made. In making this kind of decision, the following steps are involved:

**Step1**  Obtain cost data for both the Keep Decision and the Replace Decision.

a. Cost of old (book value)

b. Cost of new equipment

c. Trade-in allowance of old equipment

d. Salvage value of new equipment

e. Operating costs of old and new equipment

**Step 2** Prepare a work sheet with columns showing the relevant costs of the Keep decision and the Replace decision.

**Step 3** Compute incremental cost (sometimes called net benefit).

Only relevant costs need be included in the analysis; however, no harm is done by including the irrelevant costs. The book value of the old asset is always irrelevant and may be excluded, if desired. Trade-in allowance is always relevant. The analysis may be made on a per year basis or a total year’s basis. If made on a per year basis, then the cost of the new asset must be divided by its useful life.

**An illustrative Example of the Keep or Replace Decision**

The K. L. Widget Company is seriously contemplating replacing some old cutting department equipment with more modern and efficient equipment. The book value of the old equipment is SR 50,000. The new equipment, if purchased, will cost SR 100,000. A SR 10,000 trade-in allowance will be granted by the seller of the new equipment. The salvage value of the new equipment at the end of its life in 10 years is estimated to be SR 5,000. The salvage value of the old asset, if kept, is SR 2,000. The operating cost of the old equipment has been averaging around SR 13,000 per year. The new equipment is expected to reduce the operating cost to an average of SR 2,000 per year. The new equipment, if purchased, will be purchased totally on credit and the total amount of interest that would be paid in 10 years is approximately SR 25,000.

One approach to using incremental analysis would be as follows:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Total Life Basis (10 years)** | | |
| **Keep Old**  **Equipment** | **Buy New**  **Equipment** | **Difference** |
| Cost of old equipment (book value)  Cost of new equipment  Trade-in allowance  Salvage value  Operating costs (total 10 years)  Interest on loan | SR 50,000    (SR 2,000)  SR 130,000  \_\_\_\_\_\_\_\_\_\_  SR 178,000 | SR 50,000  SR 100,000  (SR 10,000)  (SR 5,000)  SR 20,000  SR 25,000  SR 180,000 | 0  (SR 100,000)  SR 10,000  SR 3,000  SR 110,000  (SR 25,000)  (SR 2,000) |

In the above example, notice that the book value of the old equipment was included. However, this cost may be excluded since it is irrelevant to the decision.

In the above example:

a. The relevant costs of keeping are SR 128,000.

b. The relevant cost of buying new equipment is SR 130,000.

c. The irrelevant cost included in both alternatives is SR 50,000

d. The net benefit or incremental cost of keeping the old equipment is SR 2,000.

e. Sunk cost in the analysis is SR 50,000 (book value of old equipment).

Suppose in the above example management had decided to use cash on hand to buy the new equipment. Would the answer be different concerning interest? No, if internal financing is used, then the opportunity cost of the on hand cash used must be included. Let us assume that the company can earn 6% interest. In this event, the interest given up or sacrificed would approximately be the same as the interest paid.

**Practical Applications of Incremental Analysis**

Incremental analysis is a practical and commonly used tool by both individuals and businesses regarding many different kinds of decisions. As individuals, we weigh the cost of many decisions such as what car to buy, whether or own a home or rent, and continue to paint our house or put on vinyl siding. The same is true in business. Incremental analysis is used in all functions of the business on a daily basis both formally and informally. The use of incremental analysis does not guarantee that the best decision has been made; however, it does provide a framework for organizing relevant data and looking at the decision to be made from a broader and more analytical perspective.

**Summary**

Incremental analysis can be a powerful tool in evaluating various type of decisions. Incremental analysis in a way of presenting relevant information in a direct comparison mode so as show the net benefit of making a particular decision. It is should be remembered that incremental analysis is no better than the quality of information available for analysis. Incremental analysis is a tool that focuses on certain basic concepts including the following:

Incremental analysis Relevant and irrelevant costs

Opportunity costs Sunk costs

Depreciation Fixed and variable costs

Direct and indirect Common costs

Salvage value Trade-in allowance

Net benefit

It is important that accountants and management have a basic understanding of these concepts.

**Exercise 4.1 • Matching of Cost Concepts and Costs**

Required: Match each cost with the appropriate cost. More than one cost concept may be applicable.

|  |  |
| --- | --- |
| **Cost Concepts** | **Costs** |
| 1. Inescapable  2. Escapable  3. Incremental  4. Sunk  5. Opportunity  6. Variable  7. Fixed  8. Relevant  9. Irrelevant  10. Semi-variable | A. President’s salary  B. Factory workers’ wages  C. Installation cost of new machine  D. Cost of old machine  E. Monthly rental value of warehouse  F. Repairs and maintenance  Machine A SR 2,000  Machine B SR 2,000  G. Utilities  Machine A SR 1,500  Machine B SR 2,000 |

**Exercise 4.2 • Keep or Replace**

You have been provided the following keep or replace decision information:

|  |  |  |
| --- | --- | --- |
|  | **Old Machine** | **New Machine** |
| Cost  Salvage value  Trade-in allowance  Remaining useful life  Labor costs (annual)  Repairs and maintenance  Utilities  Interest rate\* | SR 50,000  SR 10,000  SR 15,000  10 years  SR 20,000  SR 5,000  SR 1,000  - | SR 100,000  SR 5,000  ––––  10 years  SR 5,000  SR 6,000  SR 2,000  6% |

\* Assume installment financing and estimate interest by computing average size of loan over life of machine.

**Required:**

Determine whether or not the old machine should be replaced.

**Exercise 4.3 • Own or Lease**

You have been provided the following information concerning a lease or own decisions.

If equipment is owned:

Purchase price of equipment SR 50,000

Repairs and maintenance (monthly) SR 100

Utilities (monthly) SR 200

Interest on financing (annual) SR 1,500

Useful life of equipment (years) 10

If equipment is leased:

Monthly lease payments SR 600

Repairs and maintenance

(Cost is included in lease agreement)

Utilities (monthly) SR 150

**Required:**

Determine which is more desirable, own or lease?

**Exercise 4.4 • Sell now or Process Further**

You have been provided the following information concerning the sell now or process further decisions.

**Current production method cost data:**

Selling price SR 20

Units manufactured 100

Production capacity (units) 150

Labor hours required (per unit) 2

Manufacturing costs:

Material (per unit) SR 1.00

Factory labor (per unit) SR 15.00

Fixed manufacturing overhead SR 5.00

Variable manufacturing cost (per hour) SR .50

**Costs of Additional Processing:**

Labor hours (per unit) 1.0

Labor rate (per hour) SR 7.50

New selling price SR 30.00

\*If the additional processing is undertaken the variable manufacturing cost rate will remain the same.

**Required:**

Use incremental analysis to determine whether processing further should be undertaken.