

**DEPARTMENT OF HEALTH AND HUMAN SERVICES**

**ADMINISTRATION FOR CHILDREN AND FAMILIES**

**FEASIBILITY, ALTERNATIVES, AND  
COST / BENEFIT ANALYSIS  
GUIDE**

JULY 1993

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## PREFACE

This optional guide was developed to support State and ACF professionals in the development, review, and approval of feasibility studies, alternatives analyses, and cost/benefit analyses.

Comments were requested and received from both ACF central and regional office staff and were incorporated, wherever possible, in this guide. Yet, the true test of any manual is how well it supports analysts in the performance of their assigned tasks and whether it remains relevant and useful. In this sense, the final test of this guide by the ultimate users — the States — remains.

This guide seeks to establish a standard analytical approach, develop a framework for analysis and documentation, and provide worksheets to support the State during analysis and comparison of alternatives. Even with these aids, we do not underestimate the difficulty of the analysis, judgement, and determinations required of the individuals conducting feasibility, alternatives, and cost/benefit analyses. However, this guide does not attempt to provide a "cookbook" approach or a set of solutions. Although use of this guide is encouraged — to ease and expedite Federal review and approval — the guide is not mandatory.

ACF welcomes suggestions from those using this guide. An *Evaluation, Comments, and Suggestions* form is included in Appendix C to this Guide. This form or any other written comments may be sent to:

Department of Health and Human Services  
Administration for Children and Families  
Director, Office of State Systems  
370 L'Enfant Promenade, SW  
Washington, DC 20447-0001  
(202) 401-6960

ACF has developed other resources for preparing cost/benefit studies. For example, the *Companion Guide* provides examples of a cost/benefit analysis and cost/benefit measurement report, prepared under the general guidelines of this *Feasibility, Alternatives, and Cost/Benefit Analysis Guide*. In addition, ACF offers a prototype set of spreadsheet templates and macros (with brief instruction sheet) to automate the development and production of cost/benefit analysis reports recommended by the Guide. These templates are available in Lotus 1-2-3™, Microsoft Excel™, and Borland Quattro-Pro™ formats. They are recommended only for experienced users since ACF can provide only limited phone support. For further information, call or write to ACF.

# 1 INTRODUCTION

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The design, development, and implementation of an information system is a complex and expensive undertaking. To make cost-effective decisions, information system project managers rely on a series of analyses and studies required by law and regulation:

Feasibility Study,  
Alternatives Analysis, and  
Cost/Benefit Analysis.

**This handbook provides guidance on conducting such studies.**

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## 1.1 *Background*

The Department of Health and Human Services' (DHHS) Administration for Children and Families (ACF) provides national leadership and direction in planning, managing, and coordinating the nationwide administration and financing of a broad range of comprehensive and supportive programs for vulnerable children and families. These programs are, in large part, carried out by State and local agencies and are designed to promote stability, economic security, responsibility, and self-sufficiency.

While the programs are carried out at the state and local level, ACF retains responsibility for approving and monitoring systems development and implementation for Federally-assisted benefits programs.

## 1.2 *Overview*

ACF gives approval to the States in accordance with regulations which require the submission of Advance Planning Documents (APDs) and supporting studies.

Although the regulations codified in 45 CFR Part 95 require that a feasibility study, alternatives analysis, and cost/benefit analysis be conducted and submitted to ACF with the Implementation APD, generic yet comprehensive guidance broadly applicable to all State benefit programs had not been developed. States have had to determine the details of how to conduct these crucial studies on which Federal approval and funding depend.

The States' submissions, therefore, have varied widely in comprehensiveness and quality — sometimes to the disadvantage of the States and ACF. Efficient, effective, and timely decision-making are hampered in such cases.

Yet guidance should not force a highly standardized, checklist approach as might be developed for clerks or assembly line workers. Instead, guidance for decision-making professionals should:

- Suggest how to approach the analysis;
- Describe a broad range of considerations, which may or may not apply to the task at hand; and

- Provide a standardized framework for analysis and problem-solving.

