Analyzing Benefits and Costs

A Guide for Information Managers

Forest Woody Horton, Jr

The International Development Research Centre
Le Centre de recherches pour le développement international
El Centro Internacional de Investigaciones para el Desarrollo

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CONTENTS

PART 2: TECHNICAL GUIDE

PART 3: COMPUTER SOFTWARE GUIDE

FIGURES

APPENDIXES

FOREWORD

In a time of increasing competition for decreasing funds, any previously held assumptions about the value of information can no longer be left unchallenged. The merits of investing in information systems and services must be made more explicit, and nowhere is the pressure to do so more acute than in the developing countries.

This fundamental concern was the genesis of a special research program initiated by the International Development Research Centre (IDRC) in 1992. The research program has been investigating how the impact of information on development might be better defined and assessed. The first phase has surveyed current thinking and approaches, and has led to the formulation of a methodology for use in undertaking this type of evaluation. (A detailed progress report on the study has been published under: Menou, M.J., ed. 1993. Measuring the impact of information on development. IDRC, Ottawa, ON, Canada. 188 pp. ISBN 0-88936-708-6.)

This research program is multidisciplinary in its approach, taking into account economic, behavioural, technological, and other considerations. During the analysis of existing tools that might be applied in this field, the study identified a gap. What was missing was a practical guide designed specifically to help the information community in developing countries to examine more systematically the benefits versus the costs of potential resource allocations to information activities.

Although in many sectors the concept of benefit:cost analysis is not new, its application in the current context, i.e., the information field in developing countries, is somewhat novel. The need for such a management tool has become increasingly evident in the current financial climate. Consequently, IDRC was pleased to be able to call on such an eminently qualified information specialist as Dr Horton to write this practical handbook. IDRC believes the guide will enable information managers, and indeed others, to undertake the type of analysis that will help demonstrate more convincingly the value of investing in information.

Martha B. Stone, Director General
Information Sciences and Systems Division
International Development Research Centre
Ottawa, Canada

PREFACE

This three–part benefit:cost analysis (BCA) guide is the first in-depth publication expressly tailored to assisting information communities in developing countries engaged in preparing funding requests for library and information infrastructure improvement projects. It is written primarily for all levels of project personnel and reviewing officials involved in the early planning, formalization of proposals, development of alternatives, recommendation of a preferred alternative, and preparation of budget requests for projects in the field of library and information infrastructure improvement, using the broadest definition of that field.

The primary targeted audiences for this guide are government policymaking officials in social and economic development ministries, key national or subnational library and information agency and institutional officials, various participating project sponsors and contributors inside or outside the country, operating project managers and directors, and the many individual specialists and technicians who must undertake some aspect of the required benefit:cost information compilations, analyses, and syntheses. This publication has three objectives:

- To raise the level of consciousness and awareness of targeted officials, executives, and managers as to the relevance and applicability of the BCA approach to library and information infrastructure strengthening projects, as well as to the opportunities and limitations of the BCA technique;

- To persuade the targeted audiences that BCA is a practical and useful management tool (not just a theory) that can help them make better decisions and choices at all stages: early in project formulation, proposal formalization and submission, project review, budget preparation, project initiation, and periodic project evaluation and updating of initial decisions; and

- To offer practical illustrations, case examples, and detailed technical guidelines that can be used by analysts and practitioners assigned the many tasks of preparing for and carrying out the detailed benefit and cost analyses.

The author is indebted to many institutions and individuals with whom he has worked, consulted, or benefited from the expertise and resources during the course of more than 30 years of experience dealing with this area. He wishes to single out in particular the central library and Information Sciences and Systems Division staff of Canada's International Development Research Centre (IDRC) headquarters in Ottawa, and the Latin American Demographic Centre (CELADE) director, the REDATAM project director, and the REDATAM staff at the Economic Commission for Latin America (CEPAL) in Santiago, Chile.

The author also appreciates the assistance of the Director of IDRC's Latin American Regional Office (LARO) in Montevideo, Uruguay; library and staff of the Organization for Economic Cooperation and Development (OECD) in Paris, France; combined International Bank for Reconstruction and Development/International Monetary Fund (IBRD/IMF) library staff in Washington, D.C.; the Canadian Ministry of Industry, Trade and Commerce; central library of the Canadian International Development Agency (CIDA); the Harvard Institute of International Development; U.S. Agency for International Development (USAID) information centre director and staff; OIRA director and staff of the U.S. Office of Management and Budget; Information Management staff of the U.S. Department of State; Economic Analysis staff of the U.S. Internal Revenue Service; Government Systems Division of Planning Research Corporation of McLean, Virginia; Mitre Corporation of McLean, Virginia; and Booz, Allen & Hamilton of New York, a pioneer in developing BCA approaches in the information technology area.

Last but not least, the author is obligated to David E. Fried of McLean, Virginia, who assisted with the design, development, and testing of the special Excel 3 for Windows QuickStart computer program used in Part 3.

Forest Woody Horton, Jr, PhD

PART 1: MANAGEMENT GUIDE

1.0 INTRODUCTION

1.1 THREE-PART BENEFIT:COST ANALYSIS VOLUME

This Management Guide forms Part 1 of a three-part, integrated, single volume. It offers practical guidance to the library and information communities in developing countries. It is specifically designed to show the relevance, use, and applicability of an economic analysis technique known as benefit:cost analysis (BCA) in strengthening elements of their national or subnational library and information infrastructures as a part of the broader context of political, economic, and social development:

- Part 1 is a Management Guide designed to afford senior policymakers and decision-makers an overview of the BCA concept and methodology, especially in terms of its relevance and applicability to library and information infrastructure improvement projects in the developing-country context.

- Part 2 of this publication is a Technical Guide designed to lead project directors, analysts, and other technical personnel, step-by-step, through the implementation of the BCA process as it is applied to a specific project.

- Part 3 is a Computer Software Guide (with accompanying software) to facilitate the detailed numerical benefit and cost computations usually associated with such analyses.

In an era of increasingly tighter budgets, intense competition for limited funds, and a general economic recession, BCA is becoming an increasingly important analytical instrument in the arsenal of tools available to public and private officials. BCA's central purpose is to help decision-makers select the best alternative from among several options available for implementing a given project.

1.0 INTRODUCTION

The particular programmatic area in which this guidance is expected to be optimally utilized is in the domain of library and information development infrastructure improvement projects. At one stage or another in the life cycle of virtually all such projects, many different players and participants are involved, both inside and outside the developing country, including government, policy-level officials; key library and information ministry or other institutional personnel; various project sponsors and cocontributors; internal and external expert consultants; project managers and directors; project teams, including benefit:cost analysts; collaborating international, regional, and local institutions; affected local communities; and even society at large.

Figure 1–1 is a schematic diagram that portrays how benefit:cost analysis fits into the overall area of social and economic development. Note that the main target of BCA in the overall process is in the selection of a single, preferred alternative (or "best solution") from among several competing ones.

The Management Guide is primarily directed to generalist, high-level audiences in developing-country governments including, especially, members of the library and information communities. That is, Part 1 is for nontechnically oriented government officials and other institutional agency officials with broad oversight and administrative responsibility for addressing the feasibility of library and information infrastructure improvement project proposals. These proposals are routinely prepared by them or come before them and their respective institutions and governments for substantive review and evaluation, for budget analysis, and for funding or funding source(s) identification if external donors and contributors are required.

Some of those developing-country officials may be at the very highest policymaking levels of a governmental or private institution and be responsible for overall functional control of development projects. But many executives will be at the middle levels, directly concerned with considering, planning, and executing the details of a project, either as a defender of, sponsor of, or cocontributor to a particular project, or as an oversight (reviewing-level) agency. Still other individuals at lower levels require specialized knowledge of the BCA process because they are directly concerned with the planning, management, and control of a particular library or information project, perhaps in the role as project director, member of a project team, member of a project advisory or monitoring group of some kind, or as an internal or external expert consultant.

DEVELOPMENT ASSISTANCE BENEFIT:COST ANALYSIS PYRAMID

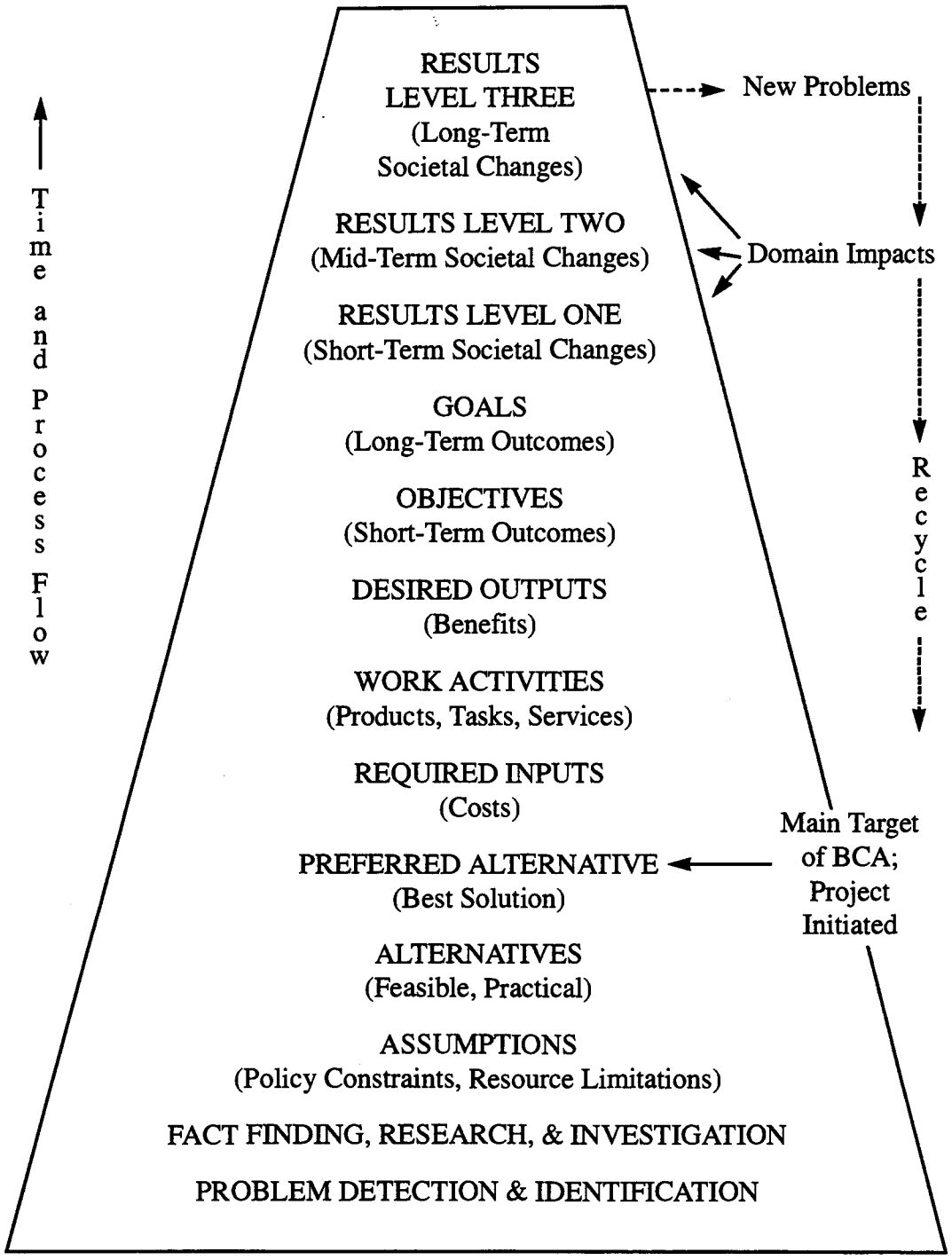

FIGURE 1–1

1.0 INTRODUCTION

This BCA publication may also be helpful internally to donor agencies, as well as other organizations and institutions interested in economic analysis techniques (e.g., academic institutes), because its contents are generally applicable to all functional areas. In other words, although the guidance is designed primarily to assist project proposers of library and information infrastructure improvement projects in these communities in developing countries, with appropriate adjustments made to account for certain differences in both theory and practice and the perspective of the reader, the guidance may also be useful to:

- Development-assistance agencies, ministries, or other institutions in donor countries;
- International, regional, or local development institutions;
- Other interested audiences (e.g., research and academic communities, philanthropic foundations); and
- Organizations working in other sectors (e.g., library and information, health, agriculture, transportation, environmental protection).

The second part of this three-part volume, the Technical Guide, contains the technical detail necessary for project managers and benefit:cost analysts to undertake a detailed analysis. Part 2 concentrates on how the BCA methodology actually works and how it can be applied, whereas this first part explains what BCA is and why it is important, its limitations, and so on. The second part also contains several specific case examples of library and information development projects to illustrate exactly how the methodology can be applied to an actual project.

The first two parts, along with the third part, a Computer Software Guide for use in manipulating actual benefit and cost data, are intended to be complementary. Certain officials, such as project directors, will find it very useful, if not absolutely essential, to become familiar with the contents of all three parts. That is why they are integrated into a single volume.

The Computer Software Guide in Part 3, and the software package included on diskette (attached to the inside back cover), is designed to facilitate the detailed mathematical manipulation of cost and benefit streams, the calculation of a break-even point, the calculation of a benefit:cost ratio, and the derivation of other

indicators associated with benefit:cost analysis, such as the payback period. The program is designed to utilize a popular spreadsheet program on the market called Excel 3 for Windows QuickStart.

Development projects, whether library and information or any other, move through a project life cycle beginning with initial idea conception through successive stages of: more concrete definition, formal proposal to targeted sponsoring and cocontributing agencies, project review by oversight (review) groups, project refinement and adjustment based on feedback, final project approval, budget preparation, funding approval, implementation, periodic evaluation and appraisal, and even during final audit stages. Elements of this guidance should be useful at each of these stages.

In summary, the collective guidance in this three-part volume, hopefully, will be widely disseminated and made available to decision-makers at all levels in those institutions in developing countries and elsewhere concerned with library and information infrastructure improvement projects. The ultimate goal is to assist decision-makers in making more informed judgments at each stage of the entire project life cycle, not just the alternatives identification stage.

Attention is drawn to Appendix C, a glossary of terms (used in benefit:cost analysis), and Appendix D, some suggested additional readings. These appendixes are designed, respectively, to assist individuals wishing to see a capsule definition of a specialized term used in BCA or to probe deeper into the subject.

1.2 WHAT IS BENEFIT:COST ANALYSIS?

Benefit:cost analysis or "BCA" (also called cost:benefit analysis or "CBA," although the latter term and acronym are now less commonly used than the former) is increasingly used in both the public and private sectors as an aid to decision choices from among competing alternative approaches. Everyone makes decisions about how to spend money and resources in exchange for expected results, and all of these decisions have a common denominator: they all weigh, more or less consciously, the benefits and costs of at least one, but usually more than one, alternative.

1.0 INTRODUCTION

The decision to buy or rent a house, for example, is a benefit:cost decision, as is the choice of buying one automobile rather than another. So is a decision by a government agency or private institution in the library and information infrastructure development field to adopt one course or action as a "preferred" course over one or more alternatives that are being formally or informally considered. This is true whether we are talking about projects in the library and information field, the health field, the energy field, the environmental field, or any other field. From an economist's viewpoint, BCA is used for projects where market prices are strongly suspected of disregarding some important parts of social benefits or social costs. In the case of public goods, the benefits of the nonpaying users (beneficiaries) are not reflected in the prices received and revenues collected by the producers (Machlup 1979, Appendix D).

In our context, BCA is a technique that helps evaluate a proposed new or improved program, project, service, activity, or resource. BCA involves itself with identifying, defining, measuring, and computing (a) the inputs (resources) that are needed, both in terms of amounts and in terms of the specific characteristics of those resources such as volume and mix; (b) the outputs (products and services), again, both in terms of amounts and in other specific attributes of those outputs; (c) production or usage factors (amounts, purposes, importance, etc.); and (d) outcomes (consequences of use and nonuse of a new or upgraded capability put in place) (see Fig. 1–2 for a BCA methodology overview).

Most benefit:cost decisions, including those in selecting a preferred project alternative, are made informally, especially where the costs are relatively modest and where the preferred course of action is so incontrovertible as to preclude the need to study any other alternatives. For example, a manager, policymaker, or other decision-maker might base his or her decision almost entirely on an oral briefing, which might or might not be very detailed. Or perhaps the decision will be based on a briefing, plus the examination of a few formal documents.

At some point, however, a decision or a project becomes so big, and the elements of the decision become so numerous and complex, that only a structured process, such as BCA, allows the decision-maker systematically to identify, organize, analyze, and interpret all of the facts and opinions needed to make a wise and politically and economically defensible choice. Although the dividing line between projects that require a formal BCA approach and those that do not may seem at first rather obvious, in practice, it takes experience, many facts, and good judgment to determine which decisions will benefit from BCAs.

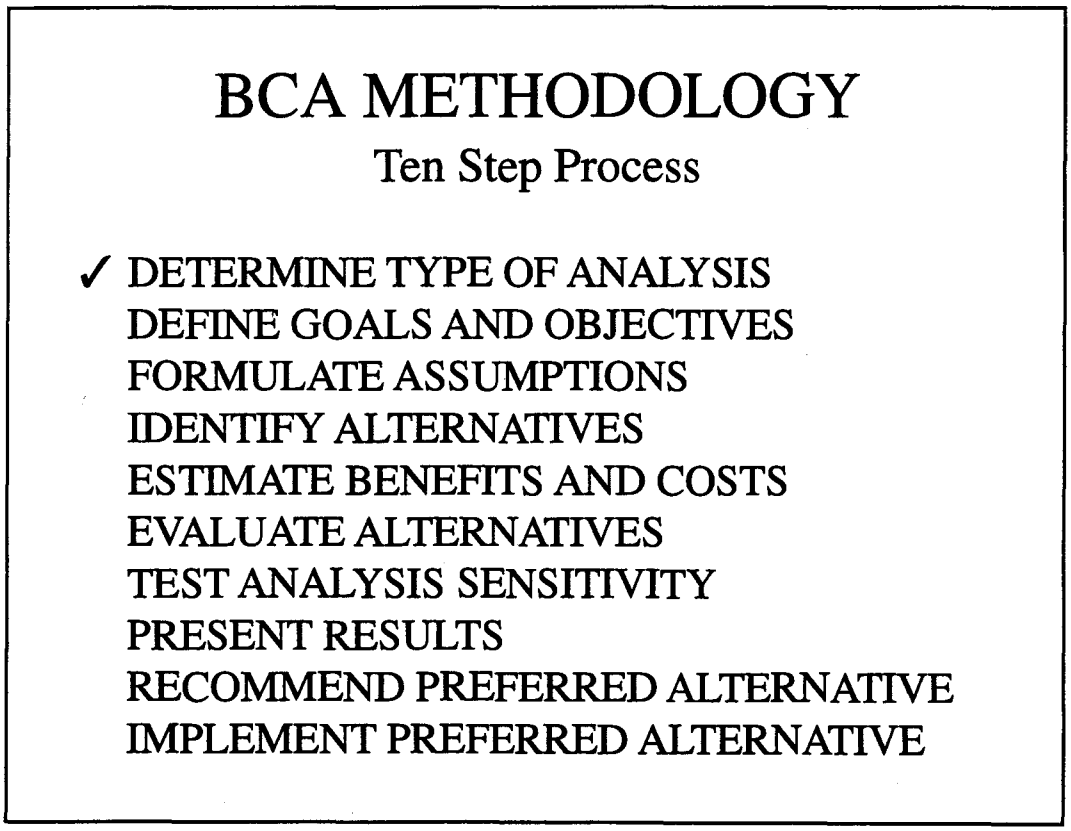

FIGURE 1–2

Government agencies and private institutions must make these kinds of decisions all the time. As mentioned, sometimes the scope and complexity of a project are small and simple enough so that a formal, structured approach to identify feasible alternatives, and to select a preferred alternative, are not required. In other words, there seems to be a broad consensus from the start that a certain avenue being considered is clearly the superior one, and a formal BCA would be a clear waste of time and money. Even governments sometimes, however, are constrained to undertake a BCA because of their own laws, rules, regulations, and policies.

Increasingly, especially in the light of greater pressure to force decision-makers to justify their planned expenditures with greater care and precision in front of higher level officials, as well as in response to greater demands for project

accountability for results and a decision audit trail, decision-makers must identify, explain, and defend the basis for their decisions. In short, officials higher up the chain of command are demanding not just an explanation of the reasons for the selection of a preferred alternative but why the lower level decision-makers did not consider other alternatives, some of which may be cheaper and perhaps even better than the one actually adopted.

Technically speaking, there is a distinction between "cost effectiveness," "efficiency," and "economy." But it is not too important for our purposes to classify BCA under a particular family of economic analysis techniques. "Benefit:cost analysis" to the layperson implicitly means balancing the benefits and values of expected outputs or outcomes against the burdens and costs of inputs and resources required to deliver those outputs and outcomes.

Finally, BCA is also related to such management techniques and application areas as planning, evaluation, assessment, inspection, audit, cost reduction exercises, downsizing, outsourcing, mergers, acquisitions, and management reviews. BCA can be useful in all of these techniques and application contexts and may be undertaken to support any one of them. Although BCA is most valuable when it is undertaken before a project is launched, still, it may be valuable while the project is being implemented or even after it has ended.

1.3 WHY IS BCA NEEDED?

First, a benefit:cost analysis may be mandated by higher authority. There are a number of situations where conducting a BCA may be mandated (apart from whatever justification project sponsoring officials might otherwise reach on economic feasibility or "sound management practices" grounds alone). Such factors are largely outside of the control of project officials, and include:

- Satisfying a law, rule, regulation, or policy (wherein benefit:cost criteria for undertaking the analysis may or may not be taken into account);
- Complying with the specific directions of a high-level, responsible official such as a minister; or
- Evaluating or justifying a decision already made.

Second, BCA may be justified on "sound management practices" grounds. That is, project sponsors and project managers may want to ensure that the "planning foundation" for a given project, especially a complex and expensive one, is solid and well thought through. As is pointed out in several contexts in this guidance, not the least of the value of BCA is the methodology's ability to ferret out hidden facts, unstated assumptions, cultural barriers, and so on, that might not otherwise be disclosed or revealed were a formal BCA not attempted.

Third, BCA is often employed when the capital investments and operating expenses are very large. What constitutes "very large" is often a matter of government policy or the lending standards and guidelines of economic analysis sponsoring or oversight institutions. It is widely held today that more convincing justifications are required for one information project to compete successfully with others for increasingly limited funds. It is to that end that BCA can be used as an effective instrument.

1.4 How does BCA Relate to Economic Analysis?

BCA is only one, albeit a very important member, of a family of an even broader set of economic tools and techniques that might be called "economic analysis" tools. Examples of other economic analyses tools, techniques, and approaches where expected values/costs are juxtaposed in an analytical framework so that they can be quantified where practicable and then examined by decision-makers to select a "best" or preferred alternative are:

- Acquisition and procurement guidelines,
- Feasibility studies,
- Long- and short-term investment algorithms,
- Capitalization techniques,
- Amortization methods,
- Depreciation accounting techniques, and
- Return on investment formulas.

A formal BCA, or at least the adaptation of some if not all of the details of BCA methodology, may be a component of any one of these examples of other economic analysis techniques and approaches.

Economic analysis is a systematic approach to evaluating the relative worth of proposed projects, based on the manipulation of both quantified and nonquantified information. The technique is based on the premise that there are alternative ways of reaching an objective, and each alternative requires certain resources (inputs) and produces certain results (outputs). The economic analysis is used to examine and relate the costs, benefits, and uncertainties of each alternative to determine the most cost-effective means of meeting the objective. There are three basic principles underlying an economic analysis:

- The analysis must investigate all reasonable alternative methods of satisfying a given objective. To be reasonable, an alternative must be technologically, operationally, and politically feasible and fall within budgetary constraints (although, strictly speaking, it is not the analyst's responsibility to ensure the last two conditions are met, analysts at least should be aware of their importance and significance in terms of the analysis);

- The analysis must consider both current and future expenditure patterns of each alternative; and

- Because there is a "time value of money," the analysis must consider not only how much an alternative will cost but also when the expenditure will be made. This consideration is included in the analysis by expressing each alternative's life-cycle costs in terms of its "present value."

1.5 USES OF ECONOMIC ANALYSIS AND BCA

Over the last decade, the conceptual and philosophical underpinnings of formal BCA, as well as the methodological (technical) details of how to apply the method to an actual decision problem (such as the challenge faced by developing-country decision-makers to choose the "best" alternative from among several "competing" ones for a given project proposal), have been greatly refined. Today,

there exists an excellent body of research literature that can be adapted and tailored to this field.

BCA and economic analysis, as mentioned, are useful at all stages of the library and information infrastructure improvement project life cycle, not just at the proposal stage. The distinction in when, where, and how to apply the techniques of BCA lies in the relationship of the analysis to the objectives of the particular stage involved.

Typically, a library and information infrastructure improvement project passes through many stages from initial idea conception through the final stages of evaluation, appraisal, and auditing. For example, in its Project Management Manual, IDRC has consolidated these into four principal stages: Project Analysis, Decision-Making, Implementation, and Evaluation (Disengagement).

Although, as mentioned, BCA can be useful at any stage, we will concentrate in this three-part volume on the first two of these phases, Project Analysis and Decision-Making for it is at these two junctures that the critical decisions are made to identify feasible alternatives and select a preferred alternative.

IDRC describes stage one, the Project Analysis Phase, as the "formative stage in which the recipient works out the design and format of the project, conducts the necessary end-user surveys, decides on training needs, establishes long-term goals and objectives, and tests a proposed methodology."

IDRC describes stage two, the Decision-Making Phase, as the "start of the main program wherein the methodology is applied to objective accomplishment. This is a period for developing links to other national and regional infrastructures, and involves working to a realistic plan of action."

Figure 1–3, Planning An Effective Information Project, schematically shows that BCA comes into play at steps four through seven. What may not so clearly be understood is that BCA can be useful simply as a communications tool, quite apart from the economic details involved in the selection of alternatives, the determination of a preferred alternative, the outcome of the detailed quantitative manipulation of cost and benefit streams, the calculation of a breakeven point, and so on. In short, the "mere" act of putting down on paper working assumptions,

1.0 INTRODUCTION

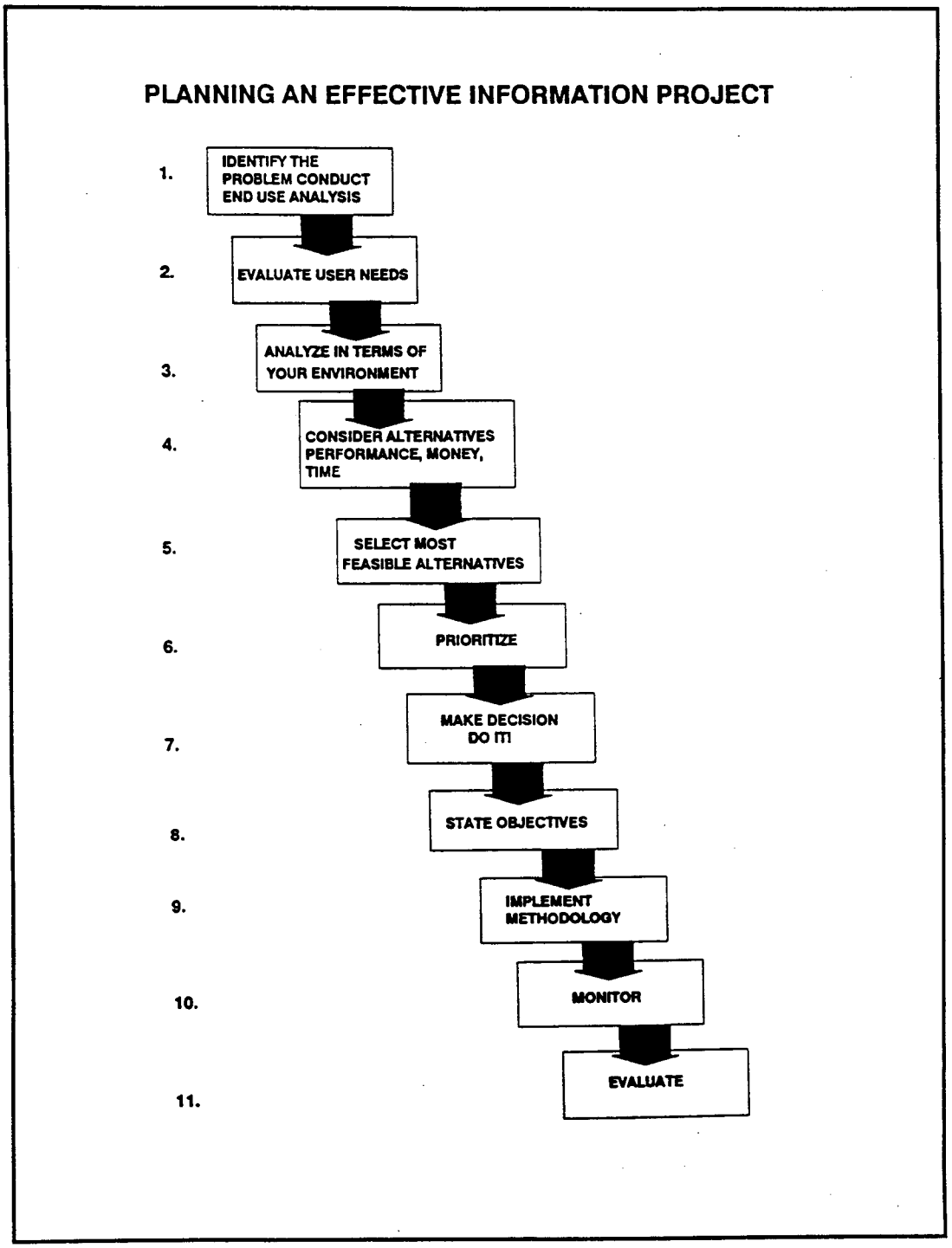

FIGURE 1–3

resource constraints, cultural barriers, and other information, in explicit form, is a very useful technique for:

- Spotlighting unstated assumptions,
- Ferreting out hidden agendas,
- Pinpointing weaknesses in project conceptualization and design,
- Exposing muddled thinking at any point,
- Forcing the collection of more and better data and information to support a complex project alternatives choice, and
- Providing insights into creative, innovative and imaginative "solutions" to problems ("alternatives" in benefit:cost terminology) that might otherwise have been stifled, ignored, avoided, held secret, or remain undiscovered had BCA not been undertaken.

Another way of expressing this last point is that BCA may well be an instance of where the "process is as important as the product."

1.6 LIMITATIONS OF BCA

Benefit:cost analysis is not a panacea. Like anything else, it is subject to certain limitations and qualifications. First, BCA does not normally establish priorities among various goals and objectives, it merely seeks to determine the most cost-effective means of satisfying a given objective.

Second, BCA is not in itself a decision-making process for choosing the most preferred means of meeting an objective; it is only an input to the decision-making process. The decision-maker must weigh the results of the analysis against other factors, some of which may not be quantifiable or economic in character, but most of which may well be qualitative in nature. Examples include such areas as health, morale, political considerations, and competing national priorities, all of which are worthy. But, by systematically quantifying what is quantifiable, and leaving the remainder as qualitative considerations, the decision-maker is better able to focus in more sharply on the analysis.

Third, care must be taken against the tendency to measure activities that are easily countable, to ignore activities that are not quantifiable, and to deal with the quantity and not with the quality of the outputs. Just because a cost item is easily identified and records are available for analysts to use to estimate total figures does not mean that less readily discernible costs should be ignored. Moreover, sometimes the qualitative aspects of a given output are more important than the quantitative ones (decision-making itself is a good example).

Fourth, it is often difficult, sometimes virtually impossible, to sort out cause and effect. That is, even if measurements of a benefit can be made, it may be difficult to attribute the causes because there may be many changes occurring at approximately the same time that could lead to the same result. But this is the same problem that confronts science and scientific measurement in general, and it is certainly not unique to the conduct of a BCA in the development area.

Fifth, sometimes BCA is not the most appropriate economic analysis technique under the circumstances. Sometimes a more specialized technique that is tailor-made to the particular situation is a better approach than using BCA. This guidance concentrates primarily on the BCA approach, but it does touch upon some of the more commonly used specialized techniques.

Sixth, a BCA cannot provide results that are more valid than the input data. Careful formulation of assumptions and careful estimates of benefits and costs are critical to the success of the BCA. Moreover, the initial set of benefit and cost figures computed almost always must be adjusted later. For example, initial benefit figures may need to be adjusted downward for learning and installation lags or adjusted upward for inflation and expected improvements in system performance and worker efficiencies or both. Or initial cost figures may need to be adjusted downward for residual value of assets sold.

But, no matter how much care is exercised during these stages, uncertainty cannot be eliminated completely. BCA necessarily involves assumptions, projects, or estimates of future events whose outcomes cannot be known with certainty. There are systematic techniques, however, for assessing the impact of uncertainty on analysis results. These are addressed in detail in Part 2.

A well-done BCA should not produce a "flawed" conclusion, i.e., point incontrovertibly to a preferred alternative that is inferior from the policy-level official's point of view. Essentially, this is true because it is always the policy-

level official, assisted by the project director's evaluations, who selects the preferred alternative, not the BCA itself. The best the BCA process can do is to identify and clarify the choices.

Every BCA begins by posing alternatives that the study then evaluates. The underlying assumptions and alternatives should continue to be examined as the study progresses. As more is learned, assumptions will often be revised or recast. Perhaps two alternatives will be combined. It is this iterative, dynamic, and continuing investigative process that the BCA promotes and documents and that gives the study its vitality and its validity. Otherwise, BCA might justifiably be regarded as a static, perfunctory exercise that blindly complies with a highly prescriptive methodology that few people can appreciate and even fewer employ effectively.

1.7 WHERE BCA IS NOT NEEDED; OR SCALED DOWN

A complete, full-blown BCA of even a fairly limited problem can become very involved and expensive. Generally speaking, therefore, analysis may be altogether unnecessary or should be reduced in scope and scaled down when it can be shown that:

- The benefits to be realized from completing the level of analysis required would not be commensurate with the effort and expenses involved for the project as a whole,

- A specific alternative or option is already mandated by legislation or regulation or has otherwise been required by higher authority, or

- The urgency of time constraints precludes full and complete analysis (e.g., in instances of health, safety, security of human beings, or political expediency).

It should be quickly pointed out, however, that, like all economic analysis tools and techniques, the scope of a BCA can be downsized to match (balance) more evenly the expected values and benefits of undertaking the analysis with expected costs and burdens incurred.

1.0 INTRODUCTION

In short, in a manner of speaking, there are guidelines for doing a BCA on a BCA or, put in different terms, rules of thumb that can be useful to select an optimal BCA course of action. To that end, four levels of analysis are offered for consideration, taking into account the need to balance costs and benefits:

Level One BCA:	**No Analysis recommended**
Level Two BCA:	**Feasibility Study only recommended**
Level Three BCA:	**Abbreviated Study recommended**
Level Four BCA:	**Detailed Study recommended**

Some brief definitions and clarifications are immediately in order. First, "feasibility study" for our purposes here is defined as a study wherein a project's goals and objectives are defined, appropriate assumptions are formulated, alternatives for accomplishing the goals and objectives are identified, and a preferred alternative is recommended, but the benefits and costs of each alternative are not defined or measured in any precise way or both (although they may be broadly identified, at least, as to their general character, and a rough order of magnitude of their value might even be approximated).

Next, "abbreviated study" as used here is defined as a limitation on the level or scope of detailed computations involved in the estimation of costs and benefits. Typically, in an abbreviated study there is relatively more emphasis given to the identification of nonquantifiable benefits than to quantifiable benefits. Finally, costs are estimated (rather than derived from accurate and complete records) and then typically rounded off.

Lastly, "detailed study" in our context means a full-blown, formal analysis where benefits and costs are estimated in detail insofar as such data are available in historical or other available documentation.

Every effort is made to quantify as many benefits as possible, and costs are pinpointed with precision. Computations are most often run through computer software spreadsheet packages of the kind described in Part 3 of this guide. The details of the four types ("levels") of analysis are addressed in the following.

In short, decision-makers and analysts must weigh the time and resources needed to perform an adequate BCA against the costs of taking the action and then decide on an optimal course. In the instance of levels one, two, and three, it may be necessary for the decision-maker to rely exclusively, or primarily, on intuition, experience, and personal judgment for making decisions on parts of problems or entire problems in the absence of hard quantitative data.

1.8 Four Common Myths Associated with BCA

There are some common myths associated with BCA that officials would do well to contemplate ("to be forewarned is to be forearmed").

Quantification Myth

BCA does not require that all benefits and all costs be quantified. Although it is true that costs are, as a general rule, easier to quantify than are benefits, there are often some costs that cannot easily be quantified (for example, in instances where certain costs cannot easily be separated as an embedded component of a larger cost structure). Moreover, some of the most important benefits may be non-quantifiable and be realizable only in the long term.

SELF-JUSTIFICATION MYTH

Cynics often claim that BCA is simply a technique for justifying a decision that has already been made by packaging that decision in obscure and obfuscatory language that laypersons feel "is so characteristic of economic analysis." To the extent that decision-makers do not probe, do not challenge, or do not take seriously the analyses performed for their benefit, then, indeed, it is easy to see how participants in the process may well come to that conclusion. But self-justification decidedly need not be an inevitable, "ulterior motive" of decision-makers or analysts.

UNCERTAINTY MYTH

It is sometimes claimed that the assumptions that must be made in benefit:cost analysis, particularly those involving the prediction of circumstances that are expected to be in existence in the "out years" (i.e., the first and subsequent years following the decision or baseline year, sometimes called "0" year) are so nebulous and vague that making reliable forecasts is like predicting the weather — fraught with peril and inexactitude. Certainly, it is true that any form of forecasting is an inexact science. Nevertheless, as has been pointed out earlier, all of us, in all phases of our lives, must make decisions involving predicting and forecasting. We cannot avoid a decision just because predicting and forecasting is difficult. Moreover, in BCA, specific techniques are available for testing the sensitivity of projections to major uncertainties.

DECISION MYTH

BCAs do not make decisions, policy officials and managers do. Decision-makers may well find themselves in a position where the preferred alternative from an economic standpoint must be rejected for political or sociocultural reasons, in which case, the "next best" alternative becomes the selected alternative. An honest decision-maker will not "hide" behind a BCA ("the devil made me do it"). A wise decision-maker will face up to the consequences of employing BCA and selecting a preferred alternative, both positive and negative.

1.9 THE BCA CREDIBILITY GAP

Beyond the four myths identified in the foregoing, the folklore that has grown up around BCA over the years, contributed to by the collective experiences, both good and bad, of individual BCA practitioners has led also to certain hazards or pitfalls for which we must be on guard. One of the most important, and consequently most serious of those experiences, is what we might call the "credibility gap."

To realize their full usefulness, BCAs must be both believable and clearly articulated to an audience of general managers who may not be technically inclined, may not be economically trained, and who may be biased against any kind of quantitative manipulation. For example, we sometimes hear people say "you cannot possibly quantify benefits and costs related to human beings."

Moreover, other managers, including high-level officials, sometimes believe that BCA results are hopelessly biased from the outset toward the preferred solution. In other words, a gap exists between what BCAs should do and what many managers believe they, in fact, are doing, and cynicism is widespread. In short, BCAs are often considered biased because:

- The study follows rather than leads a decision and, thus, appears to be done primarily to rationalize that decision, not shape it;

- The alternative choices studied by the BCA are, in some cases, "paper" or "strawman" alternatives only, selected to ensure that the preferred alternative is chosen not because they are legitimate alternatives;

- The assumptions of the study appear to have been carefully engineered to provide the "correct" result and subtly crafted to foreclose the consideration of "undesirable" alternatives;

- Management participation in the study was minimal and, instead, the study was done by "technocrats";

- As a rule, the project team or contractor responsible for managing and promoting the project also does the BCA; how disinterested and objective can such a BCA be under those circumstances ("we have put the cat to watch the canary");

- There is little or no connection between the cost figures first cited by the BCA and the budget request submitted later for the project; and

- BCA is "assumption sensitive." A small change in the study's assumptions can often produce major differences in the results.

These attitudes (hazards and pitfalls as we call them) cannot always be eliminated, but they can usually be ameliorated and at least managed. The first step in managing these criticisms is to admit that they are reasonable. This publication goes to considerable trouble to explain how each of these criticisms can be "engineered out" of a BCA study and, whenever possible, this should be done.

For example, high-level decision-makers in particular are disconcerted if the BCA and the formal project budget proposal use incompatible categories or irreconcilable data, or both, so that the projected cost and benefit figures in the BCA and the budgeted cost figures prepared later cannot be compared. Clearly, the people preparing the budget should first go back and see what figures were used and how those figures were presented in the BCA.

Even so, the careful design of the BCA will not be immediately apparent to the reviewing audiences, and an oral briefing or written report, or both, might be prepared to deal with those issues. If the criticism is justified, there may still be good and sufficient reason why the analysis was done the way it was, and these circumstances should be clearly explained.

With respect to the "cat watching the canary," this hazard can also be circumvented. For example, if a contractor or other group ("implementing agent") is used to prepare the BCA, it is probably wise not to use a contractor or agent with an actual or potential political or economic (vested) interest in the outcome of the project.

This admonition is not so easy to adhere to as it might seem. On the one hand, a "disinterested" contractor or agent will improve the study's credibility. In addition, having another contractor work with the documented project requirements and design can provide a detailed, independent critique of that work. But, on the other hand, the contractor or agent involved with the project will undoubtedly have the advantage, or at least at the study's outset, of a deeper understanding of the project. All things being equal, an independent contractor or agent, working closely with the project design/proposing team, would be the best choice. The final decision, however, should rest with the project director and project sponsor.

Ultimately, BCAs can never be entirely a "disinterested and dispassionate" document. Whether an independent contractor or other agent is used or not, the participating project director's personal attitude and behaviour will almost certainly be incorporated into the analysis and affect the decision choice of a preferred alternative outcome. This is probably both unavoidable and desirable. Only under exceptional circumstances does it make sense to isolate project managers from the decision-making processes that must go on as a prelude to project approval.

At the same time, the BCA exercise will have full value only if the project director can keep an open mind, or at least be perceived as having an open mind. This means that if the initial set of assumptions and alternatives is later changed, as they may well have to be, the study's credibility may hinge on how well these changes are documented and on the conviction and logic with which they are explained. Another way of expressing this is to be mindful of the dangers of "self-fulfilling prophecies," which, in our context, means making project directors defensive to the point that they will go to any length to defend why their preferred alternative is (or was) the "right" one. In the final analysis, BCAs can provide the

tools to examine alternatives, but no process will eliminate or compensate for managerial bias or bad judgment.

There is at least one other important reason why BCAs are not fully believed, and that is that few managers work through the study and understand how the reasoning of the study supports the decision chosen. They fear the BCA's promise is to be impenetrably technical and they are put off by unfamiliar, undocumented BCA methodologies.

Anyone attempting to judge the credibility, or overall quality, of an analysis will have to work through the reasoning of the study (but not necessarily the mathematical details). A quick reading of the executive summary will not serve! The quality and the wealth of useful information in a well-done BCA are only apparent in an examination of the details of the data, and in the structures used to organize it, and in the reasoning of the study itself leading to findings, conclusions, and recommendations. Moreover, to be widely useful, BCA studies must be accessible to high-level managers who have not participated directly in the study. The accessibility issue is important enough to address both at the beginning of the study and during the organization and drafting of the study report. Part 2 of this publication offers a number of suggestions designed specifically to improve management accessibility throughout the analysis phase.

Finally, let us review one more hazard: BCAs may become the unwitting handmaiden of powerful warring factions, each of which has a strong vested interest in different preferred outcomes. For example, in the instance of a BCA that is considering the utilization of computer technologies, that group preferring a mainframe-based solution that is strongly centralized from a control standpoint under the organization's central MIS/DP department may be in direct opposition to another group (or groups) preferring a PC-based, highly dispersed and highly decentralized solution, and much more under end users' control.

It is, therefore, important that managers recognize the issues at stake in choices such as these, because BCA studies will almost never resolve power struggles and conflicts of this type. It is no more difficult to undermine a BCA study than it is any other complex decision. As everyone knows, and fears, lengthy studies are one way to delay a project or kill it outright. This partly explains why so many managers prefer to start a project first and worry about the BCA later!

2.0 THE BCA PROCESS

2.1 INTRODUCTION AND OVERVIEW

The BCA process is a systematic methodology for developing and comparing alternative means of meeting a specific objective. The process can consist of as many as 10 or more steps, many of which should be performed and documented in the presentation of results. The elements are shown in Figure 1–2. Presented in the context of a library and information infrastructure improvement project, the 10 almost universally followed steps used in all kinds of analyses are:

1. Determining what type of BCA is most appropriate;

2. Defining the goal(s) and objective(s) for the project;

3. Formulating appropriate assumptions (including policy constraints, resource limitations, and cultural barriers);

4. Identifying alternatives for accomplishing the objectives;

5. Estimating the benefits and costs of each alternative, both quantifiable and nonquantifiable;

6. Evaluating alternatives by comparing their benefits and costs;

7. Testing the sensitivity of the analysis outcome to major uncertainties;

8. Presenting the results;

9. Recommending a preferred alternative; and

10. Implementing the selected alternative, periodically assessing feedback results, and periodically redirecting and updating the original assessment as required.

Some discretion should be allowed project officials to adjust the exact BCA methodology to meet the exigencies of time, including other competing

priorities for that same limited time, limitations on available resources to perform the analysis, and so on. In our context, determining the most appropriate type of BCA to employ is dealt with in the next section.

Except in the instance of not conducting an analysis at all, the basic 10-point iterative process outlined in the foregoing should be followed, ideally wherever possible, regardless of the type of analysis selected. Before proceeding with the details of the discussion, a few preliminaries are in order.

First, for simplicity's sake, the work unit or entity that is the object of the benefit:cost evaluation is conventionally referred to in this text as a "project," although, in reality, the object of evaluation and analysis for which the BCA is being employed may be some other kind of entity, such as a program, service, activity or resource or, even more broadly and generically speaking, a "capability."

Second, because this publication was developed by the Information Sciences and Systems Division of IDRC and targeted expressly to the library and information communities in developing countries, case examples and illustrations are drawn from the library and information domain. Thus, from time to time the text refers to a "library and information project" or an "information system" or an "information service." But readers from other fields might extrapolate the applicability of the example, with appropriate adjustments, to all other functional domains, including health, education, agriculture, and so on.

In its "themes and programs" document entitled "Meeting the Global Challenge," released in May 1993, IDRC identified three key program areas in the information field. For the most part, examples and illustrations utilized herein, and in Part 2, are drawn from these three priority areas because they are being faced by virtually all developing-country library and information communities:

- Information Policy Research,
- Information Capacity Building, and
- Software Development and Application.

2.2 BCA Project Planning and Control

There are a number of administrative and "housekeeping" arrangements that must attend the employment of any kind of formal analysis of the kind addressed here. For example, officials must ask:

- Who will undertake the analysis?
- Who will direct and lead the analysis?
- How will the analysis team be organized?
- What kind of timetable is appropriate?
- To whom will draft findings, conclusions, and recommendations be addressed?
- Will both oral briefings and formal, written reports be required, and, if so, when, and to which groups?
- Who will be the final approval authority (in BCA jargon, who will select the preferred alternative?)

For the most part, these kinds of details are not touched upon in this publication. Suffice it to say here that there are a number of companion guidance documents available to development officials, sponsors, and other interested parties that deal with project planning, project management, and project control. In this context, a BCA is "just another project." BCA directors and analysts are urged to consult those documents, in addition to this one, before embarking on a BCA. The guidance available in those other documents for projects in general is, with minor adaptation, just as valid for the BCA project exercise. Figure 1–4 shows an illustrative analysis team setup.

2.3 BCA Policy Decisions

There is an important list, however, of policy decisions connected with undertaking an analysis that does fall squarely within our scope. These decisions are referred to throughout the text in Parts 1, 2, and 3. They are here gathered together in one place for ease of reference:

POLICY DECISIONS

- Decide which of the four levels of BCA should be undertaken;
- Investigate whether a law, rule, regulation, or policy requires that a specific preferred alternative be followed;
- Identify what the policy constraints are to be included in the list of assumptions;
- Determine what the dollar threshold level criterion should be for use in deciding whether a Level One or some other Level of BCA be undertaken;
- Decide whether to treat both user and producer benefits as true benefits, or leave one or the other of them out of the calculations;
- Determine one or more discount rates to be used in present value calculations (e.g., 10%);
- Determine the economic life of the project (e.g., 20 years);
- Determine the system life of the project (e.g., 10 years);
- Determine what an acceptable minimum benefit:cost ratio should be, or whether to choose the preferred alternative as the one with the best ratio;
- Decide when and where management oral briefings and progress reports should be submitted; and
- Decide on the format and content of the final BCA report.

