Information Technology Investment: Decision Making Methodology

Chapter 7

Cost/Benefit Analysis

Chapter Outline:

I. Introduction

II. What is Cost/Benefit Analysis?

III. What is Cost/Effectiveness Analysis?

IV. Principles of Cost Benefit Analysis

I. Introduction

Extending the last chapter, Cost/Benefit Analysis includes ROI but also helps the decision process to consider intangible value-added benefits that are not considered in ROI.

Cost/benefit analysis may be used for *ex ante* (i.e., before project analysis), *ex post* (i.e., after project analysis) and in *medias res* (i.e., in progress analysis) investment evaluations

II. What is Cost/Benefit Analysis?

- ***Cost/benefit analysis*** **involves**
  - **the estimation and evaluation of the net benefits associated with alternative courses of action**
  - **identifying costs and benefits for each alternative investment,**
  - **discounting the costs and benefits back to the present,**
  - **selecting the best alternative according to a pre-specified criterion**

II. What is Cost/Benefit Analysis?

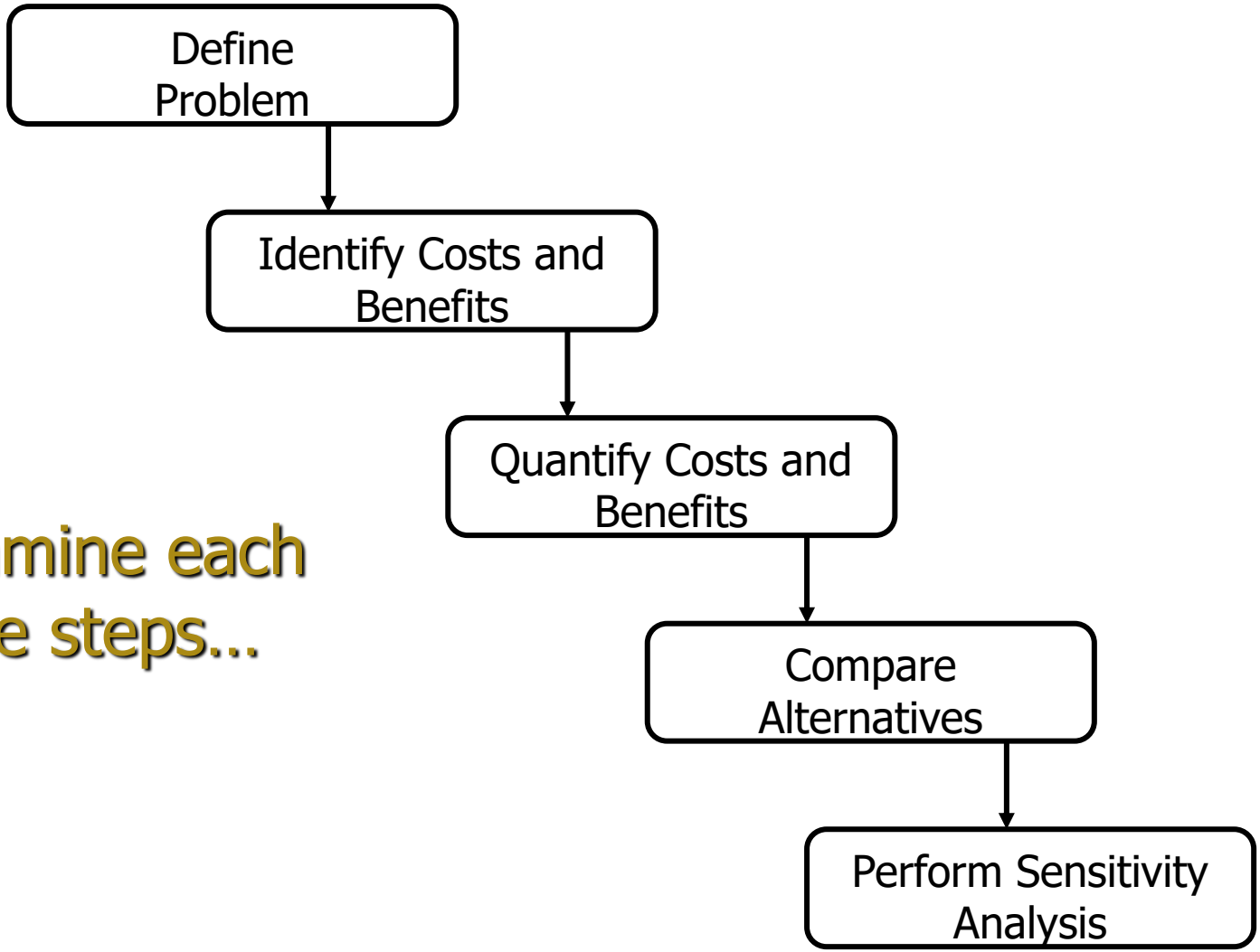
1999~2006 National Finance Act
: More than ₩50B(Gross) or ₩30B
(Government Only)