Although the studies called for in the regulation are individually named as if they stand on their own, they are, in fact, the results of an analytical continuum. The process is one of refinement, with requirements, feasibility, alternatives, and costs defined with increasing precision as the analysis continues. (See Table 1-1 on page 1-4.)

The process is also one in which the studies are closely related and dependent upon each other. For example, requirements directly affect alternatives and costs. Costs may limit feasible alternatives.

As the process continues and needs and options are refined, earlier decisions may need reassessment. Properly approached, the process is dynamic.

### **1.3 Objectives**

By issuing guidance, ACF seeks to support the practical application of feasibility, alternatives, and cost/benefit analysis by the States. Since it is neither practical nor possible to develop a "cookbook" approach to analysis, this guide has been developed for use by the States' senior analysts and managers, for the thoughtful application of analysis to decision-making.

The purpose of this document is to:

- Suggest a standard analytical approach for conducting feasibility studies, alternatives analyses, and cost/benefit analyses;
- Develop a framework for analysis and documentation; and
- Provide worksheets to support the State during analysis and comparison of alternatives.

Although use of this guide is encouraged — to ease and expedite Federal review and approval — the guide is not mandatory.

### **1.4 Analysis In Perspective**

This guide is intended to be a decision-making tool, supporting managers and senior analysts in methodically and comprehensively analyzing a range of automation solutions.

More complex, economical models for cost/benefit analysis have been developed for the business environment, employing concepts such as probability distributions and utility analysis. Such models are outside the scope of this effort, but may be employed by the States if their prior application has been successful.

### **1.5 How to Use this Guide**

*Who.* ACF developed this guide for the manager, senior analyst, and project members responsible for reviewing alternatives, developing costs, assessing benefits, and selecting a systems development approach. This guide is optional for use by State's in preparing or contracting for feasibility studies, alternatives analyses, and cost/benefit analyses. The guide will be used by Federal personnel in evaluating States' submissions.

Table 1-1: Mission And Planning Phase Documentation

Type of Document	Description of Document
Planning APD:	A written plan of action which requests funding to determine the need for, feasibility, and cost factors of an ADP equipment or services acquisition. Includes a statement of the problem or need, project management plan, budget for project planning, and estimated total project cost. Commits to preparing the feasibility study, requirements (or needs) analysis, alternatives analysis, and cost/benefit analysis.
Feasibility Study:	A preliminary study to determine whether it is sufficiently probable that effective and efficient use of ADP equipment or systems can be made to warrant the substantial investment of staff, time, and money being requested and whether the plan is capable of being accomplished successfully. Includes consideration of alternatives with associated cost/benefits.
Alternatives Analysis:	An analysis which considers the alternatives available for automation, such as transferring another State's system or enhancing an existing system. Included as part of the feasibility study.
Cost/Benefit Analysis:	Detailed evaluation of the costs and benefits of each alternative identified during the alternatives analysis. Includes costs of current and projected operations as a baseline for (1) determining which alternative to select for automation <u>and</u> (2) measuring costs and benefits of the implemented and operational system over time. Can be included as part of the Feasibility Study or stand as a separate document.
Requirements Analysis:	A detailed analysis of the information needs and the functional and technical requirements the proposed computerized system must meet. The requirements analysis usually builds on the initial functional and technical determination of need developed during the Feasibility Study.
Implementation APD:	A written plan of action — marking the transition from the mission and planning phase to the development and implementation phase — which supports the plan to acquire the proposed ADP services or equipment. Includes the statement of needs and objectives, feasibility study, requirements analysis, alternatives analysis, cost/benefit analysis, personnel resource statements, project activities, schedule, proposed budget and prospective costs, and system life.

*When.* This document can be used when preparing for, conducting, and reviewing feasibility, requirements, alternatives, or costs and benefits. An overview of the process is provided in the flowchart on page 1-7.

*Where.* The guide will be disseminated to State officials and Federal DHHS/ACF regional and headquarters personnel. Copies will be made available to other Federal agencies upon request.