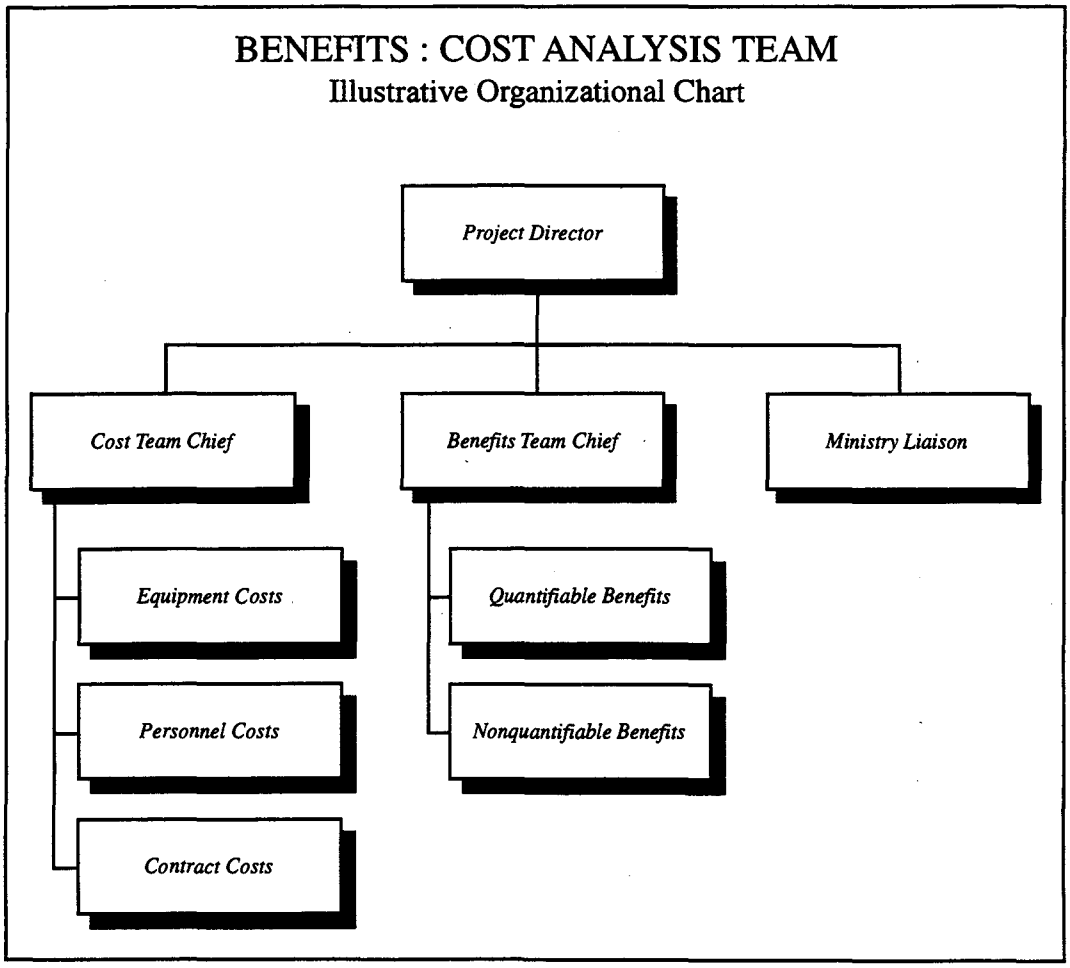

FIGURE 1–4

2.4 DETERMINING THE TYPE OF BCA REQUIRED

Remember that the specific guidelines in each of the four categories are in no priority order or other logical sequence. The adoption of one may mitigate against the selection of another (for example, the last two guidelines in each category, having to do with the use of minimum dollar and benefit:cost thresholds but both may not be required; in fact, using them both may be confusing).

2.4.1 LEVEL ONE (NO FORMAL ANALYSIS RECOMMENDED)

These guidelines are by way of example and are intended to be illustrative, not prescriptive. Neither are the guidelines in any necessary priority order, nor are they mutually interconnected in any simple, straightforward way.

2.0 THE BCA PROCESS

Illustrative circumstances or conditions that may lead officials to forego a BCA altogether for a given project under consideration include:

- The project, including the details of exactly how to design and implement a "preferred alternative," is mandated by a law, rule, regulation, policy, or other directive, allowing virtually no leeway to consider various alternatives. Here it would be a waste of time to conduct a BCA because the preferred alternative has already been preempted by the mandate dictating the project.

- Human health, safety, security, or welfare considerations are very substantial and are of such a critical import that they require immediate solutions (i.e., at most a matter of a few days, weeks, or months), or else the negative consequences in terms of the loss or degradation of the quality of human life and limb would be catastrophic (e.g., dealing with a disease epidemic or a natural disaster such as an earthquake or a flood). Under such conditions there simply is not time to undertake a formal analysis.

- Military defense and security considerations are of a very critical nature (e.g., an invasion, embargo) (admittedly, this is clearly not a social or economic development example but, rather, is offered here merely for illustration purposes). In this kind of environment of imminent danger there is no time to undertake a formal analysis.

- Impending political or social unrest, of a very serious nature, that could lead to riots, the breakdown of law and order, and so on. Again, imminent danger precludes formal analysis.

- A library and information infrastructure improvement project with projected budget expenditures of less than "W" dollars ("W" to be established by policy level officials). Here the reasoning is that there are some projects and activities that are simply too small in scope and budget to justify formal analysis (e.g., we do not need to do a formal benefit:cost weather analysis in the morning to decide whether it is worth carrying an umbrella or not). The key idea here is to establish a minimum dollar cost floor, below which no formal analysis at all would be undertaken. The precise figure used for the dollar flow would be determined by project sponsors, expected benefits are not even considered.

- A ratio of 10 or less to one, in comparing the projected benefits of adopting any alternative being considered for the project (except preserving the status quo) with the expected total cost of undertaking the next highest level of analysis alternative — a Feasibility Study. In contrast to the preceding guidelines, here the reasoning is that we are, in effect, doing a "mini BCA on the BCA" by establishing a threshold ratio benefit:cost level that we can use as a rule of thumb in deciding whether even doing a Feasibility Study would be cost effective. Here, benefits as well as costs are considered in making the determination; the precise threshold ratio level (i.e., 10:1) is a policy matter sponsors and donors would determine. It may, in fact, turn out to be higher or lower than 10:1.

It should also be remembered that sometimes BCA is not the most appropriate economic analysis technique; quite a number of other methods are available, all under the generic heading of "economic analysis." Some are touched on in Part 2.

2.4.2 LEVEL TWO (FEASIBILITY STUDY ONLY RECOMMENDED)

- The project is somewhat large and complex in nature, is expected to be costly, wherein the consequences of failure by pursuing the wrong course are moderate and could be somewhat embarrassing, and where the level of credibility and accountability required by the project sponsors to explain, defend, and justify the project to their respective constituencies is important, although not necessarily critical.

- Human health, safety, security, or welfare conditions of a nature that is expected to be very serious but where the time factor is not so critical (perhaps at least 4 months or longer are available), and management desires at least the consideration of various options, although not necessarily all of the benefit and cost details are made available to decision-makers.

- Where a law, rule, regulation, or policy mandates or strongly recommends such a study and there are no other mitigating circumstances to negate complying with that guidance.

- A library and information infrastructure improvement project with projected budget expenditures of less than "X" dollars ("X" to be established by policy level officials); corresponds with the "W" guideline in the preceding Level One category.

- A ratio of 100 or less to one (but greater than 10:1) in comparing the projected benefits of adopting any alternative being considered for the project (except preserving the status quo) with the expected total cost of undertaking an abbreviated study; corresponds with the <10:1 ratio guideline in the preceding Level One category. Remember, as a practical policy matter, officials may wish to set the ratio somewhat lower (e.g., 50:1, or even 25:1, or higher).

2.4.3 LEVEL THREE (ABBREVIATED STUDY RECOMMENDED)

- The project is large and complex in nature, is expected to be very costly, wherein the consequences of failure by pursuing the wrong course are moderate and could be somewhat embarrassing, and where the level of credibility and accountability required by the project sponsors to explain, defend, and justify the project to their respective constituencies is important, although not necessarily critical.

- Health, safety, security, or welfare conditions of a nature that is expected to be serious, but where the time factor is only moderately significant — certainly neither catastrophic nor critical but, at the other extreme, not of such a relaxed nature so as not to be a factor.

- Where a standing law, rule, regulation, or policy mandates or strongly recommends such a study and there are no other mitigating circumstances to negate following that guidance.

- A library and information infrastructure improvement project with projected budget expenditures of less than "Y" dollars ("Y" to be established by policy level officials); corresponds with the "W" and "X" dollar guidelines in the preceding Levels One and Two categories.

- A ratio of 1000 or less to one (but greater than 100:1), in comparing the projected benefits of adopting any alternative being considered for the project (except preserving the status quo) with the expected total cost of undertaking a detailed study; corresponds with the <10:1 and 10:1 – 100:1 guidelines in the preceding Levels One and Two categories.

2.4.4 LEVEL FOUR (DETAILED STUDY RECOMMENDED)

- The project is very large and extremely complex in nature, is expected to be very expensive, wherein the consequences of failure by pursuing the wrong course are very high and would be politically embarrassing and where the level of credibility and accountability required by the project sponsors to explain, defend, and justify the project to their respective constituencies is absolutely critical.

- Human health, safety, security, or welfare conditions of a nature that is expected to be significant but where the time factor is insignificant or of very modest significance.

- Where a standing law, rule, regulation, or policy mandates or strongly recommends such a study and there are no other mitigating circumstances to negate following that guidance.

- A library and information infrastructure improvement project with projected budget expenditures of less than "Z" dollars ("Z" to be established by policy level officials); corresponds to the "W", "X," and "Y" guidelines in the preceding Levels One, Two, and Three categories.

- A ratio of greater than 1000 to one, in comparing the projected benefits of adopting any alternative being considered for the project (except preserving the status quo) with the expected total cost of undertaking a detailed study; corresponds with the <10:1, 10:1 – 100:1, and >100:1 – 1000:1 guidelines in the preceding Levels One, Two, and Three categories.

Because of the relatively large amount of "number crunching" that must be performed, the last two options, abbreviated study and detailed study, can profitably utilize the special spreadsheet computer software program IDRC has developed using the Excel 3 for Windows QuickStart package.

The essence of the foregoing guidelines is that decision-makers and analysts weigh the expected benefits and values of expected resource consumptions needed to perform a given level of BCA against the costs of performing the analysis and then decide on an optimal level of analysis. In the instance of Levels One, Two, and Three, it may be necessary for the decision-maker to rely exclusively, or primarily, on intuition, experience, and personal judgment for making decisions on parts of the analysis.

Remember, also, that there is nothing immutable about changing the level of analysis in mid-stream. For example, circumstances may arise wherein officials who may have initially decided not to do any analysis at all (Level One), later decide to upgrade the scope of the analysis and direct that a Feasibility Study (Level Two) be undertaken. Or, after reviewing officials have examined the initial findings and conclusions in an Abbreviated Study (Level Three), they may then decide to expand the scope to a Detailed Study (Level Four).

It works in reverse as well. Again, if time is running out, or other unforeseen circumstances arise, it may become necessary to downsize a Detailed Study (Level Four) to an Abbreviated Study (Level Three) or even to a Feasibility Study (Level Two).

Undertaking the appropriate level of a BCA should, wherever feasible, be included as a cost line item in a project proposal budget, especially for Levels Three and Four. See Figure 1–5 for a bird's eye view of the four levels of analysis and the quantitative and qualitative factors that go into the decision-making process to select the most appropriate level, given a certain set of circumstances. Now let us move to the remainder of the nine steps in the BCA methodology. First, defining goals and objectives.

2.5 DEFINING GOALS AND OBJECTIVES

The first step in the BCA process (whether we are talking about a Feasibility Study, an Abbreviated Study, or a Detailed Study) is defining goals and objectives.

LEVEL OF ANALYSIS REQUIRED
Four Options

LEVEL OF ANALYSIS	QUANTITATIVE FACTORS	QUALITATIVE FACTORS
Level 1 - No BCA	Low $$ Investment	Legally Mandated
	< 10:1 BCA Ratio	Critical Health
	Less Than 1 Month	Critical Safety
	No Funds Available	Critical Security
Level 2 - Feas. Study	Modest $$ Investment	Sponsors Suggest
	> 10:1 < 100:1 BCA	Complex & Detailed
	Several Weeks Available	Political Embarrassment
	Some Funds Available	Easy To Do
Level 3 - Abbrev. Study	Substantial $$ Inv.	Sponsors Insist
	> 100:1 < 1000:1 BCA	Very Complex
	Several Months Available	Civil Penalties
Level 4 - Detail Study	Very Substantial $$	Sponsors Demand
	> 1000:1 BCA	Extremely Complex
	> 6 Months Available	Criminal Penalties

FIGURE 1–5

2.5.1 GOALS

Most simply stated, a goal is the long-term outcome that one hopes to achieve at the conclusion of the lifetime of the project, if not before. A goal may be an outcome that is relatively concrete and measurable, or it may be an outcome that is relatively intangible and not easily measured (but for which "impact indicators" may be available to at least help evaluators roughly assess the project's effects), such as a positive change in conditions, attitudes, or behaviours.

Goals are usually the result of trying to solve a long-standing problem, or trying to take advantage of an enhancement opportunity (as in the case of modern information handling technologies that can be cost effectively employed to replace an outdated, wasteful, and inefficient manual or semiautomated approach being used to manage information). Solving chronic societal problems nearly always is a very long-term proposition; rarely does it happen in the space of a few years or, sometimes, not even in several decades.

In short, it is not a play on words to say that goals are not the final ends unto themselves. Beyond goals lies the realm of short-, mid-, and long-term (hopefully permanent) societal changes that the entire social and economic development program hopes to bring about. It is here that the different political, economic, and social domains are really impacted by the results of a given, or group, of related projects. Usually, only historians are in a good (objective) position to evaluate "permanent" societal changes (see Fig. 1–1).

Goals are usually stated in fairly general terms and, at least implicitly if not explicitly, infer or state clearly an answer to the question: "Why is this project being undertaken and what is it expected to accomplish?" There is usually only one goal, or a very small number of goals, associated with a given project, otherwise, the project risks being regarded as overly complex and too ambitious and should be subdivided into one or more stand-alone subprojects.

2.5.2 OBJECTIVES

Most simply stated, an objective is a precondition — an event, circumstance, or condition relatively more concrete and attainable than a goal — that must be achieved on the way to accomplishing the long-term goal. Objectives are short term and mid term in nature and are expressed in fairly specific language (who, where, when, and how).

The number of objectives for a given project generally exceeds the number of goals and, where possible, the objectives associated with a given goal should be explicitly tied to its parent goal in a hierarchical fashion. The actual wording of objectives is critical in that the wording should reflect, insofar as is humanly possible, an unbiased point of view concerning the method of solving the problem (achieving the goal).

Objectives should be specific in terms of organizational assignments, responsibilities, and capabilities. They should also make clear what is to be changed versus what is to remain unchanged, in organizational terms, in systems terms, in procedural terms, and in job terms. They should not, however, be described so rigidly that the achievement of the objectives is overly constrained or burdened to such an extreme that initiatives are stifled and targets of opportunity that may arise along the way are ignored or avoided.

Objectives, like goals, should be periodically reviewed and updated in light of the experience gained throughout the BCA, as new information comes to light.

A good project plan and proposal will provide for such periodic revalidation of original goals and objectives all through the life of the project.

Objectives should also be sufficiently detailed so that they provide a firm basis for identifying and eventually selecting alternative methods of meeting the objectives and for determining the extent to which existing methods and procedures should also be revised. They should also be sufficiently detailed to allow for measurement of the results after the preferred alternative has been adopted and the solution implemented.

For example, the objective of updating an existing system should specify what new requirements the updated/upgraded system must meet. It is not sufficient to merely state the objective as "to update (or upgrade) the current system."

2.5.3 Breaking a Problem Down into Goals and Objectives

The process of breaking a larger problem down into manageable subproblems, and into goals and objectives for a project, can be summarized in a step-wise procedure.

- Identify the core problem(s) or issue(s) to be resolved.
- Break the problem down into its component parts and decide which subproblem to attack first, which second, etc., and how the subproblems interrelate.
- Exchange ideas on problem identification and resolution. To this end brainstorming, role playing, and other behavioural science and organizational dynamics techniques may be effective.
- Identify expected outcomes, outputs, and "deliverables."
- Formulate one goal, or a very few goals, to be achieved by implementing a solution.
- Formulate at least one objective, but no more than three or four, for each stated goal.

- Make sure goals are clear, realistic, and answer the questions "what and why?"

- Make sure objectives are specific, detailed, realistic, and answer the questions "who, when, where, and how?"

2.6 FORMULATING ASSUMPTIONS

Assumptions are explicit, written statements used to describe the current and future environment upon which the BCA will be based and that usually limit the scope and validity of the analysis. Every analysis, no matter how formal, will be attended by some working assumptions. We simply do not know enough about the future to avoid making assumptions.

This important and difficult exercise forces project proposers and other concerned parties to think through the project carefully and face up to uncertainties more thoroughly than they might otherwise. Assumptions include policy constraints and resource limitations, as well as cultural barriers expected to impact project implementation, both negatively and positively.

2.6.1 RULES IN MAKING ASSUMPTIONS

- Do not confuse assumptions with facts. Make assumptions only when they are absolutely necessary to bridge gaps in essential information that is unavailable or cannot be easily produced or collected.

- Be certain the assumptions are realistic.

- Ask yourself if your conclusions would be valid if one of the assumptions did not hold. If the answer is "yes," consider eliminating the assumption because it is not relevant to that particular analysis (although you may wish to document it for historical record purposes even though it is "washed out" of final deliberations).

For example, three assumptions typically included in BCA in a library and information project are:

- The estimated future utilization of the source, service, system, or other information resource (workload demand);
- The economic life of the project over which benefits are expected to accrue (sometimes called the "system life"); and
- The time period covered by the comparison (which could be longer than the economic life, but should not be shorter).

Assumptions about the useful economic life of alternatives, and of the economic life of key system components (e.g., the expected serviceability period for a piece of computer hardware), are especially crucial to the analysis. Special attention should be given to assumptions about the economic lives of investments in staff expertise and work system design in doing these analyses.

The lifetimes of major investments in human resources, applications software, and systems software and hardware are apt to be different, and these differences must be accounted for in the analysis. In the case of projects with concrete assets put in place, this is accomplished by ensuring that economic lives are equalized to that of the asset with the longest lifetime or that the residual value of assets with lives longer than those of primary interest in the analysis are excluded from costs.

2.6.2 IDENTIFYING ASSUMPTIONS

The project director must identify assumptions, and it is often useful to organize a review of the assumptions by a small group of managers with different roles to be played in the project (e.g., users, managers, intermediaries, sponsors, etc.), as well as with different functional backgrounds (e.g., someone from the human resources area, someone from the financial resources area, someone from research and development, etc.).

Then ask the following three questions about each assumption:

- Is the assumption absolutely necessary to bridge gaps in essential information?

- Is the assumption realistic and stated positively?

- Does the assumption affect the conclusions of the BCA? Keep in mind that you may want to test some of the assumptions against the conclusions of the BCA.

2.6.3 ILLUSTRATIVE ASSUMPTIONS

Some illustrative assumptions commonly used in BCAs are:

- Inflation or deflation factors for the economy in which the project will be developed and operated (expressed as a percentage);

- Changes in the cost of labour in the future, often expressed as a percentage increase or decrease;

- Changes in the cost of materials in the future, often expressed as a percentage increase or decrease;

- Changes in the demand for the product(s) or service(s) involved in the project, expressed as a volume increase or decrease, or expected workload increases or decreases;

- Changes in the size and character of the target population(s) served by the product(s) or service(s) involved in the project (including the general public if applicable), expressed as a percentage increase or decrease;

- Constancy and reliability of supply sources for inputs and resources needed by the project, including technical skills needed (e.g., in the case of natural resources, are the sources of supply expected to dry up, increase, decrease, or stay stable); and

- The degree of political stability.

2.6.4 SUMMARY OF STEPS FOR IDENTIFYING AND VALIDATING ASSUMPTIONS

- Each analysis has certain assumptions associated with it;

- Identify current and future uncertainties;
- Formulate assumptions to bridge the uncertainty gap;
- Assumptions must be:
  - Distinguished from facts,
  - Realistic, and
  - Essential for goal/objectives attainment; and
- Typical examples of assumptions used in BCAs are:
  - Estimate of future utilization of the capability,
  - Economic life of project ("system lifetime"), and
  - Time period of comparison.

2.7 IDENTIFYING ALTERNATIVES

The third step in the BCA process is to identify all feasible, or at least potentially practical, means of meeting the objectives. A discussion of the techniques and operational characteristics of each alternative can be beneficial. All alternatives should satisfy the minimum requirement of meeting the stated goals and objectives (except, by definition, maintaining the current system or "status quo").

There are almost always different means of attaining an objective. For example, very often it is possible to consider three broad avenues of approach to a solution to a problem:

- An in-house, capital-intensive approach (using machines and equipment primarily);
- An in-house, human-intensive approach (using human expertise and labour primarily); or

- An outsourced-intensive approach (buying the products or services needed from outside the organization, for example, a contractor).

2.7.1 MAINTAINING THE STATUS QUO

Maintaining the status quo is almost always one alternative and, from a purely theoretical standpoint, it is very useful to list "keeping the existing system or the status quo" as a sort of baseline alternative against which to compare the other alternatives even though, technically speaking, it does not meet all or even most of the stated goals and objectives. It will usually, however, meet at least some of the stated goals and objectives unless the existing method is deteriorating or disintegrating and is beyond salvage.

Of course, if there is no existing system or current method, then a baseline is unavailable for comparison sake. To be honest, nearly everyone associated with the project knows full well that the preferred alternative will probably turn out to be one of the alternatives other than the status quo, or else the project would not have been recommended in the first place.

Nevertheless, top decision-making officials will usually feel more comfortable, and will usually place greater credibility in the overall analysis, if they know that maintaining the status quo is a "legitimate option" open to them. Including the existing way of doing something as a baseline reference point, however badly it may be being done, also facilitates the consideration of competing projects, all of which may be vying for the same limited financial resource base that is available for funding the total project portfolio.

There is also a technical, or methodological, reason why considering the existing system or method as at least a pro forma alternative so that analysts have a common reference point or baseline against which to identify, measure, and calculate costs and benefits. Without a single framework it becomes almost impossible to make intelligent comparisons of benefits and costs on an item-by-item basis, thus throwing the entire analysis into an "apples and oranges" situation.

2.7.2 OTHER ALTERNATIVES — ALTERNATIVES 1 AND 2

It is important to identify at least one other alternative beyond the status quo, but preferably two other alternatives. In BCA terminology these are conventionally called Alternative 1 and Alternative 2, whereas the status quo is simply called the Current System or the Existing Method.

There should be at least one other way of providing a similar level of services required as the preferred alternative. Perhaps a scaled-down approach that is less ambitious than the proposed approach is feasible.

At the other extreme, it is usually a good idea to keep the total number of alternatives being considered to four or less, or else decision-makers will be confused by the complexity of too many choices. Very often alternatives above four can be consolidated. Moreover, the list of alternatives should only contain those that are reasonable and technically feasible, not "strawman" options.

2.7.3 Advantages and Disadvantages

For each alternative identified it is useful to list the advantages and disadvantages of each in a succinct and candid narrative fashion (no more than one sentence, and often just a phrase). For example, one advantage of retaining the status quo would be "no increase in cost." But a disadvantage would be "inability to achieve long-term enhancement objectives."

2.7.4 Complications in Identifying Alternatives

For a number of reasons, the identification of alternatives is a more challenging management task than it might first appear. These reasons include the timing and realism of the BCA (which must be done well before the decision is made using actual, not simulated, alternatives) and issues of organizational conflict.

The choice of alternatives can also be difficult for purely technical reasons, involving, for example, the cost of the BCA itself or the time allotted for the project. If the project is complex, different design alternatives will probably be developed as a part of the design phase of the project. This is comparable to an architectural competition or a contract competition for a new type of transportation system or building construction.

Costly though this may be, it is important to realize that, if the BCA is timely, and management takes full advantage of the process to explore the project in depth, the savings on false starts or badly conceived projects can be huge. In this perspective, the cost and effort of the BCA can be readily justified.

2.7.5 REVALIDATING THE INITIAL SET OF ALTERNATIVES

The BCA should be regarded as a sort of experiment (aeronautical engineers use the term "simulation" to test their design alternatives in a safe, low risk, minimal cost laboratory environment before investing huge sums in the actual building of aircraft) where different choices are investigated in detail. It is quite possible that in the final configuration selected, the project design could include parts of different alternatives that were originally considered.

As the analysis proceeds, new alternatives might suggest themselves, whereas others might prove impractical because of cost or technical or other requirements or constraints that arise or are folded into other alternatives. Ideally, alternatives that were initially identified but subsequently found impractical, should be documented because, characteristically, project personnel involved in BCAs will often say "didn't we already consider that possibility?"

Finally, the investigation of alternatives may also permit project managers to consider factors other than cost. For example, simplicity of design or maintenance of the completed system or other resource or capability put in place could be important.

For all of these reasons, it is critical that the project director responsible for key project decisions be directly involved in the choice and evolution of alternatives.

2.7.6 EXAMPLES OF ALTERNATIVES

Examples of alternatives in library and information projects involving the need for modern information handling technologies such as computers or telecommunications networks or both include:

HARDWARE ALTERNATIVES

- Status quo versus replacement or upgrade.
- Mainframe with remote nodes.
- Centralized versus distributed processing.
- Mini/microcomputer network vs stand-alone.
- Different vendors.
- Time-sharing from commercial sources.

SOFTWARE ALTERNATIVES

- Continuation of current services and methods.
- A new system that meets only the most important of the identified requirements (i.e., a scaled-down version providing a subset of the requirements; if a scaled-down alternative is not possible, the BCA should so state).
- A new system that meets all the requirements.
- A second system that meets all the requirements but uses a different approach.
- Considerations include phased implementation and conversion of existing software.

ACQUISITION METHODS

- The purchase alternative: buying the system or service;
- The lease alternative: making regular payments for the use of the system or service;
- The lease with option to purchase alternative; and
- The lease to ownership alternative.

Finally, keep in mind that the initial list of alternatives need not be final. As the analysis proceeds, new and better alternatives may emerge, whereas those not feasible because of funding or technical constraints may be discarded. For those alternatives eliminated, it would be useful to document the reasons.

2.7.7 SUMMARY OF STEPS IN IDENTIFYING ALTERNATIVES

- Identify the existing system or method as the baseline alternative (the current system);
- Identify at least one, but preferably two, alternatives to maintaining the current system or existing method (Alternative 1 and Alternative 2);
- Keep the total number of alternatives, including maintaining the current system or existing method, to four or less so as not to confuse decision-makers;
- Regard alternatives identification as an iterative and testing process, continuously discovering new ones, and discarding or consolidating old ones; and

- Document all alternatives considered to preclude unnecessary researching for data.

2.8 Estimating Benefits and Costs

We finally arrive at the core of BCA — estimating benefits and costs; this step is at the heart of the BCA. Estimating benefits and estimating costs involve quite different approaches, and it is best to begin with estimating costs because costs are generally more visible, more concrete, and knowing what the costs are gives us a logical starting point against which to compare the expected benefits and values.

2.8.1 Using Impact Indicators as Indicators of Benefits and Costs

First, in library and information infrastructure improvement projects, especially those involving the improvement of political, social, and cultural infrastructures, it is often difficult to pinpoint benefits and costs with precision, at least to the same degree that engineers and cost estimators can calculate the benefits and costs of projects involving physical infrastructures such as highways, dams, buildings, or preparing arable land for crops or livestock. This is because the benefits (especially), but also the costs, are often less tangible, take far longer to realize fully, impact individuals and groups or even entire societies in very diverse ways, and, ultimately, may require changes in basic human attitudes, behaviours, or even value and belief systems.

In such instances it is often useful to consider the notion of using indicators of benefits and costs as a kind of surrogate for our inability to identify, define, and measure more concrete and "scientific" benefits and costs, such as those conventionally associated with building dams, bridges or shelters, or preparing land. For example, some possible indicators of information value are:

- Positive impact on income factors (return on investment, revenue, or net profit or both);
- Willingness to pay (or exchange something else of value);
- Driving thirst for new knowledge creation;

- Reduction in costs resulting from information use;
- Productivity and efficiency improvements from information use;
- Impact of information withdrawal on problem resolution;
- Use and reuse of the information;
- Extensive citation to the information; and
- Multiple and different uses of the same information.

From a benefit:cost standpoint, the feasibility of assigning a dollar value measure (i.e., quantifying) to the illustrative value indicators listed in the foregoing varies widely in difficulty; some are relatively easy and feasible, others are quite difficult. As we proceed, therefore, with the estimation of benefits and costs for the purposes of BCA, readers and users of this three-part volume should keep in mind that the determination of whether or not a particular benefit or cost item is, in fact, a "true" benefit or a "true" cost is often, ultimately, a judgmental matter not a scientifically verifiable endeavour undertaken in the laboratory.

In using indicators, we are usually able to achieve at least a working consensus among the participants as to whether a particular item is agreeable as a benefit (or a cost), and in so doing need not jeopardize or undermine the utility of the entire benefit:cost analysis by getting hung up on this question.

2.8.2 ONE GROUP'S BENEFIT MAY BE ANOTHER GROUP'S COST

Under certain circumstances, the achievement of a consensus, even among experts in the field, as to what precisely constitutes a "benefit" and what constitutes a "cost" may not be easy because of the different perspectives and stakes of the different players and participants involved in a project.

Perhaps one of its simplest and most easily understood examples is the case of a proposed new information delivery system that a government is considering funding and putting in place a new entitlement to help a given targeted group of citizens. Here, one must consider the different perspectives of: (a) the targeted beneficiaries who will be given the entitlement, (b) the government as the information service provider and intermediary, (c) the taxpayer as the ultimate funding source to be tapped, and (d) society at large.

The interests of these four groups are quite different indeed! In a nutshell, what is a "benefit" to the targeted beneficiary is a "cost" to the taxpayer! It is the old "eye of the beholder" argument we are confronted with but clothed in benefit:cost garments.

Moving closer to the development arena, a number of major "players" or "audiences" can be identified, each of which has a distinctive, special interest in library and information infrastructure improvement projects. Sometimes, those vested interests (the polite word is "perspectives") are not in consonance or may be diametrically opposed from a benefit:cost standpoint. In extreme cases, one set of players will sometimes try to shift costs onto another group of players or benefits from another group of players or both.

For example, consider these major target audiences, all of whom are key participants in nearly all library and information infrastructure improvement projects:

- Administering government instrumentalities,
- Political leaders and political parties,
- Taxpayers,
- Project sponsors,
- Project cocontributors,
- Project output (products or services) users,
- Beneficiaries of an information service or system,
- Affected local communities, and
- Society at large.

Normally, a BCA takes the stance of identifying benefits as values to beneficiaries and users, and costs as burdens to sponsors and cocontributors. In the case of publicly funded projects, government agencies and political leaders (both national and local) are expected to take implicitly into account the worth of a project in terms of weighing the aggregated projected benefits to their respective

constituencies against the aggregated costs that will be incurred as a burden to the government's treasuries (national, provincial, and local). In the case of privately funded projects, sponsors and other lenders and contributors are expected to take implicitly into account the worth of a project in terms of weighing projected benefits to the developing country as a whole against the costs that will be incurred as a burden to the sponsors' funding sources.

In sum, it is important that the evaluation perspective be made clear at the outset and that analysts pay special attention to the danger of inadvertently shifting their perspective mid-way through their work, from one group of players or participants to another, thus confusing and undermining the analysis. Moreover, project directors and analysts must be clear as to the "project unit" that is bundled together for the purpose of analysis. Is it a single project? A group of related projects? A subdivision or single component of a project? Finally, they must be on their guard as they begin to collect data, organize the data, and begin to do the analysis and perform the computations that one group of players has not tried to influence them to shift a cost to another group, or they themselves attempt to shift a benefit away from another group.

2.8.3 COST ANALYSIS

Simply because costs are generally more visible and more concrete than benefits does not make their estimation necessarily easier than estimating benefits. Most managers regard benefit estimation as the only difficult part of a BCA. But, in fact, experience has shown that projected cost estimates and actual costs are almost always far apart.

Often, this "cost gap" is expressed in time: the project is overbudget because it is behind schedule (assuming the costs used in the budget are derived directly from the BCA). One way or another, managers pay for bad cost estimates.

Cost represents an outlay, expenditure, or price paid to acquire, construct, or manufacture capital assets and commodities as well as other expenses incurred for operating a business, running an organization, and accomplishing institutional missions, goals, and objectives. Costs include expenditures for raw materials, direct labour, and other related expenses, as well as depreciation and amortization of capital assets. We also sometimes refer to costs in this publication as "burdens" (see Fig. 1–6).

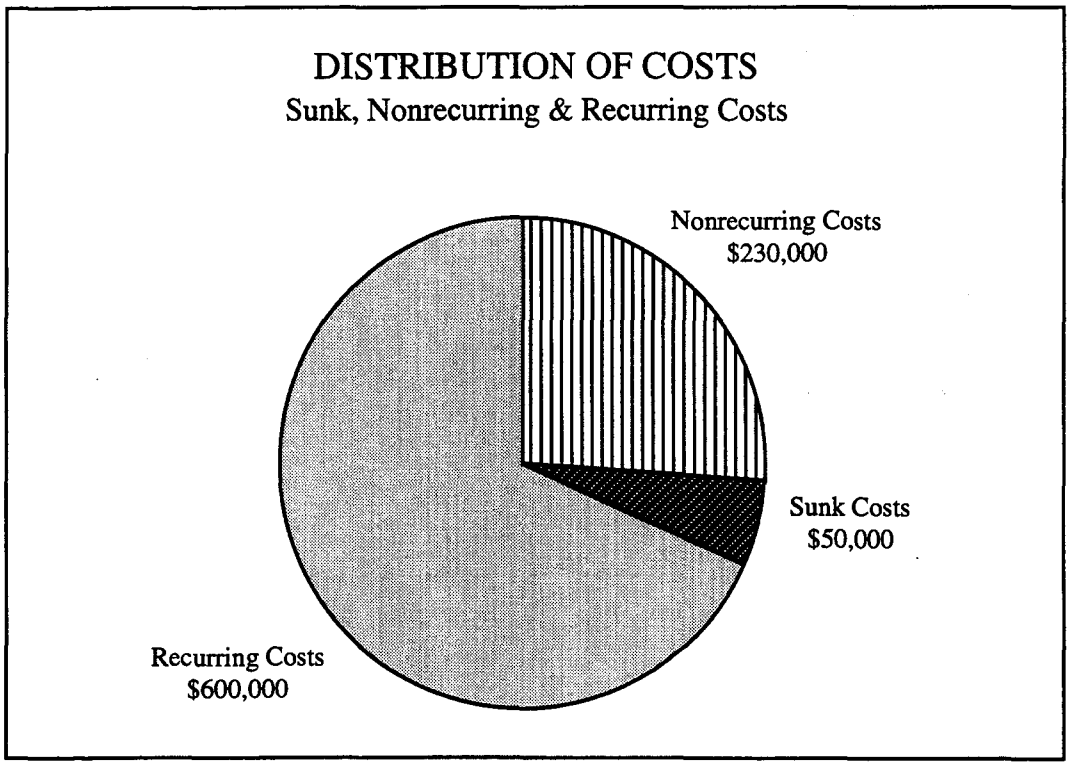

FIGURE 1–6

2.8.3.1 RECURRING, NONRECURRING, AND SUNK COSTS For benefit:cost analysis purposes, costs can be broken down by a number of different classification schemes. First, they can be categorized into three broad categories based on reoccurrence and recoverability:

- Recurring costs,
- Nonrecurring (one-time) costs, and
- Sunk (unrecoverable) costs.

Nonrecurring costs are generally associated with one time expenses. Nonrecurring costs are generally thought of as investment expenses.

Recurring costs, however, are generally associated with expenditures made on a regular, or at least intermittent, basis such as equipment maintenance or supplies replenishment. Recurring costs are often referred to as operating costs.

Finally, sunk costs are unrecoverable and their inclusion in the analysis would unfairly and inaccurately tilt the analysis too heavily in the cost direction. Sunk costs are often arguable and eventually may come down to accounting conventions used by the organization involved. An example of a sunk cost might be a fully depreciated piece of still usable, necessary equipment that need not be replaced should any of the alternatives being considered be adopted as the preferred alternative.

2.8.3.2 DIRECT AND INDIRECT COSTS Costs can also be classified on the basis of whether they are:

- Direct, or
- Indirect.

Direct costs are those material, labour, and equipment expenses that contribute directly to the production of some useful output.

Indirect costs are things like insurance, overhead, taxes, and so on.

2.8.3.3 FIXED AND VARIABLE COSTS Costs can also be classified on the basis of whether they are:

- Fixed, or
- Variable.

Fixed costs are those costs that do not change in the short run if production volume is within a specified range. White collar managerial and professional personnel, plant operating costs, insurance, taxes, and similar expenses generally (but not always) fall into that category.

Variable costs are those costs that do change in a manner that is fairly commensurate to production or workload volume increases or decreases. Blue collar, unskilled and semi-skilled labour, and expendable materials generally (but not always) fit into that category.

2.8.3.4 LOST OPPORTUNITY COSTS Then there are what are sometimes called "lost opportunity costs," the cost of not doing something. For example, if I forego a 12% investment in favour of a 10% investment, then my lost opportunity cost

is the 2% difference. Benefits are obviously lost but, less obviously, costs may also be "lost." In the latter case, this is sometimes called "cost avoidance."

Economists and BCA analysts are wary of going too far in including lost opportunity costs in formal BCA computations because the "lost opportunity" may be very difficult to pin down and requires a bit of second guessing to figure out what could have happened.

2.8.3.5 PRODUCER COSTS AND USER COSTS Costs can also be distinguished on the basis of whether they are attributed to producers (of an information service or system, for example) or users (of that service or system). User costs might be considered as offsets to benefits (that is, deducted from benefits), but that is a policy decision, not a technical decision. Some illustrative costs appear in Appendix A to give the reader a feel of the range and variety of different costs that can be included in computations.

2.8.3.6 GUIDELINES FOR COST ESTIMATING Most costs can be quantified, albeit the research effort involved may be extensive where cost accounting records are inadequate or nonexistent. Some costs defy precise quantification because:

- Their derivation from records is not easily traceable,
- Their estimation is too fraught with imponderables, or
- No commonly acceptable cost accounting standards or guideline methodology is available for making the computation.

Nevertheless, as the old saying goes, "for better or for worse, for richer or for poorer," it is necessary for project managers and analysts to make an effort at quantification. There are several essential requirements for good cost estimates. Generally self-evident, they are often violated:

- Good cost estimates depend on a reasonably complete and accurate description of the alternative. Without such a description, an estimate will contain so much undocumented guesswork that it will be virtually useless;
- The cost estimate team must have access to the alternatives team (if they are two different groups) to resolve issues that arise as the alternative document is translated into a cost structure. Again, each

resulting decision must be documented in the cost document; and

- Both the cost assumptions (prices, for example, or maintenance costs) and the cost structure (the implicit and explicit, or documented, design assumptions) must be reviewed by a group that includes the BCA analyst, the project leader, the project implementation team (if one exists at this early stage), and a budget (financially trained) person.

It cannot be overemphasized that the costing estimation exercise brings an additional level of detail to the design document and is, thus, of major importance to project managers in gaining a better understanding of project details and cost. Later, as assumptions change, it will also be much easier for key managers and budget people to understand the impact on the cost of the project.

In addition, reliable BCA cost estimation can provide the basis for the project's budget estimates that must be made later. This will only be possible, however, if the design of the cost structure is coordinated with the budget manager to arrive at a cost breakdown that can be transferred into the budget line by line. Supported by the BCA cost estimate, the project budget should be more accurate, better documented, and linked directly to the design document. As the design and budget assumptions change, the documentation should be kept up to date, providing a record of project evolution (a kind of corporate project history).

To facilitate data exchange, the original BCA cost estimates and the later budgetary estimates could both be manipulated using the same "spreadsheet" or "modeling" computer software program provided here in Part 3.

2.8.3.7 COSTING OUT THE BASELINE (CURRENT SYSTEM) As mentioned in the foregoing, in nearly all cases, there is some kind of existing system or current method of doing business, however out of date, however faulty, and however cost-ineffective it may be. Unfortunately, sometimes the existing method or system has never been documented, forcing the analysts to undertake that task as a pre-condition to moving on.

However onerous the task, estimating the costs of the existing system is the starting point of all cost calculations. Completing this task will give managers a common baseline or reference point, making it much easier to estimate the corresponding costs associated with each of the other alternatives. As mentioned earlier, without such a common baseline, analysts and decision-makers are thrown

into an "apples and oranges" situation when they try, but almost always fail, to make cross-alternative comparative evaluations of the same specific benefit or cost item.

The details of exactly how costs are further broken down into subcategories and sub-subcategories are discussed in Part 2. Suffice it to say here, by way of example, that typically in library and information infrastructure improvement projects eight major categories of inputs or costs can be identified:

- Human Factors (labour),
- Information and Communications Technologies (hardware and software),
- Systems and Processes (mixed classes of cost),
- Financial Aspects (grants, loans, guarantees, etc.),
- Plant Capacity (equipment),
- External Links and Distribution (mixed classes of cost),
- Policy and Environment (mixed classes of cost), and
- Users.

Some additional illustrative costs are identified in Appendix A to give readers a better feel of the range and variety of costs that should be considered in computations.

2.8.3.8 OTHER CONSIDERATIONS Some theorists and practitioners use the term "performance" when dealing with the cost and inputs area and the term "effectiveness" when dealing with the benefits and outputs area. In their scheme, performance is in the numerator of an equation aimed at deriving cost effectiveness, and outputs are in the denominator.

Finally, in library and information infrastructure improvement projects it is fairly typical for total costs to be shared by a number of different project sponsors (contributors), not just one sponsor. Thus, costs may need to be broken out between contributors. For example, there may be (a) a key donor contribution,

(b) one or more third-party contributions, and (c) a local contribution. Whether such a breakout of costs by contributor is required early, at the BCA stage, or is only required later as a part of the project proposal stage (after a preferred alternative is selected), is a management, not a technical, decision.

2.8.4 BENEFIT ANALYSIS

Benefits represent monetary, attributed, intrinsic, and/or relative worth, merit, usefulness, importance, and/or utility of a good, service, product, principle, item, or entity. The value of something, or the benefits of something, can be evidenced by a willingness or need to pay for, barter in exchange for, or otherwise need to use or have it available for use or other purposes (see Fig. 1–7).

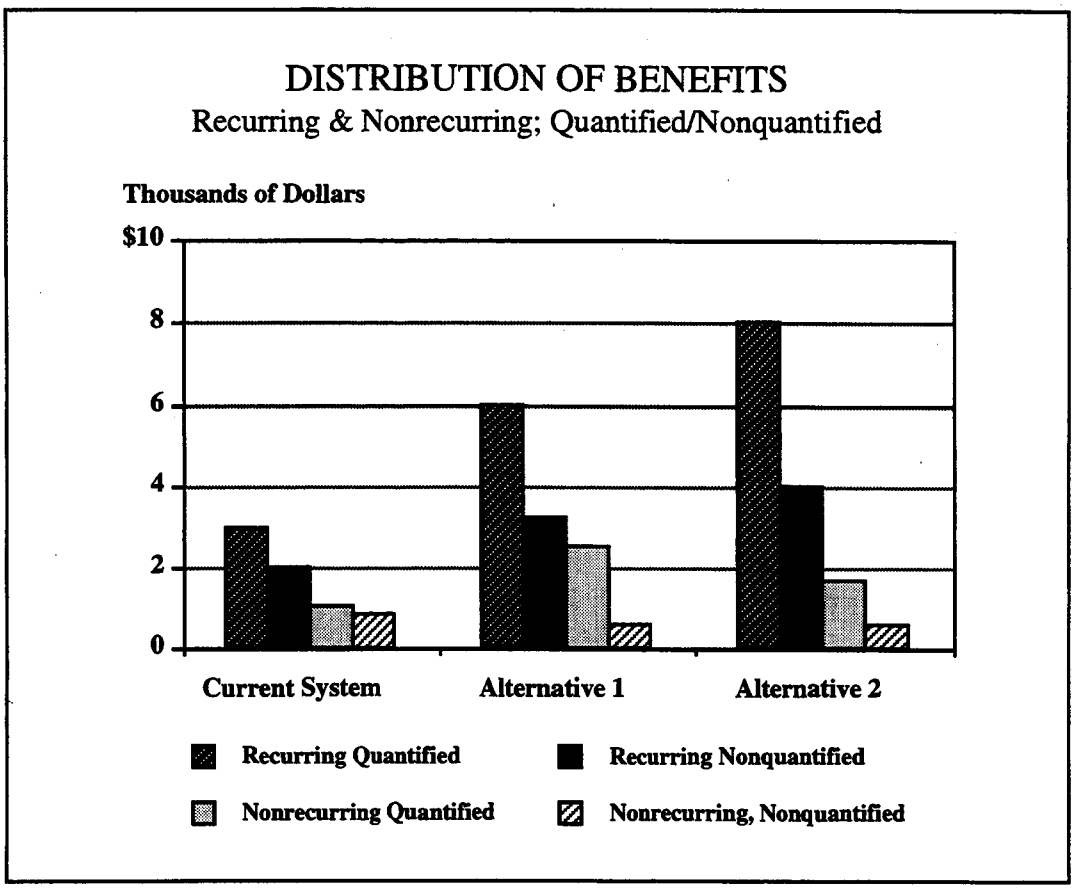

FIGURE 1–7

2.8.4.1 QUANTIFIABLE AND NONQUANTIFIABLE BENEFITS Like costs, benefits can be usefully classified in a number of useful ways for BCA purposes. For example, a very useful distinction is to differentiate between:

- Quantifiable benefits, and
- Nonquantifiable benefits.

Quantifiable benefits are those that are measurable or "countable" in some unit or another and that can ultimately be translated into monetary terms. Quantifiable benefits are thought to be "objective" in the sense that different individuals can agree on their nature and impact. But they may be subjective as well. An increase in the demand for an information product or service is usually a quantifiable benefit.

A nonquantifiable benefit is one that cannot be easily measured. It is often qualitative in nature and thought to be subjective rather than objective.

2.8.4.2 RECURRING AND NONRECURRING BENEFITS This classification includes:

- Recurring benefits, and
- Nonrecurring benefits.

A recurring benefit is one that is expected to occur repeatedly, or at least intermittently, over the life of the project. For example:

- A steady increase in the demand for an information product or service over the project's life, or at least until a level plateau is reached; and
- A steady increase in the use and reuse of information resources over the project's life, again, at least until a level plateau is reached.

A nonrecurring benefit is one that is expected to occur only once. Usually, that benefit occurs at the beginning, or early in a project, but sometimes it occurs in the middle, or even at the end, of the project:

- Value from the sale of some residual excess piece of hardware or software, and

- A one-time cost reduction (e.g., replacing a more expensive piece of equipment with a less expensive one, or a permanent reduction in the personnel level required to operate some information service).

Some additional illustrative benefits appear in Appendix B to give the reader a feel of the range and variety of different benefits that can be included in computations.

2.8.4.3 COST SAVINGS AND NEW ACTIVITIES AS BENEFITS Benefits may also be categorized according to whether or not they accrue because of:

- The undertaking of brand new activities that were never done before, or

- The cost savings that is realized because of the performing of existing activities in a more cost-effective, efficient, or economical manner.

With respect to the second category, cost savings, beneficiaries of a library and information infrastructure improvement project may enjoy benefits because of:

- Time savings,

- Improved productivity,

- Improved quality of work (fewer rejections or failures),

- Improved timeliness of work, and

- Improved morale, working conditions, etc.

2.8.4.4 OTHER BENEFIT CLASSIFICATION SCHEMES Still another useful classification of benefits is:

- Political benefits,
- Economic benefits,
- Social benefits,
- Cultural benefits, and
- Technological benefits.

The foregoing scheme is particularly useful in development settings because practitioners in that area typically think of subdividing benefits in these terms.

2.8.4.5 DISTINGUISHING QUANTIFIABLE FROM NONQUANTIFIABLE How can quantifiable benefits be realistically and credibly distinguished from nonquantifiable benefits? How can quantifiable benefits be estimated at a reasonable cost? These are the key questions BCA analysts often have difficulty answering. Fortunately, good methods to differentiate quantifiable from nonquantifiable benefits, and good methods to quantify do exist. Managers, however, may find them unfamiliar and, for some large projects, complex.

The "default" goal, to use computer jargon, is to try and quantify as many benefits as possible but, inevitably, analysts will fall short of that ideal. An oversimplified example might be the purchase of a new and more powerful mainframe computer that requires fewer people, less environmental conditioning (cooling, electrical, etc.), and allows work previously contracted out to be done in-house.

Life is seldom so accommodating! More often, a library and information project, or any other project for that matter, provides new or additional services and requires, or promotes, new ways of doing old jobs. Benefits become subjective to a greater or lesser degree: How much faster can a database search be completed? How much is that worth? What is the benefit of a new information service that never existed before, and how can it be quantified when there are few, if any, yardsticks against which to compare its worth?