Preliminary Feasibility Analysis

- **Technical Analysis**
- **Political Analysis**
- **Economic Analysis**

II. What is Cost/Benefit Analysis?

Like most methodologies, Cost/benefit analysis involves a number of steps…



Let's examine each of these steps…

II. What is Cost/Benefit Analysis?

Step 1. Define Problem

- Problem definition involves an in depth analysis of the situation; investigating the needs and requirements of an IT.

- A well-defined problem includes a specification of the objectives for an IT investment and a plan to attain those objectives.

- Possible objectives for an IT investment may be improved customer service, enhanced inventory control, or better information.

II. What is Cost/Benefit Analysis?

Step 1. Define Problem

- This part of problem definition involves generating all possible alternative courses of action.

- Cost-benefit analysis tends to be a expensive tool. By narrowing down the number of alternatives before conducting the analysis, it is possible to better manage costs.

II. What is Cost/Benefit Analysis?

Step 2. Identify Costs and Benefits

- An thorough investigation should be undertaken to identify all relevant costs and benefits, and to assign dollar value to those effects.

- This includes both tangible and intangible costs and benefits. Costs for example might be some of Table 1.

- Benefits for example might be some of Table 2. Note that many of the IT benefits are intangible. Assigning a value to intangible benefit may be a very difficult, if not impossible task.

II. What is Cost/Benefit Analysis?

Step 3. Quantify Costs and Benefits

- Several possible ways to manage intangible costs and benefits.

- One is to simply ignore them.

- Another way to manage intangibles is to conduct the cost/benefits analysis without them but list them and describe their potential effects in an addendum.

- A third way to manage intangibles is to utilize a surrogate measure for the intangible and include the effect directly into the cost/benefit analysis.

: A *surrogate measure* may be the value of a similar benefit or cost that is more easily assigned a value. An example might be where quality costs in a company may have traditionally be one tenth the costs of equipment.

II. What is Cost/Benefit Analysis?

Step 3. Quantify Costs and Benefits

- A fourth way to value an intangible is to conduct a survey to determine its value.

  : Survey may be designed to measure how valuable more timely information of an IT investment is to users.

- One additional way of valuing an intangible is to use shadow prices.

  : A shadow price is the value of an intangible, which indicates how much some specified index of performance could be increased by the use of a marginal unit of that intangible.

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

- Once all costs and benefits have been identified and quantified into a common unit of measure, the alternatives are then compared to one another based on a common criterion

- But before comparisons can be made, the costs and benefits that occur in subsequent time periods are often discounted back to today's dollars.

- It is recommended that cash flows be discounted to account for this factor. Present value (PV) analysis can be used for this task.

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

The *benefit/cost ratio* is the present value of benefits divided by the present value of costs and is calculated as follows:

$$\text{Benefit}/\text{CostRatio} = \frac{\sum_{t=1}^{n} \frac{B_t - M.C_t}{(1+r)^t}}{\text{Pr}\,esentValue(Investment)}.$$

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

In summary, the four criteria are used in this way:

1.	Maximize the ratio of benefits over costs
2.	Maximize net present value of net benefits
3.	Maximize internal rate of return
4.	Shortest payback period

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

Let's look at the use of the benefit/cost ratio from the example in the textbook:

System A	A_0	A_1	A_2	A_3
Costs:				
Hardware	**10,000**	**1,000**	**1,000**	**1,000**
Software	**13,000**	**3,000**	**3,000**	**3,000**
Services	**2,000**	**1,000**	**1,000**	**1,000**
Benefits:				
Increased productivity	**--**	**10,000**	**6,000**	**6,000**
Lower error rates	**--**	**15,000**	**5,000**	**5,000**

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

The costs and benefits for System B are:

System B	A_0	A_1	A_2	A_3
Costs:				
Hardware	**5,000**	**1,000**	**1,000**	**1,000**
Software	**10,000**	**5,000**	**0**	**5,000**
Services	**8,000**	**2,000**	**2,000**	**2,000**
Benefits:				
Increased productivity	**--**	**8,000**	**10,000**	**10,000**
Reduced workforce	**--**	**3,000**	**5,000**	**5,000**

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

The present value of costs and benefits for System A are:

	Computer System A
Present Value of Costs	$PV = \frac{25{,}000}{(1+.08)^0} + \frac{5{,}000}{(1+.08)^1} + \frac{5{,}000}{(1+.08)^2} + \frac{5{,}000}{(1+.08)^3} = 37{,}885$
Present Value of Benefits	$PV = \frac{25{,}000}{(1+.08)^1} + \frac{11{,}000}{(1+.08)^2} + \frac{11{,}000}{(1+.08)^3} = 41{,}311$

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

The present value of costs and benefits for System B are:

	Computer System B
Present Value of Costs	$PV = \frac{23{,}000}{(1+.08)^0} + \frac{8{,}000}{(1+.08)^1} + \frac{3{,}000}{(1+.08)^2} + \frac{8{,}000}{(1+.08)^3} = 39{,}330$
Present Value of Benefits	$PV = \frac{23{,}000}{(1+.08)^1} + \frac{15{,}000}{(1+.08)^2} + \frac{15{,}000}{(1+.08)^3} = 46{,}064$

II. What is Cost/Benefit Analysis?

Step 4. Compare Alternatives

The resulting benefit/cost ratios for both systems are:

	Computer System A	Computer System B
Benefit/Cost Ratios	$B/C = \frac{41{,}311}{37{,}885} = 1.090$	$B/C = \frac{46{,}064}{39{,}330} = 1.171$

See the excel file attached

II. What is Cost/Benefit Analysis?

Step 5. Sensitivity Analysis

Sensitivity analysis **is defined as a means of determining the reliability of the decision generated from a cost/benefit analysis**

- Having the actual values of every cost and benefit associated with alternative investments would be ideal.

- The values of the costs and benefits are only estimates of the true value and thus are associated with some amount of error.

- Performing a sensitivity analysis is one way to determine the degree of error in the estimates.

II. What is Cost/Benefit Analysis?

Step 5. Sensitivity Analysis

A common way is to select costs, benefits, or other parameters in the NPV calculation, and vary them to examine their effects

- The analysis may involve selecting high and low values of a parameter and assess the effects on NPV.

-The degree of dispersion of these NPVs shows how different values of a parameter affect the final NPV and corresponding decision.

- Varying just one parameter may change the highest NPV of one alternative to prefer a different alternative, making the results of the analysis unreliable.

III. What is Cost/Effectiveness Analysis?

Cost/effectiveness analysis **is another cost-analysis technique that considers costs and effects that are defined in different terms.**

- In cost/benefit analysis, alternatives are evaluated based on costs and benefits measured in monetary terms.

- In cost/effectiveness analysis, costs are evaluated based on monetary terms and benefits are gauged in terms of how effectively each alternative meets a common objective. Each alternative is evaluated based on its individual costs and its contribution to meeting the same effectiveness criterion.

III. What is Cost/Effectiveness Analysis?

- Cost/effectiveness analysis may be an appropriate alternative methodology for the evaluation and selection of IT investments when intangibles are a critically important part of the analysis

- "Cost Effectiveness Ratio" in Engineering Economy

  - $\text{CER} = \dfrac{\text{Total Cost}}{\text{Total of Effectiveness Measure}}$

  - The lower, the better

VI. Principles of Cost Benefit Analysis

- **Pareto criteria** : If at least one individual is made better off and no one is made worse off

- **Kaldor-hicks criteria** : If those who benefit could compensate those who lose

- **CBA** : To determine the net impact on social welfare Among Three Groups (beneficiaries, taxpayers, those who will be incurring losses)

VI. Principles of Cost Benefit Analysis

Typical CB Design : Table 7-1

- Cost : Initial Cost, Annual Cost
- Benefits : Gain to New & Existing Users, Disbenefits

- $$\text{CBR} = \frac{\text{PV of (Annual Benefit} - \text{Annual Cost)}}{\text{Initial Cost}}$$

$$\text{OR} \quad \frac{\text{Annual Benefit} - \text{Annual Cost}}{\text{Annual value of (Initial Cost)}}$$

VI. Principles of Cost Benefit Analysis

Stages of CBA

- Identification of Costs & Benefits

  : Historical vs. Economic

  : With-without Approach (Incremental changes over a baseline scenario, NOT before-after)

  : Real output Effect vs. Pecuniary Effects (should avoid Double Counting)

- Valuing Costs and Benefits

  : How to evaluate Intangibles such as human life, time, morality, and environmental factors?

VI. Principles of Cost Benefit Analysis

Stages of CBA

- Comparing Costs and Benefits
  : Public discount rates

- Project selection
  : Benefit-Cost Ratios ≥ 1
  : NPV ≥ 0
  : IRR ≥ Public discount rate