*How.* This guidance may be used by State analysts in a manner fitting the requirements — providing, for example, in-depth analysis for large dollar systems projects or scaling down the analysis for low dollar, limited alternative projects. The document can be followed precisely, using copies of the worksheets provided. Or, the guide may serve as a suggested approach, with States modifying or developing new worksheets to meet their needs.

*In particular, there is no requirement that States use an eight year system life: in fact, five years is more common. The determination of system life is up to the State.*

The worksheets are hierarchical; that is, each worksheet provides information which is carried forward to ensuing worksheets as the analysis progresses.

ACF will use the guide as a measure against which to evaluate States' efforts for comprehensiveness of evaluation and to consider the merits of the States' proposed solutions. ACF will consider:

Has the State thoroughly described the status quo?

Have a broad range of alternatives, varying technologically and by source, been considered?

Have the options of modifying the existing system and transferring another State's system been evaluated?

Did the State apply cost/benefit analysis to at least two — but preferably three — viable alternatives? Is the status quo one of the alternatives?

Were the status quo and all alternatives evaluated on a systems life basis?

Was present value analysis used? Was a 7 percent discount factor used?

Is the State's presentation of costs and benefits thorough, detailed, and well documented throughout the systems life? Do the cost and benefit projections appear reasonable?

Were net benefits or costs, benefit/cost ratios, and breakeven points calculated for the status quo and all alternatives?

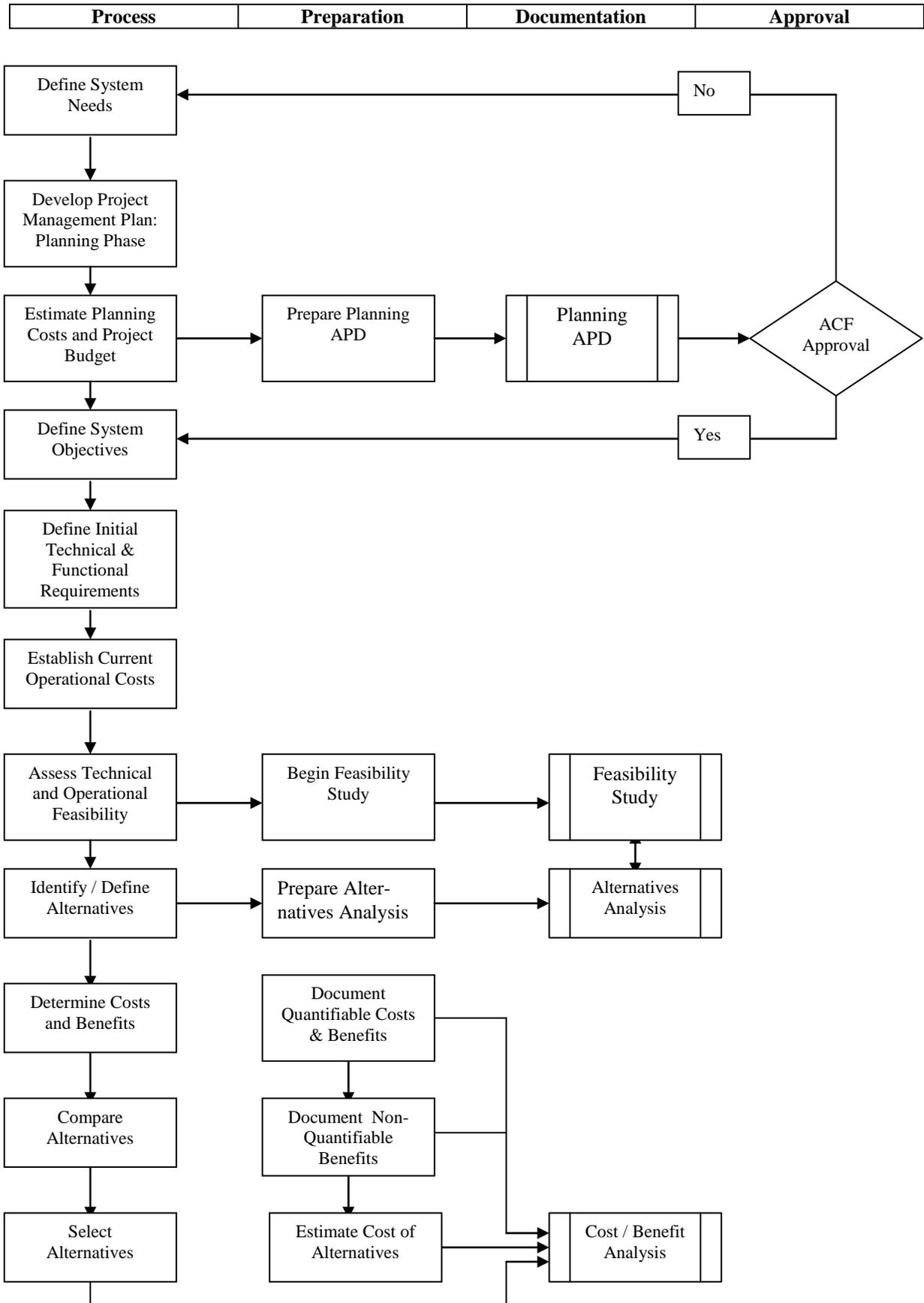
Is the selected alternative reasonable?