The difficulty is compounded because new systems often promote new ways of working that are not only difficult to measure, they are difficult to even foresee with any clarity. This is only one of the areas where BCA requires experience, imagination, and the participation of the people who will be using the system. Office automation projects, for example, are classic examples of this kind of problem.

The idealized method for measuring benefits would:

- Have a good theoretical foundation; that is, should be based on an idea that can be shown to work;
- Be reasonably simple and cheap to apply; and
- Be credible, hopefully by appealing intuitively to the common sense of the targeted audiences.

Trade-offs must always be made among these objectives. Although project managers will often delegate the BCA itself to more junior professionals, they should be involved in the choice of approach because that choice will have an important effect on the cost and credibility of the study.

Benefits that fall under the heading of production or productivity improvements, simplification of a process or procedure, or automation of a process or system that was previously operated in a manual fashion, quality control methods, and accuracy and precision improvements are much easier to quantify than are benefits that fall under the headings of improving morale, product or service quality, product reliability, increased safety, tightened security, human versatility, or replacing "lower order tasks" with "higher order tasks" (i.e., tasks that are more intellectually intensive and require greater professional competencies, knowledges, and skills).

Nevertheless, Part 2 of this publication does offer a sampling of different methods and techniques for distinguishing quantifiable from nonquantifiable benefits and estimating the benefits.

2.8.4.6 THE DELPHI METHOD When no fully acceptable alternative way of estimating benefits seems available, it is often quite useful to explore using the "Delphi Method." A layperson's definition of that technique is the pooling of expert (experienced) opinion. In such instances, a group of different stakeholders

(e.g., information providers, information intermediaries, information users, and sometimes information managers or owners) are brought together and are asked, in a rigorously controlled manner, to give their opinion as to whether or not an alleged benefit is, in their view, a "real" benefit. If they claim it is, they are asked to make an estimate (or give a range) of "how much they think it is worth" in terms of saved time, cost, etc. This technique is fully explained in Part 2 and in Appendix H.

2.9 EVALUATING ALTERNATIVES

Once the benefits and costs for each alternative have been determined, the alternatives must be evaluated and compared. Because money has a "time value," it is necessary to express them in terms of the present value (PV). In library and information infrastructure improvement projects it is also useful at this stage to prepare a variety of matrices that juxtapose benefits as outputs with costs as inputs. Sometimes such a matrix is called an "input-output" matrix, but it could just as well be called a "benefit:cost" matrix (see Fig. 1–8). Note the way such matrices should be viewed and used. For a given library and information infrastructure improvement project, the inputs (costs) would be identified along the left or stub column, and the outputs (benefits) would be arrayed across the top row as column headers.

Then the relationship or correlation between a given input and a given output is shown in the "cells" or "intersections" as they are sometimes called. One simple kind of relationship or correlation that could be shown would be the strength of the relationship. For example, a simple 5-point scale of "the strength of input–output relationships" might be:

- Weak (correlation)
- Below average
- Average
- Above average
- Strong

INPUT – OUTPUT MATRIX

Step Three: Estimate the strength of the input – output relationship using the 1 – 5 scoring range

INPUT FACTOR AREAS	MAJOR OUTPUT BENEFIT AREAS									
	Political		Economic		Social		Cultural		Technological	
	Quan	Qual	Quan	Qual	Quan	Qual	Quan	Qual	Quan	Qual
Human	3		3			5		4		
Info/Com Tech									4	
Systems & Proc.			2	3	3	3	2	3		
Financial			5	2						
Plant Capacity			3	4					5	4
Ext. Links $ Distrib.		4	1	2	2	1	2	3		
Policy & Environ.	4	5	3	3	3	2	2	3	3	3
Financial			4	2	5	2	5	3	3	3

FIGURE 1–8

The details of this technique are further elaborated in Part 2. It may also be useful to rank order the preference for alternatives considered, and document reasons why. In that way, should an unforeseen contingency arise that precludes adopting the preferred alternative, the project director and analysts are in a better fallback position to select the next most desirable alternative.

2.9.1 PRESENT VALUE (PV)

Present value is a method that allows us to add the annual benefits and costs of a project over a period of years while taking into account the time value of money. In financial terms, this is called discounting.

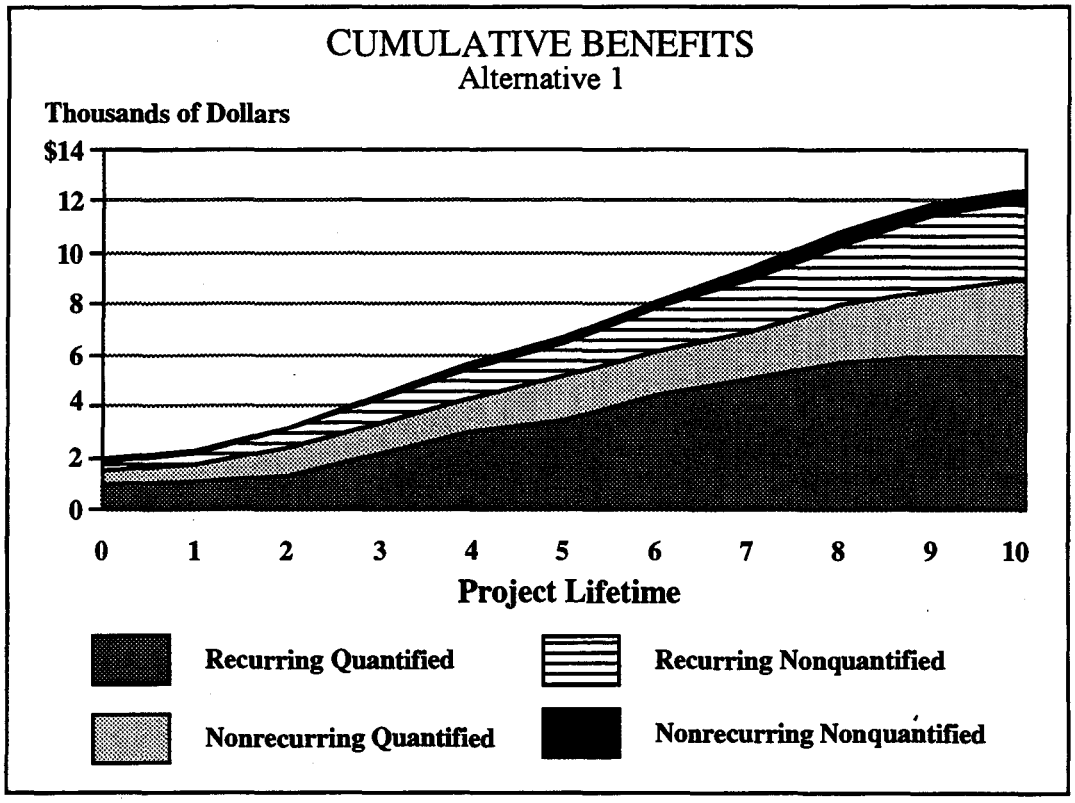

FIGURE 1–9

For example, it is better to inherit $10,000 from Uncle Joe today than in 10 years. If the money were received today, it could be invested, become productive, and earn interest over the 10-year period (see Fig. 1–9, $2,000 vs $10,000). Because money is worth different amounts depending on when it is saved or spent, some method must be found to sum up money from different time periods. "Present value" is a widely accepted method used for this purpose. The PV approach is applied as follows.

Take today's cost as the norm (or present value) and reduce the costs of future years by a "discount factor" based on an estimated time value of money (often also called the interest rate). Apply this method to each year's benefits and costs and sum the resulting amounts to determine the total benefits and costs for the project life cycle. The specific discount rate that a sponsor or lender uses is a matter of policy, and may vary depending on various criteria associated with a given policy. Discount rates are not the result of some kind of mathematical modeling computation wherein dollar values are fed into an equation. Obviously,

discount rates used by a particular developing country or development-assistance agencies like commercial interest rates, depend on many considerations, including general economic conditions.

Some governments require a specific return on investment (or discount rate) be realized for all public projects, including development projects. For example, the U.S. government has for years required a rate of 10% (which is the same as showing a positive new present value using a 10% discount rate). At first glance, the process appears more complex than it really is.

Discount factors for each year are available for different interest rates in standard texts (and in Part 2 of this publication). With the discount factors at hand, the problem reduces to a spreadsheet exercise in multiplication and addition.

Managers will need to understand present value to read BCAs. Once the concept is grasped, the mechanics will seem straightforward (see Fig. 1–10).

PRESENT VALUE CALCULATION ILLUSTRATION

Year since initiation/ expansion	Expected yearly cost	Expected yearly benefit	Discount factor for 10%	Present value cost	Present value benefit
(1)	(2)	(3)	(4)	(5)	(6)
1	$10	$0	0.909	$9.1	$0.0
2	20	0	0.826	16.5	0.0
3	30	5	0.751	22.5	3.8
4	30	10	0.683	20.5	6.8
5	20	30	0.621	12.4	18.6
6	10	40	0.564	5.6	22.6
7	5	40	0.513	2.6	20.5
8	5	40	0.467	2.3	18.7
9	5	40	0.424	2.1	17.0
10	5	25	0.386	1.9	9.7
				$95.5	$117.7

FIGURE 1–10

In Fig. 1–10, assume a 10-year project that will commit the sponsoring agency to the stream of expenditures appearing in column (2) of the table, and that will result in a series of benefits appearing in column (3). A discount factor for a 10% discount rate is presented in column (4). Present value cost for each of the 10 years is calculated by multiplying column (2) by column (4), present value benefit for each of the 10 years is calculated by multiplying column (3) by column (4). Present value costs and benefits are presented in columns (5) and (6), respectively.

There is another important pitfall here that project managers and analysts must be aware of. Quite often one finds that the economic payback period for return on the initial investment for a particular alternative is longer (e.g., 30 years) than the expected physical system lifetime (e.g., only 10 years)! Obviously, in that event, the alternative, except under unusual mitigating circumstances, should probably be disqualified. The payback period, or at least the breakeven point, must occur before the system is expected to break down or begin to degrade, or the project does not make sense.

2.9.2 Net Present Value (NPV)

The first comparison of alternatives is done by ranking them according to their net present value (NPV). The NPV is calculated by subtracting the total present value cost from the total present value benefit of the project. The higher an alternative's positive NPV, the more its benefits exceed its costs.

From the point of view of economic analysis, the alternative with the highest NPV is frequently the most desirable. Sometimes, however, that may not be the appropriate decision.

Other important considerations, such as different nonquantifiable benefits, large initial cash outlays, budgetary constraints, labour restrictions, and, yes, political considerations, may require selection of an alternative that does not have the highest NPV. In these situations, the alternative NPVs serve to establish a preliminary ranking of the choices.

There are a number of supplementary analytical techniques available to project managers that are only briefly overviewed here. It is to be emphasized that these techniques are optional and are used in special circumstances.

2.9.3 BENEFIT:COST RATIO (BCR)

A second technique to evaluate alternatives is the benefit:cost ratio (BCR). The BCR is the present value benefits divided by the present value costs. The BCR provides a measure of the benefits obtained per dollar spent. It is particularly useful when comparing alternatives with unequal costs, unequal benefits, and unequal life cycles. BCR is a measure of the return relative to the size of the investment expense. BCR does not allow comparison of the magnitude of the returns from several alternatives. I have mentioned earlier several times that sometimes economic analysis techniques, measures, or ratios other than BCA and the determination of a simple BCR may be appropriate, either in lieu of or, more commonly, in addition to using the BCA and computing a BCR. Some of these techniques, measures, and ratios follow.

2.9.4 UNIFORM ANNUAL COST (UAC)

A third technique to evaluate alternatives is the uniform annual cost (UAC). This technique is particularly useful when comparing alternatives with unequal costs, equal benefits, and unequal life cycles by annualizing costs. Like BCR, UAC does not allow comparison of the magnitude of the returns from several alternatives.

2.9.5 SAVINGS/INVESTMENT RATIO (SIR)

A fourth technique to evaluate alternatives compares one or more alternatives to a defined status quo. The costs may or may not be equal, the benefits are equal, and the economic lives are equal in length. The technique involves computing a savings/investment ratio to determine the degree of financial benefit attained from that alternative. Because savings are a necessary ingredient, this technique can only be used when there is a status quo.

2.9.6 DISCOUNTED PAYBACK ANALYSIS (DPA)

A fifth technique also compares an alternative to a defined status quo. The costs may or may not be equal, the benefits are equal and the economic lives are equal. The technique involves computing an investment/savings ratio to determine the elapsed time between the point of initial investment and the point at which the payback on the initial investment occurs. Because savings are a necessary ingredient, this technique can only be used when there is a status quo.

2.9.7 BREAKEVEN ANALYSIS (BEA)

A sixth technique is used to evaluate alternatives with costs that may or may not be equal, equal benefits and equal economic lives. This technique involves finding the point at which the alternatives have equivalent costs.

2.9.8 SENSITIVITY ANALYSIS (SA)

Finally, a seventh technique, sensitivity analysis, involves examining the assumptions of a BCA to determine their effects and influence on the final recommendations. This technique is so commonplace that instead of calling it a supplemental technique, I have included it as the seventh step in the overall 10-step BCA methodology.

Today's powerful automated modeling tools and spreadsheets have put this type of analysis within easy reach of every personal computer and every manager. Sensitivity analysis is useful in answering "what if" kinds of questions.

The essence of the procedure is to take an important assumption and vary it to observe the total effect on project costs or benefits ("what would happen if . . ."). For example, a project cost estimate that assumes the project will require five computer room personnel. Personnel costs are repetitive. Over the life cycle of the project, they continue to add up. We could use sensitivity analysis here to determine the effect on the total costs of the system assuming two, three, or four personnel. One possible trade-off might be between more personnel (a recurring cost) and more expensive equipment (a nonrecurring cost).

The value of this type of analysis to managers, design engineers, etc., should be evident. The technique can be very powerful, but it requires realistic costing, and thus depends directly on the active participation of managers and other team members who guide the target assumptions and act on the consequences.

In all of these techniques, present value analysis is performed to establish a preliminary ranking of alternatives based on both actual and discounted costs. Then one or more of the techniques described in the preceding paragraphs is used to analyze each alternative further. Taken together, this toolkit of techniques offers the analyst a solid, defensible basis upon which to make a recommendation for a preferred alternative.

Note that for every technique except UAC, the economic lives of alternatives must be equal or placed on equal terms (e.g., by annualizing or normalizing). Methods to accomplish equalization of economic or service lives are discussed in Part 2.

Before leaving this section, we should call attention to the fact that several additional economic analysis techniques are available to the analyst, but they go beyond the scope of our discussions here. Analysts should consult other sources. These other methods include the Hedonic Wage Model, Work Profile Analysis, Common Staffing System (CSS), Introspect, and the Kayak Project technique.

One final postscript to this section. Depending on how fine-tuned and complex the scope of the BCA selected, project managers may also wish to consider the residual value of certain "costs" as an offset or deduction to total costs. When residual value computations are included, the residual value of assets expected to be on hand at the end of the system life cycle must be treated as an offset or reduction to costs in order to obtain an accurate picture of the true costs. Technically speaking, in the convention of BCA methodology, an offset to costs arising from the deduction of the residual value of leftover, useful assets, is not the same thing as a "benefit," although, in the end, the final outcome amounts to the same thing. The eighth step in the BCA methodology is presenting results to management.

2.10 PRESENTING RESULTS

Once completed, the BCA should be presented, insofar as possible, in a standardized manner (see alternative formats for the BCA report in Part 2). This approach organizes the findings, conclusions, and recommendations in a familiar way and ensures that all important issues have been addressed. Most clients wish to see a draft report at this stage so that they can provide feedback to the BCA team.

But, ideally, presentation should first take the form of one or more oral briefings of preliminary findings, assumptions, constraints, and alternatives to give officials an opportunity to feed back their reactions. Perhaps they are aware of a policy constraint that was omitted from the original instructions. Or, perhaps some assumption has now come to light that had been hidden.

Then there is the question of whether the oral briefing should be given advance billing as an "information only" briefing or a decision-making meeting. Remember, the BCA itself does not make the final recommendation of the preferred alternative, management does! That means that the information shared with the officials and managers being briefed is a way of educating them as to the facts and how the findings and conclusions were drawn.

Project directors, analysts, and others who have been concerned with conducting the BCA should consider several levels of oral briefings. For example, it is often helpful to have a short, 30-minute briefing for the top-level official(s) and key assistants. The top-level briefing should avoid, for the most part, the details of the "how" of the BCA methodology and get directly to the core of the "what" and "why" of the matter.

This top-level briefing may be supplemented by a 1- or 2-hour briefing for middle-level officials that gets into greater detail. As a matter of tactics, it may be better to schedule the mid- and lower level meetings first so that any "surprises" are ferreted out before the top-level officials are brought into the picture.

Some old hands at this like to schedule a dry run, a dress rehearsal, in front of "friends of the court," individuals who are friendly but who promise to be constructively critical in their feedback and play the devil's advocate role. Such a dry run would precede the mid- and top-level briefings.

Graphics can be very helpful in oral briefings (see Figs. 1–7, 1–8, and 1–9 for some illustrative formats).

The ninth step in the 10-step BCA methodology is recommending a preferred alternative. This action is performed by management, not by the BCA team.

2.11 RECOMMENDING A PREFERRED ALTERNATIVE

A final BCA set of hypothetical results appears in Fig. 1–11 under the heading "Comparison of Alternatives." The obvious decision rule for making an economic choice between several alternatives is to select the alternative with the lowest present value that is technically, operationally, and politically feasible. Sometimes, however, that may not be the "correct" (dare we say wisest) decision.

COMPARISON OF ALTERNATIVES
(in hundreds of thousands)

	Existing System	Alternative 1	Alternative 2
Costs (pres. value)	$175	$245	$217
Benefits (pres. value)	$ 60	$296	$ 80
Net present value	($115)	$ 51	($137)
Breakeven point	N/A	1997	Not achieved
Benefit:cost ratio	0.3:1	1.2:1	0.4:1
Payback	N/A	$181	($144)

FIGURE 1–11

Mitigating factors, such as widely differing kinds of benefits that seem almost irreconcilable, large initial cost outlays, budgetary constraints, staffing restrictions, or other factors, may dictate that the lowest cost alternative not be selected.

Here, the alternatives' costs serve only to establish a preliminary ranking of alternatives. Next, any of the seven supplementary techniques identified above (e.g., benefit:cost ratio, discounted payback analysis, etc.) may be applied to help reach a decision. The analyst must remember to apply a technique only when conditions permit, e.g., a status quo is required to compute a savings/investment ratio. Only the benefit:cost is required. This additional analysis, combined with the cost figures, and a final consideration of mitigating factors, helps point the way for officials to a final decision of a preferred alternative.

Finally, bear in mind that the mathematics result in only one kind of measure to help make the final selection of a preferred alternative. Other considerations that commonly come into play include:

- Capacity for expansion, augmentation, and upgrading. Beware of "solutions" that must be completely discarded before a new one can be put in its place, modularity is usually a virtue, even if a price is paid for it;

- Acceptable minimum performance times, regardless of cost;

- Simplicity, user friendliness, and ease of learning. Even if a certain

alternative is mathematically demonstrated to be the most cost effective, it may be so complicated as to preclude adoption; and

- Technical support reliability; vendors, and other technical backstopping companies/groups must be able to show that they can continue to provide a reliable level of support over the required project life.

Finally, we come to the tenth and last step in the BCA methodology, implementing the selected alternative.

2.12 IMPLEMENTING THE SELECTED ALTERNATIVE

The final step in the BCA methodology involves the finalization of the BCA report, documenting the entire process, and containing findings, conclusions, and recommendations. Part 2 contains the details of both the format and content of the final BCA report.

Next comes the development of a plan to implement the chosen alternative. Remember, alternatives that were considered for the most part do not get into the details of implementation because that would have been considered presumptuous, premature, and a waste of time and cost. Now, however, it is imperative that a master and subsidiary timetables be prepared, purchase or lease decisions be addressed for equipment or property, delivery and testing be considered, and so forth. PERT and GANTT charts are often useful for this purpose, and there is a useful body of literature dealing with scheduling, the critical path methodology and related facets.

3.0 OTHER CONSIDERATIONS

There are considerations relevant to any economic analysis that transcend purely mathematical, quantitative, statistical, or analytical considerations. We touched on political considerations in the preceding text, but there are other aspects of the decision-making task that need to be briefly addressed, not so much because of their direct relevancy to our purposes here but to ensure that project managers and BCA analysts know how to deal with them, if at all, in the context of analysis.

3.1 BURDENS VERSUS COSTS

The costs of implementing a library and information infrastructure improvement project, in the broadest sense, are not all economic or quantitative. Sometimes, the burdens that are imposed on individuals and organizations are not so much economic as they are social, cultural, and psychological. Individuals can put up barriers to implementing a project that are just as real, and even more "costly," than are economic costs.

For example, when a government asks its citizens to fill out forms, keep records, prepare reports that must be periodically submitted, and comply with complex procedures and rules or else submit to fines, penalties, and other punishments, this "hassle factor" as it might be called, if excessive, is just as real and just as "costly" to the citizen or business as the direct economic costs of buying pencils, paper, computers, and filing cabinets are. Yet this impact is not often identified, much less quantified, as a "cost" in the formal sense used in this guide.

Project sponsors and analysts are admonished to consider such burdens if they are felt to be significant, even if they are placed under a "nonquantifiable" cost heading. In that way, decision-makers who must consider the alternatives are in a position to get a much more complete picture of not just the economic costs but the burdens and costs together.

The situation on the other side of the ledger is somewhat easier. That is, we are all inclined to think much harder about the expected values of a project, if for no other reason than we consciously or subconsciously want to present the best possible case for adopting a preferred alternative. But when it comes to

burdens of paperwork and red tape we tend to ignore the costs involved there because we may believe "it is a citizen's duty to comply with government rules and regulations, and they should not complain about it, especially if they are applying for some kind of entitlement!"

3.2 SOCIOCULTURAL BARRIERS

Another kind of "hidden cost" is a cultural barrier that may frustrate, or sometimes even become openly hostile to, an intended project implementation. Cultural barriers are rarely considered in formal BCAs. Sometimes one sees a vague reference to "resistance to change," but the enlightened project manager or analyst will try to identify cultural barriers that may be just as real a cost as a piece of equipment or the cost of a labour hour.

What are examples of sociocultural barriers?

They can take the form of religious, ethnic, racial, or gender practices and beliefs, as well as mores and belief systems and value systems relating to the individual, the group, a society, or an entire nation-state. Language is often the most visible cultural barrier in development projects, but it is less often overlooked than some of the other barriers, such as equality of access and barriers to access to information or government benefits, and the perceptions of various stakeholder audiences as to what exactly the benefits and costs of a given library and information project are to them.

3.3 ORGANIZATIONAL CULTURAL BARRIERS

Yet another kind of barrier has to do with resistance to change in companies, government agencies, and other kinds of public and private enterprises. This type of barrier is different from sociocultural barriers, although there are some obvious similarities. Job security, seniority, status, rewards, and punishments, all come into play when new capabilities are put into place or old ones are upgraded. Too often project sponsors and managers are unmindful of the very serious impacts such factors can have. Do they have a place in benefit:cost analysis? Yes, in the sense that they, too, are a kind of "burden" or "cost" that, although difficult if not impossible to quantify, are no less real. It is, therefore, very important that planners take the possibility of organizational cultures into account when planning projects.

3.4 EXTERNALITIES

The economist defines externalities as "side effects," often unintended, from doing something (e.g., implementing a library and information infrastructure improvement project) on participants who are not directly involved in the effort itself (they are "external players" as opposed to the "internal players"). Another definition is that externalities are benefits (or injuries) from producing or consuming that accrue to others than the producers or consumers and are, therefore, not reflected in the prices charged or paid (see Machlup 1979, in Appendix D).

The concept of externalities is important to BCA in terms of the difficulties in trying to circumscribe both the final cost and the final benefit lists. In plain English: "How far can and should we go in including unintended or poorly foreseen side effects from implementing a project in our computations and analysis?"

On the benefit side of the equation, we could risk artificially exaggerating and inflating our benefits estimation if we included side effect benefits that only remotely could be traced in a causal way to our project. On the cost side of the equation, we could risk artificially exaggerating and inflating our costs estimation if we included side effect costs that, similarly, could only tenuously be connected to the project.

Common sense, once again, must reign. The "reasonable person" test may be helpful here: Would a reasonable individual think of a cause–effect relationship between the externality being considered? If yes, include the item. If not, leave it out.

PART 2: TECHNICAL GUIDE

1.0 INTRODUCTION

1.1 THREE-PART BENEFIT:COST ANALYSIS VOLUME

This Technical Guide is the second of a three-part integrated volume published by the International Development Research Centre (IDRC) in the area of benefit:cost analysis (BCA) applied to library and information infrastructure improvement projects. The first part of the volume is a Management Guide designed to increase the general level of awareness of higher level policy and management officials to the concept of BCA, why it is important as an economic analysis tool, both its opportunities and its limitations, and what its major component elements are.

The third part of the volume is the Computer Software Guide and includes accompanying software on a floppy diskette. It is designed to assist users in performing the detailed benefit and cost calculations, including the calculation of a breakeven point, the calculation of a benefit:cost ratio, a payback period, and other benchmarks associated with benefit:cost analysis. The type of software (Excel) provided is commonly called "spreadsheet" software. Appendixes are placed at the end of Part 3.

Part 2 is primarily directed at the technical staffs in developing countries who must prepare for, conduct, and present analyses methods and results to higher level management and policy-level officials. The two primary target audiences for Part 2 are the operational project directors and managers, and the technical specialists who will actually undertake the detailed benefit:cost analyses.

This three-part, integrated volume is intended primarily for developing-country officials, whether they be in social and economic development ministries and agencies, general oversight government ministries, or in the library and information agencies and institutions themselves. This BCA publication may also be useful to donor agencies and to external organizations and institutions, apart from developing countries themselves, interested in economic analysis techniques

applied to social and economic development programs and projects. More specifically, the material may be of secondary benefit to:

- Development-assistance agencies, ministries, or other institutions in donor countries;
- International, regional, or local development institutions;
- Other interested audiences (e.g., research and academic communities, philanthropic foundations);
- Organizations working in other sectors (e.g., library and information, health, agriculture, transportation, environmental protection); and
- Project sponsors and cocontributors.

Part 2 contains the technical detail necessary for project managers and benefit:cost analysts to undertake a detailed BCA. It concentrates on revealing how the BCA methodology actually works, and how it can be applied, whereas the first part explains what BCA is and why it is important, its contexts, its limitations and potential pitfalls, and so on.

Although a certain amount of overlap is inevitable and, we believe desirable, the first two parts are intended to be complementary and "stand alone." But they are linked in both format and content by cross-referencing. Certain key officials, such as project directors, will find it necessary to become familiar with the contents of all three parts.

1.2 WHAT IS BENEFIT:COST ANALYSIS?

See Part 1 for a discussion of what BCA is and why it is needed.

1.3 WHAT ARE THE DIFFERENT KINDS OF ANALYSIS?

As mentioned in Part 1 (readers may want to review the corresponding material before proceeding), there are generally four options open to officials for

undertaking an analysis. The determination as to which of the four options is the most appropriate, given a set of certain circumstances, is the very first step in benefit:cost analysis:

Level One BCA:	**No Analysis recommended**
Level Two BCA:	**Feasibility Study only recommended**
Level Three BCA:	**Abbreviated Study recommended**
Level Four BCA:	**Detailed Study recommended**

Project managers and benefit:cost technicians should study the descriptions for each of the four alternatives as they appear in Part 1. The material here is intended to supplement, clarify, and elaborate upon the material in Part 1, not duplicate it. Except for the brief description of each of the four BCA options suggested, therefore, the material included in this part concentrates on how to implement the tasks involved in each step, not under what conditions they should be used. The first step, determining the most appropriate kind of analysis required, was covered in sufficient depth in Section 2 of Part 1 and is, therefore, not repeated here.

1.3.1 LEVEL ONE (NO FORMAL ANALYSIS RECOMMENDED)

Just because management and policy-level officials have determined that no formal BCA is required does not mean that project directors and analysts have nothing to do! Project proposal documentation still must contain the following information, which, in our BCA methodological terms, amounts to the first four steps on the overall procedure outlined in Part 1, plus steps 8, 9, and 10.

Thus, the following six steps must still be carried out even though no formal analysis is required (the step numbering scheme used in Part 1 is preserved here for ease of cross-reference):

STEP NO.	STEP DESCRIPTION
2.	Defining goal(s) and objective(s),
3.	Formulating assumptions,
4.	Identifying alternatives,
8.	Presenting results,
9.	Recommending a preferred alternative, and
10.	Implementing the selected alternative.

The procedures for the foregoing steps are, for the most part, already outlined in sufficient detail in Part 1. Additional guidance, however, is included in following sections on each of these steps.

1.3.2 LEVEL TWO (FEASIBILITY STUDY ONLY)

Again, as in the case of the preceding alternative, if management and policy-level officials determine that a Feasibility Study is the most appropriate recourse, then project directors and analysts must undertake the same six "nonquantitative" steps:

STEP NO.	STEP DESCRIPTION
2.	Defining goal(s) and objective(s),
3.	Formulating assumptions,
4.	Identifying alternatives,
8.	Presenting results,
9.	Recommending a preferred alternative, and
10.	Implementing the selected alternative.

The main difference between the level of detail required here in the Feasibility Study, versus that required in the No Formal Analysis option, lies in step 4, identifying alternatives, step 9, recommending a preferred alternative, and step 10, implementing the selected alternative. Additional guidance is provided in following sections on each of these steps.

1.3.3 LEVEL THREE (ABBREVIATED STUDY RECOMMENDED)

Here all nine of the steps following the determination of the most appropriate kinds of analysis required are required:

STEP NO.	STEP DESCRIPTION
2.	Defining goal(s) and objective(s),
3.	Formulating assumptions,
4.	Identifying alternatives,
5.	Estimating benefits and costs,
6.	Evaluating alternatives,
7.	Testing sensitivity of the analysis to uncertainties,
8.	Presenting results,
9.	Recommending a preferred alternative, and
10.	Implementing the selected alternative.

Here, mathematical calculations to compute the costs and benefits, and the various other alternatives evaluation measures such as the benefit:cost ratio, break-even point, and payback period are all an integral part of the analysis, and the computer software package provided in Part 3 should be very helpful. Additional guidance on each of these steps is contained in the following sections.

1.3.4 LEVEL FOUR (DETAILED STUDY RECOMMENDED)

Again, all nine of the steps following the determination of the most appropriate kinds of analysis required are required:

STEP NO.	STEP DESCRIPTION
2.	Defining goal(s) and objective(s),
3.	Formulating assumptions,
4.	Identifying alternatives,
5.	Estimating the benefits and costs,
6.	Evaluating alternatives,
7.	Testing sensitivity of the analysis to uncertainties,
8.	Presenting the results,
9.	Recommending a preferred alternative, and
10.	Implementing the selected alternative.

Here, mathematical computations to compute costs and benefits, the break-even point, the payback period and various other alternatives evaluation measures, are an integral part of the analysis. For both the Abbreviated Study and the Detailed Study, use of the spreadsheet computer software package specially developed by IDRC using the popular Excel 3 for Windows QuickStart provided in Part 3 may be productively employed to facilitate the "number crunching."

Additional guidance on each of the above steps is contained in the following sections.

1.4 How Part 2 is Structured

The main contents of Part 2 of this three-part volume are organized to correspond with the 10-step framework used in the overall BCA methodology, because this framework is common to all of the steps used in all four of the kinds of analysis (except step 1, determination of what type of BCA is most appropriate). The central differences in the text treatment of each of the 10 steps in Parts 1 and 2 lie (a) in the point of view and (b) in the level of detail. In Part 1, the point of view is "what is the step, and why is it important," and the level of detail is modest. In Part 2, the point of view is "how can the step be implemented" and the level of detail is greater. Thus, estimating costs is one of the 10 steps addressed in Part 1, and is also a major section in the following material, but the difference in approach is in the attention to how costs can be estimated rather than why estimating costs is important and where it fits in the overall BCA algorithm.

In the discussion dealing with each of the 10 steps involved in the overall methodological framework, there is reference to a "do's and don'ts checklist" for the first six steps (which tend to be the most complicated ones). This is intended to serve as a summary, bird's-eye view of the do's and don'ts the analyst should keep in mind.

So as not to overload the main text with too much material, these checklists are included as appendices at the end of the text. Analysts and other readers may find it useful to flip back to the corresponding checklist appendix after they finish reading the material in the main body of the text.

Finally, we use several case examples to demonstrate how the methodology can be applied to actual library and information infrastructure improvement projects. These examples are in the appendices. Although the examples are hypothetical, they are, nevertheless, based on a careful study of several actual social and economic development projects. In short, these case examples are as realistic as possible given that they are illustrative. The BCA methodology prescribed here may not be followed precisely in these case examples, but the main components are addressed.

The first case example involves the development of a hypothetical national information database and information system in a developing country to assist professional health care practitioners, scientific researchers, the media, and the general public to deal more effectively with a very critical health problem now

affecting virtually every region and country of the world — AIDS (Acquired Immune Deficiency Syndrome). This example is depicted in Appendix E.

The second case example involves the development of a microcomputer-based geographical information system (GIS) for local decision-makers to use in retrieving and manipulating census variables for user-defined areas, down to the smallest census area (e.g., city blocks). This example is depicted in Appendix F.

A third case example (Appendix G) deals with the challenge of selecting appropriate communications media alternatives, especially when modern office automation methods are being introduced into an information use environment for the first time.

Finally, a fourth case example (Appendix H) addresses a specialized technique called the "Delphi Method," and shows how that method can be applied to estimating benefits when quantifiable measures are impractical or virtually impossible to find or derive.

Throughout the text, reference to these case examples is woven into the discussions at strategic points to give concepts and points more substance and reality.

2.0 DEFINING GOALS AND OBJECTIVES

NOTE: Remember that step 1, determining which of the four options or "levels" of analysis is required, is covered in Part 1.

Applicability of this step to the four BCA options:

	No BCA	Feasibility Study	Abbreviated Analysis	Detailed Analysis
2. Defining Goals and Objectives	YES	YES	YES	YES

As we emphasized in Part One, there is a distinction between goals and objectives, even though in everyday parlance the two terms are often used interchangeably. Goals are long-term results or outcomes we hope to bring about by implementing a project successfully. Sometimes goals, in a literal sense, are never actually achieved (at least 100%), although project planners and sponsors fervently hoped at the beginning that they should be, and could be, and might be.

By contrast, goals are not concrete, tangible outputs. Certainly, goals are not inputs (except perhaps in the much broader, societal evolutionary sense). Both goals and objectives should be achievable, feasible, practical, and measurable, at least in general terms.

Cracknell and Rednall, in a 1986 report issued by their parent organization, the Overseas Development Administration (ODA), examined how the ODA could improve the effectiveness of its bilateral aid projects and programs by strengthening the setting of objectives and by more widespread use of performance targets and output measures. One of the central recommendations these investigators recommended was the adoption of the so-called Logical Framework Approach (LFA) to project appraisal, design and management, a technique they assert was originally introduced by the U.S. Agency for International Development (USAID) and already (by 1986) extensively in use (although modified) in Canada, some

U.N. agencies, some international and regional development banks, and several bilateral donors including the Federal German Aid Ministry and its counterparts in Australia, Belgium, Finland, and Sweden.

In the LFA, there is a front-end emphasis on seeing every project as "more than a package of inputs and outputs" but, rather, as a "problem that has to be solved," including its causes, before the most effective means of solving the problem should be identified and alternatives considered. LFA also contemplates establishing goals and objectives in an interconnected, hierarchical fashion, similar to that envisioned by a popular management technique called "Management by Objectives" (MBO) that was originally introduced in the 1950s and is still with us, albeit in the form of a fourth or fifth iteration.

Here we use some of the aspects of the LFA, as well as MBO, but try to simplify and streamline the material and then adapt it to our purposes. We certainly do not wish to put ourselves in the position of champions or advocates of the original LFA, or of MBO, but, rather, wish the material to be regarded by analysts as practical. Project sponsors and managers wishing to review the LFA technique (or even the much earlier MBO technique) in depth are directed to the literature base, beginning with the Cracknell and Rednall report (see Appendix D).

2.1 GOALS

2.1.1 DEFINING GOALS

As we said earlier, goals are long-term changes for the better that we hope to bring about to solve, or at least substantially ameliorate, some chronic problem in any development sector: health, education, transportation infrastructure, agriculture, or information services.

In our terms, a goal is more than just a "wider" or "higher" or "larger" objective, as some commentators have suggested, in an ordered, hierarchical set of goals/objectives/outputs/inputs statements relationships. Goals are the articulated ends, the changes, the outcomes, the purposes, whereas objectives are the articulated intermediate means to those ends. Objectives are stepping stones that we must first pass by to reach the treasured goals at the end of the rainbow.

Moving down the hierarchical tree another notch, outputs are then the next lower stepping stone. Outputs must be achieved before objectives can be achieved. Finally, inputs are at the base of the pyramid. Inputs must be consumed before outputs can be produced (see Fig. 1–1).

2.1.2 STEP-WISE METHODOLOGY FOR DEFINING GOALS

1. Study background documents relating to the problem to be solved; this material may be only partially procurable in the form of formal documents made available to project sponsors and project directors, and a much broader literature search may be required, including the search for some gray literature on the history of the problem and the project.

2. Conduct interviews with knowledgeable officials in both the public and the private sectors, who have special knowledge and expertise of the problem to be solved. Sometimes such individuals are public policy officials, but they are also found in the private sector, academia, the media, various kinds of consultancy firms, think tanks, other kinds of institutions.

3. Examine related projects that may have been undertaken in the past with the same or similar goals and objectives. Sometimes there are valuable lessons that can be learned from both what went right and what went wrong with related projects.

4. Subdivide the overall problem into manageable subproblems. This subdivision may well carry over into the structuring of the discrete project entities themselves. Thus, an overall, rather ill-defined initial problem may end up being subdivided into two, three, or even more discrete subproblems, each of which may take the final form of a separate project, perhaps with separate phasing.

5. Articulate at least one goal, but no more than six, for the project as a whole. The average number of manageable goals for a given project tends to be around two or three.

2.1.3 EXAMPLES OF GOAL STATEMENTS

Here are some illustrative examples of goal statements, deliberately drawn from a variety of social and economic development spheres, not just from information projects:

- To put in place a national railway system interconnecting the country's major commercial hubs and the national capital, with the first major transportation link operating in no less than 3 years from the date of project approval and funding, and the last link operating in no less than 15 years.

- To increase crop production yields for rice (or corn or some other staple commodity that is a country's major foreign exchange earner) by 10% in 2 years from the date or project approval and funding, and by 20% in 10 years.

- To train at least 20% of lower and middle-level public administrators at the central, provincial, and local levels in the use of modern information technologies, such as personal computers, by no later than 5 years from the date of project approval and funding.

- To build at least 30% more primary schools in six districts by no later than 6 years from the date of project approval and funding.

- To put in place potable water supplies for 10 rural districts by no later than 8 years from the date of project approval and funding.

- To provide at least minimal shelter for at least half of the populations in larger cities that are currently homeless or forced to utilize substandard housing.

2.2 OBJECTIVES

2.2.1 DEFINING OBJECTIVES

As stated in the foregoing, objectives tend to be "intermediate" in nature from a time accomplishment standpoint and address the conditions and precondi-

tions that need to be established or improved to facilitate goal achievement. Because goal statements are necessarily stated in general, with long time frames and using imprecise language, objectives "guarantee" us at least the possibility of navigating more directly toward that goal, with fewer false turns.

Objectives are the major guideposts along the trail that tell us whether we are on course or perhaps have gone astray somewhere. Certainly, if we have fallen down in achieving one, or some, of the objectives we may fairly assume that we are placing overall goal achievement in danger.

Objectives, like goals, are results or outcomes; they are not concrete outputs. As was pointed out earlier, objectives, in turn, are the linking pin that connects goals with outputs. Outputs are the "deliverables" that are produced as a result of implementing a project, they are not a result or an outcome like goals and objectives are.

2.2.2 Step-Wise Methodology for Defining Objectives

Here is the step-by-step methodology for defining objectives:

1. Study the goals carefully; ascertain how they interrelate, make certain the criteria outlined above for "good goals statements" have been met, and, especially, that the goals are actionable. Think in terms of three time frames — long, middle, and short.

2. Decide which courses of action are the most appropriate for ensuring that the goals can be achieved. Think of objectives as a second level, shifting the focus from the "what" and "why" to the "how," and from the long to the middle and short terms.

3. Also, now is the time to begin to answer the questions "who," "when," and "where." Who will be the players and action agents needed, in what arenas will they be operating (e.g., in headquarters units or in the field, in the halls of parliaments, in associations, in educational and training institutions, and so on). Where will those arenas be?

4. Hierarchically relate each objective upwardly to one or more goals. Usually, one objective relates most strongly to only one goal but,

occasionally, one finds a situation where the same objective can help implement more than one goal.

5. Hierarchically relate each objective downwardly to one or more outputs; technically speaking, outputs are benefits in our BCA terms.

6. Now is the time to think also about measurability — in terms of dates, amounts, times, percentages, and so on. Try to express objectives, insofar as it is feasible, in concrete and quantitative terms.

7. Articulate at least one objective, but no more than 10 or 12, for each goal. The median range is between three and six objectives per goal.

2.2.3 EXAMPLES OF GOALS AND OBJECTIVES HIERARCHICALLY RELATED

Here are some illustrative examples of statements of objectives hierarchically related to some of the goal statements in the foregoing. For ease of interrelating the goals and objectives, the goal statements are repeated:

GOAL: To put in place a national railway system interconnecting the country's major commercial hubs and the national capital, with the first major transportation link operating in no less than 3 years from the date of project approval and funding, and the last link operating in no less than 15 years.

> **OBJECTIVE:** To prepare a master plan for the detailed implementation of the project, including milestones, resource requirements, a budget, a personnel plan, and other requisites; provide for periodic evaluation of progress and problems by management-level officials; and complete in no less than 3 months from project approval.
>
> **OBJECTIVE:** To complete preparation of rail roadbeds for the first designated transportation link by no less than 12 months from approval of the detailed project implementation plan.

OBJECTIVE: To bring in necessary electrical power that will be utilized to power the first link, including site selection, generator station construction, substation site selection and construction, grid construction, and related requirements by no less than 15 months from the project implementation plan approval date.

OBJECTIVE: To obtain popular media support for the project by making contact with key personalities in the agriculture field and enlisting their support using radio, television, the print media, and so on.

GOAL: To raise the level of awareness and provide basic hands-on training to at least 20% of lower and middle-level public administrators at the federal, provincial, and local levels in the use of modern information technologies such as (a) personal computers; (b) popular PC-based software packages, including spreadsheet, word processing, database management, and personal calendaring packages; and (c) the use of e-mail by no later than 5 years from the date of project approval and funding.

OBJECTIVE: To obtain approval from the appropriate government information and other cognizant ministries, as well as their active commitment and involvement in the project including the required funding levels, so that they will provide top-level, continuous support.

OBJECTIVE: To hire, educate, and train personnel required to undertake the project, including managerial personnel and key technical professionals who combine educational and technical proficiencies.

OBJECTIVE: To establish at least 10 prototype pilot test projects to be able to demonstrate modern information handling technologies to statistically selected groups of public administrators as a pretest to validate the planned educational strategy and approach with controlled groups.

OBJECTIVE: To establish a computer classroom training facility that will allow targeted trainees to be systematically trained in a facility that is conducive to effective teaching and learning.

2.2.4 EXAMPLES OF OUTPUTS AND INPUTS HIERARCHICALLY RELATED TO OBJECTIVES

Moving to the next level down, here are some illustrations of how outputs and inputs can be hierarchically related to objectives, using the final example in the foregoing, the demonstration project for raising the awareness level of middle and lower level public administrators to the usefulness of personal computers, popular software packages, and e-mail.

This material is included for the sake of presenting a "complete picture" of the hierarchical relationship among goals, objectives, outputs, and inputs. This is even though, in actual practice, relating outputs to objectives, and relating inputs to outputs, would not be a formal requirement of the BCA process but, rather, would be an integral part of the project planning process once a preferred alternative was selected and the project director was ready to get started. Moreover, for the sake of brevity, we concatenate the process after a certain point.

The last of the objectives listed in the foregoing is chosen here:

OBJECTIVE: To establish a computer classroom training facility that will allow targeted trainees to be systematically trained in a facility that is conducive to effective teaching and learning.

OUTPUT: To identify and select a computer classroom training facility.

INPUT: Building diagrams and specifications.

INPUT: Advice of buildings space managers.

INPUT: Database literature searches.

INPUT: Funds to support the foregoing.

OUTPUT: To outfit the selected facility by providing the necessary electrical, air conditioning, plumbing, and other supporting physical infrastructures.

INPUT: The services of electricians, plumbers, carpenters, and so forth.

INPUT: Funds to support the foregoing.

OUTPUT: To provide the facility with the necessary hardware and software, including an instructor's PC, a LAN network to tie machines together, 30 individual PCs (386 machines, including half IBM compatibles and half MacIntoshes), three dot matrix printers, an overhead projector, a data projector, a large screen, black or white boards or both, and expendable supplies including printer paper, floppy diskettes, marker pens, erasers, etc.;

INPUT: Vendor catalogues.

INPUT: Procurement regulations.

INPUT: Visits to showrooms and manufacturers.

INPUT: Benchmarking alternative hardware and software.

INPUT: Funds to support the foregoing.

OUTPUT: To establish a master and subsidiary training schedules with appropriate government officials.

INPUT: Review of available training documentation.

INPUT: And so on.

OUTPUT: To prepare an overall course outline, as well as individual lesson plan outlines, identify reading materials, topics to be covered, and so forth.

Finally, analysts and readers may wish to refer to the "do's and don'ts" checklist for goals and objectives in Appendix I before proceeding further.

3.0 FORMULATING ASSUMPTIONS

Applicability of this step to the four BCA options:

	No BCA	Feasibility Study	Abbreviated Analysis	Detailed Analysis
3. Formulating Assumptions	YES	YES	YES	YES

Assumptions address circumstances and conditions that project sponsors and directors anticipate already, or will, prevail at some point during the project's life cycle — at its beginning, throughout its implementation stages, or at the end or at all times.

Assumptions include policy constraints, resource limitations, and cultural barriers expected to impact successful implementation, either negatively or positively, or sometimes even both. Assumptions also include environmental constraints.

In short, assumptions address all kinds of uncertainties — a fact of life that surrounds virtually all human endeavour. More and better information is one of the best kinds of inputs that can be brought to bear to try to reduce uncertainty.

Making assumptions and constraints explicit as an integral part of the BCA methodology because doing this:

- Allows all key players associated with the project an opportunity to challenge the assumptions and constraints in a constructive manner;

- Allows assumption advocates and proponents an opportunity to explain, defend, and justify their expectations;

- Allows BCA analysts an opportunity to employ sensitivity analysis to test what the impact on expected project outcomes, benefits, and costs would be if the assumptions (at least those that are quantifiable) were varied in terms of their magnitude, their beginning and ending dates, and other parameters;

- Helps ferret out hidden and secret agendas; and

- Addresses unknowns and uncertainties in all sectors — political, economic, social, or cultural.

A simple economic example is the assumption that the inflation rate for each of the outyears in the benefit:cost calculation will be at such and such a rate (e.g., 3% per year).

A simple, political example has to do with the quantity and quality of key institutional support, government or otherwise, and technical backstopping from a very limited number of key technical experts that the information project managers must depend on to make the project a success.

A simple sociocultural example has to do with possible cultural barriers that may frustrate efforts to implement project goals and objectives. Language, resistance to change, religious practices, family values, indigenous knowledge and belief systems, and many other factors come into play under this heading.

Systematic thinking about the information and other needs of strategic management in all sectors focuses attention on the underlying assumptions on which project sponsors must plan. These assumptions are sometimes explicit, but often they are simply taken for granted as self-evident truths. But they must be subject to critical examination and testing against reality. Many project plans have floundered because their core assumptions were too "obvious" to require challenge or scrutiny.

3.1 STEP-WISE METHODOLOGY

1. First, consider the economic and financial area and address the nature of, and extent to which, major economic trends, such as inflation, employment, prices, wages, workload, demand, supply, and other economic indicators, are expected to rise, fall, or remain stable during the project lifetime, and thereby impact the stream of benefits and the stream of costs, and ultimately the degree to which the project's stated goals and objectives can be achieved or would have to be scaled down or up to adjust for the expected economic assumptions. Also, address the adequacy and reliability of financial funding sources for the project. Pay special attention to uncertainties.

2. Next, consider the political arenas, and address the nature of, and extent to which, major political "factors and actors" may impact the project's goals and outcomes. For example, consider the questions of overall political stability; the likelihood of a new party or leader being elected, and having a different set of priorities in which the project's status may be lower or higher; the extent to which unnecessary, cumbersome, and costly bureaucratic paperwork and red tape may frustrate the achievement of project goals and objectives; and whether the project is likely to get caught in governmental or institutional turf wars, or both, where competition instead of collaboration frustrates project accomplishment. Also consider the needed collaboration of key government, sponsoring, and project implementing institutions and officials, and the likelihood that they will maintain harmonious relationships throughout the project's lifetime. Pay special attention to uncertainties.

