project planning and management series

PN-AAR-464

IPN: 37116

ACKNOWLEDGEMENT

The Project Planning and Management Series consists of a set of manuals and associated modules presenting practical approaches, tools and techniques for project planning and management. (See list on back cover). A product of the Government of Jamaica/USAID National Planning Project (1976-1980), the series was developed by the Project Development Resource Team (PDRT) of PAMCO for use in "action-training" workshops and reflects extensive experience in training and project development. All present PDRT members are contributing authors and have worked together in writing, revising and publishing the series. Special credits are due to Dr. Merlyn Kettering for design and development of the series; Dr. Bruce Brooks for writing final versions of many modules; Mrs. Marjorie Humphreys for assuming primary editing and production responsibility and for organizing draft papers into more useful materials; Mr. Lascelles Dixon, head of PDRT since 1979, for designing the cover and improving many of the illustrations; and Mrs. Christine Hinds and Miss Linette Johnson for typing the drafts and final manuscripts. Any comments on the series and its usefulness are welcome.

Marcel Knight
Managing Director
PAMCO
March, 1980

Contributing Authors:

Merlyn Kettering
Bruce Brooks
Conrad Smikle
Lascelles Dixon
Michael Farr
Marjorie Humphreys

Published by:

The Project Analysis & Monitoring Co. Ltd. (PAMCO)
Inter-Continental Hotel, 4th Floor
Kingston, Jamaica, W.I.

MODULE 23

COST - BENEFIT ANALYSIS

Bruce Brooks

PREREQUISITES:

References:

Module 1	-	Defining Objectives
Module 20	-	Cash Flow Analysis
Module 21	-	Discounting
Module 22	-	Net Present Worth Analysis
Module 24	-	Benefit-Cost Ratio
Module 25	-	Internal Rate of Return
Module 26	-	Social Analysis
Module 27	-	Economic Analysis of Projects
Module 30	-	Brainstorming

B. *DISCUSSION:* Financial Analysis of Projects

Projects require financial and economic analysis for the purpose of weighing project benefits against costs in comparison with other alternative uses of resources. This process requires the synthesis of a number of techniques which make up the project's financial analysis package and which are discussed in the group of modules numbered 20-25 in this manual.

The basic economic problem that developing countries face is that of allocating resources that are scarce (e.g., skilled labour, capital, foreign exchange, and natural resources) to a variety of different uses. A certain mix of these resources is invested in projects that result in goods and services for current consumption or in projects where the resources are used for investment in agriculture, infrastructure (roads, bridges, utilities), industry or other sectors of the economy, in such a way that the net benefit to the society is optimized. Given the limitation on resources, there is a need to make choices between alternative ways of using them.

Project analysis is used to evaluate the project alternatives in a systematic and understandable manner. It is important to be explicit as to which alternatives of a proposed project are being compared. An alternative does not necessarily need to be another project. An alterna-

DO NOT DUPLICATE WITHOUT PERMISSION

tive can be a change in the size, location, or technology of the same project, or simply doing nothing or maintaining the status quo. To do nothing does not mean that the situation will remain the same. Therefore the act of doing nothing could either have a beneficial or detrimental effect that could be compared to another project alternative proposal.

Given a limitation of resources, choices must be made among the alternative uses of the resources. Project financial analysis is one way of evaluating project alternatives and cost-benefit analysis is one of the techniques that can be used to accomplish this.

C. *PURPOSE:*

In essence cost-benefit analysis assesses the costs and benefits of pursuing different alternatives and reduces them to a common measurement which is then used to assess their contribution to the fulfilment of the national or sectoral objectives. Some projects are designed to promote national growth and others equity of income distribution, or the general health of the people. Whatever the national and sectoral objectives are, the project(s) that contribute(s) the greatest benefits toward their accomplishment should be the one(s) to which resources are devoted.

D. *USES*

Uses of Cost-Benefit Analysis

Cost-benefit analysis is a tool for identifying, assessing, and judging costs in relation to benefits and thus aiding in a decision on the financial and economic merits of a proposed project.

When it is used for the above purpose it -

(1) provides for a complete analysis of costs and benefits that includes indirect and intangible costs and benefits;

(2) enables the planner to determine whether the project will yield benefits greater than the costs of the project;

(3) assists in ranking projects to decide which should be given priority for the use of resources; and

(4) enables planners to make decisions regarding internal changes in projects that will make the projects more viable.