Has the State set forth a clear set of projected benefits and costs against which actual costs and benefits can be

measured?

Why. Requiring the submission of certain documents, without providing guidance, can hinder the ability of States to provide the needed information and hinder Federal reviewers in promptly determining the merits of the States' proposals. The guide suggests a standard approach and analytical framework for the States' consideration.

Table 1-2: Flowchart: Mission And Planning Phase



## 2 FEASIBILITY STUDY AND ALTERNATIVES ANALYSIS

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The Feasibility Study is the preliminary study that determines whether a proposed systems project is technically, financially, and operationally viable. The Alternatives Analysis, usually included as part of the Feasibility Study, identifies viable alternatives for the system design and development. Between them, the documents provide:

- An analysis of the system objectives, functional requirements, and system design concepts;
  - A determination of the feasibility of applying automated systems to effectively, efficiently, and economically improve program operations;
  - An evaluation of alternative approaches for reasonably achieving the objectives and goals; and
  - Identification of a proposed approach.
- 

### 2.1 *Overview*

The Feasibility Study is a critical document which defines the initial system concepts, objectives, requirements, and alternatives. The study also forms the framework for the system development project and establishes a baseline for further studies.

### 2.2 *Describe the Status Quo*

Following a general overview of the project, the Feasibility Study should establish the "status quo" in the State's management of benefit programs. The current environment may be a manual process, an automated process, or a combination of manual and automated functions. The environment may be paper intensive or dominated by electronic records. The environment may be centralized or distributed. Regardless of attributes, the current operating environment should be described.

Depending on the systems project being analyzed, the following factors may be addressed:

- Programmatic functions;
- Information architecture;
- System architecture;
- Hardware and software inventory;
- Interface and matching;
- Processing and data flow diagrams;
- Storage and retrieval;
- Inputs;
- Outputs;
- Workload,
- Validation / internal control;
- Security / Privacy;
- Emergency response, back-up, and disaster recovery;
- Personnel; and
- Space and Environment.

### 2.3 *Define the Problems*

Once the current operating environment has been described, the problems with the current system (previously stated in the Planning APD) should be detailed. Problems may be functional — that is, the

system may be incomplete, not fulfilling all the program requirements. Problems may be technical — for example, the system may be too slow, sized too small, or be obsolete and inefficient in terms of hardware or software. Problems may also relate to system cost or to access, limiting the ability of personnel to use system information to full potential.

This step should also include a determination of the seriousness of each problem and its effects on factors such as program clients and program financial considerations.

## **2.4 *Convert Problems to System Objectives***

Once the current operational problems are identified, the State can develop specific system objectives. For example, the system may need to be redesigned to use the powerful attributes of database management software. Or the system may need to be redesigned to provide better service to clients or to support the distributed use and processing of information. Or the system may need to be re-engineered to simplify and streamline work processes for greater efficiency and economy.