3. Next, consider the sociocultural areas and forums and address the nature of and extent of sociocultural factors that may impact project success negatively. For example, are there myths, elements of folklore, belief systems, religious beliefs, value systems, gender biases, racial stereotypes, or ethnic prejudices that might frustrate project goal achievement. Pay special attention to uncertainties.

4. Next, consider the availability of needed strategic materials, equipment, technologies, supplies, property, or other kinds of artificially made or natural resources, including the needed expertise of an expert in the field, the absence of access to which, or the interruption of a readily available and reliable flow of which, would seriously, if not fatally, impact the project.

5. Next, consider long-term weather and environmental patterns, if applicable, insofar as they may adversely impact project achievement.

6. Next, consider the need for and the impact of required scientific and technological breakthroughs, if applicable, on the project. This area includes the need for new inventions, new processes, new products and services that do not currently exist, and so on.

7. Next, consider the legal area, including trademarks, patents, copyrights, and other kinds of intellectual property rights and their impacts, along with laws, rules, regulations, and government policies that may need to be changed, put in place as new factors, or rescinded entirely, if the project is to move forward.

8. Finally, consider the leadership and management area, including the need for special education, training, experience, or knowledge on the part of key project personnel, or all these elements, especially where the project is of large dollar value, complex in nature, long in duration, and involves many different project players.

3.2 EXAMPLES OF ASSUMPTIONS

- The economic lifetime of the project itself is, at bottom, an assumption, and project planners may wish to identify the rationale that led them to arrive at a certain number of years to use in the BCA calculations.

- The project lifetime in terms of its key physical capacities (outputs and outcomes) is also, at its core, an assumption and by the same token as the preceding item, project planners may wish to identify the rationale that led them to arrive at a certain number of years to

BENEFIT
An output, value, positive result, or effectiveness in an operation or activity that is expected to be received or achieved over time as a result of undertaking a proposed investment.

BENEFIT:COST ANALYSIS
A technique for assessing the range of costs and benefits associated with a given option, usually to determine feasibility or to select a preferred course of action from among competing ones. Most costs are generally expressed in monetary terms, but benefits need not all be expressed quantitatively.

BENEFIT:COST RATIO
An economic indicator of efficiency, computed by dividing benefits by costs. When benefits are quantified in dollar terms, it is customary to discount both benefit streams and cost streams to reflect the present value of future costs and benefits. Also, present value benefit divided by present value cost.

BREAKEVEN ANALYSIS
A procedure for evaluating alternatives in terms of a common unknown variable. It involves solving for the value of the variable that will make the cumulative discounted costs for the alternative equivalent. This value is the breakeven point.

CASH-FLOW DIAGRAMS
A pictorial representation showing the magnitudes and timing of costs associated with an alternative.

CELL
In the spreadsheet program, the term used to refer to a block where a row and column intersect.

CELL ADDRESS
In the spreadsheet program, the unique location of each cell on the spreadsheet, composed of a combination of a letter (beginning with "A" for the leftmost column) and a number for each row (beginning with "1" for the topmost row).

CHART
In the spreadsheet program, a visual, interactive portrayal of data from the spreadsheet. Charts are linked to the data in the spreadsheet, and are automatically updated to reflect changes in the basic data.

3.0 FORMULATING ASSUMPTIONS

- The availability of a reliable and continuous supply of electrical power where such a condition is critical to the operation of a facility or other capability.

- The availability and accessibility of project directors to key technical advisors whose expertise may be essential to the smooth implementation of the project (e.g., a professor at a university or a key project official at some participating public or private institution).

- Continuous effective communication and collaboration between and among the key project players so that minor disagreements are not allowed to mushroom into major turf wars or confrontations.

Analysts and readers may wish to review the do's and don'ts checklist in Appendix J before proceeding.

4.0 IDENTIFYING ALTERNATIVES

Applicability of this step to the four BCA options:

	No BCA	Feasibility Study	Abbreviated Analysis	Detailed Analysis
4. Identifying Alternatives	YES	YES	YES	YES

The identification of alternatives or "solutions" to solving the overall problem(s) attendant to a project is an iterative process. Using techniques, therefore, such as brainstorming, project sponsors and managers are encouraged to list as many alternatives as they can think of for approaching and dealing with the problem(s) to be solved (see Fig. 2–1 for some criteria for identifying alternatives). The first, "rough draft" list of alternatives is, in reality, a kind of strawman list. No effort is made initially to evaluate the alternatives or prioritize them; quite the contrary. The real value in the first iteration is to try and come up with as many alternatives as possible; they can always be pruned later.

In the next step, various criteria can be established and applied to narrow the list down to those alternatives that are the most feasible and the most practical, after examining all of the alternatives in the initial pool of ideas. Use a limited set of key criteria to "qualify" an alternative because, as the number of criteria increases, the impact of each criterion is reduced thus diffusing rather than focusing the analysis.

The selection criteria should include no more than six to eight factors that are among the most important to the project. Figure 2–2 may be helpful in organizing your alternatives; this has been taken from IDRC's own ISSD Project Management Manual, Section III, Project Planning.

CRITERIA FOR IDENTIFYING ALTERNATIVES

1. CAPACITY: What is the ability, the scope, or "the grasp and the reach" of the proposed alternative in terms of efficiency and effectively achieving the project's goals and objectives? Is the alternative's capacity adequate or, to borrow a phrase, are we using a boy to do a man's job?

2. PERFORMANCE TIMES: Can the proposed alternative handle the throughput ratio required, meaning — receive the expected volume of inputs, in the sequences and according to the timeframes programmed, and transform those inputs to deliver the outputs on time in the required amounts?

3. SPEED: Is the alternative going to be able to operate at a fast enough pace, even if the throughput ratio is acceptable?

4. SIMPLICITY: Is the proposed alternative simple enough to understand and implement, or is it unnecessarily complicated? In other words, are we buying an expensive race car to deliver milk?

5. USER FRIENDLINESS: Is the alternative user friendly, or are users not taken sufficiently into account because the alternative was designed to please the engineers and designers, not the users? In the computer world there is a well-known, almost classic, criticism of the pre-1960s way of writing a computer program that was very user UNfriendly: "(first) compare, (if) unequal, (then) punish!"

6. EASE OF LEARNING: Can all of the operating requirements for implementing the alternative be learned with relative ease or are the familiarization, orientation, education, and training requirements themselves going to be particularly onerous, costly, and time consuming?

7. VENDOR RELIABILITY AND SUPPORT: Will the suppliers who are furnishing hardware, software, equipment, services, spare parts, and so on be dependable and trustworthy and do they have a proven track record of being able to respond to their customers efficiently and speedily?

8. CUSTOMER SATISFACTION: Do we anticipate that implementing this particular alternative will leave the service's or system's user satisfied? If not, why not?

9. MODULARITY FOR EXPANSION: Can the alternative we are considering be incrementally added to in stages so that we do not have to buy everything at once or are forced to purchase a completely new package every time we outlive the old one and want to upgrade?

FIGURE 2–1

FIGURE 2–2

Weighing Alternatives - a more sophisticated decision-making procedure when choices among competing alternatives are difficult. To use this process first eliminate some of the workable and unrealistic options. What should be left is no more than three competing options.

Example: (From workshop)

alternatives	impact on "problem" low/med/high	cost to complete low/med/high	resources utilized external/mixed/local	possible side effects negative···positive	learning opportunities for local people low med high	decision

Your Project

alternatives	evolution criterion (A)	evolution criterion (B)	evolution criterion (C)	evolution criterion (D)	evolution criterion (E)	evolution criterion (F)	evolution criterion (G)	etc.	etc.	etc.	decision
alternative one:											
alternative two:											
alternative three:											

How will decision be made? and who will make it? (In some projects the method of decision-making and who makes the decision is as important as what is decided.)

- how will the decision be made?
  - by authority of one person ______ ☐
  - by small, powerful group ______ ☐
  - by majority vote ______ ☐
  - by consensus ______ ☐
  - by unanimous decision ______ ☐
  - by abdication ______ ☐
  - by ______ ☐
  - by ______ ☐
  - by ______ ☐
  - by ______ ☐
  - by ______ ☐
  - by ______ ☐

- who will make the decision?
  - a project manager in a local n.g.o. ______ ☐
  - a senior executive in a local n.g.o. ______ ☐
  - a project manager in a foreign n.g.o. ______ ☐
  - a senior executive in a foreign n.g.o. ______ ☐
  - an official in a donor agency ______ ☐
  - a local gov't official ______ ☐
  - leader in the affected community ______ ☐
  - a group rep. those most affected ______ ☐
  - all the persons affected by the project ______ ☐
  - a clique within the group most affected ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐
  - ______ ☐

4.0 IDENTIFYING ALTERNATIVES

As we said in the Management Guide, the existing system, or the current method or way of doing business, however poor or deficient it may be, *must* be identified as the "baseline" alternative whether it is a viable alternative, in fact, or not. Otherwise, we have nothing with which to compare other alternatives.

Moreover, if we are to cost out newly proposed alternatives, we must know what the existing system costs anyway. Finally, it should be mentioned that even though the proponents of a given alternative may be very disappointed, occasionally one encounters a situation where, after carefully considering all of the alternatives proposed, the decision-maker decides *not* to undertake *any* of the alternatives but, instead, keep the status quo! So, be sure to list the "current system" or "existing system" (or use similar language) as the baseline alternative, even though you fully expect that decision-makers are going to select one of the other alternatives as the preferred alternative.

One of the most ubiquitous and complex modern information and communications media challenges facing all kinds of organizations is the challenge of choosing from among alternative communications media. Appendix G is a case example of this problem and is included in this part because it offers insights into alternatives definition, identification, measurement (weighting), and selection.

4.1 STEP-WISE METHODOLOGY

1. Examine goals and objectives and list them separately. Try to determine if a single alternative might maximize the achievement of all, or most, or at least several related goals and objectives.

2. Brainstorm a list of all feasible and practical alternatives. Do not make any attempt yet to weigh each one or list them in any particular priority or logical order.

3. Convene a panel of project officials plus some "outsiders" who can be expected to render an objective viewpoint because they have no vested interest in the project's outcome. Set up a simple weighting scheme (e.g., 5 being the highest priority, 4 the next, and 0 the lowest), and rank order the objectives as a part of a peer group exercise.

4. Eliminate ties by reiterating the above step.

5. You should end up with at least three alternatives, including the existing system (the status quo), but no more than six alternatives. You may arbitrarily have to chop off alternatives above seven.

6. Present your alternatives identification process and document results to the appropriate management-level officials being prepared to explain, defend, and justify your actions.

4.2 EXAMPLES OF ALTERNATIVES

Quite often in social and economic development projects there are at least three broad avenues that can be taken to achieve goals and objectives:

- A human-intensive approach;
- A capital-intensive approach; and
- Subcontracting or assigning the task to another party (sometimes called "outsourcing").

In the first instance, the project proposer is recommending that the project be undertaken largely, if not exclusively, in-house, using direct-hire employees, both regular and part time, and using some overtime if necessary. Machines may be used, but they tend to be secondary in importance. They assist and support a process rather than substitute for human beings as the primary production modality. Subcontracts may be judiciously used but, again, they are not the primary implementing vehicle.

In the second instance, the project sponsor is recommending that the project also be undertaken largely, if not exclusively, in-house but using machines primarily (e.g., computers and other automated equipment) rather than relatively more costly labour (that is, per unit of output produced) as the primary production modality. Again, subcontracts may be judiciously used but they are not the primary implementing vehicle.

In the third instance, the project sponsor is recommending that the project be contracted out, "outsourced," or otherwise assigned or delegated to a third, usually out-of-house party. Sometimes the job may be assigned to another

subsidiary, department, or group. Contracts and subcontracts under this alternative are the "name of the game."

Analysts and readers may wish to review the do's and don'ts checklist for identifying alternatives in Appendix K.

5.0 ESTIMATING COSTS AND BENEFITS

Applicability of this step to the four BCA options:

	No BCA	Feasibility Study	Abbreviated Analysis	Detailed Analysis
5. Estimating Costs and Benefits	NO	NO	YES	YES

Readers, again, may wish to review briefly the corresponding material in Part 1. We began by addressing the cost area in Part 1 and will do the same here. Until now, benefit:cost analysts without extensive economic or accounting training can be expected to do reasonably well in following these recommended guidelines. Depending on the complexity of benefits and costs in the calculations, however, it may be well at this juncture for the analyst to seek the assistance of various kinds of financially trained professionals should their own technical expertise be deficient in some respect.

For example, "finding" costs can be very difficult. Their sources, how the costs are derived or originated, and how they are presented in the analysis are all areas at which the cost accountant has become considerably adept. Moreover, if there is doubt as to what properly constitutes a "benefit," or how to carry out a given calculation, the skills of a development economist may be required. Perhaps the best recourse is for the analyst to at least begin and reserve the decision as to whether specialized assistance is required.

Also, beware of double counting. Double counting means counting an item as a positive benefit in the benefits estimation part of the analysis and then reducing costs for the same item in the costs estimation part of the analysis. How to treat cost avoidances and cost reductions is a notorious example. These items can be treated either as an offset to costs (in which case a net cost figure must be obtained) or as a benefit. The treatment you select is a management decision, not a technical decision.

Finally, most project managers involved in BCA find it useful to assign the benefits estimation tasks to one individual (or a "benefits team") and the cost estimation tasks to another individual (the "costs team"). The latter may include someone with special finance and accounting training and aptitudes, whereas the latter may include someone with training and interests that lie more in the social sciences.

5.1 A BENEFIT:COST CLASSIFICATION FRAMEWORK

In introducing this section it may be useful to stand back and look at a very broad classification framework for both costs and benefits. Before doing so, however, it is well to point out that there is no single, "best" cost or benefit classification scheme. Experts disagree on how to categorize both cost and benefit elements. The BCA team, therefore, should make recommendations to management on a scheme, or several schemes, that they think would best serve the needs of a particular project analysis.

Costs and inputs, as well as benefits and outputs, can be usefully subdivided into eight major categories from a summary framework standpoint. As has been stressed before, some of these cost and benefit elements will be quantifiable but others will be nonquantifiable. In the following scheme, no initial attempt has been made to differentiate between the two categories.

Obviously, for those cost elements for which quantification is attempted, some multiplier factor or another will have to be used. For example, in the case of human factors, a salary and fringe benefits factor (or more than one) must be used to calculate labour costs once hours, man-days, man-weeks, or man-years have been determined.

In the case of land and property factors, a real property or square footage of office space factor might be used. In the case of equipment, equipment hours might be calculated and then an operating cost factor multiplier used. In the cost of materials, a cost of raw materials, semifinished goods, or finished goods must be derived. We tell you how to do this later. But first, the scheme itself.

CATEGORY 1

Human Factors (translate into labour costs; largely quantifiable and recurring):

- Technical Knowledges, Competencies, and Skills
- Management and Leadership Knowledges, Competencies, and Skills
- Access to Education and Training Facilities
- Behavioural Parameters (Sociopsychological; includes Attitudes)
- Available Labour (includes Productivity)
- Demographic Considerations
- Socioeconomic Elements (includes Rewards, Status, Income)
- Personnel Security Clearances for Sensitive Positions
- Cross-Cultural Factors (includes Race, Religion, and Ethnic, Age, and Sex considerations, as well as Value Systems and Belief Systems)

CATEGORY 2

Information and Communications Technologies (translate into equipment costs, both recurring and nonrecurring; largely quantifiable):

- Computers and Automatic Data Processing (ADP) (includes Microelectronics and Associated Equipment, all Collection, Storage, Retrieval and Dissemination Media and Modes such as CD-ROM, Optical Disc, etc.)
- Telecommunications Networks Linkages (Local and Wide Band)

- Software (Shelf and Customized)
- Human–Machine Interface (e.g., User Friendliness)
- Ergonomic Factors
- Media Facilities
- Indigenous Technologies
- Technical Support

CATEGORY 3

Systems and Processes (translate into material or equipment costs; largely recurring; largely quantifiable):

- Existing Information Flows (Baseline; includes Information Content)
- System Requirements
- Inputs (includes Data Collection)
- Throughputs
- Outputs (includes Products and Services)
- Feedback Loops (both Positive and Negative)
- Organizational Dynamics
- Procedures
- Safeguards

CATEGORY 4

Plant Capacity (translate into property or equipment costs; both recurring and nonrecurring; largely quantifiable):

- Space Planning and Design
- Engineering, Ventilation, and Electrical
- Communications
- Lighting
- Maintenance
- Plumbing
- Furniture and Equipment
- Supplies and Materials
- Location (Accessibility)
- Security
- Obsolescence and Depreciation

CATEGORY 5

External Linkages and Distribution (translate into equipment or labour costs; both quantifiable and nonquantifiable):

- Information, Communications, and Telecommunications Networks (Global, Regional, National, and Local)
- Institutional Networks (Global, Regional, National, and Local)
- Individual Networks (Global, Regional, National, and Local)

- Publics (Constituencies and Clienteles)
- Beneficiaries

CATEGORY 6

Policy and Environmental Factors (translate into sunk costs or non-recurring costs; largely nonquantifiable):

- Political Commitment
- National Support Capacity
- Appropriate National Information Policies
- Top Management Commitment
- Organizational Culture
- Societal Culture
- Political Culture
- Economic Culture (includes Funding)
- Physical Environment
- Ethics Considerations

CATEGORY 7

Users (translate into labour costs; both quantifiable and nonquantifiable; largely recurring):

- Needs Assessment
- User(s) Profile(s) and Entry Points
- Motivation, Attitude, Behaviour, etc.

- Feedback Channels
- Willingness/Ability to Pay
- Use and Adoption
- Education and Training
- Accessibility and Exposure
- Awareness and Literacy Level
- User Constraints
- User Satisfaction

Now we are ready to take up costs and benefits separately. First, costs.

5.2 COST ANALYSIS

Cost represents the price paid to acquire, construct, or manufacture capital assets and commodities as well as other expenses incurred for operating a business, running an organization, and accomplishing institutional missions, goals, and objectives. The value and the worth of those outlays or expenditures is entirely a different matter, and takes into account the uses made of the inputs.

Costs include outlays or expenditures for raw materials, direct labour, and other related expenses, including overhead, as well as depreciation and amortization of capital assets. Another useful triad for considering costs is to think in terms of:

1. Creation and start-up costs (bringing a facility up and "on line"),
2. Production (or operating) costs (keeping it going), and
3. Maintenance, repair, take down, and replacement costs (making sure it operates smoothly and at full or desired capacity and eventually dismantling it).

In this regard, user costs can be distinguished from producer costs. If they are, then management may wish to deduct user costs from benefits, but that again is a policy or management decision, not a technical decision.

A cost can also be seen as incurring a risk, even though the risk may not be quantifiable in monetary terms (or any other terms for that matter). Risks are probably more constructively dealt with under the heading of Assumptions than as an "add-on" to costs.

For BCA purposes, any positive impact of a factor on the project's outcome is termed a benefit, whereas any negative impact of a (or even the same) factor is termed a cost. As mentioned in the foregoing, therefore, cost savings and cost avoidances could be termed either a benefit or a "negative cost" (i.e., an offset to costs). Consequently, the treatment of cost reduction (savings) and cost avoidance is usually determined by your purpose in conducting the analysis. Which is to say that, like the distinction between producer and user costs discussed earlier, whether to treat cost savings and cost avoidances as a benefit or as a negative cost offset is a policy matter, not a technical matter.

5.2.1 Cost Classification Schemes

Costs can be classified in many different ways, as we shall see. Even though, as pointed out, no single classification scheme is necessarily best for all analyses. There is one cost classification scheme that is very heavily used in BCAs:

- Sunk (nonrecoverable) costs,
- Nonrecurring (one-time) costs, and
- Recurring costs.

Because costs are incurred throughout the life of a project or system, the total cost to the project sponsors of acquisition and ownership of an alternative over its full life must be considered. This includes costs for research, developing, design, testing, operation, maintenance, and, in some cases, retirement or disposition of the residual assets, if any, at the conclusion of the project. The timing and special valuation of these costs are important insofar as the value of money depends on when that money is expended or received.

Finally, in library and information infrastructure improvement projects it is fairly typical for total costs to be shared by a number of different project sponsors (contributors), not just one sponsor. Thus, costs may need to be broken out between contributors. For example, there may be: (a) a "local" (developing-country) contribution, (b) one or more third party contributions, and (c) a key donor contribution. Whether such a breakout of costs by contributor is required early, at the BCA stage, or is only required later as a part of the project proposal stage (after a preferred alternative is selected), is a management, not a technical, decision.

5.2.1.1 SUNK COSTS The principle of full life-cycle analysis applies to all benefits and costs that occur after the decision to start a project is made. The BCA includes both the cash flows that the decision can affect as well as the noncash factors such as nonquantifiable benefits and costs.

Costs incurred before the decision to proceed with a preferred alternative are sunk and cannot be altered or recaptured. For example, if an alternative is linked to a research effort undertaken before the decision point involving past expenditures of $300,000, the research cost must be disregarded when estimating the cost of the alternative. The $300,000 is a sunk cost and cannot be affected in any way by the choice among alternatives. Another example might be a fully depreciated piece of still usable, necessary equipment that need not be replaced should any of the alternatives being considered be adopted as the preferred alternative.

Although the inclusion of sunk costs in actual cost computations would unfairly and inaccurately tilt the analysis too heavily in favour of costs, and unfairly against benefits, their mention as supplemental information may be of interest to decision-makers. But, if they are, they should be clearly annotated as a sunk or "nonadd" cost. What really constitutes a sunk cost is sometimes arguable and eventually may come down to standard accounting conventions used by the organization in the country involved or by prevailing national or local business accounting practices.

5.2.1.2 NONRECURRING COSTS Nonrecurring costs are generally associated with one-time expenses, although some confusion arises because the expenditures may be spread out over several years of the project's lifetime (e.g., a lease-to-purchase agreement for equipment typically results in installment payments over several years). Still, there is an important technical distinction from a BCA

standpoint between an installment payment in an outyear for an outright purchase made versus a payment for a recurring expense associated with operating or maintaining some facility, service, or other capability. Thus, nonrecurring costs are generally thought of as investment expenses. The return expected on that investment implicitly manifests itself in the results of the benefit:cost calculation.

Another way to think of nonrecurring costs is to think in terms of the four stage triad: creation, operation, maintenance, and replacement/dismantling. Non-recurring costs tend to be more heavily concentrated at the first and at the last stage — creation and replacement/dismantling.

Examples of nonrecurring costs for an information systems project involving acquiring and preparing a site, and extensive hardware and software and labour costs might include:

CAPITAL OUTLAYS

Site Preparation for the Facility
- Grounds acquisition and preparation
- Buildings
- Facilities
- Outfitting

Other
- Studies
- Conversion and Parallel Operations

Systems Design
- Feasibility Studies
- Benefit:Cost Analyses
- Requirements Studies
- Consultancy Reports
- Benchmarking
- Research
- Request for Development of Contractor Proposals

Software Development, Testing and Modification
- Database Creation (creating a new information source)
- Information System Design, Development, and Testing
- Information Service Design, Development, and Testing
- Local Modification (in-house)
- Contract and SubContract Costs
- Purchase Costs (off-the-shelf)
- Alpha and Beta Testing
- Systems and Programing Documentation
- Tutorial Materials, including User Manuals

Hardware Acquisition, Testing, and Development
- Computer Mainframes (including storage)
- Computer Mini Computers
- Computer Microprocessors/PCs
- Telecommunication WANs
- Telecommunication LANs
- System and Subsystem Integration
- Office Automation, including Workstations
- External Database (literature) Searching

Facilities
- Repairs and Alterations to Space
- Wiring and Electrical Preparations
- Air Conditioning Preparations
- Plumbing Preparations
- Communication Preparations

Education and Training
- Training Fees for Trainers
- Travel
- Lodging
- Per Diem
- Training Equipment and Materials, Demos, Videos
- Space Rental

Support Costs
- Travel
- Computer Services
- Telecommunications Services
- Furniture and Fixtures
- Special Equipment
- Materials
- Labour

Security, Safety, and Privacy
- Equipment
- Procedures Development
- Special Personnel Clearances
- Encryption and other Data Protection Tools
- Special Environmental Control Costs
- Consultant Reports

Take Down, Replacement, and Dismantling
- Mothballing
- Salvage
- Surplusing

5.2.1.3 RECURRING COSTS Recurring costs are generally associated with expenditures, typically expended on a regular basis such as equipment operation, maintenance and repair, or the furnishing of needed labour and supplies that are required over the lifetime of the project to keep the project operating at peak efficiency. Recurring costs are often referred to as operating costs.

Recurring costs can also be classified on the basis of whether they are:

- Direct, or
- Indirect.

Direct costs are those material, labour, and equipment expenses that contribute directly and proportionately to the production of some useful output, product, or service. Indirect costs are things like insurance, overhead, taxes, and so on, which are not usually proportionately related to production volume.

Recurring costs can also be classified on the basis of whether they are:

- Fixed, or
- Variable.

Fixed costs are those costs that do not change in the short run if production volume is within a specified range. White collar managerial and professional personnel, plant operating costs, insurance, taxes, and similar expenses generally (but not always) fall into that category.

Variable costs are those costs that do change in a manner that is fairly commensurate to production or workload volume increases or decreases. Blue collar, unskilled, and semiskilled labour and expendable materials generally (but not always) fit into that category.

In terms of the aforementioned four-stage triad: creation, operation, maintenance, replacement/dismantling, recurring costs are concentrated primarily in the middle two steps — operation and maintenance.

Examples of recurring costs for an information systems project involving extensive hardware and software costs might include:

Grounds and Facilities Maintenance and Repair
- Buildings
- Plant (e.g., electrical)
- Services
- Landscaping

System Operations
- Database Maintenance (adds, deletes, and changes)
- Information System Maintenance
- Information Service Maintenance
- Systems Administration
- Network Administration
- Computer Operators
- Telecommunications Operators
- Data and Database Administrators; System Operators

Hardware Maintenance
- Computer
- Telecommunications
- External Links; Gateways

Software Maintenance
- Integration
- Upgrades and Enhancements (new versions)
- Documentation

Support Costs
- Training
- Travel
- Supplies
- Magnetic Media
- CD-ROM
- Other Optical Media
- Overtime

Systems Security, Safety, and Privacy

5.2.2 TREATMENT OF COST ELEMENTS

The following is a representative list of cost elements to be included for each alternative considered in a BCA. The list is intentionally broad and it is unlikely that any one analysis will include all of the cost elements described. The analyst should consider the list as a checklist, against which each alternative should be measured. It should also be noted that the final list of elements of cost must be entered into the Excel computer program if the spreadsheet software is to be used for making the calculations (see Part 3). For each cost element we take up one or more conventional method by which the cost element is derived and estimated:

RESIDUAL VALUE Residual value is an estimate of the value of the proposed investment at the end of its project life. Future residual value reflects factors such as the continued usefulness or commercial value of an asset and increases or decreases in value. Residual value is considered in cases where different components of a project or system or different project alternatives have different economic lives. For instance, investments in human resources and work

system changes, and structural changes to buildings, often outlive specific equipment and spare parts. It would be inappropriate to charge the full cost of these investments to the shorter life cycle of the equipment and spare parts. By considering the residual value of these assets, the lives of project components can be equalized. Residual value is sometimes also referred to as terminal value or salvage value. When salvage value is applied to equipment, it must take into account any take down, removal, dismantling, or disposal costs. Generally, residual value is treated as an offset to investment costs.

RENTAL In those instances where a product is being leased, recurring payments are made on a regular basis. These costs may be obtained from the vendor. If the lease includes a lease-to-purchase or lease with option to purchase, the expense is generally treated as an investment cost.

REGULAR PERSONNEL COSTS Personnel costs include all direct and indirect labour costs, including employee fringe benefits. Regular personnel costs are defined as investment or operating costs, depending on when they are incurred in the life cycle of the project. The method to be used for calculating personnel costs depends upon whether the requirements are expressed in numbers of people or in staff hours of work. It is often useful to pick an average salary level if several different grades or pay scales are involved:

1. **NUMBER OF PERSONNEL METHOD** When the personnel services are specified in terms of the number of personnel required, the base pay should be accelerated by a figure to account for the fringe benefits offered employees. Example: fringe benefits add on to the base pay calculation:

• Retirement	7.9%
• Health and life insurance	10.6%
• Unemployment, bonuses, awards etc.	1.8%
• Total	20.3%

Thus, in the foregoing example, base pay should be increased by 20.3% to account for fringe benefits.

2. **STAFF YEARS OF WORK METHOD** When personnel requirements are specified in terms of the number of staff years of work required, the base pay must be increased both for the normally furnished fringe benefits (e.g., 20.3% in the foregoing example) and for the formal training, annual vacation, sick leave, and other classified absences (e.g., maternity, death of spouse or family member, etc.). This is necessary because, due to such absences, more than one person is required to perform one staff year of work (one staff year is commonly defined as 2,087 hours). It should be noted that the next acceleration rate is approximately 63%, because fringe benefits are accrued by an employee both when on leave and when at work. Example of X staff years of work per year resulting in 1.2X as the requirement:

> Each of these 1.2X people costs the project sponsor 136% of the annual salary each year. The total annual personnel cost of X staff years of work, therefore, is approximately (1.2X) X (1.3585) = 1.63X times the annual salary.

Of course, if planned overtime at either regular or premium rates is required, then such calculations must be included.

OTHER PERSONNEL COSTS Personnel costs not included in Regular Personnel Costs as defined in the preceding section, include such costs as travel, per diem, moving expenses, training, retraining, sabbaticals, etc.

MATERIALS, SUPPLIES, UTILITIES, AND OTHER SERVICES The cost of supplies and materials used in utilizing a product or providing a service. Included in this figure are the costs for handling, storage, custody, and protection of property, and the cost of utility services, including electric power, gas, water, and telephone and other communication costs, etc., related to the operation. Cost of material and supplies should include consideration for reasonable overruns, spoilage, or defective work.

MAINTENANCE AND REPAIR The cost of maintenance and repair to buildings, property and equipment utilized by the project. Capital improvements are considered an investment cost rather than an operating cost. In the absence of specific known costs, use 15% of the direct equipment acquisition costs as the estimated average annual maintenance and repair figure.

SUPPORT COSTS (INCLUDING OVERHEAD) The costs of accounting, legal, local procurement, medical services, receipt, storage and issue of supplies, police, fire, and other services sometimes called overhead. Also, include the costs of terminating or cancelling any existing arrangements ("take down" costs) as a result of implementing the preferred alternative. If the status quo is not a viable alternative when estimating support costs associated with an alternative, care must be taken to itemize only those support costs that will change as a result of the implementation of the alternative; the remaining costs are sunk costs. If the status quo (current method), however, is a viable option being considered, then the full support costs must be included in the base calculations.

5.2.3 OTHER COSTING CONSIDERATIONS

Beyond the various cost derivation and estimation methods described in the foregoing, there are a number of other considerations that analysts must take into account and, as a result, make appropriate adjustments and offsets to the initial set of estimated cost figures.

DEPRECIATION When considering the recurring annual costs associated with a given alternative, the analyst may ask the question: What do I do about the fact that this facility is going to wear out and will have to be replaced or dismantled? Or: How do I include an allowance for depreciation? The answer is that if equipment is a major cost component in the project operation, then either a straight line or accelerated method of depreciation of costs may be appropriate, depending on how fine-tuned the analyst wishes to be. Certainly, if some equipment must be replaced during the project's lifetime, then some provision for replacement or take down and dismantling, as well as disposition, must enter the calculations.

INFLATION The effects of inflation during the project lifetime may impact on the decision-maker's preference for one alternative over others under consideration. When this is the case, the analysis should include an explicit mention of what kind of inflation factor is used in the calculations, in the section on

Assumptions. In short, the debate about whether an inflation factor of X%, Y%, or Z% is the most appropriate one to use should occur "up front" when the assumptions and constraints are first being addressed. It is too late to get into a squabble on inflation when the final figures are being tabulated. Deflation factors are also possible, but are much less commonly seen in modern economic times.

CONSTANT DOLLARS AND CURRENT DOLLARS To avoid distortions caused by changes in the value of the unit of measure when the general price level changes, all estimates of costs and quantifiable benefits should be made initially in terms of constant dollars, as of the analysis base year (Year 0). Another way of saying this is to say "in terms of the general purchasing power of the dollar at the time of the decision." In the BCA, projected annual costs should vary only to the extent that the required level of procured goods and services is expected to vary during the project life. For example, it would be legitimate for annual costs to reflect an increase in the anticipated amount of repairs needed, as measured by prices in effect at the beginning of the project life, because this represents a real cost increase and not an inflationary one. Estimates may reflect changes in the relative prices of cost or benefit components or both in the BCA, where there is a reasonable basis for estimating such changes, but should not include any forecasted change in the general price level during the planning period.

5.2.4 COST ESTIMATING METHODS

We have looked at the main kinds of cost elements that need to be considered in the analysis, but where do we get the actual figures, the data itself? How do we make the estimates once we locate the figures? Several generally accepted methods for estimating costs were described earlier in the case of salaries. But there are a number of other generic ways to estimate (measure) costs once they have been identified, whether salary costs or other costs. The three most basic approaches are price quotes, historical comparison, and the industrial engineering method.

PRICE QUOTES Cost identification is the obvious process of reviewing commercial price schedules. Additional sources of cost estimates include government publications or published vendor price lists, parts catalogues, etc.

HISTORICAL COMPARISON A specialized method of judgment, called the historical comparison or analogy method, may be used to estimate costs by making direct comparisons with historical information on similar existing

alternatives or their components. The major caveat of this method is that it is basically a judgment process and, as a consequence, requires a considerable amount of experience and expertise if it is to be done successfully. Moreover, judgment should always be recognized for what it is, a guess, albeit an educated guess by an expert. As we said earlier, the services of a professional financial accountant may be invaluable to the cost estimation team at this point. Some financial professionals specialize in offering their services to clients precisely for this purpose.

Estimation of facilities acquisition costs may place heavy reliance on the historical comparison method. At the activity level, the process will obviously be influenced by the recent history of construction costs for that region. Even if cost estimates are available from an "expert" source, such as a local architect and engineering firm, these estimates will essentially be extrapolations of the firm's recent experience in labour, materials, and overhead costs.

INDUSTRIAL ENGINEERING METHOD This approach consists of consolidation of estimates from various separate work segments into a total project estimate. For example, the estimated cost of producing a new model "widget," which will entail work contributions from 10 separate work divisions in a plant, could well be an aggregation of 10 separate and detailed estimates, each of which might itself be composed of several subestimates.

5.2.5 STEP-WISE METHODOLOGY FOR ESTIMATING COSTS

1. Prepare a "strawman" list of costs without making any attempt to subdivide them into quantifiable or nonquantifiable, recurring or nonrecurring, or sunk and so on.

2. Pass the strawman list around among the BCA team, and once the team is satisfied that the list is fairly complete, expose it to a wider circle of project players and obtain feedback.

3. If desirable, begin to refine the list; that is to say, subdivide the benefits into sunk versus nonrecurring versus recurring, because that decision is probably the easiest. But, remember, the decision on how fine-grained the cost analysis is going to be (i.e., how many and how detailed the subclassifications) is a management decision, not a prescriptive methodological mandate.

4. Then proceed to additional subdivisions. Divide the benefits into quantifiable and nonquantifiable, meaning, at this stage, that at least you have determined that the cost in question is at least partially quantifiable and you have at least some idea of how to find documentation to support estimation and measurement of the cost.

5. At this stage, you should be in a good position to distinguish between areas where cost information is more or less readily available and areas where such cost factors are not available and you should consider using an indicator of costs (indicators of cost are less obvious than indicators of benefits).

6. Prepare a simple matrix of the kind shown in Fig. 2–3, that correlates benefits (including indicators) with the sources and kinds of documentation you expect to utilize to develop the benefits. This matrix then becomes a work program. In some cases, you will inevitably find that the primary source of the information you need and had hoped would contain the necessary material does not, in fact, contain it, and you will have to fall back on secondary sources.

7. Estimate each cost and enter the cost into a table of the kind shown in Fig. 2–4.

8. Continue this process until all costs have been entered into the cost table. We will later address how the "number crunching" then proceeds in the final stages of the analysis, either manually or using the special BCA software package (see Appendix A for an illustrative list of cost elements).

5.3 BENEFITS ANALYSIS

Benefits represent monetary, attributed, intrinsic, and/or relative worth, merit, usefulness, importance, and/or utility of a good, service, product, principle, item, or entity. The value of something, or the benefits of something, can be evidenced by a willingness or need to pay for, barter in exchange for, or otherwise need to use or have it available for use or other purposes.

CORRELATING BENEFITS WITH INFORMATION SERVICES

INPUTS				Major Output Benefit Areas				
				Political	Economic	Social	Cultural	Technological
* MAJOR ASSESSMENT INDICATORS	Human Factors	QUANTITY (N) QUALITY (L) VALUE	N					
			L					
	Info Communication Technologies		N					
			L					
	Systems & Processes		N					
			L					
	Financial Aspects		N					
			L					
	Plant Capacity		N					
			L					
	External Linkages & Distribution		N					
			L					
	Policy & Environment Factors		N					
			L					
	Users		N					
			L					

FIGURE 2–3

ENTERING COST DATA

Date _____

	FY	FY	FY	FY	FY	FY	System Life Costs
Investment Costs							
System Design							
Staff Years							
Contract Services							
Software Development							
Staff Years							
Contract Services							
Hardware Acquisition							
Telecommunications							
Data Transmission							
Space Alterations							
Training							
Support Costs							
System Security							
OPERATING COSTS							
System Operations							
Staff Years							
Hardware Lease							
Hardware Maintenance							
Software Maintenance							
Staff Years							
Contract Services							
Supplies							
Magnetic Media							
Training							
Contract Services							
Telecommunications							
Systems Security							
Total Costs							
Investment Costs							
Operating Costs							
Discount Factor							
Annual PV Costs							
Investment Costs							
Operating Costs							
Cumulative PV Costs							

FIGURE 2–4

Depending on your point of view, a benefit may be (a) a positive effect of adopting an alternative in order to, let us say, increase information use or reuse, or improve access or equality of access to information; or (b) a "negative cost" (i.e., a cost offset) such as a reduction in the cost of doing something (a cost reduction or cost avoidance).

Some benefits are in the form of concrete outputs (whether precisely measurable or not is another question):

- Increased productive capacity to process a higher volume of requests;
- Reduced time to process a request for some kind of service;
- Reduced cost because of replacing older equipment with newer equipment that is capable of processing transactions faster;
- Greater productivity — producing more products with no increase in inputs, or even less inputs;
- Greater utilization of natural resources;
- Improved conservation of natural resources;
- Reducing the learning time to perform an operation;
- Reduced space needs because of simplifying or streamlining some process or office operation; and
- Greater crop yields due to the use of fertilizers or advanced agricultural technologies.

Some benefits are not in the form of concrete outputs; they are intangible in nature, and are either very difficult or virtually impossible to measure:

- Displacement of lower order, more routine tasks, with higher order, more intellectually intensive tasks, because of the introduction of modern management techniques or methods, or modern technologies, or both;

- Improving the "appropriateness" or suitability of a given information resource to the targeted audiences and purposes for which it is intended;
- Improved quality of decision-making;
- More enlightened policy formulating by government officials;
- Education's long-term effects; and
- The introduction of life-saving health products (e.g., drugs) or life-prolonging technologies.

5.3.1 BENEFIT CLASSIFICATION SCHEMES

The benefits expected of any alternative may be classified in a much larger number of ways than the traditional elements used in the cost analysis. Whereas cost elements tend to be relatively fixed in number, and more conventional in character, benefit "elements" are much more diverse in nature, difficult to identify, difficult to measure, and subject to wide differences of opinion, even among the experts, as to their relevance (i.e., cause–effect relationship to the costs).

Notwithstanding the foregoing, like certain major cost classification schemes (e.g., recurring versus nonrecurring, fixed versus variable), benefits can also be classified by a number of major ways for BCA purposes. Once again, it is useful to point out that no single benefits classification scheme is paramount or serves all purposes. But there are some schemes that are extensively used in BCA analyses. For example, a very useful distinction is to differentiate between:

- Quantifiable benefits, and
- Nonquantifiable benefits.

5.3.1.1 QUANTIFIABLE BENEFITS Quantifiable benefits are those that are identifiable, measurable, and can be weighed (or "weighted") in terms of the benefits or savings expected. For example, the following kinds of activities tend to be prima facie quantifiable, although sometimes when the analyst probes deeply it turns out they cannot be so easily quantified, or quantified fully, because the benefits are too intangible or an "easy consensus" does not exist on which to base

the weighting of the benefits or their relevance to costs incurred. We will take up examples in several contexts.

First, a broad, generic list of examples of the kinds of benefits that are generally quantifiable:

- Increases in product or service output as a function of increases in resource inputs or no changes in resource input levels. This is the classic productivity measure, where inputs are put in the numerator and outputs in the denominator, and the ratio is the "productivity ratio."

- Direct reduction in costs as a result of introducing a new method, system, or process. This is often called a "cost reduction" or a "cost savings."

- Direct reduction in time to perform a task, as a result of introducing a new method, system, or process. This is often called a "time savings" and is quantifiable by using a salary factor as the multiplier.

- Creating new assets where none existed before, or increases in the value (worth) of an existing asset; the asset is valued in accordance with conventional asset accounting techniques.

- Improvements in product or service quality that lead to increases in use.

- Displacement of more expensive resource inputs with less expensive resource inputs. This is sometimes called "substitution" in industrial engineering parlance.

- Speeding up a process or operation so that more output is produced with little or no change in the input levels; productivity increases are thus measurable.

- Simplifying a process or operation (doing the same things but in fewer steps) so that more output is produced with little or no change in the input levels; productivity increases are thus measurable.

- Streamlining a process or operation, or "value engineering" a product or service (combining, paralleling, consolidating, or synchronizing steps) so that more product or more service can be delivered with little or no change in the input levels; productivity increases are thus measurable.

Second, a list of the kinds of benefits that are generally quantifiable drawn from the information resources management field:

- Increased ability to know how to go about independently finding needed information, as measured in terms of time savings.

- Increased availability of information products and services to users, as measured by larger numbers of holdings and services to which users are entitled.

- Greater intellectual access to information holdings and services, as measured by time savings between general awareness of the sought information's existence and precise identification of the source of the specific information needed.

- Greater physical access to information holdings and services, as measured by time savings between knowledge of the appropriate information source and the actual retrieval of the specific information needed.

- Greater use and reuse of existing information products and services, as measured by numbers of users, frequency of use, reduced cost of use, and similar measures.

- Greater number of "hits" (or fewer "misses") in on-line database searches.

- Fewer rejects resulting from the gap between expected knowledge and actual knowledge from using an information product or service.

5.3.1.2 NONQUANTIFIABLE (QUALITATIVE) BENEFITS Nonquantifiable (qualitative) benefits are those benefits that are relatively intangible and are somewhat difficult, very difficult, or even sometimes impossible to measure or

weigh in terms of their impact. Often the central difficulty stems from trying to establish a direct cause:effect relationship between inputs and outputs, because there are too many uncontrollable variables at play at the same time, and analysts are unable meaningfully and scientifically to correlate output changes to specific inputs or input changes or both.

Some economists distinguish between the benefits of information itself (that is, its content) and the benefits of the medium (including the services and systems and remainder of the delivery infrastructure related thereto) by which the information is obtained. But this distinction is much harder in practice to make than it is to state in philosophical terms if for no other reason than, ultimately, the value of information is utterly dependent on the unique and nonreplicable individual use of the information context, which varies from one person to another, from one minute to the next. Or, to use the much-quoted McLuhan saying "the medium is the message."

Still other economists state unequivocally that there is no direct relation between the volume of information and its value. In summary, our experience is that most project sponsors will not want to complicate matters by trying to make these philosophical distinctions in the context of BCA. Rather, we will list these kinds of values and benefits as nonquantifiable and make no effort to try and quantify them.

First, a broad, generic list of examples of the kinds of benefits that are generally somewhat difficult to quantify, very difficult to quantify, or even impossible to measure or weigh in terms of their impact:

- Improvements in the quality of decision-making;
- Improvements in health and working conditions;
- Improvements in morale;
- Improvements in physical safety;
- Improvements in physical security;
- Improvements in privacy;

- Reducing uncertainty in problem-solving and decision-making;
- More harmonious relationships between workers, and between workers and management levels;
- Improved customer satisfaction;
- Fewer lost opportunities;
- Fewer risks incurred;
- Improvements in income security; and
- Improvements in quality of life.

Second, a list of the kinds of benefits that are generally difficult or even impossible to quantify drawn from the information resources management field:

- The impact of more accurate information delivered to users on the quality and timeliness of problem-solving and decision-making;
- The impact of more comprehensive information delivered to users;
- The impact of more credible information delivered to users;
- The impact of more relevant information delivered to users;
- The impact of more timely information delivered to users;
- Greater browsability of information holdings;
- Improved formats and presentation of information delivered to users;
- Improved communicability to secondary users of information received by primary users;
- The impact of withholding unneeded information ("reducing noise");

- The availability of alternative information storage, retrieval and delivery mechanisms, media, and modalities (e.g., CD-ROM, video, audio, interactive, multimedia);

- The availability of alternative information searching mechanisms, media and modalities (e.g., hypertext);

- The shifting and displacement of lower order, less important, and less critical work from higher paid professionals to lower paid para-professionals and clerical personnel, thereby allowing higher paid workers to undertake more creative and intellectually intensive tasks;

- Improvements in organizational effectiveness (in both for-profit and not-for-profit information use environments); and

- Long-range impact of improved education, information literacy, and reasoning ability.

5.3.2 Recurring vs Nonrecurring Benefits

Another useful benefits classification scheme is:

- Recurring benefits, and

- Nonrecurring benefits.

Recurring benefits are those expected to reoccur over the project lifetime, usually regularly (e.g., daily, weekly, or annually) but, sometimes, irregularly or intermittently.

We spoke earlier of the four stages of creation and start-up, operation, maintenance, and replacement or dismantling. Recurring benefits tend to occur in the second and third stages.

Nonrecurring benefits are those expected to occur only once, usually at the beginning of the project or toward the end of it. Nonrecurring benefits are analogous to one-time costs.

We can identify at least three kinds of costs as nonrecurring:

- Cost reduction,
- Value enhancement, and
- Other (e.g., offsetting receipts).

Cost reductions are activities in which a benefit is realized because material, labour, or some element of overhead cost has been reduced. If a cost is avoided entirely, then it is called Cost Avoidance. For example, contractual costs may be reduced by renegotiating more favourable terms and conditions, or the cost of raw materials may go down, or the cost of labour may decline.

Value enhancement benefits are realized when value is added to an existing product, service, process or operation, thus allowing us to maintain the same level of output, or even increase the level, without changing the levels of inputs or perhaps even decreasing the levels of inputs.

An offsetting receipt is an example of the third kind of nonrecurring benefit. In this instance, a cost incurred in one area is compensated for ("offset") by a cost decrease in another area. For example, the introduction of equipment, such as automation, may decrease labour costs.

5.3.3 BENEFITS ARISING FROM NEW ACTIVITIES

Benefits may also be categorized according to whether or not they accrue because of:

- The undertaking of new activities that were never done before, or
- The savings that is realized because of the performing of existing activities in a more cost-effective, efficient, and economical manner.

With respect to the second category, savings, beneficiaries of a library and information infrastructure improvement project may enjoy benefits because of:

1. Time savings,

2. Improved productivity,

3. Improved quality of work (fewer rejections or failures),

4. Improved timeliness of work, and

5. Improved morale, working conditions, etc.

5.3.4 Immediate, Delayed, and Potential Benefits

Benefits can also be classified on the basis of whether the results can be expected immediately, will be delayed for some period of time (months or even years), or are "potential," meaning the value cannot yet be defined, much less measured, and is similar to an "indirect" benefit or an externality.

5.3.5 Other Benefit Classification Schemes

The following checklist of categories of benefits may be useful to the analyst in an effort to include possible benefits related to an alternative. The list is not intended to be all inclusive. It is only illustrative of some of the types of benefit categories that could be applicable to a given analysis, depending on objectives, and the nature of the problem being solved:

1. **Acceptability** Consider the alternative in terms of whether it may interfere with the operation of parallel or higher echelon organizations.

2. **Accuracy** What is the error rate? It may be possible to measure errors per operating time period, the number of errors introduced into a system, and so on.

3. **Availability** When can a system or capability be delivered or implemented? When is it needed to meet proposed output schedules? What is the lead time for spare parts delivery?

4. **COST AVOIDANCE/COST REDUCTION** Cost avoidance is not incurring (or reducing) additional costs to produce work that is not currently being produced. Cost avoidance is also the prevention or reduction of additional costs that would otherwise result. An example would be increased productivity compensating for an anticipated increase in workload. Cost reduction would result if the alternative reduces or prevents an increase in funds that would otherwise be necessary. Not replacing costs reduced in one year becomes cost avoidance in future years. On the one hand, if you define benefits as the positive effect of an alternative or program, cost avoidance and cost reduction would be treated as benefits. On the other hand, if you define benefits as the output of an alternative or program, cost avoidance and cost reduction would be considered as reductions to cost (negative costs).