DO NOT DUPLICATE WITHOUT PERMISSION

3

E. *DEFINITIONS:*

Description of the Process Used

The multi-stage process which is used in this module begins with the specification of objectives that the project is to achieve and the generation of technically feasible alternatives for achieving the objectives. Objectives specification and generation of alternatives entails the use of other tools and techniques outlined in Modules 1 and 30. The evaluation criteria used to decide whether a project is reaching the specified objectives are drawn from priorities established by national and local government and are usually in the form of policies, e.g., to raise income levels, to raise health standards, to increase employment, etc.

Project costs are indirect, (e.g, pollution, displaced workers, needed changes in infrastructure, cultural impacts), and direct (e.g., land, labour, materials, management skills, and utilities development). The project benefits are more readily perceived and measured mainly because they are quantifiable. They include benefits like increases in production, earning power and services, or decreases in specific costs such as labour, materials, and power. Indirect benefits of a project include such things as reduction in unemployment, increase in skills, increases in other related industries, and greater equity in income distribution.

There are costs and benefits that may be intangible including greater beauty as a result of the project, increased morale in the area affected, goodwill, and community spirit. These are noted by the planners and are explained and presented to the decision makers for inclusion in the total analysis.

Costs and benefits are identified and analyzed from the standpoint of (a) the project itself, (b) the total economy of the country and (c) the social cost-benefit standpoint.

(a) The cost-benefit evaluation of the project itself is accomplished by using market values of inputs and outputs.

(b) The evaluation from the viewpoint of the national econom is done with shadow prices. Most shadow prices are adjusted market prices which reflect the true benefit or cost to the economy, e.g., the market price of flour in the market place and the world price that the government must pay for flour. Market prices may be distorted by subsidies in different forms, and these distortions need to be accounted for by correcting them, using shadow prices.

(c) The social cost-benefit analysis of a project is also important. But it is more controversial because it

DO NOT DUPLICATE WITHOUT PERMISSION

requires the use of "conversion factors" to weight cost-benefit estimates of social factors associated with a project. Subjectively estimated social cost-benefit conversion factors incorporate social - political goals into the analysis, e.g., independence from foreign imports or equitable distribution of project benefits. For most projects the analysis of economic efficiency and the incorporation of the recognized social cost-benefits in verifiable and quantified form are sufficient for financial evaluation of a project proposal.

F. *LIMITATIONS AND ADVANTAGES OF COST-BENEFIT ANALYSIS*

Limitations

1. Many social costs and benefits are exceedingly difficult to measure because they cannot be quantified. For example, the value of recreation, education, or programs to increase security are not measurable. As a result those costs and benefits that can be measured often are the only ones included in the analysis. But, those that are not quantifiable should also be noted and considered in the analysis to the best of the project planner's ability.

2. Financial and economic efficiency is often considered as the overriding goal of a project cost-benefit analysis. But an efficient project may be ineffective when compared to other alternative approaches even though the other alternatives may be less efficient, because of the high social costs associated with the economically efficient project.

3. Increases in production from a large project may result in a decline in prices which in the longer run would result in a failure of the project based on the original cost-benefit analysis. In this case, more care must be taken in forecasting the future benefits.

Advantages

1. Objectives that are socially desirable can be treated by considering them as a part of the criteria used for evaluation of a proposed project.

2. The focus of cost-benefit analysis is on the direct and indirect cost-benefit factors but side effects of the project.

DO NOT DUPLICATE WITHOUT PERMISSION

3. All economic and financial costs and benefits are reduced to a common measurement (usually monetary) which permits comparison of different alternatives.

H. *OUTPUT OF THE ANALYSIS:*

The cost-benefit analysis when properly done gives the decision makers and those providing funds the information needed to:

1. judge the economic and financial merits of each project or project alternative when each is examined against the minimum acceptable returns on resources invested in the project;

2. rank project alternatives in the order of the magnitude of their internal rate of return or benefit-cost ratios; and

3. gain an understanding and appreciation of intangible factors associated with projects that are related to both the economic and non-economic criteria for evaluating projects.

G. *ASSUMPTIONS:*

There are a number of assumptions that are necessary when using this tool. These assumptions are:

1. all costs and benefits that are relevant to the project can be identified before action is taken to implement the project;

2. all costs and benefits are valued at their net present worth by deciding on the discount rate to be used. The discount rate that is assumed should take into account the time preference for money which could be invested in this project as compared to other possible investments; and

3. inflation will affect all project alternatives equally and will therefore have the same effect on all future cash flows. If the planners feel that the inflation rate can be accurately forecast for different time periods during the life of the project, the estimates should be used to assess their impact on the project costs and benefits.