In defining objectives, various elements must be considered: program needs, costs, level of effort, time schedules, allowable operational changes, ease of future modification and expansion, and system security and reliability. Whatever the element needing improvement, objectives should be defined in a clear, specific, and measurable manner and in terms general enough to be met using different automation strategies.

System objectives are critical to ensuing analysis — whether conducted to support the Feasibility Study, requirements analysis, or development of testing plans. In terms of the Feasibility Study, the objectives form the framework for the formulation of the initial system requirements, are used to ascertain the acceptability of alternatives, and form the basis for generating costs and benefits during the ensuing Cost/Benefit Analysis. See Table 2-1 on the following page for examples of system objectives.

## **2.5 *Identify System Constraints and Assumptions***

Constraints are factors that lie outside — but have a direct impact on — the system design effort. Constraints may be:

- Laws and regulations — for example, State, Federal, or independent regulatory agencies may require specific design approaches for new systems or mandate specific changes to existing systems.
- Technological — for example, new equipment must be compatible with existing equipment;
- Socio-political — for example, the Governor mandates that all public assistance ADP functions be combined and managed by a common data base management system;
- Financial — for example, proposed development and implementation costs must remain within a specified budget.

- Operational — for example, space, staffing levels, skill mix, and capability and competence factors may limit system options.

However, system constraints should not be used to artificially restrict or direct the system. The objective is to plan the best system for the problem to be solved, not to fabricate and impose constraints that limit the system alternatives.

As with objectives, system constraints are critical to ensuing phases of the feasibility study. They can affect system requirements and the acceptability of alternatives.

Assumptions are factors predicted to apply to the program or systems project. For example, the project's operational or *system life* — *the time required to plan, design, acquire, and implement the system plus its operational life* — must be predicted and thus forms a critical assumption during the Feasibility Study. This assumption directly affects the period of time for comparison of costs and benefits of system alternatives and — for all practical purposes — sets the range of time within which the system development breakeven point must occur.

Four rules apply to making assumptions:

- Make assumptions when essential information cannot be determined or where the analysis is critically dependent on certain factors, conditions, or future events;
- State assumptions realistically and in precise terms;
- Include only assumptions which will affect the analysis; and
- Document the logic underlying the assumption in the event its soundness needs to be reassessed.

In addition to systems life, other common assumptions in cost/benefit analysis are project development and implementation schedule, estimated future workloads, and projected costs and values. Assumptions can be categorized as:

- Cost/Resource,
- Functional/Programmatic,
- Technical, and  
Systems Life.

Table 2-1: Representative System Objectives

Cost/Resource	Functional/Programmatic	Technical
<p>Reduced Costs</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul> <p>Controlled Costs</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• in what manner</li> </ul> <p>Streamlined Processes</p> <ul style="list-style-type: none"> <li>• in what manner</li> <li>• by what measure</li> </ul> <p>Reduced Staffing</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul> <p>Improved Staffing Utilization</p> <ul style="list-style-type: none"> <li>• in what manner</li> <li>• by what measure</li> </ul> <p>Increased Productivity</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul> <p>Fewer Manual Functions</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• in what manner</li> </ul> <p>Increased Resources</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul>	<p>Improved Services to Clients</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• in what manner</li> </ul> <p>Reduced Error Rate</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul> <p>Increased Collections</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul> <p>Improved Management Information</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• in what manner</li> </ul> <p>Improved Controls</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by what measure</li> </ul> <p>Interface / Matching</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• in what manner</li> </ul> <p>Less Data Redundancy</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• in what manner</li> </ul> <p>Compliance with Federal Requirements</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• in what manner</li> </ul>	<p>Faster Record Retrieval</p> <ul style="list-style-type: none"> <li>• what records</li> <li>• by how much</li> </ul> <p>More Timely Reporting</p> <ul style="list-style-type: none"> <li>• what reports</li> <li>• by how much</li> </ul> <p>Less Processing Time</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul> <p>Improved Access</p> <ul style="list-style-type: none"> <li>• by area</li> <li>• by how much</li> </ul> <p>Improved Security</p> <ul style="list-style-type: none"> <li>• in what manner</li> <li>• by what measure</li> </ul> <p>Increased Automation</p> <ul style="list-style-type: none"> <li>• by function</li> <li>• in what manner</li> </ul> <p>Improved Emergency Response, Back-up, and Recovery</p> <ul style="list-style-type: none"> <li>• by function</li> <li>• in what manner</li> </ul>