5. **FUNCTIONALITY** Consider how well or how quickly a new system runs or other capability performs. Can red tape and paperwork be eliminated or at least reduced? Can bureaucracy be minimized? Can new features and functions be put in place to help citizens leader a safer, healthier, richer, or fuller life?

6. **INTEGRATABILITY** Consider how the workload and product manufacture and delivery of the organization will be affected by the changes necessitated in modification of existing facilities and infrastructures, including equipment, personnel training, operating space, and so on.

7. **MAINTAINABILITY/CONTROLLABILITY** Has adequate human engineering been performed? Are ergonomic methods and approaches used? When the system fails, is there a fail-safe mechanism, a fallback, an emergency plan?

8. **MANAGEABILITY** What is the span of control? Can it be reduced or expanded to achieve greater optimal manageability? What is the management and supervision layering situation? Can the number of layers be reduced? Is a hierarchical or a flatter type of organization preferable?

9. **EMPLOYEE MORALE** This could be measured directly by using opinion survey or indirectly by looking at a morale surrogate indicator such as vacation, compensatory leave, overtime, and sick leave records.

10. **PRODUCTION** The number of transactions performed or items produced for each alternative (e.g., number of reports printed). This could be related to comparable time periods of the analysis.

11. **PRODUCTIVITY** Rate of production, which may be measured by the number of items per hour, volume of output related to staff hours, etc. Remember, staff year reductions will result in cost avoidance or cost reduction.

12. **QUALITY** Will a better quality product or service be obtained? Could quality be graded, thus measurable? If not, a description of improvement could be given. What is the impact of varied quality?

13. **RELIABILITY** This attribute of benefits might be in terms of the ability of a new service or facility to render the required degree and quality of service repeatedly, even under time pressures and difficult operating conditions.

14. **SAFETY** Number of accidents, hazards involved, pollution problems, environmental hazards, in the workplace, in the home, and on public streets.

15. **SECURITY** Are assets, sensitive information, critical stockpiles of natural resources, and other materials in need of protection adequately protected to prevent fraud, abuse, misuse, disclosure, or waste?

16. **SERVICE LIFE** Consider how long the proposed system or other capability will affect the organization's workload or output. What about obsolescence?

17. **UPGRADEABILITY/MODULARITY** Can the new capability put in place by the project be upgraded, incrementally, with ease, or will large components of the existing system or capability have to be dismantled and officials have to start over from scratch?

18. **VERSATILITY/FLEXIBILITY** In worst-case scenarios, will services still be renderable and products still producible, if automated or semiautomated modes of operation fail. In other words, will manual modalities and traditional modalities still be available?

A final benefits classification scheme that we will use to close this section is as follows:

1. **POLITICAL BENEFITS** For example, consider improved quality of policy formulation, increased awareness of government politicians to existing or potential economic and social problems, greater efficiencies in public administration and in governance, etc. Empowerment of the people fits under this heading.

2. **ECONOMIC BENEFITS** For example, consider employment benefits, small and emerging business assistance, dealing with economically depressed areas, better planting and weather information furnished to farmers, etc. Sustainable development fits under this heading.

3. **SOCIAL BENEFITS** For example, consider reduced tax burdens, greater productivity of service delivery to citizens, a more informed populace, greater health protection, greater crime deterrence, etc.

4. **CULTURAL BENEFITS** For example, consider multilingual programs where dual or multilinguistic environments exist, assistance to the arts, improved access to libraries and museums and archives, etc.

5. **TECHNOLOGICAL BENEFITS** For example, consider making available more state-of-the-art technologies to assist populations in personal, family, job, and societal contexts.

The foregoing scheme is particularly useful in social and economic development settings because practitioners in that area typically think of subdividing in these terms (see Appendix B for an illustrative list of benefits).

5.3.6 QUANTIFYING BENEFITS

This step involves devising a measurement system for the quantifiable benefits (discussed in the foregoing) associated with each alternative. In fact, there may be any number of different measures. Every reasonable effort should be made to identify and quantify benefits in units or dollars with supporting rationale. If benefits cannot be quantified in dollars, they should be expressed, where possible, in measurable units. If benefits can neither be quantified in dollars nor expressed in measurable units, they should be weighted in terms of relative importance to each other and to the associated benefits measured in dollars or in units or in both.

1. **CONVERSION OF MEASURABLE BENEFITS INTO EQUIVALENT MONETARY VALUE** Some factors that are generally described in non-dollar terms can be converted into equivalent monetary values with varying degrees of difficulty. These may include factors such as time savings and error reduction. These benefits, which are generally not expressed in monetary terms, are often amenable to a fairly straightforward monetary conversion and a comparison among alternatives on a dollar value basis.

   To claim an efficiency/productivity increase as a valid benefit, there must be a documented need for the increased workload capacity. In other words, there must be an alternative use to which the "new" staff resources can be put, such as reducing a backlog of maintenance. Lacking this, there is no benefit, or at least no quantifiable benefit, derived from the project.

2. **CONVERSION OF BENEFITS INTO A NONMONETARY VALUE** Other ben- efits may not be readily converted to a dollar figure. Nonetheless, many of these factors can be expressed in some common unit of measure and subsequently compared in consistent units (such as percentage satisfaction with services provided, etc.). Such factors should be maintained in or converted into a common, non-dollar unit of measure and compared separately from other, quantified factors. Often, this common unit of measure can be related to dollars. For example, it may cost $X to achieve Y% of satisfaction.

5.3.7 MEASURING NONQUANTIFIABLE (QUALITATIVE) BENEFITS

Nonquantifiable (or Qualitative) benefits have the potential of major impact on BCA, as well as on the decisions that result. The goal in the analysis of intangible factors is to improve the overall assessment by providing a sound methodology. At first blush, it seems like a contradiction in terms to try to "measure qualitative factors." But rough orders of magnitude can often be approximated, and that is what we are trying to do here.

There are a number of generally accepted guidelines for including intangible factors in an analysis. The procedure used depends on the purpose of the analysis and the nature of the intangibles. The Delphi Method, for example, is becoming popular as a means of integrating intangible factors with quantifiable benefits. Intangible factors can be ranked by informed experts or other individuals in terms of their relative importance to the results of the analysis. Ratio or interval ranking of the nonquantifiable benefits is mandatory for whichever type of decision support system used.

Such a ratio or interval ranking of intangibles can be used to describe the degree to which a proposal achieves a given objective. Although no strict quantification is implied in this evaluation, the decision-maker is provided with an adequate description of all factors evaluated in the analysis and their relative importance to achieving the goals and objectives. Appendix H provides a case example of the use of the Delphi approach to a major office automation project.

5.3.8 STEP-WISE METHODOLOGY FOR ESTIMATING BENEFITS

1. Prepare a "strawman" list of benefits without making any attempt to subdivide them into quantifiable or nonquantifiable, recurring or nonrecurring, political or economic or social, and so on.

2. Pass the strawman list around the BCA team and, once the team is satisfied that the list is fairly complete, expose it to a wider circle of project players, and obtain feedback.

3. Begin to refine the list. Begin to subdivide the benefits into nonrecurring vs recurring, because that decision is probably the easiest.

4. Proceed to further subdivisions. Divide benefits into quantifiable and nonquantifiable, i.e., at this stage, you have determined that the benefit in question is at least partially quantifiable, and you have some idea of how to measure the benefit.

5. You should now be in a good position to distinguish between areas where benefits are more or less readily identifiable and measurable, and areas where benefits are not readily identifiable and measurable and you should consider using an indicator of benefit value, or consider simply rank ordering the benefit in a final listing.

ENTERING BENEFITS DATA

DATE ____

Benefits	FY	FY	FY	FY	FY	FY	System Life Costs
Accuracy							
Availability							
Cost Avoidance							
Maintainability							
Morale							
Opportunity Yield							
Production							
Productivity							
Quality							
Reliability							
Revenue Enhancement							
Other (Identify)							
Total Benefits							
Discount Factor							
Total PV Benefits							
Cumulative PV Benefits							

FIGURE 2–5

6. Prepare a simple matrix of the kind shown in Fig. 2–3, that correlates benefits (including indicators) with the sources and kinds of documentation you expect to utilize to develop the benefits. This matrix then becomes a work program. In some cases, you will inevitably find that the primary source of the information you need and had hoped would contain the necessary material does not, in fact, contain it, and you will have to fall back on secondary sources.

7. Estimate each quantifiable benefit and enter the amount into a table of the kind shown in Fig. 2–5. Of course, if the Excel program as described in Part 3 is being used, then the data should be entered there as well.

8. Continue this process until all benefit amounts have been entered into the benefits table; we will later address how the "number crunching" then proceeds in the final stages of the analysis, either manually or using the special BCA software package.

Analysts and readers may wish to consult the do's and don'ts checklists for costs and benefits that appear as Appendixes L and M, respectively, before proceeding.

6.0 EVALUATING ALTERNATIVES

In evaluating or comparing alternatives, the best alternative is sometimes apparent by inspection alone. In most cases, however, all factors do not point to selecting the same alternative. Or, put another way, there is usually no a priori consensus among the key decision-makers, in part because they implicitly or explicitly make different assumptions, assign different weights to the same assumption, disagree with each other in one respect or another on the project goals and objectives, or sometimes are in direct conflict with one another.

When this is the case, it is necessary to put all of the alternatives on a common basis of time and cost to make a valid comparison.

6.1 EVALUATING ALTERNATIVES WITHOUT PRESENT VALUE

One simple, essentially nonmathematical way to make comparisons among several alternative ways of implementing a library and information infrastructure improvement project is to prepare a variety of matrices that juxtapose benefits as outputs with costs as inputs. Sometimes, such a matrix is called an "input–output" matrix, but it could just as well be called a "benefit:cost" matrix (see Fig. 1–8)..

Note the way such matrices should be viewed and used. For a given library and information infrastructure improvement project, the inputs (costs) would be identified along the left or stub column (not quantified, that is, no specific actual cost figures are entered), and the outputs (benefits) would be arrayed across the top row as column headers (again, without specific, actual amounts entered).

Then the relationship or correlation between a given input and a given output is shown in the "cells" or "intersections" as they are sometimes called. One simple kind of relationship or correlation that does not depend on the use of actual cost figures and quantified benefit amounts that could be shown would be the strength of the relationship.

For example, a simple 5-point scale of "the strength of input–output relationships" might be:

1. Weak (correlation)
2. Below average
3. Average
4. Above average
5. Strong

It may also be useful to rank order the preference for alternatives considered and document reasons why. In that way, should an unforeseen contingency arise that precludes adopting the preferred alternative, the project director and analysts are in a better fallback position to select the next most desirable alternative.

6.2 EVALUATING ALTERNATIVES WITH PRESENT VALUE

The second technique that is very central to BCA is to use actual cost and quantified benefit figures and apply present value discounting. The present value (PV) is the estimated current worth of future benefits or costs derived by discounting the future values, using an appropriate discount rate, readily available in discount tables.

As we mentioned in Part 1, present value analysis is a method that allows us to add the annual benefits and costs of a project over a period of years while taking into account the time value of money. In financial terms, this is called discounting.

But, before discounting, we must first put all competing alternatives on the same footing. In metaphorical terms, all horses must first be brought to the starting gate so that they each have the same distance within which to run the race. In technical terms, statisticians, economists, and accountants sometimes call this "normalizing" the data.

6.3 NORMALIZING ALL ALTERNATIVES TO THE SAME BASELINE

To use PV analysis as the primary basis for decision-making aimed at selecting a preferred alternative from among several competing ones, the following assumptions apply:

1. Benefits that have not been put in monetary terms are equal for all alternatives. When benefits are not equal, the least costly alternative will not necessarily be the best alternative. The best alternative may in fact be the one that costs more, yet produces a significantly higher level of benefits. In this case you need to devise a method of calculating the benefit:cost ratio that weights the unquantified benefits and adds them to the quantifiable benefits in the development of a benefit:cost ratio. Thus, when benefits are unequal, the decision should not be based solely on the PV analysis (for that matter, even when they are equal, other factors beyond the result of the "number crunching" should be taken into account).

2. Service lives of the alternatives must be finite or placed on finite terms (e.g., 10 or 15 years). That is, the intended estimated life of the alternative must be specified. For example, Alternative 1 is estimated to have a physical life of 6 years. Alternative 2 has an estimated life of 10 years. Alternative 3 has an estimate life of 15 years. The current system has an estimated life of 2 years.

3. Service lives of alternatives must be equal, or else they must be placed on equal terms. This can be accomplished in one of two ways. First, by using the "common multiple approach." In a simple example using the foregoing alternatives, equipment and other needed capabilities for Alternatives 1 and 2 would be augmented (replaced, upgraded, etc.) 9 and 5 years, respectively, bringing all three alternatives up the same estimated life of 15 years. A second way to handle the problem is to compare alternatives based on the alternative with the shortest life span, by considering the residual value of assets with longer life spans. Thus, again using the foregoing example, ignoring the current system, a 6-year life span would be used. The problem with this approach is that it ignores the situation where mission life outlasts an artificially created project life.

6.4 THE CONCEPT OF PRESENT VALUE (PV)

Present value means taking today's cost as the norm (or present value) and reducing the costs of future years by a "discount factor" based on an estimated time value of money (often also called the interest rate). Apply this method to each year's benefits and costs, and sum the resulting amounts to determine the total benefits and costs for the project life cycle.

The specific discount rate that a government, sponsor, or donor uses is a matter of policy, and may vary depending on various criteria associated with a given policy. Discount rates are not the result of some kind of mathematical modeling computation wherein dollar values are fed into an equation. Obviously, discount rates used by governments or development-assistance agencies, like commercial interest rates, depend on many considerations, including general economic conditions.

At first glance, the process appears more complex than it really is. Discount factors for each year are available for different interest rates in standard texts (and in Part 2 of this guide). With the discount factors at hand, the problem reduces to a spreadsheet exercise in multiplication and addition. Managers will need to understand PV to read BCAs. Once the concept is grasped, the mechanics will seem straightforward, especially if a spreadsheet program of the type described in Part 3 is used.

If the costs are more or less equal from month to month during the year, an average discount factor for each year may be used rather than a discount factor for each month. You may or may not wish to make the following kinds of fine-tuned distinctions:

- Distinguishing between investment costs and operating costs;
- Distinguishing between recurring, nonrecurring, and sunk costs;
- Distinguishing between fixed and variable costs;
- Distinguishing between direct and indirect costs; or
- Compensating for residual values by adjusting total costs.

Remember, as we have said in the foregoing, the decision on how detailed or how fine-grained your subdivisions of the data should be is essentially a function of (a) whether the source data and records are readily available at that level, and (b) whether presenting the data at that level would help illuminate the information for management to help them make a better decision for a given project.

It is at this point that the project director should be in the best position to decide whether the Excel program described in Part 3 should be utilized or not. If the answer is "yes," then the following material should be read with the computer software program in mind rather than manual computation sheets.

6.5 PV CALCULATION: METHODOLOGY FOR COSTS

Here is the methodology for calculating the present value of future cost streams "manually." If you are using the Excel computer program described in Part 3, then you would enter the data on-line, directly into the "cells" provided (this procedure is detailed more fully in Part 3):

1. For each alternative, determine the costs and year (fiscal or other type of accounting year used) in which the costs are incurred;

2. List the relevant costs by type in the left-hand column;

3. Insert the fiscal year costs in the appropriate column on the right for each cost category listed in the left-hand column;

4. If you are distinguishing investment and operating costs, enter the investment costs. Enter the total at the bottom. Repeat for operating costs. Add the investment costs total and the operating costs total. Enter the total annual cost at the bottom of the form; if you are not making such a distinction, or other subclassification distinctions, ignore this step;

5. Look up the average discount factor corresponding to the year from any set of discount or interest tables (you can obtain these from most banks, accounting firms, statistical offices, brokerage and insurance firms, or books in your library). Write the amount in the discount factor space for that year;

6. Multiply the total annual cost (step 4) by the average annual discount factor for that year. Enter the present value at the bottom. Repeat for investment costs and operating costs (if applicable);

7. Repeat steps 1–6 for each fiscal year of the system or project life;

8. Add the total PV costs for each fiscal year to determine the present value cost for all fiscal years;

9. Calculate the remaining economic value of ownership of all assets and resources as of the last month of the system or project life, if any; make the PV calculation to obtain the discounted residual present value; and

10. Calculate the adjusted cost by subtracting the discounted residual value from the total present value cost.

Repeat this process for every alternative considered.

6.6 PV CALCULATION: METHODOLOGY FOR BENEFITS

Here is the methodology for calculating future benefit streams manually; once again, if you are using the Excel computer program, you should consult the procedure in Part 3:

1. For each alternative, determine the benefit amounts and year (fiscal or other type of accounting year used) in which the benefits are expected to be realized;

2. List the relevant benefit amounts by type in the left-hand column (see the examples in Appendix O);

3. Insert the fiscal year amounts in the appropriate column on the right for each benefit category listed in the left-hand column;

4. If you are distinguishing nonrecurring and recurring benefits, enter the nonrecurring amounts. Enter the total at the bottom. Repeat for recurring amounts. Add the nonrecurring amounts total and the recurring amounts total. Enter the total annual benefits amount at the bottom of the form; if you are not making such a distinction, or other subclassification distinctions, ignore this step;

5. Look up the average discount factor corresponding to the year from any set of discount or interest tables (you can obtain these from most banks, accounting firms, statistical offices, brokerage and insurance firms, or books in your library). Write the amount in the discount factor space for that year;

6. Multiply the total annual benefits amount (step 4) by the average annual discount factor for that year. Enter the present value at the bottom. Repeat for nonrecurring benefits and recurring benefits;

7. Repeat steps 1–6 for each fiscal year of the system or project life; and

8. Add the total PV benefit amounts for each fiscal year to determine the present value benefits for all fiscal years.

Repeat the process for each alternative.

6.7 EXAMPLES

EXAMPLE 1: NO SUBCLASSIFICATIONS; YEARS ALONG VERTICAL AXIS

Assume a 10-year project that will commit the sponsoring agency to the stream of expenditures appearing in column (2) of Figure 2–6, and that will result in a series of benefits appearing in column (3). A discount factor for a 10% discount rate is presented in column (4). Present value cost for each of the 10 years is calculated by multiplying column (2) by column (4); present value benefit

for each of the 10 years is calculated by multiplying column (3) by column (4). Present value costs and benefits are presented in columns (5) and (6), respectively (see Fig. 2–6). There is another important pitfall here that project managers and analysts must be aware of. Occasionally, one finds that the economic payback period for return on the initial investment for a particular alternative is longer than the expected physical system (project) lifetime!

In that event, the alternative, except for rare mitigating reasons, should probably be disqualified. Ideally, the payback period, or at least the breakeven point, should occur before the system is expected to break down/degrade.

EXAMPLE 2: RESIDUAL VALUE SCENARIO; YEARS ALONG HORIZONTAL AXIS

The format is very similar to the preceding example, except that the years are along the horizontal instead of the vertical axis (see Fig. 2–7).

PRESENT VALUE CALCULATION — FORMAT 1

Sample format for discounting deferred costs and benefits

Year since initiation, renewal or expansion	Expected yearly cost	Expected yearly benefit	Discount factor for 10%	Present value cost [Col. (2) x Col. (4)]	Present value benefit [Col. (3) x Col. (4)]
(1)	(2)	(3)	(4)	(5)	(6)
1	$10	$0	0.909	$9.1	$0.0
2	20	0	0.826	16.5	0.0
3	30	5	0.751	22.5	3.8
4	30	10	0.683	20.5	6.8
5	20	30	0.621	12.4	18.6
6	10	40	0.564	5.6	22.6
7	5	40	0.513	2.6	20.5
8	5	40	0.467	2.3	18.7
9	5	40	0.424	2.1	17.0
10	5	25	0.386	1.9	9.7
				$95.5	$117.7

FIGURE 2–6

PRESENT VALUE CALCULATION — FORMAT 2

Residual value scenario: Years along horizontal axis

COSTS	YEAR 0	1	2	3	4	5	6	7	Total
System Life Cost									
Present Value Cost									
Residual Value									
Present Value Factor									
Discounted Res. Value									
Adjusted Cost									
Cumulative Costs (CC)									

BENEFITS	YEAR 0	1	2	3	4	5	6	7	Total
System Life Benefit									
Present Value Benefits									
Net Present Value									
Benefit : Cost Ratio									
Cumulative Benefits (CB)									

BENEFITS	YEAR 0	1	2	3	4	5	6	7	Total
Payback (Diff. CC/CB)									
Payback Period									

FIGURE 2–7

6.8 NET PRESENT VALUE (NPV)

The second comparison of alternatives that is often done is the calculation of the net present value or NPV (the first comparison discussed in the foregoing was the calculation of the simple annual present values, the PVs).

The NPV is calculated by subtracting the total present value cost from the total present value benefit of the project. The higher an alternative's positive NPV, the more its benefits exceed its costs.

From the point of view of economic analysis, the alternative with the highest NPV is frequently the most desirable. But, as pointed out, often that may not be the "correct" decision. Other important considerations, such as different nonquantifiable benefits, large initial cash outlays, budgetary constraints, labour restrictions, and, yes, political considerations, may require selection of an alternative that does not have the highest NPV. In these situations, the alternatives' NPVs serve to establish only a preliminary ranking of the choices. A final ranking takes into account the nonquantitative factors.

The guidelines provided up to now are standard in terms of virtually all benefit:cost analyses. From this point onward, however options are available to the analyst. Some additional analytical techniques are very commonly used and are strongly recommended, others are used only under very special circumstances.

6.9 SUPPLEMENTARY ANALYTICAL TECHNIQUES

There are a number of supplementary analytical techniques available to project managers that are only briefly overviewed here. It is emphasized that these techniques are optional and are used in special circumstances.

6.9.1 BENEFIT:COST RATIO (BCR)

A second technique (beyond PV/NPV methods described in the foregoing) used to evaluate alternatives is the benefit:cost ratio (BCR). The BCR is obtained by dividing the benefits (or, preferably, the present value benefits) by the costs (or, preferably, the present value costs).

The BCR provides one measure of the benefits obtained per dollar of input costs spent. The BCR is particularly useful when comparing alternatives with unequal costs, unequal benefits, and unequal project life cycles. Most library and information infrastructure improvement projects involve inequalities of this type, and the assumption of equivalent benefits, costs, or life cycles would be a very poor one.

Some techniques, therefore, must be devised for comparing alternatives that assess both costs and benefits, where the costs or benefits, or both, are unequal among the alternatives being considered. The technique generally recommended is BCR.

The alternative with the highest BCR is the one that is economically the most cost effective but other circumstances and conditions may mitigate selecting the alternative with the highest BCR as the preferred one. The use of the BCR is but one more tool in our arsenal of aids to help us make the "correct" decision. Here is a simple example of comparing three solutions to a problem using the BCR technique where the buy option has the highest BCR:

	Alternative	Present Value Cost
1. Compute the present value cost	Status Quo	$540,406
	Alt. 1 (buy)	380,090
	Alt. 2 (rent)	403,910

	Alternative	Present Value Cost
2. Compute the present value benefit	Status Quo	$950,000
	Alt. 1 (buy)	900,000
	Alt. 2 (rent)	900,000

	Alternative	Benefit:Cost Ratio
3. Compute the benefit:cost ratio	Status Quo	1.76
	Alt. 1 (buy)	2.37
	Alt. 2 (rent)	2.23

6.9.2 BREAKEVEN ANALYSIS (BEA)

A third common comparison technique used in BCA is to evaluate alternatives graphically with costs that may or may not be equal, benefits that may or may not be equal, and economic lives that may or may not be equal. This technique involves finding the point at which the different alternatives being considered have equivalent costs or benefits.

Breakeven analysis (BEA) is essentially a technique used to display graphically the relationship between alternative cost patterns. The technique involves finding the point at which the costs or benefits are equivalent, but other factors should be considered in making a final decision. To either side of the breakeven point, one alternative or the other has the economic advantage. When an alternative is compared against the status quo (if one exists) the breakeven point determines when savings will begin to accrue.

Breakeven charts are useful in analyses because they provide the analyst with the capability to visually compare the alternatives at any point in time. Graphic presentations are straightforward and easily understood.

Breakeven analysis is also a useful tool for analyzing the financial characteristics of one or more alternatives when relative desirability depends upon the quantity of some variable, such as the number of units produced or the number of hours of system operation. Breakeven analysis determines the point at which the cost of considered alternatives is equal (for an example, see Fig. 2–8).

The horizontal axis is scaled to measure time in yearly intervals over the project lifetime, although monthly intervals might be used. Still other convenient and meaningful units of measurement, however, could be used, such as the number of units produced or hours of operation.

The vertical axis is scaled off in dollars. The discounted, annual cost patterns can be charted for each of the alternatives. In Figure 2–8, the breakeven point occurs at year 4 for the considered alternative. Several alternatives could be juxtaposed on the same chart to depict different breakeven points, but care should be exercised in not making the chart too "busy."

BREAKEVEN ANALYSIS

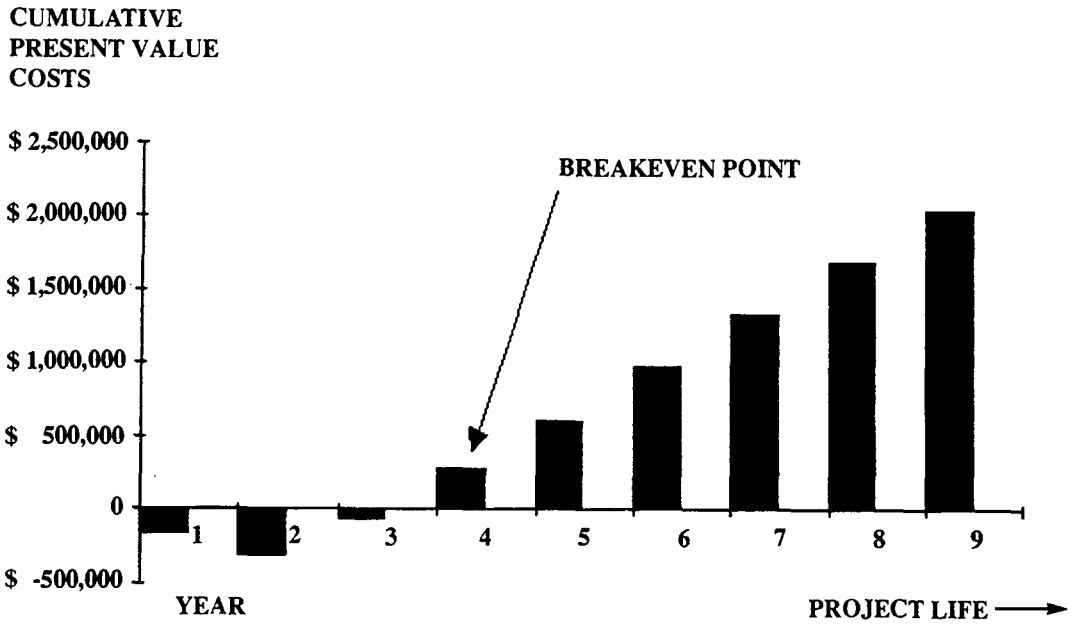

FIGURE 2–8

Clearly, this technique is just as applicable for comparing the benefits of different alternatives. Moreover, it would be possible to use the same graphic technique for comparing benefit:cost ratios.

Always remember that we are dealing with *cumulative* costs or benefits here. That means that the breakeven point is not the first year in which yearly benefits outweigh yearly costs but, rather, the first year in which the cumulative benefits outweigh the cumulative costs. The breakeven point using cumulative figures may not occur until one or more years after the year in which benefits first outweigh costs.

Readers and analysts may wish to check the do's and don'ts checklist for comparing alternatives in Appendix N before proceeding.

7.0 TESTING SENSITIVITY TO MAJOR UNCERTAINTIES

Finally, a fourth common technique used for comparing alternatives is sensitivity analysis (SA). This technique is so important that we actually consider it to be the seventh step in the overall 10-step BCA methodology. It is almost always used by analysts.

The SA technique involves examining the assumptions of a BCA to determine their effects and influence on the final recommendations. Today's powerful automated modeling tools and spreadsheets have put this type of analysis within easy reach of every personal computer and every manager.

The essence of the procedure is to take an important assumption (often called a "parameter" by technically trained professionals) and vary it to observe the total effect on project costs or benefits. For example, a project cost estimate that assumes the project will require five computer room personnel. Personnel costs are repetitive. Over the life-cycle of the project, they continue to add up. We could use sensitivity analysis here to determine the effect on the total costs of the system assuming two, three, or four personnel. One possible trade-off might be between more personnel (a repetitive cost) and more expensive equipment (a nonrepetitive cost).

The value of this type of analysis to managers, design engineers, etc., should be evident. The technique can be very powerful, but it requires realistic costing and, thus, depends directly on the active participation of managers and other team members who guide the target assumptions and act on the consequences.

Another way to look at sensitivity is to understand that it refers to the relative magnitude of change in one or more elements of an analysis that will cause a change in the ranking of alternatives. In a sensitivity analysis, if one particular factor or cost alternative can be varied over a wide range without affecting the ranking of alternatives, the analysis is said to be insensitive to uncertainties regarding that particular element. Economists sometimes refer to a product as being "price insensitive" meaning customers are willing to buy the product over a wide price range because it is considered relatively indispensable to livelihood, or they want it "at any price."

7.0 TESTING SENSITIVITY TO MAJOR UNCERTAINTIES

Sensitivity analysis does not require any sophisticated techniques. What is required is the ability to recognize uncertainties in the analysis and to deal with them in a logical manner.

7.1 STEP-WISE METHODOLOGY

1. Is the analysis really necessary? If there is complete certainty and the ranking of alternatives establishes one option as markedly superior to the rest, the analyst should not be concerned about testing for sensitivity. It is only when there is uncertainty and the best choice is not clear, that further investigation is required.

2. If SA is indicated, the analyst must then select which parameters to test. There is no single aspect or criterion that can be presented that will provide a definitive approach to selecting the most important parameter or factor in all sensitivity analyses. Each analysis is unique in that it possesses its own set of costs and assumptions. As a rule, sensitivity analysis should treat dominant input variables, that is, those having a significant impact on the total present value cost, the benefits accruing to a given alternative, or both. Of course, identification of the major cost contributors does not necessarily mean that the truly critical items have been isolated. The choice of input variables for sensitivity may depend not only upon relative dominance but also upon the degree of confidence that can be placed in these estimates. Some of the elements that should be considered are:

   COST ESTIMATES Effects of increasing or decreasing major cost elements; that is, those which have a significant impact on the present value cost;

   LENGTH OF PROJECT LIFE Effects of a shorter or longer project life on the payback of the different alternatives;

   VOLUME, MIX, OR PATTERN OF WORKLOAD Effects of variation in the estimated volume, mix, or pattern of workload;

REQUIREMENTS Effects of potential changes in requirements resulting from either executive, legislative (parliamentary) or judicial mandate, or changes in functional or organizational structure;

CONFIGURATION OF EQUIPMENT AND FACILITIES Effects of changes in configuration of equipment and facilities;

ASSUMPTIONS Effects of alternative assumptions concerning requirements, operations, facilities, conditions in the future, dependability of sources of strategic materials, and so on; and

CONVERSION COSTS Effects of variation in costs of the changing from one modus operandi to another.

3. Select one factor at a time if more than one is to be tested (you must hold all other factors constant while the effect of changing one parameter is tested). Rework the analysis (i.e., cost estimation, benefit estimation, present value calculations, net PV calculation, and the derivation and use of various supplemental techniques such as BCR and BEA.

EXAMPLE: Will results change in the following if system development costs are raised to $200,000 from $180,000? to $210,000?

	Alternative 1 (proposed)	**Alternative 2 (status quo)**
	(dollars in thousands)	
Year One (includes most of start-up and nonrecurring costs):		
Equipment	$ 80	$ 80
System Development	180	0
Site Preparation	35	0

Year Two to Nine:

Personnel	$ 80/yr	$120/yr
Other Operating Cost	20/yr	25/yr

SOLUTION:

- The net present values for Alternatives 1 and 2 are:

PV(Alt. 1) = 0.954($80 + $180 + $35) + 5.088($80 + $20)
= $281,000 + $509,000
= $790,000

PV(Alt. 2) = 0.954($80) + 5.088($120 + $25)
= $76,000 + $738,000
= $814,000

Thus, Alternative 1, the proposed system, is less costly.

- If system development is increased to $200,000:

PV(Alt. 1) = 0.954($80 + $200 + $35) + 5.088($80 + $20)
= $301,000 + $509,000
= $810,000

Because $810,000 is still less than the status quo option ($814,000), the analysis is not sensitive to a $20,000 increase.

- If system development is increased to $210,000:

PV(Alt. 1) = 0.954($80 + $210 + $35) + 5.088($80 + $20)
= $310,000 + $509,000
= $819,000

Because \$819,000 is greater than \$814,000, we can say the analysis is sensitive to an increase of \$30,000 (\$210,000 – \$180,000) in system development.

- Suppose, to use one more example, personnel costs in the above illustration were increased to \$85,000?

  PV(Alt. 1) = 0.954(\$80 + \$180 + \$35) + 5.088(\$85 + \$20)
  = \$281,000 + \$534,000
  = \$815,000

Thus, an increase in personnel costs to \$85,000 would make the analysis sensitive in terms of changing the outcome (because \$815,000 is higher than \$814,000).

- One final example. Suppose we wanted to perform a sensitivity analysis to determine what would happen if, in the foregoing example, the project life was 5 years instead of 8 years? Based on a 5-year project life, the present values of Alternatives 1 and 2 are recomputed:

  PV(Alt. 1) = 0.954(\$295) + 3.616(\$100) = \$643,000
  PV(Alt. 2) = 0.954(\$ 80) + 3.616(\$145) = \$600,000

Alternative 2 is now less costly than Alternative 1. Because the ranking of alternatives has, therefore, changed, the analysis is sensitive to a shorter project lifetime.

7.2 SPECIALIZED TECHNIQUES

7.2.1 UNIFORM ANNUAL COST (UAC)

The uniform annual cost (UAC) technique is a cost-oriented approach to evaluating alternatives with unequal costs, equal benefits, and unequal project lives. The technique involves putting all life-cycle costs for each alternative in terms of an average annual expenditure. The alternative with the lowest UAC is the most economical choice (although not necessarily the preferred choice because of other considerations).

7.0 TESTING SENSITIVITY TO MAJOR UNCERTAINTIES

The UAC requires converting each alternative into an equivalent hypothetical alternative having uniform recurring costs. The conversion is such that the total net present value costs of the actual alternative and its hypothetical equivalent are the same. The hypothetical alternatives are compared to determine the one with the lowest uniform recurring cost.

EXAMPLE: Perform the following calculations to obtain a UAC for each alternative:

1. Compute the PV costs for each alternative;

2. Divide the PV cost for all years by the sum of the discount factors for the project life of the alternative (b_n). Cumulative discount factors are found in tables readily available in reference books, banks, and so on.

The UAC represents the amount of money which, if budgeted in equal yearly instalments, would pay for the project. Note, that this is not the same as taking a simple average. For example, a theoretical system with a five year life and an acquisition cost of $10 million would have an average annual acquisition cost of $2 million. Using UAC, the annual cost would be approximately $2.5 for the same acquisition:

Simple Average	**UAC Method**
$10M = $2M	PV = $10M = $2.5M
5	b_n 3.977

The use of a simple average for determining the average annual cost for economic analysis purposes is inappropriate because it fails to acknowledge the time value of money. The UAC, however, does incorporate this concept in its formula. In the foregoing example, the significance of the $2.5M UAC is this: If $2.5M were to be spent each year for 5 years, the total net present value of the payments would be $10M, the same as the actual net PV of the alternative.

7.2.2 SAVINGS:INVESTMENT RATIO (SIR)

The savings:investment ratio (SIR) technique is used to compare a proposed alternative to the status quo. The alternative and the status quo may or may not have equal costs, but their benefits are equal, as are their project lives. The technique involves calculating:

1. The alternative's investment costs,

2. The life-cycle cost savings between the alternative and the status quo, and

3. The ratio of (2) to (1).

The SIR determines the degree of financial benefit attained from the alternative. For an investment to be economically sound, the SIR must be greater than 1.

Many analyses evolve from a situation where a given requirement is already being met at the present time, but a less costly situation is perceived. You compute a SIR to measure the degree of financial benefit to be attained from that investment.

In an analysis, the SIR establishes the relationship between a proposed alternative and its status quo. When there is more than one alternative, the SIR technique will determine which alternative produces the most savings per dollar invested; however, it will not necessarily determine the least costly alternative. Consequently, the results of the SIR technique can be misleading to the decision-maker. It is suggested, therefore, that the SIR technique be reserved for analyses which compare a proposed alternative to the status quo.

7.2.3 DISCOUNTED PAYBACK ANALYSIS (DPA)

Discounted payback analysis (DPA) is used to compare a proposed alternative to the status quo. The benefits for the alternative and the status quo are equal, as are the economic lives. This technique involves calculating:

1. The alternative's investment costs,

2. The life-cycle cost savings between the alternative and the status quo, and

3. The ratio of (1) to (2).

This ratio determines the period required for a project's accumulated savings to offset investment costs. Each alternative may be compared against the status quo. The alternative with the lowest ratio presents the quickest "payback period."

Often project reviewers are interested in when a project will "pay for itself." When that question arises, it is useful to calculate the payback period. DPA calculates the payback period, the elapsed time between the point of initial investment and the point at which the payback on the initial investment will occur.

The calculation of the payback period is not affected by the duration of the project's lifetime. For example, a 4.5 year payback period means the same thing whether the lifetime is 10 years or 25 years.

Generally, the shorter the time until the investment is paid back, the more attractive the investment is considered. This preference, however, is not always justified from the standpoint of cost effectiveness. An investment with a longer payback period may be more cost effective than an investment with a shorter payback. For example, a project that costs $10,000, saves $4,000 a year, lasts 4 years, and, therefore, has a simple payback of 2.5 years, will be less cost effective than a project that costs $10,000, saves $3,000 a year, lasts 6 years, and, therefore, has a simple payback period of 3 1/3 years.

Another weakness of the payback period lies in its failure to address cash flows beyond the period necessary to recover investment costs. If significant one-time costs are to occur after the estimated point of payback (e.g., major repair or overhaul costs, or site restoration costs), the payback period will tend to overstate the economic attractiveness of the proposed project.

Although the payback method is sometimes used to establish priorities for competing projects, it should not be used as the primary determinant in selecting a preferred alternative.

7.2.4 OTHER CONSIDERATIONS IN USING ALTERNATIVES COMPARISON TECHNIQUES

In all of these common and specialized techniques used as tools to help analysts compare alternatives and test their rank ordering against changes in assumptions and other parameters, present value analysis is performed to establish a preliminary ranking of alternatives based on both actual and discounted costs. Then, one or more of the techniques described in the preceding paragraphs is used to analyze each alternative further. Taken together, this toolkit of techniques offers the analyst a solid, defensible basis upon which to make a recommendation for a preferred alternative.

It is important to emphasize that for every technique except UAC, the economic lives of alternatives must be equal or placed on equal terms (e.g., by annualizing or normalizing).

One final postscript to this section. Depending on how fine-tuned and complex the scope of the BCA selected, project managers may also wish to consider the residual value of certain "costs" as an offset or deduction to total costs. When residual value computations are included, the residual value of assets expected to be on hand at the end of the system life cycle must be treated as an offset or reduction to costs to obtain an accurate picture of the true costs. Technically speaking, in the convention of BCA methodology, an offset to costs arising from the deduction of the residual value of leftover, useful assets is not the same thing as a "benefit," although, in the end, the final outcome amounts to the same thing.

8.0 PRESENTING RESULTS

8.1 SOME GENERAL POINTS

It is important that decision-makers be presented with a full disclosure of all pertinent information uncovered during the analysis, not just the results of the "number crunching" parts of the analysis. Decision-makers must also be presented with the results of considering any "mitigating factors" that the analysts believe could have a bearing on the final decision process and the disclosure of which would assist the decision-maker in reaching a more informed final decision.

Once completed, the BCA should be presented, insofar as possible, in a standardized, straightforward, and easily understood manner, whether in briefing or in formal written contexts. This approach organizes the findings in a familiar way and ensures that all important issues have been addressed.

It is of particular importance in benefit:cost analysis because many decision-makers fear numbers; they are uneasy and uncomfortable with figures and, therefore, analysts must go out of their way to ensure that the presentation of mathematical information is devoid of as much technical jargon and mumbo jumbo as possible.

Once the decision-makers have accepted a preferred course of action, this will be the appropriate time and place for developing the detailed master timetable and the subsidiary supporting schedules for planning, for resource availability, for construction, for developing and testing, for education and training, and so on. That process is described in the following in the final BCA methodology step, describing the implementation process.

It is at that final step, not here, that PERT and GANTT charts are often useful for this purpose, and there is a useful body of literature dealing with scheduling, the critical path methodology, and related facets.

8.2 ORAL BRIEFINGS

Ideally, the presentation of results should first take the form of one or more oral briefings of preliminary findings, assumptions, constraints, and alternatives,

to give officials an opportunity to feed back their reactions. Perhaps they are aware of a policy constraint that was omitted from the original instructions, or perhaps some assumption has now come to light that had been hidden. It is not uncommon for the decision-makers to redirect the analyst to rework the numbers based on inputs that may not have been known when the analysis was first undertaken. Perhaps new information has come to light in the meantime.

Then there is the question of whether the oral briefing should be given advance billing as an "information only" briefing or an actual decision-making meeting. Remember, the BCA itself does not make the final recommendation of the preferred alternative, management does! That means that the information shared with the decision-makers being briefed is a way of educating them as to the facts, how the findings and conclusions were drawn up, how the numbers were crunched, and how the preferred alternative was finally selected.

Project directors, analysts, and others who have been concerned with conducting the BCA should consider several levels of oral briefings. For example, it is often helpful to have a short, 30-minute briefing for the top-level official(s) and their key assistants. The top-level briefing should avoid for the most part the details of "how" the BCA methodology was undertaken and get directly to the core of the "what" and "why" of the matter, the outcome, the results.

This top-level briefing could then be supplemented by a 1 or 2 hour briefing for middle-level officials that gets into greater detail, including a brief discussion of the methodology. As a matter of tactics, it may be better to schedule the lower and mid-level meetings first so that any "surprises" are ferreted out before the top-level officials are brought into the picture.

Some old hands at this like to schedule a dry run, a dress rehearsal, in front of "friends of the court," persons who are friendly but who promise to be constructively critical in their feedback and play the devil's advocate role. Such a dry run would precede the aforementioned mid- and top-level briefings.

Graphics are very helpful in presenting the results of the analysis. Bar charts, histograms, pie charts, and other ways of showing the material.

8.3 FORMAL WRITTEN REPORTS: FIRST ILLUSTRATION

Sooner or later a formal, written report must be prepared by the analysts and the project director. Usually, the formal report first passes through one or more draft stages and, ultimately, is produced as a final report.

Here is one illustrative way to organize your material:

1. **BACKGROUND** In this section, probably no less than one or two pages, nor no more than five or six pages, you would review the history of the project. If there were preceding stages, they would be discussed here, and the current status mentioned to "set the stage" for the current analysis to be undertaken.

2. **TYPE OF ANALYSIS UNDERTAKEN** In this section, you would explain why the particular kind of analysis was undertaken (e.g., Feasibility Study, Abbreviated Analysis or Detailed Analysis).

3. **DESCRIPTION OF THE EXISTING SYSTEM** Describe how the existing system works (which we have variously described also as the status quo and the current method), if any. Pay special attention here to highlighting exactly where and why the existing method is deficient and why improvements are needed. In other kinds of evaluations, this section is sometimes referred to as the "findings" section. In some cases, a brand new capability needs to be put in place where nothing comparable existed before.

4. **ALTERNATIVES CONSIDERED** Identify each alternative and make sure you give it a brief name. Number each one. If the existing system is a viable option, so indicate. If the existing system is not a viable option, explain and justify reasons why. Alternatives should be consecutively numbered as 1, 2, 3, etc.

5. **BENEFIT:COST ANALYSIS FOR EACH ALTERNATIVE** Here is the section where the main number crunching results are presented. Utilize the formats already outlined in the foregoing in this part under cost analysis and benefit analysis.

6. SENSITIVITY CONSIDERATIONS If sensitivity analysis was undertaken, indicate why and in what areas (i.e., which factors or parameters were altered, and how much and in which direction).

7. THE PREFERRED ALTERNATIVE Here is the section where the comparison is made between the alternatives. This is the place for presentation of any breakeven analysis, the benefit:cost ratios, and related comparison measures. Explain and defend why the preferred alternative was selected over the other competitors.

8. IMPLEMENTING THE PREFERRED ALTERNATIVE Here is the section to put in the highlights of how the preferred alternative would be implemented; in other words, the skeleton of a project plan. But, remember, that at this point management has not yet officially and formally accepted the preferred alternative, so it would be presumptuous and wasteful to get into too much detail. Reserve this section for key decisions that management would need to make to set the stage for implementing the preferred alternative.

8.4 FORMAL WRITTEN REPORTS: SECOND ILLUSTRATION

Here is a second illustration of how the contents of the BCA might be organized. Perhaps you will want to combine some elements of the first example in the foregoing, with the second example here.

1. EXECUTIVE SUMMARY The Executive Summary will be an overview for key, top-level officials, typically between 5 and 10 pages in length (not counting a figure or two). Following a brief introduction that addresses the broad context for the analysis (why and under what circumstances it was undertaken), the report should list the alternatives that were examined. To the extent that a rather obvious, major alternative was not considered, the reasons should be indicated. Following a recitation of the alternatives considered (e.g., the baseline or current method, alternative 1 and alternative 2), the report should next discuss the methodology followed in performing the analysis, paying special attention to unusual or unconventional techniques and methods.

Next, major findings will be highlighted. It is here that a summary spreadsheet of the kind produced by the Excel computer program and discussed in more detail in Part 3 should be included.

Finally, the report should set forth its recommendation as to which alternative, if any, is considered the preferred alternative. Occasionally, the report makes no recommendation, instead preferring to document the resulting computations, list the other (nonmathematical) considerations, and then identify the pros and cons of each of, say, the two major competing alternatives.

2. **GENERAL INFORMATION SECTION** After the Executive Summary, the first major section of the main body of the report is the General Information Section. Here, the report should first provide a summary of each of the alternatives considered, highlighting the key similarities as well as dissimilarities between them.

Next, the report should discuss the analysis environment, i.e., the identification of the project sponsor(s), other key participants and players, functional requirements for the project in broad terms, goals and objectives, and assumptions (including policy and resource constraints).

Also discussed here should be the possibility of the preferred alternative being utilized ("shared") by other organizations, both internal and external, including foreign and public, if applicable, beyond the client organization (in availability, entitlement and accessibility terms).

The concluding portion of the General Information Section addresses the various key references utilized in the analysis, including project request/authorization, previously published analyses if any, documents relating to related projects, key technical documents examined, key applicable laws or policies or regulations if any, and estimation parameters used in the analysis (e.g., discount rates, inflation factors).

3. **MANAGEMENT SUMMARY SECTION** The second major part of the main body of the report addresses the scope of the analysis, performance and characteristics (functional specs) including operational requirements for the preferred alternative, project life, workload increase factors, and evaluation criteria employed in making a final selection of the preferred alternative, and a summary of recommendations.

4. **DESCRIPTION OF ALTERNATIVES** The third major part of the main body of the report lays out the detailed information for the present method, approach, or system, and each of the alternatives considered. Included in each subsection here is a description of the work activities performed, the information flow processes, and the project's infrastructures required for support, including hardware and software if the project involves automation. Also included in this section is the detailed cost analysis for each alternative, followed by the detailed benefits analysis.

5. **COMPARISON BENEFIT:COST SUMMARY** The fourth major part of the main body of the report is divided into six subparts. The first subpart is a presentation of the total actual PV costs, by functional cost component area and by fiscal year over the project life, as well as total PV costs, obtained from the Excel computer program.

   The second subpart is a presentation of the total actual and PV benefits obtained from the Excel computer program. Benefits are presented in a structural format that best makes sense to the expected reader audience. For example, benefits by information life-cycle activity is one useful way of doing this when the project involves upgrading a major information flow throughout its entire life cycle (i.e., production or collection, organization, analysis, dissemination, use, disposition). Also, cost reduction and cost avoidance benefits are singled out and distinguished from other benefits.

   The third subpart presents the net present value calculation, as obtained from the Excel computer program. The fourth subpart presents the benefit:cost ratio calculation as obtained from the Excel computer program. The fifth subpart presents the payback

period for the preferred alternative, obtained from the Excel computer program. The sixth subpart is a final summary of recommendations.

6. **SENSITIVITY ANALYSIS SECTION** This part of the report addresses various sensitivity factors designed to answer "what if" kinds of questions. For example:

   - What if the project life were changed from X years to Y years, what impact would that have on the calculations?

   - What if the inflation factor were decreased from X percent to Y percent, what impact would that have on the calculations?

   - What if the workload assumptions changed (that is, the volume, the mix, or the pattern), what impact would that have on the calculations?