DO NOT DUPLICATE WITHOUT PERMISSION

I. *STEPS IN COST-BENEFIT ANALYSIS:*

STEP 1. Identify the project costs and benefits that will result when implementing the project.

1a. Identify groups who will be affected directly and indirectly.

1b. Project the costs and benefits over the life of the project (SEE MODULE 20 - CASH FLOW ANALYSIS).

1c. Summarize the assumptions associated with the incremental costs and benefits.

STEP 2. Determine the present worth of all future costs and benefits

2a. Discount cash flows to the present, using the most logical discount rate (SEE MODULE 21 - DISCOUNTING).

2b. Compute the net present worth of the projected cash flow (SEE MODULE 22 - NET PRESENT WORTH ANALYSIS).

STEP 3. Analyse and determine the efficiency measures of project performance.

3.1 Compute the benefit-cost ratio (SEE MODULE 24 - BENEFIT-COST RATIO ANALYSIS).

3.2 Compute the internal rate of return (SEE MODULE 25 - INTERNAL RATE OF RETURN ANALYSIS).

STEP 4. Consider the project for funding if:

4.1 the net present worth is zero or positive where net present worth is computed at a discount rate equal to the opportunity cost of capital;

4.2 the benefit-cost ratio is 1.0 or greater (using benefits and costs which have been discounted at a rate equal to the opportunity cost of capital); and

4.3 the internal rate of return is not less than a minimum acceptable rate of return, i.e., the opportunity cost of capital (usually specified at 15% or higher).

DO NOT DUPLICATE WITHOUT PERMISSION

STEP 5. Rank the alternative projects or components of a project.

5.1 Rank the alternatives in order of descending internal rate of return or benefit-cost ratio measures, unless the alternatives are mutually exclusive.

5.2 If the alternatives are mutually exclusive, select the one with the largest net present worth.

STEP 6. Repeat Steps 2 through 4 for each alternative project.

STEP 7. Complete the analysis with a consideration of non-monetary impacts of the project.

7.1 Impacts which may be quantified (but not in monetary units) should be listed. (SEE MODULE 26 - SOCIAL ANALYSIS).

7.2 Impacts which may be qualitatively estimated should be presented alongside the quantitative data. The relevant impact, importance, or significance of the factors may be assessed verbally to aid decision-makers.

Example

The Ministry of Agriculture in Country X asks for a cost-benefit analysis of three possible production alternatives for small farmers (20 acres). The three alternative projects identified by the project analysts are:

Option 1. A Broiler Production Project

Option 11. A Horticultural Production Project

Option 111. A Market-hog Production Unit

The analysis considers these three alternative means for using resources in Country X.

Financial analysis of the three options begins with estimations of the projected cash flows. Project Option 1 is analysed in MODULE 20 - CASH FLOW ANALYSIS. Project Option 11 is analysed in MODULE 22 - NET PRESENT WORTH ANALYSIS. Project Option 111 is analysed in MODULE 24 - BENEFIT-COST RATIO ANALYSIS.

The cash flows for the three Options are summarised in MODULE 25 - INTERNAL RATE OF RETURN ANALYSIS. A summary of the assumptions is shown in ILLUSTRATION 1 of MODULE 25.

DO NOT DUPLICATE WITHOUT PERMISSION

Four measures of financial soundness were computed for each of the options. Option 11 gives the largest total cash flow over the ten year project life and Option 111 gives the second largest cash flow. This comparison is shown in MODULE 21 - DISCOUNTING. There are three discounted measures that are commonly applied to projects; NET PRESENT WORTH, BENEFIT-COST RATIO, and INTERNAL RATE OF RETURN. All consider the stream of benefits and costs over the period of time. A discount rate of 15% was assumed to reflect the best return on money invested in the alternative projects.

The three options are not considered to be mutually exclusive, so the net present worth criteria cannot be used to select the best project. Net Present Worth is a measure of the financial feasibility of each option and will show which project has the highest value of future earnings when these future earnings are discounted to the present.

Benefit-Cost Ratio and Internal Rate of Return measure project efficiency. Benefit-Cost Ratio shows the benefits per unit of cost. For these three options, NUMBER 11 has the most favourable Benefit-Cost Ratio and is therefore considered to be most efficient. OPTION 1 is next most efficient.