## **2.6 *Develop Initial Functional and Technical Requirements***

The Feasibility Study should include an initial statement of the functional and technical requirements for the system. The baseline requirements should relate to the objectives and constraints discussed in the previous sections, summarized as follows:

- **Functional Objectives** — the requirements should support mission and program needs. For example, the State may require that the new system improve service to the public and be compatible with and capable of accessing information in related State benefit systems.
- **System Objectives** — the requirements should be developed in a manner which will support the objectives. For example, if a system objective is to allow processing at the local level, the initial system requirements should reflect a distributed system and the need to analyze the new information architecture during the system design phase.
- **System Constraints** — The functional and technical requirements should conform to, rather than oppose, the system constraints. For example, if the Governor has mandated a single, integrated data base, systems built of separate data bases should not be considered.

An overview of the system requirements should reflect a broad range of factors, for example:

- Functional, programmatic requirements;
- Information needs;
- System needs;
- Interface and matching requirements;
- Processing and data flow needs;
- Storage and retrieval requirements;
- Inputs;
- Outputs;
- Workload, projected over time;
- Validation and internal control needs;
- Security / Privacy requirements;
- Emergency response, back-up, and disaster recovery;
- Accessibility requirements for the disabled; and/or
- Space and Environment.

The requirements should be stated briefly and in functional terms, to the extent possible. Their development during the Feasibility Study supports the selection of suitable alternatives. These functional and technical needs are greatly expanded later in the planning phase

## **2.7 Assess Project Feasibility**

through the Requirements Analysis.

Once the initial system requirements are defined, the State should verify the technical, operational, and financial feasibility of the project.

Technical feasibility refers to the capability of current technology and methods of operation in meeting user requirements. Technical feasibility should include consideration of the state of the technology — for example, is the technology "leading edge" (with commensurate risk) or is the technology "mature" (with associated industry standards and lesser risk).

Operational feasibility refers to the ability of the enhanced system to fit the operational pattern and resources of the organization.

Financial feasibility refers to the ability of the State to fund (with Federal financial participation) the costs of developing and implementing the system.

Since limited resources — especially human and dollars — may affect feasibility, findings from the technical, operational, and financial feasibility analysis may require redefining or appending the system objectives and constraints.

## **2.8 Identify Alternatives**

The first step in identifying alternatives is to survey the possibilities and to consider the wide range of alternatives which may be available. The first part of the process is analytical and judgmental, resulting in eliminating alternatives which are not technically or operationally feasible. Therefore, alternatives are measured against considerations of project feasibility.

States should consider more than one technological design alternative when considering an automation project. For example, a system may be centralized, relying on mainframes for the bulk of processing. Or a system may be distributed, relying on personal computers and minicomputers for the bulk of entry and processing. Table 2-2 suggests representative alternatives for different types of requirements.

Regardless of technological approach, current systems can frequently be modified — *or* another State's system may fulfill the programmatic requirements of Federal benefit programs and serve as a transfer model.

States are required by regulation [45 CFR §95.605.1(vi)] to consider transferring systems developed in other States to meet the requirements. This helps expedite system development, minimize cost, and ensure project success.

Whenever possible, several alternatives reflecting different technological approaches — including the options of modifying current systems and transferring another State's system — should be analyzed. The alternatives may represent opposing strategies and should be described in sufficient detail to permit differentiation.

All alternatives should meet the established objectives within the system constraints, and depend on costs and benefits to determine the most favorable alternative.