   By doing sensitivity analysis, management can better see how "sensitive" or susceptible the conclusions and recommendations are. The principle is analogous to price sensitivity in supply-demand relationships of a normal commercial product. We say an item is "price sensitive" if a slight change in price, up or down, evokes a relatively large change in demand (up if the price is down, down if the price is up).

7. **EVALUATION AND CONCLUSIONS SECTION** The final section of the report summarizes the final conclusions and explains, defends, and justifies the final recommendation as to a preferred alternative.

8. **OTHER SECTIONS** Additionally, some reports may also contain appendixes, which can include the detailed spreadsheets from the Excel computer program, a glossary of terms, additional readings, and other supplementary materials.

8.5 A CHECKLIST FOR PRESENTING RESULTS

- The BCA should be complete in itself. Reviewers should not have to search other documents for information necessary for comprehensive and detailed support of the analysis. For each cost element included, the documentation should be indexed accordingly for ease of access and should address, at a minimum, the following:

  - Specific data sources

  - Method of data derivation (perhaps "by inspection" is the default choice)

  - An assessment of the accuracy of the major cost element estimates, on a scale of 1–5, similar to the following:

  1. "Highly reliable, data sources and methods have impeccable record."

  2. "Reliable, data sources often used, although not necessarily verifiable."

  3. "Probably reliable, but no real basis for verification."

  4. "No basis for making an evaluation judgment."

  5. "Strictly guesswork."

- Special attention should be given to identifying the dominant cost elements, those whose present value equivalents have a significant impact on the total present value cost of the alternatives under investigation. For example, in some projects personnel costs are the dominant cost element; in other projects equipment and capital costs are the dominant cost element; and

- Identify any cost elements that are sensitive, politically or otherwise. Such costs are subject to more careful review than might otherwise be required, and thus demand complete documentation.

9.0 SELECTING A PREFERRED ALTERNATIVE

Here is what a final BCA set of hypothetical results might well look like:

COMPARISON OF ALTERNATIVES
(in hundreds of thousands)

	Existing System	Alternative 1	Alternative 2
Costs (pres. value)	$175	$245	$217
Benefits (pres. value)	$ 60	$296	$ 80
Net present value	($115)	$ 51	($137)
Breakeven point	N/A	1997	Not achieved
Benefit:cost ratio	0.3:1	1.2:1	0.4:1
Payback	N/A	$181	($144)

The obvious decision rule for making an economic choice between several alternatives is to select the alternative with the lowest present value that is technically, operationally, and financially feasible. Sometimes, however, that may not be the "politically correct" (dare we say wisest) decision. Mitigating factors, such as widely differing kinds of benefits that seem almost irreconcilable, large initial cost outlays, budgetary constraints, staffing restrictions, or other factors, may dictate that the lowest cost alternative not be selected.

In those situations, the alternatives' costs serve only to establish a preliminary ranking of alternatives. Next, any of the seven supplementary techniques identified above (e.g., benefit:cost ratio, discounted payback analysis,

etc.) may be applied to help reach a decision. The analyst must remember to apply a technique only when conditions permit, e.g., a status quo is required in order to compute a savings/investment ratio. Only the benefit:cost is required.

This additional analysis, combined with the cost figures, and a final consideration of mitigating factors, helps point the way for officials to a final decision of a preferred alternative.

In selecting a preferred alternative, make sure to:

- Determine the present value of both the benefits and the costs of all alternatives;
- Compute the net present value for each alternative;
- Make a preliminary ranking of alternatives based on the net present value computations;
- Consider mitigating factors, such as different benefits, large initial cash outlays, budgetary constraints, labour restrictions, or political constraints;
- Apply benefit:cost ratio and sensitivity analyses to test the impact of change on the final alternatives' rank ordering because of changes in the assumptions and constraints; and
- Make sure the final recommendation is just that — a recommendation and not a prescriptive mandate, the failure to adopt which would, in the eyes of the analyst, lead to all kinds of dire adverse consequences.

Finally, remember that we pointed out in Part 1 that the mathematical measures are only one consideration. There are other considerations that usually must be taken into account when determining a preferred alternative:

- Capacity for expansion, augmentation and upgrading. Beware of "solutions" that must be completely discarded before a new one can be put in its place. Modularity is usually a virtue, even if a price is paid for it;

- Acceptable minimum performance times, regardless of cost;

- Simplicity, user friendliness, and ease of learning. Even if a certain alternative is mathematically demonstrated to be the most cost effective, it may be so complicated as to preclude adoption; and

- Technical support reliability; vendors, and other technical backstopping companies or groups must be able to show that they can continue to provide a reliable level of support over the required project life.

10.0 IMPLEMENTING THE SELECTED ALTERNATIVE

The final step involves the development of a plan to implement the chosen alternative. Remember, however, that you should not get into too great a level of detail because that would be considered presumptuous, premature, and a waste of time and cost at this stage. After all, management has not yet decided whether they will accept or reject the recommendation of a preferred alternative.

After all is said and done, the main purpose for including this final step in the BCA methodology is to pinpoint any "last minute surprises" that may occur during implementation that were not adequately addressed in the alternatives consideration process.

This final step involves the development of a plan (really, just a broad outline of a plan) to implement the chosen alternative. What should be touched upon here, but not spelled out in detail, are such things as timetables for construction, purchase or lease of equipment or property or both; the need and timing of key equipment delivery and testing; the kinds of specialized personnel training that will be required; any parallel operations if both the old way of doing business and the new way of doing business are to both be concurrently pursued for a limited period of time; payment schedules for funding the project; and so on.

11.0 REVALIDATION

Once new information resource capabilities have been put in place they usually must be upgraded or updated or otherwise changed in some way at a later time. This is particularly so in this day and age of rapidly, and radically, changing state-of-the-art modern information handling technologies. The incessant barrage of new technologies has kept information managers busy trying to figure out if the latest approaches becoming available would merit making additional changes to existing information sources, services, and systems.

It may become necessary, therefore, to update an original BCA. If and when this happens, it is necessary to review the original assumptions to see if they have changed (e.g., new policy guidance may have been issued or new resource limitations may have been set), determine if new alternatives have emerged, recalculate both benefits and costs based on new components, and recompute the

various benefit:cost measures such as the payback period and the benefit:cost ratios for the various alternatives. Of course implementation schedules will also have to be amended based on the new timetable.

Here is a list of some of the reasons why a BCA must be undertaken again to revalidate initial findings, conclusions and recommendations:

1. New law, policy, directive, or regulation mandating updating or re-doing the initial analysis;

2. Contradictory study with different findings and recommendations; new research findings;

3. Re-competition of large core equipment or property purchases, necessitated by procurement and contracting regulations, or other reasons for new competition;

4. Demands by top level officials for updating or upgrading;

5. Demands by inspector, audit, legal, or compliance officials for recalculating;

6. Mathematical errors in initial calculations;

7. Errors in assumptions or priorities, including new and more stringent budgetary resource limitations;

8. Mistakes in applying parameter factors;

9. Major changes in goals or objectives or both;

10. Availability of new technologies, thereby presenting new alternatives that should be considered;

11. Unforeseen technical operating problems with the preferred alternative, unforeseen disasters; and

12. Protests by unsuccessful bidders or "third parties."

So, revalidation, in a sense, "closes the feedback loop," and the entire BCA process starts anew. We have chosen not to list it as an 11th step in the overall BCA methodology. Rather, our purpose in including it is to alert BCA practitioners to the likelihood that they may well be called back later to take another look at their original work with a view to updating it.

PART 3: COMPUTER SOFTWARE GUIDE

1.0 INTRODUCTION

1.1 BASIC PURPOSE

Part 3 is a Computer Software Guide, along with accompanying software placed in a diskette jacket on the inside back cover of this publication to facilitate the manipulation of benefit and cost data involved in the BCA. The computer software package used is one of the leading packages belonging to the spreadsheet family of application packages and is called Excel 3 for Windows QuickStart.

This computer software package is designed to facilitate what may well turn out to be extensive "number crunching" involved in benefit:cost analysis. The use of such a computer-assisted program for data manipulation should be very useful to BCA project directors and analysts, especially where either the Abbreviated Study or Detailed Study BCA options have been selected. The great advantage of the spreadsheet computer program is that if, for example, you make a change in a single figure somewhere on a spreadsheet, the myriad impacts of that change are automatically reflected throughout the entire set of spreadsheets.

After the various parameters have been settled upon (e.g., number of years in the project lifetime, inflation factor, discount rate, etc.), and after the benefit and cost streams have been calculated, both the parameters and the data values can then be entered into the PC-based Excel software program and manipulated for the current system or method, Alternative 1, Alternative 2, and any additional alternatives.

A family of interrelated, illustrative "spreadsheet templates" is provided as a general-purpose guideline. These exemplary formats should be helpful to users to envision what a completed set of spreadsheets might well look like (see Appendix O). Moreover, the family of spreadsheets may be customized by the user to his or her particular needs. For example, we use an inflation rate of 3% (0.03) in the examples, and a present value factor of 10% (0.1). So do not be put off, for example, by the sample entries because you have full control over them!

You can also change the wording on any of the so-called fixed headers, by deleting any of them, adding new ones, and so on. In short, the family of spreadsheet templates used here is purely for illustrative and guidance purposes.

Also, you have complete control over the number of years for the project's life; 10 years is used in the illustrative spreadsheet template only for example purposes. You determine the present value (discount) rate to be used, the number of project years, and the inflation rate factor. The computer program will also be very useful for undertaking the "what if" sensitivity analysis calculations.

1.2 HARDWARE AND SOFTWARE SPECIFICATIONS

As mentioned, the package used is Excel 3 for Windows QuickStart. To provide optimum performance for Excel, your PC and software should meet or exceed the following requirements.

1.2.1 HARDWARE REQUIREMENTS

- IBM or compatible computer with a hard disk and an 80386 or 80486 processor;
- At least 2 MB of RAM; more memory gives greater flexibility;
- EGA or VGA graphics card or graphics cards with proprietary Windows drivers;
- 720K or 1.44M floppy disk drive;
- A printer capable of supporting graphics; dot matrix printers can be used, but laser printers provide better resolution of data and graphics; and
- A mouse to facilitate input.

1.2.2 SOFTWARE REQUIREMENTS

- Windows version 3.0 or higher running in standard or enhanced mode when using DOS;
- MS-DOS 3.1 or higher;
- Excel 3 version or higher (earlier versions are unable to process the data).

2.0 OVERVIEW OF EXCEL 3 FOR WINDOWS QUICKSTART

If you are experienced with Windows, you will be familiar with many of the concepts used in Excel for Windows. If you are new to Windows, you may wish to either learn the basic features on your own, or seek the assistance of a more experienced computer professional, such as a programmer or systems operator, or even another user who uses spreadsheet applications regularly. This type of user is often found in finance and accounting, or budget offices.

You do not need to be an expert in computer spreadsheet software packages to use this package. Nor do you have to be an expert spreadsheet user, or Windows user, to perform detailed computations. After a little practice with the conventions, it should come easily to you. But if you do have continuing difficulty, you may wish to seek the assistance of a financial professional who is also computer literate in spreadsheets.

This latest version of Excel includes the following enhancements over earlier versions:

- Presentation capabilities that enable you to draw objects and create a chart directly on your worksheet;
- A tool bar that gives you graphical access to commands, including automatic summation, text box, formatting icons, styles, drawing tools, the Button tool, the Camera tool, and outline controls;
- Outlining hides detail and quickly displays the desired level of detail for summary reports and charts;

- The Solver application can be used for simple or complex goal-seeking analysis;

- Data consolidation enables you to link similarly labelled data in different worksheets into a summary worksheet;

- 3-D charting offers you the option of building 3-D area, line, column, and pie charts; charts are automatically linked to the spreadsheets. If you change data, the charts will update automatically. Similarly, if you change the name of a worksheet, the charts must be regenerated. Users should devise a naming convention relating charts to their spreadsheets; and

- The Q+E utility enables you to access databases from other programs.

3.0 THE DETAILED PROCEDURE

3.1 THE SPREADSHEET: GENERAL COMMENTS

As in all spreadsheet applications, the spreadsheet itself is the key tool. The spreadsheet is a kind of template. How the spreadsheet template is formatted, including specification of the contents to be included is, therefore, crucial to the smooth execution of the spreadsheet program.

These instructions address the basic method of formatting the spreadsheets, and inputting data into them. Some data must be entered manually and some data are computed by the software program automatically. Manual data must be ready and available for entry when needed. The challenge is much like many cooking recipes — you must have all the ingredients at hand before you can proceed efficiently.

As mentioned, a family of interrelated spreadsheet template guides is provided here as a general-purpose framework for data entry. Instructions are provided where appropriate to tell users how they may modify the template guides to customize them to their particular needs. You may add new entries, change existing ones, or delete them entirely.

Included as Appendix O is a case example of how the family of spreadsheets is used and how they look with data filled in (these data are hypothetical, but are designed to be realistic for demonstration purposes). It must be stressed, however, that the case examples in Appendix O are just that, illustrations. Readers should not infer, for example, that a discernible pattern, such as an increase trend of X% per year, or Y% per year is, somehow, "the norm" for all such BCA projections. That is not the case! In short, the actual data values employed in the case example in Appendix O are purely suggestive.

3.2 THE SPREADSHEET: SPECIFIC COMPONENTS

The spreadsheet template is a guide to help you (a) enter certain cost and benefit data values manually, and (b) calculate and present certain summary information automatically. The key elements of the spreadsheet format are:

- The project identifiers (fixed and variable),
- The column and row headers,
- The formulas,
- The cost section for all project years (including a special spreadsheet designed exclusively to help calculate costs for major nonrecurring items),
- The benefit section for all project years, and
- The summary section.

Once you have entered the variable project identifier headers (e.g., the name of the project), when printing spreadsheets, the headers automatically print out at the top of each page. The overall headers (e.g., "Benefit:Cost Analysis," "Conducted For," "Basic Elements of Cost," "Unit Cost," etc.) can also be changed using the standard Excel "Global Replace" feature described below and in Excel user manuals.

Data values are entered into the blocks called "cells" in spreadsheet application programs. Each cell has a unique address called the Cell Address.

Cell Addresses are composed of two elements, a letter header designating the column (e.g., A, B, etc., beginning at the leftmost column), followed by a number header designating the row (e.g., 1, 2, beginning with the topmost row). Thus a particular cell might be designated "A4" (first column from the left, fourth row down from the top) or "D7" (fourth column over from the left, seventh row down from the top) (see Fig. 3–1).

Rows are also identifiable by a single, comprehensive consecutive numbering scheme used throughout the entire family of spreadsheets. Thus, in these instructions, we sometimes make a reference such as "see rows 9–29."

Cost breakdowns are of two types. Some detailed cost data must be entered manually by the user (in the appropriate year(s) column), whereas other costs are automatically calculated (derived) from data that have already been entered by the user. Care must be exercised to avoid entering costs in the second category, i.e., into fields for which the program will automatically generate a figure and, therefore, do not require manually entered data.

Benefit data entry is also of two types. Some must be entered manually by the user (again, in the appropriate year(s) column), whereas other benefit data are computed automatically by the Excel program. The summary breakdowns are calculated by the program itself automatically.

3.2.1 How To Enter Variable Project, Column, and Row Headers

Using the family of spreadsheet templates provided in the program as a guide, the various header components, both "fixed" and variable, are entered or changed as follows:

- The Project Name should be entered in cells B2–C2 (the Project Name will then appear on all pages);

- The Inflation Rate to be used should be entered as a decimal in cell B3 (the rate will then be used in all calculations);

SPREADSHEET LAYOUT

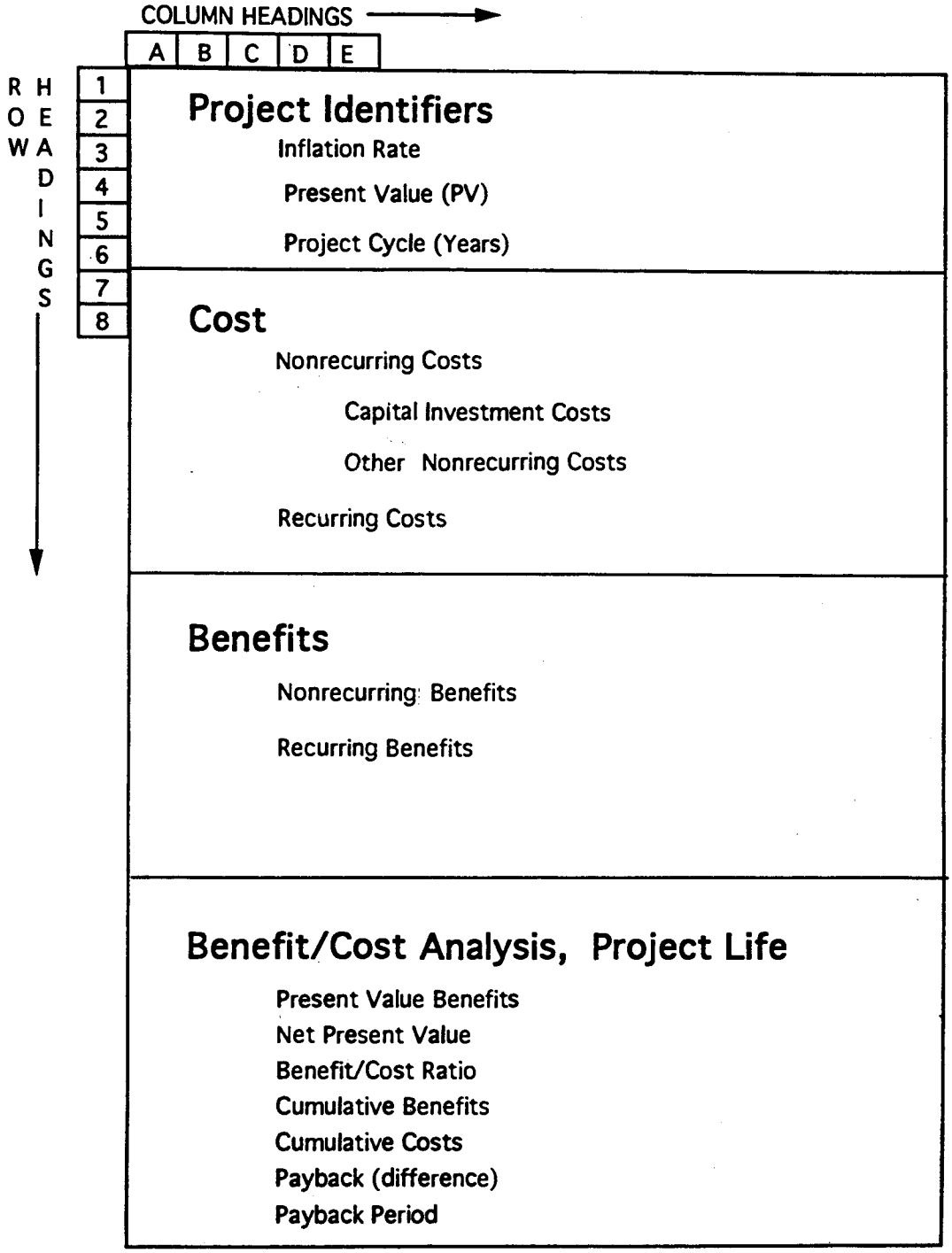

FIGURE 3–1

- The Present Value (PV) factor (also sometimes called the discount factor) to be used should be entered as a decimal in cell B4 (the PV factor is based on the choice of a particular discount rate, such as 10% or 12%; PV tables are readily available from financial offices, the library, etc.); and

- The Project Life (i.e., number of years) to be used should be entered in cell B5. For illustration purposes, our sample program uses 10 years. But project lives exceeding 10 years may be used (up to 20). The number of columns may need to be changed to reflect the selected total number of years.

In instances where the project life is less than 20 years, the spreadsheet functions normally except in cases of calculating the residual value of the project.

Any of the fixed header components may be changed by using the Excel Global Search feature (similar to "find and replace" in other kinds of packages such as word processing).

Column and Row Identifiers used in the illustrative spreadsheet templates may also be changed by doing a Global Search. For example, the term "Equipment 1" is used in the spreadsheet templates as a row identifier, in both the cost and the benefit sections of the family of spreadsheets. Suppose you want to change it to "Level 1 Switches." To do that, use the Excel Global Search functionality.

3.3 How to Enter Data Values Manually

3.3.1 How to Enter the Cost Data

The basic elements of cost data provided in Appendix O are illustrative. In the case of nonrecurring costs, related to each basic element of cost is the Unit Cost. If a row is unused, merely leave the Unit Cost zero and the spreadsheet will calculate a zero value.

The user must insert the number of units for each basic element per year (see rows 9–29). The spreadsheet then multiplies the number by the unit cost and the inflation rate (see rows 31–51). The spreadsheet has zeroes entered as a

default. If the user first makes a nonzero entry, and then changes the entry back to zero, enter a zero. In other words, do not leave the field blank!

By using formulas (described in a following section), the user can instruct the spreadsheet program how to perform certain calculations on the data values entered into a particular cell. For example, if a certain row of costs or, let us say, present values, is to be accumulated, then the formula tells the program how to do that. Formulas are preceded by an equal (=) sign.

3.3.1.1 NONRECURRING COSTS For nonrecurring costs, for each year of the project life the user may enter a figure, or may not enter a figure, depending on whether there are any nonrecurring costs or not for that particular year. Typically, most nonrecurring costs are incurred in year one, or in the first few years of the project. But, sometimes, nonrecurring costs may be entered in the middle years, or even, less frequently, in the later years, or, in rare cases, non-recurring costs may be incurred in each of the years of the project (see Appendix O for examples).

A special member of the family of spreadsheets provided is customized to exploit the computational power of the Excel program so as to calculate automatically total nonrecurring costs in instances where a particular nonrecurring cost item is spread among more than one year.

Thus, suppose a particular item of capital equipment were incurred in years 1, 3, 4, and 7. By entering "1" (or whatever number of pieces was purchased) in the appropriate year cell, the Excel program will automatically total the number of items of that piece of equipment, and calculate a total cost that is adjusted for inflation (see rows 31–51).

3.3.1.2 RECURRING COSTS There are two methods for entering recurring costs. In either case, the data values must be entered manually. In the instance of equipment lease, as an example of the first type, the lease may require a flat rate over the period of the project. In the instance of maintenance, as an example of the second type, equipment cost may increase at the rate of the assumed inflation. The user would enter the costs for these two types of entries differently.

In the first type, the flat rate example, the user may copy the entry for the first year across the columns for all years. In the second type, the inflation rate increase example for maintenance, the user may multiply the previous year entry

by the inflation factor in row 3. Users must take care not to enter inflation factors twice (e.g., multiplying already inflated nonrecurring costs by yet another inflation factor).

If the user requires more rows than those provided for in the standard template, they may be added. For example, there may be some additional cost elements, or the user may wish a finer breakdown. Make sure to add the additional rows in a standard fashion to each of the relevant sections of the cost section (i.e., for all alternatives), viz.:

- One entry must be made in the "Basic Elements of Cost," and
- An additional row must be inserted in the cost sheets for each of the alternatives (i.e., the current system, Alternative 1, Alternative 2, and any additional alternatives).

3.3.1.3 SPECIAL CASE OF COST AVOIDANCE/COST REDUCTION ITEMS Readers will remember from Parts 1 and 2 that cost avoidance and cost reduction items may be treated either as a benefit or as an offset to costs (a negative cost). The decision is a policy or management decision, not a technical one. These are shown in our examples as a benefit.

But if your management decides to treat these items as offsets to cost, then they should be added to the spreadsheets as the very last item(s) of cost just before the "total nonrecurring cost" row (i.e., row 62), and they should be entered in parentheses (denoting a negative cost). Do not place them higher up, or do not intersperse them higher in the basic cost element rows, or the program will not treat them properly. If, however, your management decided to treat these items as benefits, then they may be entered in the normal fashion as a positive figure on the benefit spreadsheet as a nonrecurring benefit item as shown in examples in Appendix O.

3.3.2 HOW TO ENTER THE BENEFITS DATA

3.3.2.1 NONRECURRING BENEFITS As in the case of nonrecurring costs, for each year of the project life the user may enter a benefits figure, or may not enter a figure, depending on whether there are any nonrecurring benefits or not for that particular year (see rows 86–99). Typically nonrecurring benefits are incurred

early, as in year one or in the first few years of the project. But, often, non-recurring benefits may be realized in the later years (see Appendix O for illustrations).

3.3.2.2 RECURRING BENEFITS Like costs, some benefit data must be entered manually, but other benefit data may be derived because of direct relationships with cost data (see rows 102–124).

An example of the former are all "new" benefits (i.e., those benefits that are not related to any cost savings, but, rather, are due to a new quantifiable improvement or value that is expected). This benefit data must be entered manually.

As an example of the latter, if there is a cost saving due to reduced maintenance on some piece of equipment, and management has determined that cost savings are to be treated as a benefit (rather than an offset to costs), then those benefits will directly correspond to the costs.

The last example emphasizes the need for cross-consistency among the row identifiers in both the cost and the benefit sections of the spreadsheets. Thus, where possible, for consistency's sake, it is highly desirable to use the same row identifier in the benefit section that was used in the cost section. Recurring benefit values often rise more dramatically in later years due to the impact of the learning curve "kicking in." The procedure for adding additional rows for benefits is exactly that prescribed in the foregoing for cost rows, whether for recurring or nonrecurring benefits. All data must be entered manually.

3.4 THE FORMULAS

A formula starts with an equal (=) sign and serves to tell the spreadsheet program how to perform a calculation using the data value in a particular cell. As the user creates a formula, it is displayed on the formula bar of the spreadsheet.

A formula might require that a number be added to another, subtracted from another, multiplied by another, or divided by another. For example, in certain of the present value calculations, numbers are accumulated from left to right within the same row. Formulas are the methods the user employs to tell the program exactly how to do that.

3.5 SUMMARY SECTION

This part of the spreadsheet package provides a complete summary of all computations. All computations here are automatic, and cell values should not be changed without a thorough understanding of the consequences. Data are not normally entered manually at this final stage. If a user inadvertently enters or changes a value in this section, he or she may undo the entry immediately with the Edit/Undo command.

It is from this stage that material in graphic form is drawn for the final stage of the BCA methodology — presentation of results. In some instances it may be important to provide a printed summary of the results without detailed data for each of the years (e.g., for the very top level of decision-makers).

Where the project life is less than 20 years, the user may mask the intervening columns (Format/Column Width/Height, after highlighting the intervening columns). Additionally, because the display will not be centred, the printed display may be centred (File/Page Setup/Centre Horizontal/Centre Vertically/Portrait).

APPENDIX A

SOME ILLUSTRATIVE COSTS

(Note: This example project involves automating and upgrading an information system involving workstations linked by a network)

1. What are the costs to plan, design, develop, test, and install the system?

2. What are the costs to purchase/lease, install, initialize, and test hardware?

3. What are the costs to purchase/lease, install, initialize, and test shelf software?

4. What are the costs to plan, design, develop, install, initialize, and test customized software?

5. What are the costs to purchase/lease, install, initialize, and test the basic networking software?

6. What are the costs to purchase/lease, install, initialize, and test communication links?

7. What are the costs to acquire and train staff (include basic salary and wages, fringe benefits, and associated employee and labour expenses)?

8. What are the facility and environment control costs for the system?

9. What are the costs to operate the system?

10. What are the costs to maintain the system?

11. What are the costs to evaluate the system periodically?

12. What are the costs to retire the system?

13. What are the contractual support costs?

14. What are the indirect space occupancy costs?

15. What are the security and privacy costs?

16. What are travel costs?

17. What are overhead costs?

APPENDIX B

SOME ILLUSTRATIVE BENEFITS

IMPROVED QUALITY OF INFORMATION ITSELF

GREATER:

1. Accuracy
2. Comprehensibility
3. Credibility
4. Currency
5. Pertinence
6. Precision
7. Relevance
8. Reliability
9. Simplicity
10. Validity
11. Practicality

IMPROVED PLANNING, MANAGEMENT & CONTROL OF INFORMATION HOLDINGS

IMPROVED:

1. Accessibility
2. Availability
3. Browsability/Searchability
4. Format and Presentation (production flexibility, storage, retrieval, handling, and media)
5. Usability/Reusability
6. Awareness of new acquisitions
7. Retrievability
8. Deliverability

IMPACT ON ORGANIZATIONAL PRODUCTIVITY

1. Faster learning curve for new tasks, with a sharper incline.

2. Upgraded work function importance (includes appreciation of information as a valued but costly resource that must be budgeted for by operating units).

3. Greater interchangeability of personnel within established parameters, such as job descriptions and occupational standards.

4. Greater task integration (a more "seamless web").

5. Improved synchronizing among tasks (e.g., overlapping where feasible).

6. Less need for clerical support, more semiautomation, and automation.

7. Less lost, misfiled, or missing information.

8. Increased self-reliance because more informed.

9. Increased autonomy (ability to operate with minimal external support and guidance; ability to resist undue pressure).

10. Increased competitiveness (alignment on national and international standards of cost effectiveness).

IMPACT ON FINANCIAL POSITION

1. Reduced total capital investments or operating costs or both. What is the quantitative effect? What is the qualitative effect?

2. Reduced per unit operating costs. What is the quantitative effect? What is the qualitative effect?

3. Reduced maintenance costs. What is the quantitative/qualitative effect?

4. Creation of new assets.

5. Greater exploitation of existing assets.

6. Displacement of expensive resource inputs.

IMPACT ON ORGANIZATIONAL EFFECTIVENESS

1. Reduced program ineffectiveness (fraud, abuse, waste). What is the quantitative/qualitative effect?

2. Improved program effectiveness (quality of service, expanded service). What is the quantitative/qualitative effect?

3. More timely recognition of new opportunities that can be capitalized upon, and threats or risks to be avoided or dealt with.

4. Improved new product development support.

5. Improved research and development support.

6. Improved sales and marketing support.

7. Improved production and manufacturing support.

8. Improved corporate (central) staff services support (e.g., legal, personnel, financial, planning).

APPENDIX C

GLOSSARY OF TERMS

ABBREVIATED STUDY
One of three kinds of benefit:cost analysis; an approach that includes consideration of various alternative courses of action, including the identification of specific benefits expected, and specific costs to be incurred, and goes so far as to make general estimates of the order of magnitude of such benefits and costs, but uses approximation rather than precise mathematical methods.

A FORTIORI ANALYSIS
A technique used to overcome a decision-maker's preconceived bias. Numerical values of unknowns are set in favour of the less-desired alternative. If the eventual comparison of alternatives still favours the "preferred" alternative, the decision-maker is assured that his or her inner bias did not affect the decision.

ALTERNATIVES
The different courses of action, means, or methods by which objectives may be attained.

ASSUMPTIONS
Explicit statements used to describe the current and future environment upon which the benefit:cost analysis is based. Assumptions are made to support and reasonably limit the scope of the analysis.

BASELINE YEAR
The starting point for the benefit:cost analysis, beyond which decisions deal with future courses of action. It is the "today" in the analysis. May be referred to as "Year 0."

BASIC ELEMENTS OF COST
In the spreadsheet program, the major identification of costs that, because they are unique and exclusively measurable, are listed separately under nonrecurring costs.

BCA METHODOLOGY
A formal, 10-step process that may be used by development assistance project directors for planning, implementing, controlling, and evaluating a benefit:cost analysis applied to a project.

BENEFIT
An output, value, positive result, or effectiveness in an operation or activity that is expected to be received or achieved over time as a result of undertaking a proposed investment.

BENEFIT:COST ANALYSIS
A technique for assessing the range of costs and benefits associated with a given option, usually to determine feasibility or to select a preferred course of action from among competing ones. Most costs are generally expressed in monetary terms, but benefits need not all be expressed quantitatively.

BENEFIT:COST RATIO
An economic indicator of efficiency, computed by dividing benefits by costs. When benefits are quantified in dollar terms, it is customary to discount both benefit streams and cost streams to reflect the present value of future costs and benefits. Also, present value benefit divided by present value cost.

BREAKEVEN ANALYSIS
A procedure for evaluating alternatives in terms of a common unknown variable. It involves solving for the value of the variable that will make the cumulative discounted costs for the alternative equivalent. This value is the breakeven point.

CASH-FLOW DIAGRAMS
A pictorial representation showing the magnitudes and timing of costs associated with an alternative.

CELL
In the spreadsheet program, the term used to refer to a block where a row and column intersect.

CELL ADDRESS
In the spreadsheet program, the unique location of each cell on the spreadsheet, composed of a combination of a letter (beginning with "A" for the leftmost column) and a number for each row (beginning with "1" for the topmost row).

CHART
In the spreadsheet program, a visual, interactive portrayal of data from the spreadsheet. Charts are linked to the data in the spreadsheet, and are automatically updated to reflect changes in the basic data.

COLUMN
In the spreadsheet program, a vertical line of cells. Columns are designated by a letter, or two letters if necessary.

COMPOUND INTEREST
Interest that is computed on both the original principal and its accrued interest.

CONSTANT DOLLARS
Computed values that remove the effect of price change over time. An estimate is said to be in constant dollars if costs for all work are adjusted so that they reflect the level of prices of a base year.

CONTINGENCY ANALYSIS
A form of sensitivity analysis used to evaluate the effect of new factors or conditions in an analysis by asking "what if" questions.

COST
The value or price of inputs or resources used or expended in producing a good or service. Costs are usually expressed in dollar terms, or as the term "in kind" infers, may be sometimes expressed in equivalencies, such as a commodity or other object of value used by societies for trade, barter, and commerce.

COST AVOIDANCE
Savings realized by eliminating a planned expenditure of resources. A cost avoidance can only occur when adopting a nonstatus quo alternative. A cost avoidance may or may not be considered a benefit in benefit:cost analysis.

COST ESTIMATE
Cost projection for an expected transaction based upon information available.

CURRENT DOLLARS
Level of costs in the year the actual cost will be incurred. When prior costs are stated in current dollars, the figures given are the actual amounts paid out. When future costs are stated in current dollars, the figures given are the actual amounts expected to be paid including any amount due to future price changes.

DEFINING GOALS AND OBJECTIVES
The second step in the BCA Methodology.

DEFLATION
A persistent decline in prices or wages over a period of time.

DETAILED STUDY
One of three benefit:cost analysis techniques. The detailed study approach is the most detailed and the most complete of the three available methods. It involves quantifying as many benefits as possible and computing relatively exact dollar figures for both quantified benefits and quantified costs. Almost always cost figures are manipulated using specialized computer software packages that are commonly called "spreadsheet" packages.

DETERMINING TYPE OF ANALYSIS
The first step in the BCA Methodology.

DISCOUNTED PAYBACK
A technique for determining the time period over which accumulated present value savings are sufficient to offset the total present value investment costs of a proposed alternative to the status quo.

DISCOUNT FACTOR
The multiplier for any specific discount rate that translates expected cost or benefit in any specific future year into its present value. Mathematically, the discount factor is $1 / (1 + 1)^n$ where *"1"* is the discount rate and "n" is the number of years since the date of the initiation, renewal, or expansion of a project. Another formula sometimes used is $1 / (1 + r)^t$ where "r" is the discount rate and "t" is the number of years since the date of initiation, renewal, or expansion of the project.

DISCOUNTING
A computational technique using interest rates to calculate the present value of future benefits and costs. Used in evaluating alternative investment proposals that can be valued in money.

DISCOUNT RATE
A rate used to relate present and future dollars. This rate is expressed as a percentage and is used to reduce the value of future dollars in relation to present dollars to account for the time value of money. Same as interest rate.

ECONOMIC ANALYSIS
A systematic approach to quantifying, estimating, and evaluating the relative worth of proposed projects. Basically, the technique consists of ten steps. Benefit:cost analysis is one tool available in the family of economic analysis techniques.

ECONOMIC LIFE
The period of time over which the benefits to be gained from a proposal may be reasonably expected to accrue. The economic life of a project begins the year the investment starts producing benefits and may be limited by the mission life, physical life, or technological life (the term "systems lifetime" is sometimes used for any or all of the latter three terms).

ESTIMATING BENEFITS AND COSTS
The fifth step in the BCA Methodology.

EVALUATING ALTERNATIVES
The sixth step in the BCA Methodology.

EXPECTED ANNUAL BENEFIT
The dollar value (in constant dollars) of goods and services expected to result from a project for each of the years it is to be in operation.

EXPECTED ANNUAL COST
The expected annual dollar value (in constant dollars) of resources, goods, and services required to establish and carry out a project. All economic costs, including acquisition, possession, and operation costs should be included, regardless of the identity of the funding source.

EXPECTED ANNUAL EFFECTS
An objective, nonmonetary measure of project effects (e.g., an impact indicator) expected for each of the years a project is in operation. When a dollar value cannot be placed on the effects of projects, an objective measure of effects may be available and useful to enable the comparison of alternative means of achieving specified project goals and objectives. These effects should be estimated for each year of the planning period and are not to be discounted.

FEASIBILITY STUDY
One of three kinds of benefit:cost analysis. This technique addresses the practicality of one or more alternative courses of action by identifying the kinds of benefits and costs expected, but without getting into quantification or the details of mathematically computing various benefit:cost measures.

FILE SAVE
A spreadsheet program feature that allows the user to save data that have been entered. It is important to save often to reduce the accidental or catastrophic loss of data. Care must be taken not to overwrite important files by changing the name of the file after saving the old file (data).

FIXED COSTS
That component of production cost that does not change in the short run if production volume is within a specified range.

FORMULA
In the spreadsheet program, an entry to a cell that calculates numbers (values). A formula starts with an equal sign (=). As the user creates the formula, it is displayed on the formula bar of the spreadsheet.

FORMULATING ASSUMPTIONS
The third step in the BCA Methodology.

FRINGE BENEFITS
Allowance and services provided to employees as compensation in addition to basic salaries and wages.

GOALS
The ultimate end results expected to be achieved when a project is fully implemented over its entire life cycle. See also objectives.

HEADING
In the spreadsheet program, the top row entries of each column, printed on each page, to facilitate reading of data on each page.

HISTORICAL COST
The cost of any objective, based upon actual asset outlay, determined after the fact. Any method of cost determination may be used.

IDENTIFYING ALTERNATIVES
The fourth step in the BCA Methodology.

IMPACT INDICATOR
A surrogate unit of measure that can be used in project planning, evaluation, and in analytical techniques, such as benefit:cost analysis, where more precise mathematical or empirical measures are unavailable or impractical to try to derive. Commonly used in social research.

IMPLEMENTING THE SELECTED ALTERNATIVE
The tenth and final step in the BCA Methodology.

INDUSTRIAL ENGINEERING METHOD
Cost estimating technique whereby estimates for various separate work segments are consolidated into a total project estimate.

INFLATION RATE
The general level of prices and wages over a period of time usually changes at a certain rate, called the inflation rate. Generally (but not always), the inflation rate results in a persistent rise in prices. But where prices and wages are falling, a deflator is used instead of an inflator.

INPUT
A resource, most often human, financial, physical, or natural, that incurs a cost for its acquisition, deployment, and utilization and, when effectively and efficiently deployed and utilized, produces outputs.

INTANGIBLE BENEFITS
Those improvements in performance and production that cannot be quantified with any degree of precision using known techniques. Sometimes, an Impact Indicator may be useful as a surrogate for measuring and evaluating intangible benefits. Same as nonquantifiable or qualitative benefits.

INTEREST
A price (or rent) charged for the use of money.

INVESTMENT COST
One-time costs associated with the acquisition of real property, nonrecurring services, nonrecurring operations, and maintenance (start-up) costs and other one-time costs. Despite their one-time nature, investment costs may extend over periods of more than one year.

LEAD TIME
The period of elapsed time between initial funding or decision to proceed and the commencement of economic life.

LIFE CYCLE
The time from the beginning date of a project to the end of the project's life.

LIFE CYCLE COST
The total cost to the project's sponsor, donor, or other accountable authority of acquisition and ownership of a system or service (or other capability) over its full life. It includes the cost of development, acquisition, operation, support, and, where applicable, disposal or recycling.

LOST OPPORTUNITY COST
The cost of foregone opportunities. The sacrificed amount of money, equipment, or units of production that could have been realized by a separate course of action (i.e., by adopting a different alternative) with the same time and effort expended.

MISSION LIFE
The period of time over which a need for an asset is anticipated.

MOUSE
In the spreadsheet program, an interactive input device that allows users to indicate and select items from the screen by "clicking on" an entry or feature.

MOUSE POINTER
In the spreadsheet program, an arrow that appears to the user, denoting the position of the mouse on the screen.

NONRECURRING COST
Cost that occurs on a one-time basis; to be distinguished from recurring cost.

OBJECTIVES
Intermediate or interim results that a decision-maker wants to attain. Objectives are the "means to the ends," whereas goals are considered the ultimate ends. In benefit:cost analysis, objectives must be stated that do not preclude alternative approaches from being considered.

OPPORTUNITY COST
See Lost Opportunity Cost.

OUTPUT
A product, service, or, more broadly, the result which comes about by effectively and efficiently deploying and utilizing various inputs that are "mixed together" in optimal amounts.

OUTPUT MEASURES
Useful descriptors of functions, tasks, or missions performed by an organization, expressed in relation to those assigned.

PHYSICAL LIFE
The estimated number of years that a machine, other piece of equipment, building, agricultural property, domesticated farm animal, system, service, or other capability can be used to accomplish the results for which it was initially acquired. Also called "mission life" and "system life."

PRESENTING RESULTS
The eighth step in the BCA Methodology.

PRESENT VALUE
The estimated current worth of future benefits or costs derived by discounting the future values, using an appropriate discount rate.

PRESENT VALUE BENEFIT
Means each year's expected yearly benefit multiplied by its discount factor and then summed over all years of the planning (system lifetime) period.

PRESENT VALUE COST
Each year's expected yearly cost multiplied by its discount factor and then summed over all years of the planning (system lifetime) period.

PRESENT VALUE NET BENEFIT
The difference between the present value benefit and the present value cost.

PROJECT
For the purposes of this guide, a development-assistance information project is being considered for support.

PROJECT LIFE
The lead time together with the economic life.

PROJECT LIFE CYCLE
The stages through which a development assistance project passes, beginning with project conception, project initiation, project proposal, project review, etc.

RECOMMENDING A PREFERRED ALTERNATIVE
The ninth step in the BCA Methodology.

RECURRING COSTS
Expenses for personnel, material consumed in use, operating, overhead, and support services, and other items that reoccur periodically during a given project.

RESIDUAL VALUE
The computed value of an asset at any point in time. At the end of the lifetime of a project, an asset's residual value is sometimes referred to as it's "salvage value."

ROW
In the spreadsheet program, a horizontal line of cells. Rows are designated by a number.

SAVINGS/INVESTMENT RATIO
The ratio of discounted future cost savings to the discounted investment cost necessary to effect those savings. A ratio of one indicates that the present value of savings is equal to the present value of the investment.

SENSITIVITY ANALYSIS
A technique for assessing the extent to which reasonable changes in assumptions or input variables (amounts, costs) will affect the preference ranking of alternatives.

SPREADSHEET
A grid, or template, commonly used in computer software programs, such as the Excel QuickStart package, labelled with columns and rows, that allows for entry of values and formulas relating one cell to another.

SUNK COSTS
A nonrecoverable cost that has been expended as a result of a prior decision. Because sunk costs have been irrevocably expended or committed, they play no role in a current economic analysis.

TANGIBLE BENEFITS
Those improvements that can be identified, measured, and quantified. They do not include savings in recurring operating expenses; those savings are already reflected as reductions in cost.

TERMINAL VALUE
The proceeds (less removal and disposal costs, if any) realized upon disposition of a tangible asset. It is usually measured by the net proceeds from the sale or other disposition of the asset or its fair market value if the asset is traded for another asset and there is a marketplace for it.

TESTING ANALYSIS SENSITIVITY
The seventh step in the BCA Methodology.

TIME VALUE OF MONEY
A name given to the notion that the use of money costs money. A dollar today is worth more than a dollar tomorrow because of the interest costs related to expenditures and benefits that occur over time. Projected annual savings or cash inflows have present values less than their undiscounted dollar values.

UNIT COST
In the spreadsheet program, the identifiable no-year (uninflated) value of a basic element of cost.

APPENDIX D

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APPENDIX E

CASE EXAMPLE 1: AIDS PROJECT

PROJECT TITLE:
NATIONAL AIDS RESEARCH INFORMATION RESOURCE

1. GOALS AND OBJECTIVES

OVERALL PROJECT GOAL: To create a major new AIDS information management facility that integrates four components into a single architecture: (a) a central on-line database, (b) an information system, (c) a supporting telecommunications network, and (d) a document clearinghouse that will be regarded as a major national health care information resource service and made available to and accessible by: (a) accredited national, regional, and international public health (PH) institutions and organizations; (b) authorized practicing PH and other health care professionals; (c) qualified academic, PH and other health research facilities; (d) PH and health-related mission government departments; and (e) other qualified users and beneficiaries on an "as needed" basis.

LONG-TERM GOAL (SUBSTANTIAL ACHIEVEMENT 10 YEARS OUT OR LONGER): To decrease the incidence of endemic AIDS in the population from X% to Y% by the end of the outyear period (e.g., 0Y + 10) by creating positive conditions allowing high-risk populations to become more fully aware of the political, economic, social and human (personal) consequences of dysfunctional attitudes and behaviours, including life-styles and value systems and belief systems that increase the likelihood of acquiring AIDS or AIDS-related diseases.

MID-TERM GOAL (SUBSTANTIAL ACHIEVEMENT IN 5–10 YEAR TIME FRAME): To increase the level of awareness of high-risk AIDS populations to dysfunctional attitudes and behaviours from A% to B% per year during the outyear period (e.g., 0Y + 5 to 0Y + 10).

SHORT-TERM GOAL (SUBSTANTIAL ACHIEVEMENT BY THE END OF THE 4TH YEAR OUT): To sensitize the target PH user and beneficiary groups to the existence of the new information resource (the central database, the information system, and the functioning of the clearinghouse), entitlement and access preconditions, responsibilities for data input (quality and quantity), and data output (relevance, accuracy, completeness). This is to ensure that 95% of all targeted user groups are fully aware of the full potential of the new resource and are using the information assets (knowledge in the database, human expertise of the system administrators and managers, etc.), in an effective and efficient manner.

2. ASSUMPTIONS (INCLUDING POLICY CONSTRAINTS)

WORKLOAD GROWTH: SUPPLY OF INFORMATION MATERIALS: Assume that the new items added to the database shall increase from a range of from A to B in the first year the facility becomes fully operational (Stage 1, Database Creation and Bringing Up On-line), C–D for the next X number of years (Stage 2, Rapid Growth and Diffusion of Knowledge), E–F for the next Y number of years (Stage 3, Leveling Off, Maturity), and is extrapolated to grow from G to H for the years following year (0Y + 10) when the facility and the database are fully mature and operational.

WORKLOAD GROWTH: DEMAND FOR INFORMATION MATERIALS: Assume that the demands from users for access and retrieval of items from the database shall increase from a range of from G to H in the first year the facility becomes fully operational (see above for corresponding wording for this factor).

PRODUCTIVE, PHYSICAL LIFETIME OF THE RESOURCE: Assume that the database, information system, and clearinghouse will remain in a fully functioning, productive status without requiring any major modifications or upgrades until (0Y + 10), thereafter a new BCA will be required to consider taking advantage of any major new technology or information management handling breakthroughs that will have occurred by that time, as well as new service delivery modalities and changes in user demand patterns and materials supply patterns.

ECONOMIC LIFE CYCLE COVERED BY THE ANALYSIS: Assume that a 10-year information resource economic life cycle period is optimal on the grounds that the resource's capabilities and technological infrastructure will remain relatively stable for that period of time.

INFLATION RATE ADJUSTMENT: Assume an inflation rate of X% per year as the basis to project the streams of quantified benefits and costs during the system life (payback) period.

BASE SALARY AND FRINGE BENEFIT COST PROJECTIONS: Assume salary and benefit base rates used to calculate cost streams will rise by A% during the first 3 years of the project, B% for the next 3 years, and C% for the remaining 4 years.

3. ALTERNATIVES

STATUS QUO (ALTERNATIVE 1): Do not create the new resource. Continue with a fragmented, dispersed, and decentralized approach to dealing with the AIDS information challenges facing the country. This is considered the "baseline" or current method or existing system. (Note: In the main text we are told we usually do *not* call the current system "Alternative 1." This is an exception.)

MODIFY THE CURRENT METHOD (ALTERNATIVE 2): Essentially keep the present decentralized, dispersed approach to sourcing, servicing, and delivering AIDS information but make modest, selective changes to upgrade and enhance its effectiveness and efficiency.

CREATE THE MAJOR NEW NATIONAL AIDS INFORMATION RESOURCE (ALTERNATIVE 3): Create a brand new, major centralized AIDS information resource facility integrating into a single AIDS information management architecture four components: a central on-line database, an integrated information system, a telecommunications supporting network, and a documents clearinghouse.