Economic and financial measures of investment worth are only a tool for decision-making. Many qualitative, non-qualitative and non-economic criteria must be considered when making project evaluation decisions. The quantitative analytical tenchniques discussed in this Module are for improving the decision-making, *but are not to be substituted for judgment, which of necessity must include many of the non-financial and non-economic criteria used to judge the relative worth of projects.*

There may be confusion between the use of the terms economic and financial analysis. Economic analysis of project worth gives answers to the decision-makers on the basis of the project's contribution to the total economy. When doing economic analysis project costs do not include taxes - (property, sales, income), because these are transfer payments within the economy of a country and are also benefits to the economy. The financial measurement of project worth is done for a specific entity in the country's economy such as a firm, a sector, or a corporation, where the benefit stream goes to the specific entity.

Economic analysis also uses shadow prices to determine the costs and benefits of a project. But when financial analysis of a project is done the prevailing market prices are used. The examples shown in MODULES 20, 22, 24 and 25 are financial measures of project worth, because market prices were used to arrive at costs and benefits.

DO NOT DUPLICATE WITHOUT PERMISSION

Cost-Benefit Analysis Summary

The Cost-Benefit Analysis includes measures that determine which alternative project will give the greatest return on the money invested. Therefore it is a summary of the results from each of the measures which are shown in the Modules, the results of which are tabulated in ILLUSTRATION 1.

The measures used to arrive at a Cost-Benefit Analysis of projects are:

TOTAL CASH FLOW	-	(MODULE 20)
NET PRESENT WORTH	-	(NPW - MODULE 22)
BENEFIT-COST RATIO	-	(BCR - MODULE 24)
INTERNAL RATE OF TETURN	-	(IRR - MODULE 25)

The three projects compared are:

Option 1	Broiler Production
Option 11	Horticulture Production
Option 111	Pork Production.

Earlier PDRT working papers relevant to this topic include "Criteria to test Project Worthiness: Project Analysis and Appraisal", M. Kettering, 1977. (25 pages).

DO NOT DUPLICATE WITHOUT PERMISSION

10

ILLUSTRATION 1

COST-BENEFIT ANALYSIS OF THREE PROJECT OPTIONS

OPTIONS AND RANK	TOTAL[1] CASH FLOW	NET PRESENT WORTH	BENEFIT-COST RATIO
1 Broiler	123	46	1.2
11 Horticul-ture	2516	1209	2.8
111 Pork	200	40	1.1
Rank order of Options: 1st	11	11	11
2nd	111	1	1
3rd	1	111	111

1) Cash Flow & NPW are in thousands of monetary units.

DO NOT DUPLICATE WITHOUT PERMISSION

Project Planning and Management Series.

MANUAL - I Planning for Project Implementation
MANUAL - P Project Planning
MANUAL - M Project Management
MANUAL - PF Pioneer Farm Implementation Planning

MODULES

1. Defining Project Objectives (Objective Trees
2. The Logical Framework
3. Work Breakdown Structure
4. Activity Description Sheets
5. Project Organization
6. Linear Responsibility Charts
7. Project Scheduling - Bar Charts
8. Bar Charting for Project Control/Scheduling
9. Project Scheduling - Network Analysis
10. Milestones Description Charts
11. Resource Planning & Budgeting
12. The Role of PAMCO
13. Project Technology Analysis
14. Demand Analysis
15. Market Strategy Analysis
16. Project Area Analysis
17. Project Costs & Benefits
18. Project Profile
19. Financial Analysis
20. Cash Flow Analysis
21. Discounting
22. Net Present Worth Analysis
23. Cost-Benefit Analysis
24. Benefit-Cost Ratio Analysis
25. Internal Rate of Return
26. Social Analysis of a Project
27. Economic Analysis of Projects (including Border Pricing)
28. Financial Statements & Ratios
29. Project Selection & Ratios Analysis
30. Brainstorming
31. Decision-making System for Projects
32. Project Institutional Environmental Analysis
33. Ecological Analysis for Projects
34. Introduction to Contracts, Jamaican Contract Documents & Tendering Procedures
35. Selection & Use of Consultants
36. Project Documents for Planning & Implementation
37. Report Writing for Projects
38. Project Files
39. Formats for Pre-Feasibility & Feasibility Studies
40. Motivation of Employees and Personnel Evaluation
41. Design of a Project Management Control System
42. Evaluating & Forecasting Project Progress & Performance
43. Project Termination
44. Introduction to Lending Agencies
45. Organizing and Conducting Conference Meetings
46. Withdrawal of and Accounting for Loan Funds in the Financing of Projects