## **2.9 *Determine Risks and Effects***

For each alternative developed, the effects and risks of the proposed alternative on the current environment should be described:

- Program impacts — determine how the new system initiative will affect current program operations and new program requirements;
- Equipment impacts — determine how new equipment requirements will affect current systems and whether technological risks, such as obsolescence, maintainability, availability, expandability, reliability, flexibility, and compatibility, are inherent;
- Software impacts — describe what additions, conversions, or modifications are needed on existing applications and support software;
- Information impacts — determine how information will be affected, including accessibility, conversion, reformatting into databases, and storage media;
- Organizational impacts — describe organizational, schedule, accountability, personnel, and skill requirement risks and changes;
- Operational impacts — set forth the effects on operations, such as user and operating center procedures; user / operator and other relationships; source data processing; data entry procedures; information storage, retention, and retrieval requirements; privacy; output reporting, media, and schedules; system failure and recovery procedures; and security and back-up requirements;
- Developmental impacts — identify the effect of the development activity on current computing, staffing (including users), space, system security, and contractual support resources;
- Space and facility impacts — describe the effect on space, both in terms of square footage and necessary modifications to facilities; and
- Cost impacts — set forth financial risks and factors that may affect developmental or operational costs and influence the development, design, and operation of the proposed system.

**Table 2-2: Representative Alternatives**

<b>Alternative Platforms/Capacity Enhancement</b>	<b>Alternatives for Implementing Applications</b>
<p>Platform (or architecture) alternatives range from stand-alone solutions to mainframes to distributed processing networks. Requirements for capacity increases may affect platforms as well as other options.</p>	<p>Alternatives range from modifying current systems, transferring and modifying another State's system, incorporating off-the-shelf solutions, to initiating custom development (when more cost-effective and timely solutions do not exist).</p>
<p>Architecture</p> <ul style="list-style-type: none"> <li>• Client/server LAN and micros</li> <li>• Distributed</li> <li>• Mainframe</li> <li>• Minicomputer</li> <li>• Work station</li> <li>• Microcomputer (stand-alone)</li> </ul> <p>Outsourcing (Contracting out)</p> <p>Acquire Services (other than equipment)</p> <ul style="list-style-type: none"> <li>• From other State agencies</li> <li>• Commercially</li> </ul> <p>Reconfigure Existing Resources</p> <p>Use of Non-automated Alternatives</p> <ul style="list-style-type: none"> <li>• Reallocating or increasing personnel</li> <li>• Manual systems or work processes</li> </ul>	<p>Transferring/Modifying another State's System</p> <ul style="list-style-type: none"> <li>• Using In-house Services</li> <li>• Using Contract Services</li> <li>• Using a Combination</li> </ul> <p>Off-the-shelf Software</p> <ul style="list-style-type: none"> <li>• Generalized, such as DBMS</li> <li>• Specialized, such as payroll</li> </ul> <p>Modifying or Redesigning Current Systems</p> <ul style="list-style-type: none"> <li>• Using In-house Resources</li> <li>• Using Contract Services</li> <li>• Using a Combination</li> </ul> <p>Custom Development</p> <ul style="list-style-type: none"> <li>• Using In-house Services</li> <li>• Using Contract Services</li> <li>• Using a Combination</li> </ul>
<b>Alternatives for Acquiring Services</b>	<b>Alternatives for Obtaining Support Services</b>
<p>Services include teleprocessing, computer time, electronic mail, voice mail, and cellular telephone. Alternatives include using both in-house and contractual solutions, as well as sharing or borrowing resources.</p>	<p>Support Services include source data entry, training, custom software development, systems analysis and design, software conversion, facilities management, maintenance, equipment operation, network management, studies, and evaluation.</p>
<p>Increase in In-House Resources</p> <p>In-house Development of Service Capability</p> <p>Resources Sharing with other State Agencies</p> <p>Contractual Commercial Services</p> <p>Temporary Commercial Services</p>	<p>Increase in Permanent Staffing</p> <p>In-house Development of Service Capability</p> <p>Resources Sharing with other State Agencies</p> <p>Contractual Commercial Services</p> <ul style="list-style-type: none"> <li>• Manpower Based</li> <li>• Project Based</li> <li>• Full Service, Per Call, On Call</li> </ul> <p>Temporary Commercial Services</p>