4. COSTS AND BENEFITS

COSTS

1. NONRECURRING COSTS

CAPITAL OUTLAYS

Site Preparation for the Facility
- Grounds Acquisition and Preparation
- Buildings
- Facilities
- Outfitting

Other
- Studies
- Conversion & Parallel Operations

Systems Design
- Feasibility Studies
- Benefit:Cost Analyses
- Requirements Studies
- Consultancy Reports
- Benchmarking
- Research
- Request for Development of Contractor Proposals

Software Development, Testing, and Modification
- Local Modification (in-house)
- Contract and Subcontract Costs
- Purchase Costs (off-the-shelf)
- Alpha and Beta Testing
- Systems and Programming Documentation
- Tutorial Materials, including User Manuals

Hardware Acquisition, Testing, and Development
- Computer Mainframes (including storage)
- Computer Mini Computers
- Computer Microprocessors/PCs
- Telecommunication WANs
- Telecommunication LANs
- System and Subsystem Integration
- Office Automation, including Workstations
- External Database Searching

Facilities
- Repairs and Alterations to Space
- Wiring and Electrical Preparations
- Air Conditioning Preparations
- Plumbing Preparations
- Communication Preparations

Education and Training
- Training Fees for Trainers
- Travel
- Lodging
- Per Diem
- Training Equipment and Materials, Demos, Videos
- Space Rental

Support Costs
- Travel
- Computer Services
- Telecommunications Services
- Furniture and Fixtures
- Special Equipment
- Materials
- Labour

Security, Safety, and Privacy
- Equipment
- Procedures Development
- Special Personnel Clearances
- Encryption and other Data Protection Tools
- Special Environmental Control Costs
- Consultant Reports

2. RECURRING COSTS

CAPITAL IMPROVEMENTS

Site Maintenance for the Facility
- Grounds Maintenance
- Buildings Maintenance
- Facilities Maintenance

Other
- Studies

Systems Design
- Consultancy Reports
- Benchmarking
- Research
- Request for Development of Contractor Proposals

Software Development, Testing, and Modification
- Local Modification (in-house)
- Contract and Subcontract Costs
- Purchase Costs (off-the-shelf)
- Alpha and Beta Testing
- Systems and Programming Documentation
- Tutorial Materials, including User Manuals

Hardware Maintenance, Testing, and Development
- Computer Mainframes (including storage)
- Computer Mini Computers
- Computer Microprocessors/PCs
- Telecommunication WANs
- Telecommunication LANs
- System and Subsystem Integration
- Office Automation, including Workstations
- External Database Searching

Facilities
- Repairs and Alterations to Space
- Wiring and Electrical Maintenance
- Air Conditioning Maintenance
- Plumbing Maintenance
- Communication Maintenance

Education and Training
- Training Fees for Trainers
- Travel
- Lodging
- Per Diem
- Training Equipment and Materials, Demos, Videos
- Space Rental

Support Costs

- Travel
- Computer Services
- Telecommunications Services
- Furniture and Fixtures
- Special Equipment
- Materials
- Labour

Security, Safety, and Privacy

- Equipment
- Procedures Development
- Special Personnel Clearances
- Encryption and other Data Protection Tools
- Special Environmental Control Costs
- Consultant Reports

BENEFITS

SHORT-TERM BENEFITS (0Y TO 0Y + 2):

- Increased awareness ("information literacy") by users and beneficiaries the existence of, applications and uses for, and methodology for using the new information resource (could be quantified if, for example, a specific awareness level, such as 33% of target populations, were selected by 0Y + 1);

- Operation of a single, central, authoritative resource to replace a multiplicity of fragmented, dispersed, and decentralized resources in the current system;

- Increased availability of the information resource to a wider group of targeted users, audiences, and clienteles (could be quantified if, for example, a specific targeted level for new targeted populations, such as 20%, were selected by 0Y + 1);

- Wider, faster, and more effective access to the information resource (could be quantified if access were benchmarked in terms of the time it takes to access a specific item of information, and comparing the old with the new times);

- Improved retrievability and document delivery of hard copy outputs e.g., research materials, published articles, books (could be quantified if retrieval and document delivery were benchmarked in terms of the time it takes to retrieve a specific item of information or document, or document image, and comparing the old with the new times);

- Improved usability of data, documents and literature from the information resource;

- Decreased AIDS endemic incidence from X% to Y% (e.g., a very modest incremental decrease of say 5%) traceable to changes in dysfunctional attitudes and behaviours brought about by utilizing the information resource.

MID-TERM BENEFITS (0Y + 2 TO 0Y + 5):

- Faster and more effective application and utilization of knowledge to AIDS research and development (e.g., in drug testing programs);

- Faster and more effective application and utilization of knowledge in AIDS public awareness programs;

- Faster and more effective application and utilization of knowledge in AIDS education/training programs, both formal and informal;

- Reduced turnaround time from X (hours/day) to Y (hours/day) in searching for information;

- Reduced turnaround time from X (hours/day) to Y (hours/day) between retrieving and applying information;

- Greater sharing of information between PH institutions and professionals;

- Greater reuse of information assets;
- Decreased instances of lost or missing information;
- Sixty-six percent awareness level achieved on existence of, applications for, and methodology for using the new information resource for targeted user populations;
- More effective public policy decision-making relating to high risk behaviour of target populations associated with AIDS.

LONG-TERM BENEFITS (0Y + 5 TO BALANCE OF LIFETIME):

- Reduced AIDS incidence from A% to B% in the primary targeted population as a whole;
- Reduced AIDS incidence from C% to D% in the highest high-risk targeted population;
- Reduced AIDS incidence from E% to F% in the secondary high-risk targeted population;
- Ninety-five percent awareness level achieved on existence of, applications for, and methodology for using the new information resource for targeted user populations;
- Very effective public policy decision-making relating to high-risk behaviour of targeted populations associated with AIDS.

APPENDIX E

5. EVALUATION OF ALTERNATIVES

A. FOR BASELINE ALTERNATIVE 1 (EXISTING METHOD)

YEAR
(in hundreds of millions of dollars)

COSTS	0	1	2	3	4	5	6	7	Total
Project Life Cost									
Present Value Cost									
Residual Value (only cumulative figures shown)									
Present Value Factor			(Detailed figures omitted)						
Discounted Res. Value									
Adjusted Cost									
Cumulative Costs (CC)	0.04	0.08	0.10	0.12	0.13	0.15	0.17	0.19	0.20
BENEFITS									
Project Life Benefit									
Present Value Benefits (only cumulative figures shown)			(Detailed figures omitted)						
Net Present Value									
Cumulative Benefits (CB)	0.01	0.06	0.10	0.14	0.16	0.18	0.20	0.24	0.25
SUMMARY									
Benefit:Cost Ratio (CB/CC)									1.25
Payback (CC-CB)	-0.03	-0.02	0.00	0.02	0.03	0.03	0.03	0.05	
Payback Period (1st +)				X					

B. FOR ALTERNATIVE 2 (ENHANCED EXISTING METHOD)

YEAR
(in hundreds of millions of dollars)

COSTS	0	1	2	3	4	5	6	7	Total
Project Life Cost									
Present Value Cost									
Residual Value (only cumulative figures shown)			(Detailed figures omitted)						
Present Value Factor									
Discounted Res. Value									
Adjusted Cost									
Cumulative Costs (CC)	0.06	0.09	0.15	0.22	0.29	0.36	0.42	0.44	0.45
BENEFITS									
Project Life Benefit									
Present Value Benefits (only cumulative figures shown)			(Detailed figures omitted)						
Net Present Value									
Cumulative Benefits (CB)	0.04	0.09	0.23	0.30	0.37	0.46	0.56	0.63	0.68
SUMMARY									
Benefit:Cost Ratio (CB/CC)									1.51
Payback (CC-CB)	-0.02	0.00	0.08	0.08	0.08	0.10	0.14	0.19	
Payback Period (1st +)			X						

C. ALTERNATIVE 3: NATIONAL AIDS INFORMATION RESOURCE

YEAR
(in hundreds of millions of dollars)

	0	1	2	3	4	5	6	7	Total
COSTS									
Project Life Cost									
Present Value Cost									
Residual Value (only cumulative figures shown)			(Detailed figures omitted)						
Present Value Factor									
Discounted Res. Value									
Adjusted Cost									
Cumulative Costs (CC)	0.04	0.08	0.23	0.29	0.36	0.39	0.46	0.57	0.68
BENEFITS									
Project Life Benefit									
Present Value Benefits (only cumulative figures shown)			(Detailed figures omitted)						
Net Present Value									
Cumulative Benefits (CB)	0.02	0.05	0.20	0.29	0.39	0.42	0.70	0.9	61.2
SUMMARY									
Benefit:Cost Ratio (CB/CC)									1.76
Payback (CC-CB)	-0.02	-0.03	-0.03	0.00	0.03	0.03	0.24	0.39	
Payback Period (1st +)					X				

D. DERIVING THE COMPARISON YARDSTICKS

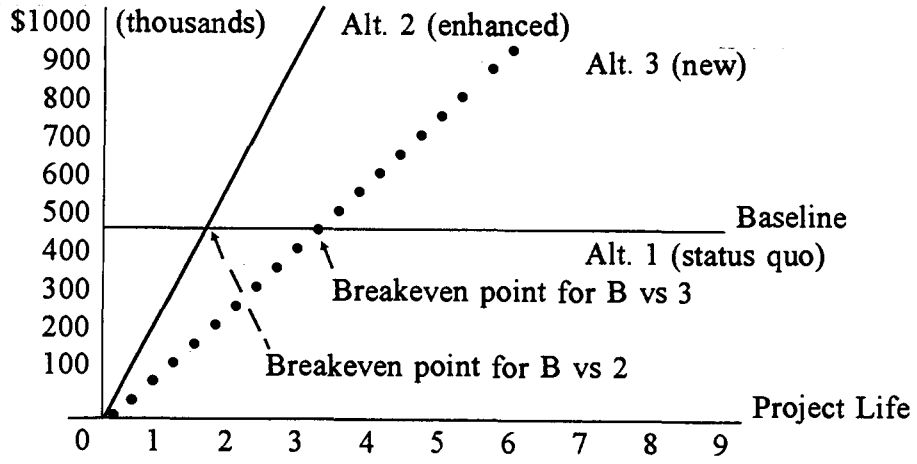
	Alternative	Present Value Cost
1. Compute the cumulative PV costs	Baseline Alt. 1 (status quo)	$ 200,000,000
	Alt. 2 (enhanced)	450,000,000
	Alt. 3 (new)	680,000,000

	Alternative	Present Value Benefit
2. Compute the cumulative PV benefits	Baseline Alt. 1 (status quo)	$ 250,000,000
	Alt. 2 (enhanced)	680,000,000
	Alt. 3 (new)	1,200,000,000

	Alternative	Benefit:Cost Ratio
3. Compute the benefit:cost ratio	Baseline Alt. 1 (status quo)	1.25
	Alt. 2 (enhanced)	1.51
	Alt. 3 (new)	1.76

In the foregoing simple example, the new option has the highest BCR.

4. Use breakeven analysis



Thus, in the foregoing breakeven analysis, Alternative 2 reaches a breakeven point with the Baseline in a little less than 2 years, whereas Alternative 3 reaches a breakeven point with the Baseline in about 3.5 years.

6. TESTING SENSITIVITY TO MAJOR UNCERTAINTIES

PROBLEM: What is the sensitivity of the analysis and outcome to a doubling of the expected demand for products and services (i.e., going from X workload to Y workload). To simplify the problem, assume the only costs directly affected by the workload increase are personnel and other operating costs (some variable costs). Also, assume benefits are proportionately affected, although, in reality, benefits might not be proportionately affected.

Costs For Workload X
(all figures in hundreds of millions)

	Baseline (status quo)	**Alt. 2 (enhanced)**	**Alt. 3 (new)**
Year 1 (includes most of start-up, nonrecurring costs):			
Equipment	$20	$70	$ 80
Other Production Costs	$10	$20	$ 30
Site Prep.	$ 0	$10	$ 30
Personnel	$75	$90	$100
Years 2–9 (yearly averages used for the period):			
Personnel	$80/yr	$95/yr	$125/yr
Other Operating Costs	$20/yr	$25/yr	$30/yr

Costs For Workload Y
(all figures in hundreds of millions)

	Baseline (status quo)	**Alt. 2 (enhanced)**	**Alt. 3 (new)**
Year 1 (includes most of start-up, nonrecurring costs):			
Equipment	$20	$70	$ 80
Other Production Costs	$10	$20	$ 30
Site Prep.	$ 0	$10	$ 30
Personnel	$75	$90	$100
Years 2–9 (yearly averages used for the period):			
Personnel	$120/yr	$145/yr	$190/yr
Other Operating Costs	$ 30/yr	$ 40/yr	$ 50/yr

SOLUTION:

STEP 1: Calculate NPV costs for alternatives under workload X:

PV Baseline = 0.954($20 + $10 + $75) + 5.088($80 + $20)

= $100,170 + $508,000

= $608,170

PV(Alt. 2) = 0.954($190) + 5.088($95 + $25)

= $181,260 + $610,560

= $791,820

PV(Alt. 3) = 0.954($240) + 5.088($125 + $30)

= $228,980 + $788,640

= $1,017,620

STEP 2: Calculate NPV costs for alternatives under workload Y:

PV Baseline = 0.954($20 + $10 + $75) + 5.088($120 + $30)

= $100,170 + $763,200

= $863,370

PV(Alt. 2) = 0.954($190) + 5.088($145 + $40)

= $181,260 + $941,280

= $1,122,540

PV(Alt. 3) = 0.954($240) + 5.088($190 + $50)

= $228,980 + $1,373,780

= $1,602,760

STEP 3: Calculate percentage increases for costs:

Baseline = $608,170/$863,370 = 70%

Alternative 2 = $791,820/$1,122,540 = 71%

Alternative 3 = $1,017,620/$1,602,760 = 63%

STEP 4: Because we were told the benefits remain the same proportionately, as the percentage increase for Alternative 3 was the least, if Alternative 3 were the preferred alternative to start with, then we would not change the recommendation based on the foregoing increase in costs (along with the other constraints given to us).

NOTE: The remaining three steps in the BCA methodology, presenting results, recommending a preferred alternative, and describing the implementation process, are relatively straightforward and further amplification in the context of this case study is believed to be of only very marginal value; they are, therefore, omitted.

APPENDIX F

CASE EXAMPLE 2: GIS PROJECT

PROJECT TITLE: PC-BASED DATA RETRIEVAL AND GIS SOFTWARE FOR DECENTRALIZED PLANNING

1. GOALS AND OBJECTIVES

OVERALL PROJECT GOAL: To assist developing countries in Latin America and the Caribbean to bring about a sustainable and orderly transformation of production, with social equity, by providing them with a practical methodology and companion set of demographic data manipulation tools that can be applied in "building block" fashion. Tools will include a specially developed PC-based computer software package for addressing spatial population-related applications, emphasizing decentralized information use, primarily at the local decision-making level, in both the public and the private sectors. Such customized software will have the capability to interface with commercial off-the-shelf GIS software packages, thereby extending its applicability and versatility and to increase the long-term utilization of population and housing censuses as prime information sources that can be associated with the data from other disciplinary areas through data retrieval and GIS technology.

LONG-TERM GOAL (SUBSTANTIAL ACHIEVEMENT 5 YEARS OUT OR LONGER): To have in place an effective and efficient general-purpose PC-based computer software tool, and associated methodology, that has a demonstrated track record in substantially improving: (a) delivery of social services, including primary health services, with equity and target group focalization; (b) planning for urban growth with constraints on expansion; (c) assessing the effect of tourism development on local environments and populations (with special consideration for small island countries); (d) other similar kinds of generic economic and social applications of the software and general approach.

MID-TERM GOAL (SUBSTANTIAL ACHIEVEMENT IN 2–5 YEAR TIME FRAME): To increase to at least 70% the level of awareness of collaborating national, regional, subregional, and local agencies, institutions (e.g., the national statistical organizations (NSOs)) and decision-makers of the existence of, availability to, and accessibility by users to the set of PC-based GIS-related computer software tools provided. This is so that this audience not only understands what tools and approaches are available, and what applications they can use them for, but how to use them efficiently, including not only their opportunities

(e.g., applications), but their risks and limitations as well (e.g., policy constraints, computer and information literacy limitations, education and training resource limitations, etc.).

SHORT-TERM GOAL (SUBSTANTIAL ACHIEVEMENT BY THE END OF THE SECOND YEAR OUT): To mount successfully a series of no less than six pilot study tests, in geographically dispersed test sites, under disparate environmental conditions, and targeting a different user audience in each case. This is to facilitate (a) demonstrating the general feasibility of the proposed approach and software; (b) measuring cost effectiveness, including the pinpointing of both benefits and costs (both quantifiable and nonquantifiable); (c) validating the methodology, working assumptions and constraints; (d) educating and training user audiences, including "application literacy training"; (e) identifying specific actual and potential application areas and problems to be solved; and (f) modeling and simulating different promising data visualization and analysis scenarios.

2. ASSUMPTIONS (INCLUDING POLICY CONSTRAINTS, RESOURCE LIMITATIONS AND CULTURAL BARRIERS)

INITIAL DEPENDENCY ON HISTORICAL PRIMACY OF NATIONAL STATISTICAL ORGANIZATIONS (NSOs): Assume that the focal project implementation agent must work almost exclusively, initially at least, with the NSOs because the NSOs have historically owned and physically possess most of the required data. NSOs initially will probably not release their micro data readily for reasons of custom and "statistical secrecy." But, hopefully, they can be convinced that if their data are shared with others, they become even more valuable than if they are kept secret. Many NSOs are relatively weak within the overall governmental structure, and suffer from low wages and lack of motivation. There is often a high turnover of personnel, particularly of the more capable professionals who are lured away by more attractive offers from the private sector, international NGOs, or more developed or richer developing countries.

RELATIONSHIP OF NSOs WITH USERS: Assume that the NSOs will utilize the new project tools provided (e.g., the computer software) for internal purposes and for answering questions (e.g., by providing cross-tabulations or tables from external users). Different types of users may be treated preferentially depending on historical practice and custom. Grass-roots users may find access especially difficult, at least initially, because the NSOs are accustomed to dealing with experienced users whom the NSOs have already oriented and partially trained.

PRESSURES TO CHARGE FOR INFORMATION: Assume that NSOs face the added difficulty of assigning a cost for tabulations provided. If there are very many requests, the NSOs also face the danger of becoming overwhelmed and may have to increase resources allocated to providing information or the NSOs will have to provide the data to external users who, in turn, would have to do the manipulations. Then it would be only a short step, as the NSOs see the demand for their census data, to be more intent on charging for the information (that is not necessarily a bad thing, but should be anticipated, planned for, and budgeted for).

INITIAL BIAS TOWARD MAINFRAMES: Assume that at first, mainframe oriented use of the new project tools provided will probably prevail (i.e., produce the maximum number of preconceived tabulations), instead of working interactively with the data, simply because of more intimate familiarity of the initial user populations with mainframe operations and protocols rather than microcomputer operations and protocols.

INITIAL ORIENTATION TOWARD PROGRAMMERS/ANALYSTS: Assume that ideally, operational users should not be programmers or systems analysts but, in the light of prior experience, it can be expected that the technical NSO staff may attempt to gain and retain control of the project tools because they have the status of a de facto "high priesthood," a danger that must be guarded against.

UNIT PRICING OF PC EQUIPMENT: Assume that PC equipment in Latin America and the Caribbean will be fairly limited initially and will be expensive, but the situation is expected to improve over time as unit prices decline. Initially, small, hard disks will probably be the rule. Also, it may be worthwhile to explore an archival technology such as WORM.

SUPPLY-SIDE CREATION OF DEMAND: Assume that, economically speaking, the new project tools provide supply-side creation of demand, i.e., an increase in supply will "liberate" the demand. The supply-demand equation supposes the existence of potential secondary users of population information, i.e., those who use population data in addition to the data from their own fields of concern.

PERSISTENCE TOWARD DECENTRALIZATION AND REGIONALIZATION: Assume that the tendency toward decentralization and regionalization within some countries, begun in the late 1980s, will persist and extend to other countries. Assume that there will be increasing interest in strengthening capabilities of local

authorities to take responsibility for local planning and implementation. Initial decentralization in many NSOs will be via their regional field offices, i.e., there will be spatial but not administrative decentralization. Initial decentralization for some countries will be more difficult because they do not have a subnational NSO structure in place.

BIAS TOWARD MULTIDISCIPLINARY DATABASES: Assume that most potential users will be concerned with data from their own disciplines and fields of specialization and will want to use population censuses, etc., only in addition to their own data. These secondary "users" will want to be able to work with multidisciplinary databases (i.e., their data in association with census data in a single database).

REQUIREMENT FOR MAPS: Assume that users will normally require maps (paper or otherwise) to specify the area(s) of interest and to look at the spatial distribution of the results (recognized as key only toward the end of the new project tools development).

USEFULNESS OF A DEMONSTRATION EFFECT: Assume that a demonstration effect can be used as a tactical advantage (e.g., a Caribbean island nation as well as a South American country should serve as dual demonstration areas, thus having a stronger impact on the balance of the countries within their respective sub-regions than would otherwise be the case if a single prototype were used).

USER PROFILE LIKELIHOOD: Assume that potential users are:

1. Likely to be employees of local government, semi-autonomous agencies or non-governmental organizations (NGOs); in most of the countries of Latin America and the Caribbean these, and those in smaller private firms, may be slower to recognize the value of "demographics" and, therefore, must be introduced first to the use of such data for their own special purposes;

2. Secondary users of population data reside outside the capital cities and are geographically dispersed;

3. Most will have few colleagues nearby to assist in using the data and technology, and in making decisions based on data analysis;

4. The potential users are numerous, as there are many municipalities, regions, and firms, making it impossible to train all new users centrally;

5. Users will utilize these technologies only occasionally because they are likely to have more than one function;

6. Many will have limited skills in the use of computer-based methods and processing, except, perhaps, those employed in the larger or richer municipalities, regions, or companies; they will be heterogeneous with respect to their occupational backgrounds and experience; and

7. Most users will not take advantage of the documentation and tutorial materials; most will assume that learning must be via a formal training seminar.

LANGUAGE BIAS: Most users will know only their own native language (i.e., Spanish in most Latin American countries and English in the Caribbean subregion) and, therefore, both English- and Spanish-language instructional manuals and other tutorial materials will be required. Later, French and other language materials may also be required.

3. ALTERNATIVES

BASELINE (STATUS QUO): Do not provide for the new microbased tools. Rather, continue with a largely centralized, largely manual, and largely uncoordinated approach, classically followed by the central NSOs in developing countries, to dealing with the efficient demographic data information manipulation challenges facing such countries. This is considered the "Baseline," and is also referred to as the Current Method, or Existing System.

INCREMENTAL MAINFRAME IMPROVEMENTS (ALTERNATIVE 1): Continue to use the mainframe as is currently the case, with pregenerated, aggregate data or with microdata, or both, but make selective, incremental improvements (e.g., develop a more powerful mainframe-based GIS). Do not, however, move to either a distributed or decentralized microcomputer environment. Retain policy formulation and policy execution role and perform all data manipulations centrally at the NSO, perhaps with a few subnational NSOs selectively involved. Little direct and active local participation and involvement.

MICROCOMPUTER DECENTRALIZED APPROACH (ALTERNATIVE 2): Create a brand new set of microcomputer based tools, either IBM compatible or MAC or both, and move incrementally toward a fully decentralized model for demographic and related microdata manipulation locally, backstopped centrally by NSOs, but where the NSO role is gradually transformed from that of an "information czar" (where all work is done centrally) to that of a data custodian, with the emphasis on facilitation and technical counselling (but retaining policy formulation). Substantially enhanced direct and active local participation and involvement role.

4. COSTS AND BENEFITS

COSTS

1. NONRECURRING COSTS

CAPITAL OUTLAYS

Database Creation (includes mainframe downloading and conversion to microfiles)

Site Preparations for the Project Office

Other

Consultant Studies (external university and other)

Systems Design (for the PC-based GIS)
- Feasibility Studies
- Benefit:Cost Analyses
- Requirements Studies
- Consultancy Reports (internal)
- Benchmarking
- Research
- Request for Development of Contractor Proposals

Software Development, Testing, and Modification
- Local Modification (in-house)
- Contract and Subcontract Costs
- Purchase Costs (off-the-shelf)
- Alpha and Beta Testing
- Systems and Programming Documentation
- Tutorial Materials, including User Manuals

Hardware Acquisition, Testing, and Development
- Computer Microprocessors/IBM Compatible PCs/MACs
- Mainframe-Micro Links

Facilities
- Repairs and Alterations to Space
- Wiring and Electrical Preparations
- Air Conditioning Preparations
- Plumbing Preparations
- Communication Preparations

Education and Training
- Training Fees for Trainers
- Travel
- Lodging
- Per Diem
- Training Equipment and Materials, Demos, Videos
- Space Rental

Support Costs
- Travel
- Computer Services
- Telecommunications Services
- Furniture and Fixtures
- Special Equipment
- Materials
- Labour

Security, Safety, and Privacy
- Equipment
- Procedures Development
- Special Personnel Clearances
- Encryption and other Data Protection Tools
- Special Environmental Control Costs
- Consultant Reports

2. RECURRING COSTS

CAPITAL MAINTENANCE

Site Maintenance for the Project Office

Other
- Internal Studies (e.g., Marketing)

Systems Design
- Consultancy Reports
- Benchmarking
- Research
- Request for Development of Contractor Proposals

Software Development, Testing, and Modification
- Local Modification (in-house)
- Contract and Subcontract Costs
- Purchase Costs (off-the-shelf)
- Alpha and Beta Testing
- Systems and Programming Documentation
- Tutorial Materials, including User Manuals
- Publications
- Translations

Hardware Acquisition, Testing, and Development
- Computer Microprocessors/
- IBM Compatible PCs/MACs
- Mainframe-Micro Links

Facilities
- Repairs to Space
- Wiring and Electrical Maintenance
- Air Conditioning Maintenance
- Plumbing Maintenance
- Communication Maintenance

Education and Training
- Training Fees for Trainers
- Travel
- Lodging
- Per Diem
- Training Equipment and Materials, Demos, Videos
- Space Rental for Conferences, Meetings, etc.

Support Costs
- Travel
- Computer Services
- Telecommunications Services
- Furniture and Fixtures
- Special Equipment
- Materials
- Labour

Security, Safety, and Privacy
Equipment
Procedures Development
Special Personnel Clearances
Encryption and other Data Protection Tools
Special Environmental Control Costs
Consultant Reports

BENEFITS (Quantifiable marked by asterisk)

SHORT-TERM BENEFITS (0Y TO 0Y + 2)
("0Y" means baseline or starting year)

- *Increase in uses of census data (i.e., demand for) by 50% by end of 0Y + 2 years.
- *Reduction in the volume of paper tabulations that are generated by 30% by end of 0Y + 2 years.
- *Increase in number and types of users by 50% by end of 0Y + 2 years.
- Increase in ability to combine data from different levels via hierarchical processing (e.g., can study the family and individuals within the family).
- Identifies new markets for the new information services provided (this goes substantially beyond user demand for specific data).
- Improves basic computer and information literacy levels because users are required to achieve a minimal level of both before they can optimally exploit and utilize the new tools.
- Facilitates research because there is much greater "interaction" with the data, i.e., the speed and ease of getting results (tabulations and tables) from the system allows a user to move back and forth between theory and data.

MID-TERM BENEFITS (0Y + 2 TO 0Y + 5):

- Improved planning capability on the part of local level authorities.
- Previous censuses, usually ignored, become more valuable since they can be used to establish trends.
- Facilitation of integration of data from different topics (in multidisciplinary databases and through connection to more sophisticated GIS).
- Facilitation of decentralization of demographic statistical system to regional, subregional, and local level authorities, thereby improving its access and utilization potential.

LONG-TERM BENEFITS (0Y + 5 TO BALANCE OF LIFETIME):

- Provides greater justification for holding the census, thereby ensuring richer long-term utilization.
- Census cartography becomes of permanent value.
- Helps modernize NSOs and enhance their status and long-term viability as broad-based, versatile, and modern information institutions.
- Facilitates democratization of data by empowering a far larger spectrum of users to access and employ the information, with less bureaucratic interference.

APPENDIX F

5. EVALUATION OF ALTERNATIVES

A. FOR BASELINE (STATUS QUO)

YEAR
(in hundreds of thousands of dollars)

	0	1	2	3	4	5	6	7	Total
COSTS									
Project Life Cost									
Present Value Cost									
Residual Value (only cumulative figures shown)									
Present Value Factor			(Detailed figures omitted)						
Discounted Res. Value									
Adjusted Cost									
Cumulative Costs (CC)	0.02	0.04	0.06	0.08	0.10	0.12	0.14	0.14	0.70
BENEFITS									
Project Life Benefit (only cumulative figures shown)									
Present Value Benefits			(Detailed figures omitted)						
Net Present Value									
Cumulative Benefits (CB)	0.01	0.01	0.02	0.05	0.08	0.09	0.09	0.09	0.46
SUMMARY									
Benefit:Cost Ratio (CB/CC)									0.66
Payback (CC-CB)	-0.01	-0.03	-0.04	-0.03	-0.02	-0.03	-0.05	-0.05	
Payback Period (1st +) (positive payback never occurs)									

B. FOR ALTERNATIVE 1 (ENHANCED MAINFRAME APPROACH)

YEAR
(in hundreds of thousands of dollars)

COSTS	0	1	2	3	4	5	6	7	Total
Project Life Cost									
Present Value Cost									
Residual Value (only cumulative figures shown)									
Present Value Factor			(Detailed figures omitted)						
Discounted Res. Value									
Adjusted Cost									
Cumulative Costs (CC)	0.05	0.07	0.09	0.12	0.14	0.16	0.23	0.27	1.13
BENEFITS									
Project Life Benefit									
Present Value Benefits (only cumulative figures shown)									
Net Present Value			(Detailed figures omitted)						
Cumulative Benefits (CB)	0.03	0.04	0.06	0.09	0.13	0.17	0.26	0.34	1.12
SUMMARY									
Benefit:Cost Ratio (CB/CC)									0.99
Payback (CC-CB)	-0.02	-0.03	-0.03	-0.03	-0.01	0.01	0.03	0.07	
Payback Period (1st +)						X			

C. ALTERNATIVE 2: MICROCOMPUTER-BASED APPROACH

YEAR
(in hundreds of thousands of dollars)

COSTS	0	1	2	3	4	5	6	7	Total
Project Life Cost									
Present Value Cost									
Residual Value (only cumulative figures shown)									
Present Value Factor			(Detailed figures omitted)						
Discounted Res. Value									
Adjusted Cost									
Cumulative Costs (CC)	0.02	0.04	0.07	0.09	0.14	0.17	0.23	0.28	1.04
BENEFITS									
Project Life Benefit									
Present Value Benefits (only cumulative figures shown)									
Net Present Value			(Detailed figures omitted)						
Cumulative Benefits (CB)	0.00	0.01	0.04	0.12	0.18	0.24	0.34	0.40	1.33
SUMMARY									
Benefit:Cost Ratio (CB/CC)									1.28
Payback (CC-CB)	-0.02	-0.03	-0.03	0.03	0.04	0.07	0.11	0.12	
Payback Period (1st +)				X					

D. DERIVING THE COMPARISON YARDSTICKS

	Alternative	Present Value Cost
1. Compute the cumulative PV costs	Baseline (status quo)	$ 0.70
	Alt. 1 (enhanced)	$ 1.13
	Alt. 2 (micro, new)	$ 1.04

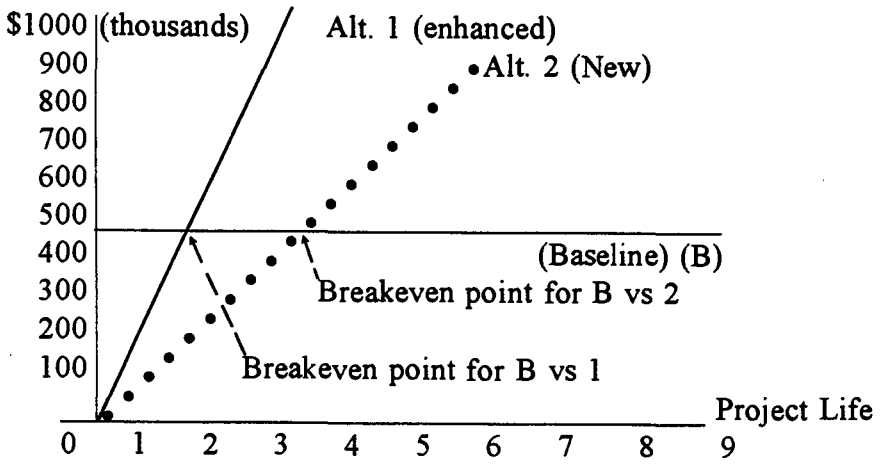
	Alternative	Present Value Benefit
2. Compute the cumulative PV benefits	Baseline (status quo)	$ 0.46
	Alt. 1 (enhanced)	$ 1.22
	Alt. 2 (micro, new)	$ 1.33

	Alternative	Benefit:Cost Ratio
3. Compute the benefit:cost ratio	Baseline (status quo)	0.66
	Alt. 1 (enhanced)	0.99
	Alt. 2 (new)	1.28

Thus, in the foregoing simple example, Alternative 2 has the highest BCR.

Cumulative PV
Costs (in hundreds of thousands)

4. Use breakeven analysis (illustrative only here)



Thus, in the above breakeven analysis, Alternative 1 reaches a breakeven point with the Baseline in a little less than 2 years, whereas Alternative 2 reaches a breakeven point with the Baseline in about 3.5 years.

6. TESTING SENSITIVITY TO MAJOR UNCERTAINTIES

PROBLEM: What is the sensitivity of the analysis and outcome to a doubling of the expected demand for products and services (i.e., going from X workload to Y workload). To simplify the problem assume the only costs directly affected by the workload increase are personnel and other operating costs (some variable costs). Also, assume benefits are proportionately affected, although, in reality, benefits might not be proportionately affected.

Costs For Workload X
(all figures in hundreds of thousands)

	Baseline	Alt. 1	Alt. 2
Year One (includes most of start-up, nonrecurring costs)			
Equipment	$ 0.01	$ 0.02	$ 0.03
Other Production Costs	$ 0.01	$ 0.01	$ 0.01
Site Prep.	$ 0.00	$ 0.02	$ 0.01
Personnel	$ 0.03	$ 0.01	$ 0.01
Years 2–9 (yearly averages used for the period)			
Personnel	$ 0.26/yr	$ 0.03/yr	$ 0.02/yr
Other Operating Costs	$ 0.02/yr	$ 0.01/yr	$ 0.01/yr

Costs For Workload Y
(all figures in hundreds of thousands)

	Baseline (status quo)	**Alt. 1 (enhanced)**	**Alt. 2 (new)**
Year 1 (includes most of start-up, nonrecurring costs)			
Equipment	$ 0.01	$ 0.02	$ 0.03
Other Production Costs	$ 0.02	$ 0.02	$ 0.02
Site Prep.	$ 0.00	$ 0.02	$ 0.01
Personnel	$ 0.06	$ 0.03	$ 0.02
Years 2–9 (yearly averages used for the period)			
Personnel	$ 0.14/yr	$ 0.06/yr	$ 0.26/yr
Other Operating Costs	$ 0.05/yr	$ 0.02/yr	$ 0.02/yr

SOLUTION:

STEP 1: Calculate the net present value costs for the alternatives under the workload X situation:

PV Baseline = 0.954($0.01 + 0.01 + 0.03) + 5.088(0.26 + 0.02)

= $ 0.0478 + $1.41

= $1.46

PV(Alt. 1) = 0.954($0.02 + 0.01 + 0.02 + 0.01) + 5.088(0.03 + 0.01)

= $ 0.057 + $ 0.20

= $ 0.26

PV(Alt. 2) = 0.954($0.03 + 0.01 + 0.01 + 0.01) + 5.088 (0.02 + 0.01)

= $ 0.057 + $ 0.15

= $ 0.21

STEP 2: Calculate the net present value costs for the alternatives under the workload Y situation:

PV Baseline = 0.954($0.01 + 0.02 + 0.06) + 5.088($0.14 + 0.05)

= $ 0.086 + $ 0.97

= $ 1.06

PV(Alt. 1) = 0.954($0.02 + 0.02 + 0.02 + 0.03) + 5.088($0.06+0.02)

= $ 0.086 + $ 0.41

= $ 0.49

PV(Alt. 2) = 0.954($0.03 + 0.02 + 0.01 + 0.02) + 5.088($0.26 + 0.02)

= $0.076 + $1.425

= $1.50

STEP 3: Calculate the percentage increases for costs.

Baseline = $1.46/$1.06 = 1.38%

Alternative 1 = $ 0.26/$0.49 = 0.53%

Alternative 2 = $ 0.21/$1.5 = 0.14%

STEP 4: Because we were told the benefits remain the same proportionately, as the percentage increase for Alternative 2 was the least, if Alternative 2 was the preferred alternative to start with, then we would not change the recommendation based on the foregoing increase in costs (along with the other constraints given to us).

NOTE: The remaining three steps in the BCA methodology, presenting results, recommending a preferred alternative, and describing the implementation process, are relatively straightforward and further amplification in the context of this case study is believed to be of only very marginal value; they are, therefore, omitted. For ease of reading and simplicity's sake, detailed figures in most of the tables have been omitted.

APPENDIX G

CASE EXAMPLE 3: ALTERNATIVE COMMUNICATIONS MEDIA

1. THE CHALLENGE

One of the most ubiquitous and complex challenges facing all kinds of organizations today is the question of identifying, measuring, and evaluating alternative communications media. The superimposition of electronic communications channels on top of manual channels has complicated a decision that, 40 or 50 years ago, was relatively much simpler.

A generic case example is offered here with the hope that the approach taken, especially the use of a simple analytical matrix, may be useful to readers in helping to identify, measure (weigh), and evaluate alternatives in general. Our scenario is any medium or large sized organization, whether in the public or private sectors, faced with the need to employ a wide variety of communications channels to communicate both internally and externally.

2. THE CHANNELS

Communication channels may be broadly grouped in two categories: manual and electronic. Among a large variety of electronic channels available are the telephone, informal messaging using e-mail, formal messaging using e-mail, electronic file transfer of data or document images or pictures, internal local area networks, wide area networks, broadcasting, two-way radio, mobile telephones, the use of commercial data networks, teletype, fax, and computer conferencing and video conferencing. Sometimes telephones or one of the other channels are required in both secure and nonsecure modes, especially where sensitive or secret data are involved. Internet is a major new option.

Among an equally large variety of manual channels available are face-to-face meetings, the use of couriers and pouches, regular mail and posts, special mail and posts (e.g., in the United States the use of certified, registered, insured, or overnight delivery), and international postal services. If we were addressing communication channels in older societies, we could obviously expand the list to include carrier pigeons, drums, smoke signals, and many other methods. But, for our purposes, we will limit our discussion to "modern" methods. Obviously, not all channels may be available to a given organization — at any price. Moreover, the feasibility of using a certain channel may be questionable, given circumstances of "environmental noise," convenience and other variables.

3. PARAMETERS IN CHANNEL SELECTION

Decision parameters or factors in channel selection is a useful way to identify alternatives systematically, measure (weigh) them, and make a final evaluation and selection of those the organizations desire to employ. For example, the need for speed, on the one hand, and the need for security, on the other hand, are, to variable degrees, usually always present (implicitly or explicitly) in the decision to select one communications channel over another. Nearly always there is a trade-off between speed and security. On less sensitive, routine matters, speed is usually paramount. But, where the information to be transmitted is very sensitive or secret, then secrecy is paramount, even if it is achieved at the expense of speed.

In the accompanying figure, the following illustrative factors are used (certainly one could think of still other factors):

RESPONSE SPEED relates to the urgency of both sending a message and obtaining an answer rapidly. This is clearly an important factor in rapidly escalating crisis situations, especially those involving human health, safety, and security.

SECURITY/CONFIDENTIALITY relates to the need to ensure that the degree or level of channel security is commensurate with the security classification and sensitivity of the message being transmitted. Some channels should not be used for sensitive or secret information because they are insecure.

COST (value-for-money) relates to the desire to ensure that the selected channel is cost effective (e.g., in sending books and bulky materials).

CONVENIENCE refers to the ready availability of the channel to senders and receivers. For example, whether or not a particular communications channel is in one's own office, or in the office next door, or down the hall, or on another floor of one's building, or across town, or in the next country, has a bearing on the communications decision.

Department of State Alternative Communications Media

						FAIS (Electronic)		*Other (Electronic)*		
	Face-to-Face	Couriers & Pouches	Telephone	Regular U.S. Mail	Certified & Registered U.S. Mail	Electronic Mail (Informal Exchanges)	*Official* Msgs. (Formal Exchanges)	Commercial Data Networks	FAX	
Response Speed										
Security/ Confidentiality										
Cost (Value-for-Money)										
Convenient to Use										
Transmission Reliability										
Recall & Retrieval										
Need to Capture & Record										
Reproduc-ibility for Distribution										
Treat as Public Record										
Message Authentication										
Time to Reflect										

Key

● Critical ◍ Important ◎ Secondary ○ Unimportant ⊗ Not Applicable

TRANSMISSION RELIABILITY relates to the need to minimize message garbling; it is imperative sometimes that a message be transmitted verbatim because the penalty of misunderstanding may be very high indeed. Sometimes, for example, telephone connections are very poor and the older teletype technology was much less reliable.

EASE OF RECALL AND RETRIEVAL relates to the need to ensure that the communication content can be recalled and viewed again, either in electronic or hard copy form. Unless tape recorded, this is not possible with face-to-face meetings or telephone conversations using equipment without recording capability.

NEED TO CAPTURE AND RECORD relates to whether or not the communication needs to be captured (in some medium) and made a matter of record (but not necessarily an "official" record).

REPRODUCIBILITY FOR DISTRIBUTION relates to the need to distribute a message quickly and automatically (or semiautomatically) once received, internally or externally, to many intended audiences and recipients in parallel; preferably, without extensive rekeying of information from one medium or system or network to another.

TREAT AS A PUBLIC RECORD means that some law, policy, or operational requirement demands that a message be treated as an official record. This parameter is especially prevalent in public organizations such as government agencies.

MESSAGE AUTHENTICATION means there is a need to verify the authenticity of the message and sender. The idea is to guard against spurious messages or disinformation, and ensure that the proper level of authority has, indeed, authorized the transmission of a message.

TIME TO REFLECT relates to the need to consider carefully the meaning and significance of a message, which takes time, sometimes considerable time, before a response can be made or some other action taken.

GRAPHICS CAPABILITY relates to the need for a channel to transmit pictures or images, not just data, or text, or voice.

INTERACTIVE CAPABILITY relates to the need for a channel to allow for two-way, not just one way communication (synchronous or asynchronous).

The foregoing are illustrative factors. Other considerations that might come into play include:

- Reducing telephone tag
- Bridging international time zones more effectively
- Promoting informality or even colloquialism
- Better calendar/diary management
- One-stop message shopping
- Efficient action tracking and tracing

4. THE EVALUATION PROCESS (COMPARING ALTERNATIVES)

In our example as depicted in the foregoing figure, a simple five-level scheme is used to assist in the evaluation of alternatives, and the eventual selection of a preferred alternative:

CRITICAL means the factor is paramount (e.g., in the already mentioned trade-off between security and speed, if speed is of the essence, then this highest ranked category would be used).

IMPORTANT means that the factor is very significant, and of substantial consequence, but not necessarily critical.

SECONDARY means that the factor does come into play in the channel selection process, but is not of primary importance.

UNIMPORTANT means that the factor is somewhat relevant, but is neither a primary nor even a secondary factor.

NOT APPLICABLE means that the factor is irrelevant.

CASE EXAMPLE 4: DELPHI APPROACH

Benefit:cost analysis—A Delphi approach

Forest Woody Horton, Jr.
John S. Pruden

Federal agencies must increasingly justify budget requests with numbers instead of rhetoric. The Department of State, in seeking to prepare its analysis of benefits and costs, found virtually no useful, parallel case studies, so it developed a new approach using the Delphi Technique.

Inf Manage Review, 1988, 3(4), 47–54

Federal government agencies live in a Gramm-Rudman era of large budget deficits that have one very tangible consequence—an increasingly tough Congress and White House that force agencies to justify budget requests with numbers instead of rhetoric. Agencies are scrambling to learn the tools and tricks of this very old quantitative technique that has suffered many name changes over the years with each new wave of renewed interest—benefit-to-cost analysis (BCA). In a former life, BCA was called cost-to-benefit analysis, until somebody observed that you cannot divide by zero and, therefore, reversed the denominator and numerator.

THE RELEVANT REGULATIONS

OMB Circular A-11

While there are several mandates requiring BCA to be used to justify new planned programs and expenditures, the one that strikes terror into the hearts of federal agencies is Office of Management and Budget (OMB) Circular A-11, the "budget preparation bible."

That regulation stipulates that for "major initiatives" involving the acquisition, operation, and use of information technology systems, a BCA is required along with the agency's budget submission. The relevant section reads:

> Agencies will provide detailed life-cycle benefits and costs for major information technology initiatives contained in the budget request. These analyses must be submitted before any such initiatives can be considered for funding.[1]

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The views expressed here are solely those of the authors and do not represent the official position of the Department of State. This article is not endorsed by Planning Research Corporation, the firm by whom the authors were employed while undertaking the work documented in this paper.

It is somewhat like the requirement to prepare environmental impact statements when proposed new government programs are in some way going to impact the environment.

Federal Information Processing Standards Publication No. 64

There is another regulation agencies are supposed to follow in formatting their analyses—Federal Information Processing Standards (FIPS) Publication No. 64, "Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase."[2]

The title alone belies its obsolescence. First of all, its emphasis is on documentation, of which cost justification is only a part. Second, it is directed to computer programs, whereas today there are telecommunications networks, office automation, compact disk, read-only memory (CD-ROM), and many other information technologies. Third, it emphasizes the initiation phase, to the exclusion of the operation, maintenance, phase-down, phase-out, and possible replacement phases.

Still, for better or for worse, agencies must follow this outdated regulation. A task force is at work now to update it.

THE DEPARTMENT OF STATE'S MAJOR INITIATIVE

When the Department of State (DOS) came to the problem of how to format and present benefits and costs in the context of an enormously large and complex multidimensional "major initiative," it found virtually no useful existing case studies of parallel, or even closely related BCAs. Indeed, it was ironic that BCA methodology calls for a careful examination of alternative ways of resolving a problem using information technologies, but when it came to finding suitable alternative approaches to the analysis itself, there were virtually none.

Use of the Delphi Technique

As a consequence, the Department had to take a "new" approach—the so-called Delphi Technique. The Delphi Technique, used in fields such as social science research, statistics, biometrics, and econometrics, involves the pooling of expert opinions based on a rigorous methodology.

The BCA was performed under the auspices of the DOS Information Technology Planning Staff, with major support from Planning Research Corporation (PRC) under a systems engineering and technical assistance contract.

Objectives of the Foreign Affairs Information System

The central focus of the DOS information development effort is on the Foreign Affairs Information System (FAIS). The FAIS design philosophy that has evolved over the past several years takes advantage of converging technologies to bring about these expected improvements:

- more efficient communication,
- enhanced security,
- workload reduction, and
- better use of information.

These objectives are in harmony with the need to improve overall DOS performance in the face of expected cost and personnel reductions. The FAIS attributes contributing to the above objectives are outlined below.

More efficient communication

FAIS will link together the office automation environments of bureaus and posts and link them, in turn, to the Department's central computer facility. This secured network will permit the paperless movement of messages worldwide. The traditional delineation of communications by type (e.g., cable, memorandum, report) will fade away, replaced by information transmission and receipt to and from electronic mailboxes that may be reviewed at the user's convenience.

Not only will worldwide information exchange be effected, but the major local workload of consultation, drafting, clearance, and approval can also take place electronically without resort to paper.

Enhanced security

There is a compelling need to reduce the paper holdings at U.S. embassies in the face of rising ter-

rorist threats and to control access to sensitive information and ensure its accountable use. FAIS development addresses each of these requirements.

There is a compelling need to reduce the paper holdings at U.S. embassies in the face of rising terrorist threats and to control access to sensitive information and ensure its accountable use.

A key design feature in FAIS is the automatic inclusion of all official communications in the central archive in Washington, D.C., regardless of type. This comprehensive file, accessible on-line to any authorized user in the network, will obviate the need for archival paper files in the bureaus or at overseas posts. Security of information and personnel will be materially improved because of the lack of advantage to any physical intruder (terrorist, mob, etc.) in gaining access to U.S. facilities. Through the use of an effective security module to be utilized by all FAIS system components, constant security control will be maintained in a manner not possible heretofore.

Workload reduction

By making extensive use of electronic mail functions to support information exchange at all levels, FAIS will have the potential to eliminate the rekeying of any document once it is generated. This is not a trivial accomplishment for the DOS, where the major clerical workload throughout the organization is converting information received in one paper form into another form. In the electronic environment of FAIS, any item received or retrieved can be converted to a word processing document for alteration, editing, and conversion to another form without the penalty of rekeying.

To facilitate this process, FAIS makes use of a unique concept called the "electronic envelope," which is a standardized descriptive record that is external to content. Use of this technique makes form conversion very simple and readily facilitates the reuse of existing text in many different types of products.

Electronic mail will make possible significant reductions in personnel now required to carry out the functions of dissemination, primary distribution, and indexing. By use of the envelope, most of this work can be absorbed at the originating point without imposing a workload that does not already exist.

Better use of information

It has been said that information is the only product of the DOS and its effective use the only measure of its success. Policy formulation and implementation must be based on the best and most-current information available, and to this end, the DOS has constantly strived to improve field reporting. The objective of FAIS is to make this resource useable and available to the widest audience of legitimate recipients.

FAIS will make the combined information holdings of local offices, bureaus, and the central archive available to users at multifunctional workstations. By this means, information can be conveniently researched and extracted as input to decision-making processes at all levels. Furthermore, information retrieved can be reused directly, without having to traverse the stages of paper copying and rekeying.

Because of its real-time updating feature, users will no longer have to wait as central or local files are updated in order to gain access. Retrieval will use off-the-shelf software that will use natural language as the search key, thus enabling untrained users to benefit from its full potential.

FAIS, therefore, has as its major objective the cost savings and efficiency improvements that are clearly at the core of the current congressional mood. The problem that faced the Department was finding a realistic way to measure projected costs and benefits within the framework of this very large and multifunctional application of emerging technologies.

ALTERNATIVE APPROACHES

Two alternative approaches were examined:

1. Continued operation of the Department's present basic FAIS infrastructure, enhanced by a new Database Management System (DBMS) package that would allow immediate updating and text searching, operating in an environment of im-

proved communications, and vastly expanded, albeit unlinked, office automation (OA) utilization.

2. Establishing the worldwide network described in the above sections that would link the OA environments of the Department's 26 Washington, D.C., headquarters bureaus and its more than 250 overseas posts to each other and to the central data processing (DP) facilities of the Department, using a new telecommunications network.

It should be emphasized that FAIS is a broad information management infrastructure that uses the information life-cycle concept as a roadmap to integrate the composite benefits of hardware, communications, and technology to serve the Department's needs for responsive, secure, and affordable problem-solving and decision support. More succinctly put, it is a way of going rather than a discrete application. Its planned implementation is a continuum reaching forward for a number of years.

Above all, what distinguishes FAIS in the Department's total information systems/technology schema is that it is the integrating element that links together all of the stages of the information life cycle with the supporting hardware and software technology infrastructures. One can see immediately, therefore, that the benefit to cost challenge confronting the Department was far more complex than replacing or upgrading a mainframe or minicomputer, or putting in a wide or local area network, or simply moving from a manual information handling environment to an electronic one by installing IBM, Wang, DEC, or other OA equipment.

THE INFORMATION LIFE CYCLE IN FOREIGN POLICY FORMULATION AND EXECUTION

The information-handling processes that support the formulation and execution of foreign policy at the DOS follow a classic life-cycle pattern. This is not in the sense of the "systems life-cycle" concept that means "from birth-to-death" tracking of hardware or software deployment, but in an information birth-to-death sense, which means from the moment information is first created until it is finally destroyed, becomes obsolete, or is retired in the archival sense.

The information-handling processes that support the formulation and execution of foreign policy at the Department of State follow a classic life-cycle pattern in the information birth-to-death sense.

The Department's information life cycle follows nine stages (Figure 1).

Stage 1: Draft/revise

Following appropriate guides, secretaries, typists, and some officers key text or draft official documents either directly or by transcription from shorthand or recorded media. Cables, congressional correspondence, diplomatic notes, and interoffice memoranda are all generated in this fashion.

Stage 2: Clearance/approval

In some DOS bureaus or offices, the drafter is the recipient of all clearance actions of approval, rejection, or comment, and is tasked with all subsequent revisions. In other units, clearance moves ahead one level at a time, with actions reflected back only to the previous level.

Stage 3: Formal/informal exchanges

Exchanges of views on policy and operational matters is a constant process within every office in the DOS and overseas. It takes place at every juncture in development of official documents and in ordinary interchange between individuals and organizations.

Stage 4: Local retrieval/reuse

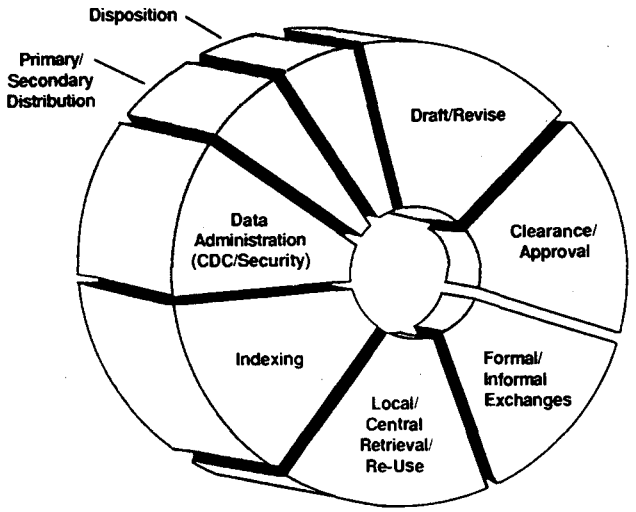
Office and bureau files generally exist in paper form throughout the domestic and overseas environments. Some paper files have their automated counterpart in bureau and office word processing (WP) or DP files, from which limited retrievals can be made and the retrieved text used without rekeying.

Stage 5: Central retrieval/reuse

The Department's central archive consists of a microfilm file of official communications dating back

Figure 1

DEPARTMENT OF STATE INFORMATION LIFE CYCLE



to 1973 and a paper file of material predating 1973. An on-line index and citation file is maintained for the microfilm text files with the most recent (up to three years old) cable texts also available on-line.

Stage 6: Indexing/acquisition

The central archive accessions material in three ways: (1) electronic receipt of incoming and outgoing State cables; (2) processing of incoming and outgoing hard-copy communications (followed by microfilming and indexing); and (3) retired materials coming from bureaus, offices, and post collections.

Stage 7: Primary and secondary distribution

The distribution stage involves a broad array of techniques applied by specialized units, to disseminate messages, documents, and data from the point of electronic receipt to the point of ultimate-user receipt. Whereas electronic messages coming into the Department from around the world move at 186 million miles per second, it sometimes takes weeks to move from the point of electronic receipt in the Department to the ultimate recipients.

Stage 8: Disposition

Typical methods of final disposition of a document include permanent retention in the National Archives, purging, or destruction.

Stage 9: Systems administration

Administration includes the classification and declassification of documents classified under security regulations; data integrity controls; user administration, including the use of passwords; configuration management for system functions and programming of the central archives and telegram distribution; and some other housekeeping functionalities.

COSTS

Development of costs for the BCA followed rather straightforward, conventional methodologies. Cost component items were broken down into discrete line items for which costs could be directly ascertained from accounting records, derived, or estimated.

In the case of the hardware infrastructure, the Department identified bureau processors, the domestic network, the worldwide telecommunications network, post processors, primary distribution/gateway processors, and the central database processors as the main hardware cost components.

These were then further subdivided by the various recurring/nonrecurring, capital vs. operating/maintenance, and other "slices" required by FIPS Publication No. 64. While the approach was straightforward, the calculations were complex and detailed.

BENEFITS

It is the benefit side of the equation that employs the Delphi Technique and is, therefore, of more interest in the context of this article.

After finding no fully acceptable alternative way of estimating benefits, the Department finally settled on the so-called Delphi Technique, perhaps more simply understood as a pooling of expert opinion.

The landmark studies of knowledge worker productivity published by Booz-Allen & Hamilton in 1980 were taken as the starting point, cross walking to the Department's life-cycle activities impacted by the adoption of either alternative (Figures 2 and 3).[3] It should be noted that Figure 3 is a composite portrayal of the average time spent by officers in each of the eight "FAIS impactable" activities (sometimes called "functionalities"). However, this does not mean that, for example, 2 percent of all officers spend their time on indexing. It means that of that subset of the total officer population that is engaged in indexing, on the average they spend 2 percent of their time on that activity. Elsewhere in this article it is pointed out that only 5 percent of the total officer population is estimated to be involved in indexing, in contrast to draft/revise, where 100 percent of the officer population is involved.

Figure 2

KNOWLEDGE WORKER (OFFICER) PRODUCTIVITY

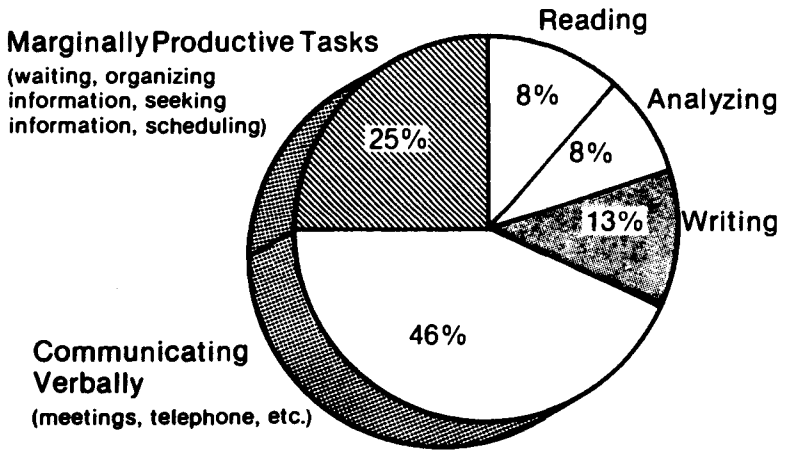


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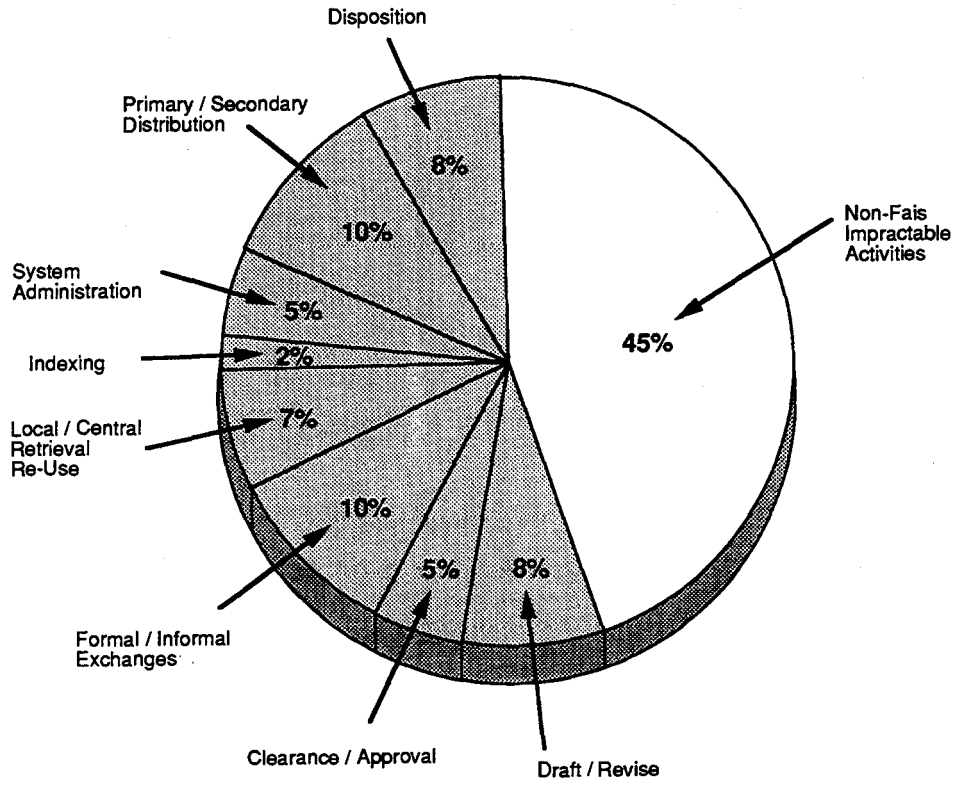
Figure 3

DEPARTMENT OF STATE INFORMATION LIFE-CYCLE ACTIVITIES (PRELIMINARY ESTIMATES), COMPOSITE PORTRAYAL: OFFICERS



Parameters for calculating benefits

In effect, the course chosen was to compare the value enhancements that the Department expected for the two alternatives at each of the nine stages of the information life cycle. The next step was to estimate and cost out the benefits by following an algorithm with five parameters involving different variables, including

1. a "utilization profile" of the function based on whether adoption and exploitation were expected to be gradual, delayed, or rapid;
2. an estimate of the percentage of the total user population involved at each of the nine stages of the life cycle;
3. a calculation of the quantified benefit based on salary and overhead factors;

4. a sensitivity analysis used as a factor to modify results, based on changing workloads, assumptions, or parameters, to prevent benefits from either being overstated or understated over time (to be used to update the original analysis); and
5. an "availability factor," defined as the degree to which system functions would, in fact, be brought on-line and made available according to the master implementation schedules.

Of course, nonrecurring benefits, cost avoidances, and cost reductions were considered also (e.g., eliminated and redefined functions, eliminated and redefined positions, savings generated by discontinuance of lower unit costs of existing hardware/software installations and associated personnel and other supporting resources, declining workloads because of a shift from one operating environment to another, and new procurements of hardware/software present in one alternative that would be obviated by adopting the other alternative).

Value enhancements

Value enhancements are time savings expressed as dollars spread across the entire organization and include, for purposes of estimating recurring benefits,

Value enhancements are time savings expressed as dollars spread across the entire organization.

the following illustrative kinds of benefit improvements that would accrue under each alternative:

- improved productivity (efficiency),
- improved quality of decision making,
- improved performance of tasks (effectiveness),
- improved learning curve,
- upgraded work-function importance,
- automated replacement of certain manual tasks,
- the discontinuation of certain manual tasks altogether,
- greater interchangeability of personnel,
- eliminated intermediate steps,
- greater task overlapping,
- less need for clerical support,
- reduced reliance on paper files,
- greater reuse of information assets,
- faster response time,
- reduced turnaround time,
- tighter security and reduced violations, and
- decreased instances of lost or missing information.

RESULTS

After estimating the recurring and nonrecurring quantifiable benefits for each alternative, unadjusted results were then passed through the appropriate net-present-value calculations based on the prescribed 10 percent discount factor called for by the regulations. A payback period was computed, at which point in some distant year the adoption of one alternative over the other could be seen to reach a break-even point. The cumulative, aggregate-discounted benefits would then begin to exceed the cumulative, aggregate-discounted costs at a much faster rate for the preferred alternative.

In late 1987 the estimated calculations were validated, using six different stratified samples of foreign-service personnel (six groups of 12 each), to determine whether the initial estimates, assumptions, parameters, and policy constraints were valid. The actual test results, using 70 foreign-service personnel, were extremely close to the estimated results.

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APPENDIX I

CHECKLIST FOR FORMULATING GOALS AND OBJECTIVES

A. GOALS

1. DESCRIBE THE BACKGROUND OF THE PROBLEM FIRST

Before attempting a statement of the problem to be solved in succinct fashion, it is generally a good idea to begin by focusing on "the current situation" or "the current conditions," articulating both their "good" and their "bad" aspects in a narrative, "story fashion." Perhaps, you could call this narrative "background" or "findings and conclusions" (or perhaps even using two sections, one historically oriented, the other current time frame-oriented. In this way, reviewers usually get a much better "feel" for the situation because they understand the background conditions better that led to the need for doing something about the problem. Otherwise, decision-makers are confronted with a problem statement "out of the blue," as it were, with no reference point or antecedents, no history, no context and, unless they are already experts in the field, they start off confused and bewildered by simple ignorance.

Here is where to address the political, economic, and sociocultural environments and the other environments (e.g., the internal organizational cultures) in which the project's "solution" must be able to survive if it is to flourish.

2. MAKE SURE THE PROBLEM IS CHRONIC

The problem to be solved (or at least significantly ameliorated) should be long standing (chronic) rather than temporary or short term and one that has resisted "grand design solutions" (i.e., by passing a law, by establishing a new government policy, or by formulating a rule or regulation). Typically, a problem has been around for years, and a goal statement formulated to address the problem should not be so ambitious (and, therefore, unrealistic) as to suggest, literally, the problem can be completely solved in a year or two. Rather, typically, time frames for good goal statements are 5 or 10 years, or perhaps even longer terms, for those problems that are notoriously intractable and have defied previous attempts to resolve them.

3. TRY TO QUANTIFY IF POSSIBLE

The problem need not necessarily be articulated in quantifiable terms, although where such quantification, or even partial quantification is feasible, it should be attempted; for example, by using an expression such as "increase or

decrease by X% over Y years). There will be times, however, when only a qualitative characterization of the goal is feasible. Most of the time there will be both quantifiable benefits and quantifiable costs, and nonquantifiable benefits and nonquantifiable costs.

4. BE CAREFUL OF SOUNDING VAGUE AND MOTHERHOODISH

The problem may be political, economic, social, or cultural in character, or some mixture of these. Care should be taken, however, not to circumscribe the problem to be addressed in such vague and broad ("motherhoodish") terms so as to make goal statements themselves ambiguous or nebulous or even silly.

5. USE INDICATORS OF GOAL ACHIEVEMENT

Goals are rarely, if ever, achievable or measurable in precise, finite, "all or none," "yes or no" terms, especially for projects heavily skewed to political and social benefits rather than economic benefits. Rather, project planners and proposers are usually "forced" to use indicators or measures of goal achievement, including performance measures and cost-effectiveness measures, both in ex-post analysis and earlier during monitoring stages.

6. DO NOT PLAGIARIZE OTHER GOAL STATEMENTS

No two goal statements will be precisely alike, because all projects are different, even where the problem to be solved by a project in two countries, geographically side-by-side, and with very similar political, economic, and social conditions, appears to be quite similar. There is, therefore, no "universal" or normative goal statement that can be used under all circumstances. Each goal statement must be customized to the particular parent problem that it is intended to address.

7. SMALL GOALS CAN BE JUST AS BEAUTIFUL AS LARGE GOALS

Goals, like projects, may be "national," "regional," or "local" in scope, priority, impact (in terms of target populations and groups), and applicability (in terms of results intended to be achieved). From a project sponsor's standpoint, however, a "local" goal may be just as important, or even more important, than some competing "national" project or goal.

8. USE ACTIONABLE, PRO-ACTIVE WORDS

Goal statements formulated to address a problem should be expressly stated in actionable, pro-active terms rather than in passive terms, using active verbs and a syntax structure that concretely identifies subjects (actors) and objects (targets) rather than indefinite nouns and pronouns.

9. THE MEANS VERSUS THE ENDS

Goal statements are the ends to be brought about. Objective statements bridge means with ends because they are more specific and get at least partially into how the ends are to be achieved.

B. OBJECTIVES

1. CONCRETE ATTAINABILITY

Unlike goals, objectives should be attainable in a fairly literal and concrete sense.

2. HIERARCHICAL UPWARD RELATIONSHIP TO GOALS

All objectives must be interrelated in hierarchical fashion to the parent goal to which it most nearly applies. Occasionally, the same objective may fit under more than one goal but, in most situations, that is not the case. Goals, however, generally number one, a few, or at most less than a half dozen, objectives tend to be greater in number because they are more specific.

3. HIERARCHICAL DOWNWARD RELATIONSHIP TO OUTPUTS AND INPUTS

Objectives are upwardly linked to parent goals and are downwardly linked first to project output components and then the outputs are linked to inputs.

4. USE ACTIONABLE, PRO-ACTIVE WORDS

Even more so than goals, objectives should be articulated in quantifiable, prescriptive and pro-active terms wherever such quantification and specificity, or even partial quantification, are at all feasible; for example, by using an expression

such as "increase or decrease by X % over Y years). Like goals, however, there will be times when only a qualitative characterization of the objective is feasible and by using expressions such as "should", "must," and "will."

5. DO NOT PLAGIARIZE OTHER OBJECTIVES STATEMENTS

Like goals, no two objectives statements will be precisely alike. There is, therefore, no "universal" or normative objective that can be used under all circumstances. Each objective must be customized to the particular parent goal to which it hierarchically belongs.

6. HOOKS AND HANDLES AS LINKING PINS

Objectives should ideally have "hooks and handles" in their articulation that allow key development assistance "players" to link the outputs that the project is expected to produce (the benefits in our BCA context) for the objectives to be achieved and, in turn, the inputs that the project is expected to utilize to produce those outputs (the costs in our BCA context).

7. THE INPUT HOOKS AND HANDLES

With respect to inputs, the "hooks and handles" are the human, physical, financial and natural resources, tools, equipment, methods, key personnel (labour, personnel), key institutions and organizations, and other materials and supplies that will be deployed (the costs in our BCA context).

8. THE OUTPUT HOOKS AND HANDLES

With respect to outputs, what the "hooks and handles" objectives should identify are the various outcomes or consequences from successful implementation of a project, in such terms as time saved, improved productivity, improved quality of work, improved timeliness of work, and so on (the benefits in our BCA context).

APPENDIX J

DO'S AND DON'TS CHECKLIST FOR FORMULATING ASSUMPTIONS

1. GET SOME DEVIL'S ADVOCATES

Outside directors and consultants can play a useful role by playing devil's advocate and asking questions and introducing new factual and interpretive materials. Internal players are often "too close to the problem" to be fully objective in articulating assumptions.

2. FOSTERING THE RIGHT ORGANIZATIONAL CULTURE

Encouraging alternative assumptions among the key project players is critical. This is essentially a matter of developing the assumptions in an organizational cultural climate that is positive and is fostered and supported by the top-level officials.

3. USING BRAINSTORMING

The technique known as "brainstorming" is often very valuable in helping to identify and define hidden assumptions, because it is a method that encourages "wild ideas" and does not permit negative criticism of such ideas at early stages.

4. WHAT YOU DON'T KNOW CAN HURT YOU

Bear in mind that "what you don't know CAN hurt you" if your group is inclined to give up to easily in identifying assumptions.

5. USING THE "WHAT IF" TECHNIQUE

Using the "what if" technique is another useful method for articulating assumptions. This is a directed, iterative method where participants are asked "what if such and such happened, or should occur; what impact would that have on the project's goals, objectives and outcomes?

6. WHAT IS THE WORST CASE SCENARIO?

Under the "assumptions context" ask: "In a worst case scenario, what would be the worst that could happen if this project fails? Is the cognizant government/department/other sponsor) willing to take that gamble? Should a fail safe option be explored? Is a fail safe option implicit in one of the alternatives?

APPENDIX K

DO'S AND DON'TS CHECKLIST FOR IDENTIFYING ALTERNATIVES

1. BEGIN BY REVIEWING GOALS AND OBJECTIVES

Carefully review the project goals and objectives to ensure that you have a firm grasp on exactly what it is that is expected to be accomplished.

2. REVIEW THE ASSUMPTIONS

Review the list of assumptions and, bearing them in mind, look at each objective separately and ask: "How can I accomplish this objective with the expected resource levels, policy constraints and likely cultural barriers, and other constraints within which I will have to work, including the time frame allotted?"

3. STRIKE THE RIGHT BALANCE

Remember, alternatives are broad avenues, not side-street activities — there is an important distinction between them. Objectives are far wider than activities. Objectives answer the questions "who, where, when and how," are expressed in actionable and achievable terms, even pro-active and proscriptive terms, whereas activities are usually stated in passive terms and are descriptive (they tell you the detailed tasks, duties, and jobs that have to be carried out) rather than prescriptive terms.

4. ALTERNATIVESMANSHIP

There is a danger in alternatives identification that is sometimes known by its broad, more popular term "grantsmanship." We might call it "alternativesmanship" were that term not such a mouthful, but the idea is essentially the same; decision-makers should be on guard against the situation where strawman alternatives are articulated just to make their (secret) preferred alternative look better. We all know what this "game" is, and forewarned is forearmed. Some cynics have pointed out that sometimes they see the second alternative (the "poor orphan" alternative) in a list of four that is "obviously a poor choice because the soup is simply too thin to be nourishing and tasty." This is followed by the "albatross" alternative, which is "obviously too rich for our blood, and so complex and unwieldy that we probably would never even get it off the ground." This is followed, of course, by the final choice, which is the (secretly) preferred one. The deviousness here is transparent to experienced decision-makers.

5. ERR IN THE DIRECTION OF TOO MANY

Better to risk having too many objectives (realizing they can be trimmed back later) than to have too few objectives at the start, and thereby risk not accomplishing goals because there simply are not enough courses of action in play to make the project work. This is sometimes called the "minimal critical mass" idea.

6. THE MOST BANG FOR THE BUCK

Consider crafting alternatives in such a way as to embed one level of alternative that is comparatively less ambitious and requires a relatively modest level of resources in a larger alternative. This is somewhat like the choice facing car buyers of a Rolls Royce, Mercedes, Buick, Ford, new used car, or keeping their old car. Obviously decision-makers, like car buyers will want the "most bang for the buck" in the end, but carefully crafted alternatives are one of the best ways to help decision-makers zero-in on the optimal mix of project sophistication with available financial and other resources.

APPENDIX L

DO'S AND DON'TS CHECKLIST FOR ESTIMATING COSTS

1. DESIGNATE A LEAD COST ANALYST

Designate the lead cost analyst and/or subdivide the overall BCA team into a "cost team" and a "benefits team."

2. ENLIST THE HELP OF A FINANCIAL ADVISOR

Consider whether the services of a finance and accounting specialist will be required to assist the team; is such an individual readily available, or will he or she have to be brought in from the outside.

3. ACCESS TO HISTORICAL DOCUMENTATION

Good cost estimates depend on ready access to any original project proposal and design concept documents that may have already been prepared. Without such documentation, detailed cost estimates will contain so much undocumented guesswork that they will probably be virtually useless.

4. PROJECT DIRECTOR SHOULD BE "HANDS-ON" TYPE OF PERSON

Ideally, the cost estimate team must have access to the project proposal director or team or both to resolve issues that arise as the proposal document is translated into a cost structure, alternatives considered, and a preferred alternative eventually selected. In short, the project manager should ideally be a "hands-on" kind of individual who is not afraid to sit down with the cost team and wrangle through the knotty details — a rather thankless chore, admittedly.

5. NEED FOR DECISION AUDIT TRAIL

Each resulting decision must be documented in the cost document (i.e., there should be a "decision trail"). For example, could cost records be found or not or, in their absence, did derivation or indirect methods of cost estimation have to be used; what was the official name of the cost records used; from whom was cost information obtained?

6. CONSIDER ALL COST ELEMENTS AT THE START

Determine what the specific cost elements are going to be in the calculations. Initially, at least, consider all cost elements and then, progressively, eliminate the ones you believe are irrelevant or only marginally important and decide what level of detail of the data will be collected.

7. COST RECORDS BY CONTRIBUTOR

Determine whether costs need to be identified and broken out differently based on different cost accounting policies and practices followed by different contributors (e.g., the IDRC contributions, third-party contributions, and local contributions). Ideally, of course, project directors should try and obtain consensus from all contributors that cost information can be obtained, recorded, and presented in the same manner, or at least compatible format.

8. FORMAL DATA COLLECTION PLANS

If the cost element data required are large and complex, consider preparing a formal data collection plan, identifying likely sources for the data, contact persons, interview schedule, and so on.

9. OPTIMAL COST ESTIMATING METHODOLOGIES

For each major cost element to be considered, decide on the cost estimating methodology; consider using "by inspection" as the default. If historical, well-documented cost data are not readily available, you may be forced to consider using cost derivation techniques.

10. COSTING REVIEWS

Finally, both the cost assumptions (prices, for example, or maintenance costs) and the cost structure (the implicit and explicit, or documented, design assumptions) must be reviewed by a group that includes the project leader, the design team, the implementation team (if one exists at this point), and a budget person.

APPENDIX M

DO'S AND DON'TS CHECKLIST FOR ESTIMATING BENEFITS

1. DESIGNATE LEAD BENEFITS ANALYST

Designate the lead benefits analyst, and/or subdivide the overall BCA team into a "cost team" and a "benefits team," if this was not already done when the cost analysis was initiated.

2. START BY REVIEWING HISTORICAL PROJECT DOCUMENTATION

Good benefit estimates depend on a reasonably well-documented project proposal. Without such historical documentation, benefit estimates will contain a great deal more guesswork than will otherwise be necessary; review as much historical data as is possible, and interview key officials who were associated with the project's initial formulation.

3. COORDINATION BETWEEN SUBGROUPS

Ideally, the benefits-estimating team, like the cost-estimating team, must have access to the proposal team to resolve issues that arise as the benefit:cost analysis final decisions are translated into a project design document and a project budget structure. Again, each resulting decision must be documented in the cost document.

4. IDENTIFY AND CLASSIFY AND CATEGORIZE BENEFITS

Identify the benefits for which estimates must be calculated. Classify them in various useful ways (not necessarily mutually exclusive schemes, but be sure not to double count if several nonexclusive schemes are used). Next, subdivide them into the most detail level of categories. Decide which are quantifiable and which are nonquantifiable. Determine what source data need to be examined to make the calculations. Finally, decide which benefit estimation methodology is most appropriate; will the Delphi Method have to be used?

5. USING IMPACT INDICATORS

Use impact indicators where direct, more conventional, and standard units and measures of benefits may not be possible or cost effective. For example, suppose expected improvements in employee morale were a stated objective of adopting an alternative. One might do a direct opinion survey to obtain the

information, but examination of vacation, compensatory leave, sick leave, and overtime records may be just as revealing and more cost effective.

6. PEER REVIEW

Finally, both the benefit assumptions (values, prices, use of indicators, etc.) and the cost structure (the implicit and explicit or documented, design assumptions) must be reviewed by a group that includes the project leader, the design team, the implementation team (if one exists at this point), and, ideally, the financial advisor person.

7. DON'T OVEREMPHASIZE THE READILY OBSERVABLE AND COUNTABLE

Weight should be given to both qualitative and quantitative factors. Resist the temptation to assign relatively more weight to a factor just because it is quantifiable. At the extreme, the exclusive, or virtually exclusive, use of quantitative factors could seriously distort the analysis and mislead decision-makers because it overemphasizes physical output without regard to quality of output.

8. DON'T QUANTIFY THE NONQUANTIFIABLE

Don't attempt to quantify the nonquantifiable; that sounds like a silly truism, but it is a recurring source of analysis distortion, misuse, and abuse. There comes a point when quantifying a benefit (or a cost, for that matter) is neither sensible nor possible (even if it were sensible).

APPENDIX N

DO'S AND DON'TS CHECKLIST FOR COMPARING ALTERNATIVES

1. MINIMAL PROJECT REQUIREMENTS COMPLIANCE

Make certain that each of the alternatives complies with at least the minimal level of project requirements. In short, make sure that there are no "strawman" alternatives that have been inserted into the process just to make sure the preferred alternative "looks good" by comparison.

2. THE DEVIL'S ADVOCATE

If each alternative has a "champion" or advocate, allow that individual to make his or her best case by orally arguing the alternative in front of a jury of peers, most of whom have no vested interest in any of the alternatives being selected and, therefore, can play "the devil's advocate."

3. DEVELOPING SELECTION CRITERIA

If a formal list of selection criteria is to be used in making a final decision, make sure that all of the criteria have been identified and clearly defined and explained.

4. WEIGHTING THE SELECTION CRITERIA

If a weighting scheme is to be used in applying the selection criteria, attempt to achieve consensus on those weights.

5. PROS AND CONS; ADVANTAGES AND DISADVANTAGES

List the pros and cons, the advantages and disadvantages of each alternative being considered. Be suspicious if an alternative has no disadvantages listed.

6. QUALITATIVE AND QUANTITATIVE FACTORS

Remember that the "number crunching" that is the product of either manual or computer-assisted methods (such as the Excel computer program) is only one element of the final decision-making process. In the end, almost always both quantitative and qualitative factors must be included.

7. SOLUTION RELIABILITY, FLEXIBILITY, AND DURABILITY

Make sure that the preferred alternative that is adopted does not impose unacceptable burdens on the implementing agencies. For example, sometimes adopting a proprietary product as the "best solution," or one element of the preferred approach, may stifle flexibility in servicing and support. The "one vendor solution," in short, may, from a quantitative standpoint alone, be the apparent winner. But what happens if that vendor goes out of business?

8. MODULARITY AND UPGRADING

Remember the virtues of modularity and upgrading should you want to expand or extend later on, and consider them in your selection criteria list. Rarely can a project be expected to last forever, particularly if it involves the utilization of modern information and telecommunications technologies, which are changing very rapidly indeed.

9. DIVIDING THE PROCESS INTO TWO STAGES

If the stakes are high, the dollar investment very large, and the project very complex, it may be useful to subdivide the final selection process into two stages — preliminary and final. The preliminary stage would eliminate all but the best two finalists, and the final stage would then result in the "best of the finalists." Allowing a suitable "cooling off period" between the two stages is also psychologically helpful.

BENEFIT:COST ANALYSIS												
CONDUCTED FOR:	*PROJECT NAME*											*PROJECT NAME*
Inflation Rate (decimal)	0.03	1	1.03	1.0609	1.092727	1.12550881	1.15927407	1.1940523	1.22987387	1.26677008	1.30477318	
Present Value (decimal)	0.1	1	0.90909091	0.82644628	0.7513148	0.68301346	0.62092132	0.56447393	0.51315812	0.46650738	0.42409762	
Project Life Cycle (years)	10											
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
NON-RECURRING COST WORKSHEET (Manual)	**UNIT COST**	Number of Units	Number of Units	Number of Units	Number of Units	Number of Units	Number of Units	Number of Units	Number of Units	Number of Units	Number of Units	
Site/Facility	$3 400	1	1	1	1	1	0	0	0	0	0	5
Initial Cost, Equipment 1	$2 000	6	4	2	1	0	0	0	0	0	0	13
Initial Cost, Equipment 2	$4 000	6	4	3	2	0	0	0	0	0	0	15
Initial Cost, Equipment 3	$2 000	1	2	3	4	0	0	0	0	0	0	10
Initial Cost, Equipment 4	$3 000	1	2	3	4	0	0	0	0	0	0	10
Initial Cost, Equipment 5	$3 000	1	2	3	4	0	0	0	0	0	0	10
Initial Cost, Equipment 6	$3 000	1	2	3	4	0	0	0	0	0	0	10
Initial Cost, Equipment 7	$3 400	1	2	3	4	0	0	0	0	0	0	10
Communications Equipment	$4 000	3	3	3	3	3	3	3	3	3	0	27
Environmental Equipment	$5 000	40	14	12	5	2	1	0	0	0	0	74
Security/Privacy Equipment	$654	100	12	12	4	2	0	0	0	0	0	130
Labor 1	$0	0	0	0	0	0	0	0	0	0	0	0
Labor 2	$0	0	0	0	0	0	0	0	0	0	0	0
Labor 3	$0	0	0	0	0	0	0	0	0	0	0	0
Materials 1	$0	0	0	0	0	0	0	0	0	0	0	0
Materials 2	$0	0	0	0	0	0	0	0	0	0	0	0
Other Costs	$600	34	4	3	2	1	0	0	0	0	0	44
Residual Value 1	$100	0	0	0	0	0	0	2	3	4	5	14
Residual Value 2	$1 000	0	0	0	0	0	0	7	6	5	4	
Residual Value 3	$10 000	0	0	0	0	0	0	1	2	3	4	

BENEFIT:COST ANALYSIS												
CONDUCTED FOR:	***PROJECT NAME***											***PROJECT NAME***
Inflation Rate (decimal)	0.03	1	1.03	1.0609	1.092727	1.12550881	1.15927407	1.1940523	1.22987387	1.26677008	1.30477318	
Present Value (decimal)	0.1	1	0.90909091	0.82644628	¯0.7513148	0.68301346	0.62092132	0.56447393	0.51315812	0.46650738	0.42409762	
Project Life Cycle (years)	10											
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
COSTS FOR (CURRENT METHOD)												
Non-Recurring Costs (automatic)												
Site/Facility		$3 400	$3 502	$3 607	$3 715	$3 827	$0	$0	$0	$0	$0	
Equipment 1		$12 000	$8 240	$4 244	$2 185	$0	$0	$0	$0	$0	$0	
Equipment 2		$24 000	$16 480	$12 731	$8 742	$0	$0	$0	$0	$0	$0	
Equipment 3		$2 000	$4 120	$6 365	$8 742	$0	$0	$0	$0	$0	$0	
Equipment 4		$3 000	$6 180	$9 548	$13 113	$0	$0	$0	$0	$0	$0	
Equipment 5		$3 000	$6 180	$9 548	$13 113	$0	$0	$0	$0	$0	$0	
Equipment 6		$3 000	$6 180	$9 548	$13 113	$0	$0	$0	$0	$0	$0	
Equipment 7		$3 400	$7 004	$10 821	$14 861	$0	$0	$0	$0	$0	$0	
Communications Equipment		$12 000	$12 360	$12 731	$13 113	$13 506	$13 911	$14 329	$14 758	$15 201	$0	
Environmental Conditioner		$200 000	$72 100	$63 654	$27 318	$11 255	$5 796	$0	$0	$0	$0	
Security/Privacy Equipment		$65 400	$8 083	$8 326	$2 859	$1 472	$0	$0	$0	$0	$0	
Labor 1		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Labor 2		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Labor 3		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Materials 1		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Materials 2		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	
Other Costs		$20 400	$2 472	$1 910	$1 311	$675	$0	$0	$0	$0	$0	
Other Non-Recurring Costs (manual)												
Studies		$5 000										
Procurement Planning		$10 000										
Preparation Costs		$3 444	$4 555	$2 222	$1 000							
Conversion Costs						$10 000						
Review/Management Overhead							$40 000					
Training/Travel/Other		$1 000	$1 000	$1 000	$1 000	$1 000	$1 000	$1 000				
Involuntary Severance Costs								$10 000				
Contractual Direct Support Services		$4 000	$4 545	$4 545	$4 545							
Incremental Overhead Costs		$5 000	$5 000	$5 000	$5 000	$5 000	$5 000	$5 000	$5 000	$5 000	$5 000	
Total Non-Recurring Costs		$380 044	$166 001	$165 800	$133 729	$46 735	$65 708	$30 329	$19 758	$20 201	$5 000	

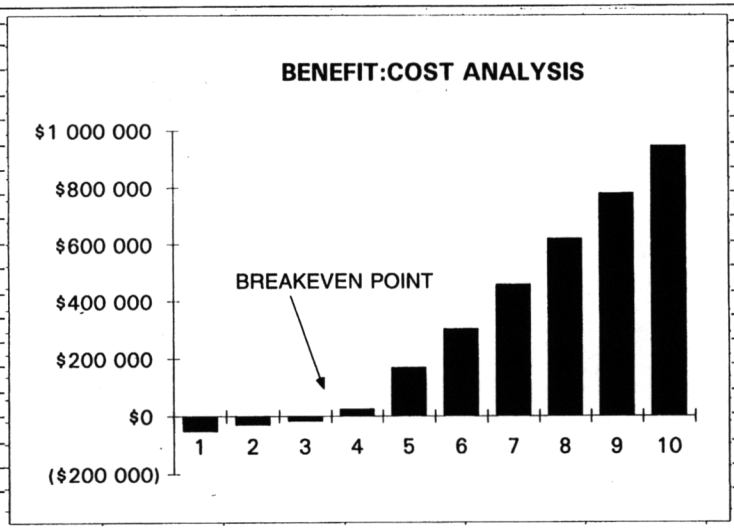
BENEFIT:COST ANALYSIS												
CONDUCTED FOR:	*PROJECT NAME*											*PROJECT NAME*
Inflation Rate (decimal)	0.03	1	1.03	1.0609	1.092727	1.12550881	1.15927407	1.1940523	1.22987387	1.26677008	1.30477318	
Present Value (decimal)	0.1	1	0.90909091	0.82644628	0.7513148	0.68301346	0.62092132	0.56447393	0.51315812	0.46650738	0.42409762	
Project Life Cycle (years)	10											
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
Recurring Costs												
Equipment Lease, Rentals		$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	
Equipment Maintenance		$1 200	$1 200	$1 200	$1 200	$1 200	$1 200	$1 200	$1 200	$1 200	$1 200	
Other Lease, Rentals												
Other Maintenance		$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	
Personnel salaries & benefits		$12 000	$12 000	$12 000	$12 000	$12 000	$12 000	$12 000	$12 000	$12 000	$12 000	
Direct Support Services		$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	
Travel and Training		$1 000	$1 000	$1 000	$1 000	$1 000	$1 000	$1 000	$1 000	$1 000	$1 000	
Space Occupancy												
Supplies and Utilities		$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	
Security & privacy		$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	
Contractual Services		$200	$200	$200	$200	$200	$200	$200	$200	$200	$200	
Overhead		$250	$250	$250	$250	$250	$250	$250	$250	$250	$250	
Total Recurring Costs		$15 060	$15 060	$15 060	$15 060	$15 060	$15 060	$15 060	$15 060	$15 060	$15 060	
TOTAL COSTS		$395 104	$183 061	$180 860	$148 789	$81 795	$80 768	$45 389	$34 818	$35 261	$20 060	
PROJECT LIFE COST												$1 185 906
PRESENT VALUE COST		$395 104	$166 419	$149 471	$111 788	$42 207	$50 150	$25 621	$17 867	$16 450	$8 507	$983 585

BENEFIT:COST ANALYSIS												
CONDUCTED FOR:	***PROJECT NAME***											***PROJECT NAME***
Inflation Rate (decimal)	0.03	1	1.03	1.0609	1.092727	1.12550881	1.15927407	1.1940523	1.22987387	1.26677008	1.30477318	
Present Value (decimal)	0.1	1	0.90909091	0.82644628	0.7513148	0.68301346	0.62092132	0.56447393	0.51315812	0.46650738	0.42409762	
Project Life Cycle (years)	10											
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
BENEFITS FOR (CURRENT METHOD)												
Non-Recurring Benefits (manual)												
Cost Reduction		$2 000	$2 100	$6 300	$6 615	$20 000	$21 000	$22 050	$23 153	$24 310	$25 526	
Value Enhancement Site/Facility		$2 300	$2 415	$3 623	$3 804	$48 000	$50 400	$52 920	$55 566	$58 344	$61 262	
Value Enhancement Equipment 1		$4 000	$4 200	$6 510	$6 836	$7 177	$7 536	$7 913	$8 309	$8 724	$9 160	
Value Enhancement Equipment 2		$2 100	$2 205	$2 315	$2 431	$2 553	$2 680	$2 814	$2 955	$3 103	$3 258	
Value Enhancement Equipment 3		$1 300	$1 365	$1 433	$1 505	$1 580	$1 659	$1 742	$1 829	$1 921	$2 017	
Value Enhancement Equipment 4		$1 200	$1 260	$1 323	$1 389	$1 459	$1 532	$1 608	$1 689	$1 773	$1 862	
Value Enhancement Equipment 5												
Value Enhancement Equipment 6												
Value Enhancement Equipment 7												
Cost Avoidance												
Other												
Total Non-Recurring Benefits		$12 900	$13 545	$21 504	$22 580	$80 769	$84 807	$89 047	$93 501	$98 175	$103 085	

BENEFIT:COST ANALYSIS												
CONDUCTED FOR:	*PROJECT NAME*											*PROJECT NAME*
Inflation Rate (decimal)	0.03	1	1.03	1.0609	1.092727	1.12550881	1.15927407	1.1940523	1.22987387	1.26677008	1.30477318	
Present Value (decimal)	0.1	1	0.90909091	0.8264628	0.7513148	0.68301346	0.62092132	0.56447393	0.51315812	0.46650738	0.42409762	
Project Life Cycle (years)	10											
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
Recurring Benefits (manual)												
Cost Reduction												
Site/Facility		$5 000										
Equipment 1		$13 990										
Equipment 2		$2 333										
Equipment 3		$10 000										
Equipment 4		$2 000										
Equipment 5		$2 500										
Equipment 6		$3 000										
Equipment 7		$3 500										
Communications Equipment		$13 181										
Environmental Conditioner		$29 999										
Personnel		$66 000	$72 600	$79 860	$87 846	$96 631	$106 294	$116 923	$128 615	$141 477	$155 625	
Support Services		$20 000	$22 000	$24 200	$26 620	$29 282	$32 210	$35 431	$38 974	$42 872	$47 159	
Travel & Training		$30 000	$33 000	$36 300	$39 930	$43 923	$48 315	$53 147	$58 462	$64 308	$70 738	
Space Occupancy		$10 000	$11 000	$12 100	$13 310	$14 641	$16 105	$17 716	$19 487	$21 436	$23 579	
Supplies & Utilities		$5 000	$5 500	$6 050	$6 655	$7 321	$8 053	$8 858	$9 744	$10 718	$11 790	
Security & privacy		$112 000	$50 000	$17 000	$9 100	$958						
Services												
Overhead												
Cost Avoidance												
Total Recurring Benefits		$328 503	$194 100	$175 510	$183 461	$192 755	$210 977	$232 074	$255 282	$280 810	$308 891	
TOTAL TANGIBLE BENEFITS		$341 403	$207 645	$197 014	$206 041	$273 524	$295 784	$321 121	$348 783	$378 985	$411 976	
PROJECT LIFE BENEFITS												$2 982 277
PRESENT VALUE BENEFITS		$341 403	$188 768	$162 821	$154 802	$186 821	$183 658	$181 265	$178 981	$176 799	$174 718	$1 930 036

BENEFIT:COST ANALYSIS												
CONDUCTED FOR:	*PROJECT NAME*											*PROJECT NAME*
Inflation Rate (decimal)	0.03	1	1.03	1.0609	1.092727	1.12550881	1.15927407	1.1940523	1.22987387	1.26677008	1.30477318	
Present Value (decimal)	0.1	1	0.90909091	0.82644628	0.7513148	0.68301346	0.62092132	0.56447393	0.51315812	0.46650738	0.42409762	
Project Life Cycle (years)	10											
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
BENEFIT/COST SUMMARY												
(for CURRENT METHOD)												
TOTAL COSTS		$395 104	$183 061	$180 860	$148 789	$61 795	$80 768	$45 389	$34 818	$35 261	$20 060	
PROJECT LIFE COSTS												$1 185 906
PRESENT VALUE COSTS		$395 104	$166 419	$149 471	$111 788	$42 207	$50 150	$25 621	$17 867	$16 450	$8 507	$983 585
RESIDUAL VALUE 1		$0	$0	$0	$0	$0	$0	$200	$300	$400	$500	
RESIDUAL VALUE 2		$0	$0	$0	$0	$0	$0	$7 000	$6 000	$5 000	$4 000	
RESIDUAL VALUE 3		$0	$0	$0	$0	$0	$0	$10 000	$20 000	$30 000	$40 000	
PRESENT VALUE FACTOR		1	0.90909091	0.82644628	0.7513148	0.68301346	0.62092132	0.56447393	0.51315812	0.46650738	0.42409762	
DISCOUNTED RESIDUAL VALUE		$0	$0	$0	$0	$0	$0	$9 709	$13 496	$16 514	$18 872	$58 592
ADJUSTED COST		$395 104	$166 419	$149 471	$111 788	$42 207	$50 150	$15 912	$4 371	($65)	($10 365)	$924 993
TOTAL TANGIBLE BENEFITS		$341 403	$207 645	$197 014	$206 041	$273 524	$295 784	$321 121	$348 783	$378 985	$411 976	
PROJECT LIFE BENEFITS												$2 982 277
PRESENT VALUE BENEFITS		$341 403	$188 768	$162 821	$154 802	$186 821	$183 658	$181 265	$178 981	$176 799	$174 718	
NET PRESENT VALUE												$1 930 036
BENEFIT/COST RATIO												2.09
CUMULATIVE BENEFITS		$341 403	$530 171	$692 993	$847 794	$1 034 615	$1 218 273	$1 399 538	$1 578 519	$1 755 318	$1 930 036	
CUMULATIVE COSTS		$395 104	$561 523	$710 994	$822 782	$864 989	$915 139	$940 760	$958 628	$975 077	$983 585	
PAYBACK (DIFFERENCE)		($53 701)	($31 352)	($18 002)	$25 012	$169 626	$303 134	$458 778	$619 891	$780 241	$946 452	
PAYBACK PERIOD												Year 4

BENEFIT:COST ANALYSIS												
CONDUCTED FOR:	*PROJECT NAME*											*PROJECT NAME*
Inflation Rate (decimal)	0.03	1	1.03	1.0609	1.092727	1.12550881	1.159274074	1.194052297	1.229873865	1.266770081	1.304773184	
Present Value (decimal)	0.1	1	0.909090909	0.826446281	0.751314801	0.683013455	0.620921323	0.56447393	0.513158118	0.46650738	0.424097618	
Project Life Cycle (years)	10											
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	TOTAL
BENEFIT/COST SUMMARY												
(for CURRENT METHOD)												
TOTAL COSTS												
PROJECT LIFE COSTS												
PRESENT VALUE COSTS												
RESIDUAL VALUE 1												
RESIDUAL VALUE 2												
RESIDUAL VALUE 3												
PRESENT VALUE FACTOR												
DISCOUNTED RESIDUAL VALUE												
ADJUSTED COST												
TOTAL TANGIBLE BENEFITS												
PROJECT LIFE BENEFITS												
PRESENT VALUE BENEFITS												
NET PRESENT VALUE												
BENEFIT/COST RATIO												
CUMULATIVE BENEFITS												
CUMULATIVE COSTS												
PAYBACK (DIFFERENCE)												
PAYBACK PERIOD												



About the Institution

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