## **2.10 Determine Risks and Effects**

For each alternative developed, the effects and risks of the proposed alternative on the current environment should be described:

- Program impacts — determine how the new system initiative will affect current program operations and new program requirements;
- Equipment impacts — determine how new equipment requirements will affect current systems and whether technological risks, such as obsolescence, maintainability, availability, expandability, reliability, flexibility, and compatibility, are inherent;
- Software impacts — describe what additions, conversions, or modifications are needed on existing applications and support software;
- Information impacts — determine how information will be affected, including accessibility, conversion, reformatting into databases, and storage media;
- Organizational impacts — describe organizational, schedule, accountability, personnel, and skill requirement risks and changes;
- Operational impacts — set forth the effects on operations, such as user and operating center procedures; user / operator and other relationships; source data processing; data entry procedures; information storage, retention, and retrieval requirements; privacy; output reporting, media, and schedules; system failure and recovery procedures; and security and back-up requirements;
- Developmental impacts — identify the effect of the development activity on current computing, staffing (including users), space, system security, and contractual support resources;
- Space and facility impacts — describe the effect on space, both in terms of square footage and necessary modifications to facilities; and
- Cost impacts — set forth financial risks and factors that may affect developmental or operational costs and influence the development, design, and operation of the proposed system.

## **2.11 Rank Alternatives**

If more than three or four alternatives have been developed, the State should rank alternatives so that only the most likely to achieve the system objectives efficiently, effectively, and economically are analyzed during the cost/benefit analysis. Criteria for ranking the alternatives should be established and may include factors which:

- Minimize personnel expenses over the system's operational life;
- Require minimal physical facility changes;
- Assure high levels of availability, reliability, maintainability, or expandability;

- Meet requirements for ease of use and ready access to information;
- Achieve desired distribution of processing to minimize point-of-entry delays;
- Achieve redundancy to guard against total system outages;
- Limit development time; or
- Retain a centralized information repository for reasons of security.

Once the State has isolated no more than four and no less than two viable alternatives — one of which is the status quo — the cost/benefit determination may proceed.

Table 2-3: Feasibility Study — Suggested Outline

<p>Executive Summary</p> <p>Overview</p> <ul style="list-style-type: none"> <li>• Purpose and Scope</li> <li>• Study Methodology</li> <li>• Points of Contact</li> <li>• References (such as prior APDs)</li> </ul> <p>Current Environment, generally:</p> <ul style="list-style-type: none"> <li>• Programmatic functions</li> <li>• Information Architecture</li> <li>• System(s) Architecture</li> <li>• Hardware and Software Inventory</li> <li>• Interface and matching</li> <li>• Processing and data flow</li> <li>• Storage and retrieval</li> <li>• Inputs</li> <li>• Outputs</li> <li>• Workload</li> <li>• Validation / internal control</li> <li>• Security / Privacy</li> <li>• Emergency response, back-up, and disaster recovery</li> <li>• Personnel</li> <li>• Space and Environment</li> </ul> <p>Current Problems</p> <ul style="list-style-type: none"> <li>• Functional</li> <li>• Technical</li> <li>• Access</li> <li>• Cost</li> </ul> <p>System Objectives</p> <ul style="list-style-type: none"> <li>• Cost/Resource</li> <li>• Functional/Programmatic</li> <li>• Technical</li> </ul> <p>System Constraints</p> <ul style="list-style-type: none"> <li>• Laws and Regulations</li> <li>• Technological</li> <li>• Socio-Political</li> <li>• Financial</li> <li>• Operational</li> </ul> <p>Assumptions</p> <ul style="list-style-type: none"> <li>• Cost/Resource</li> <li>• Functional/Programmatic</li> <li>• Technical</li> <li>• Systems Life</li> </ul>	<p>Initial Functional and Technical Requirements</p> <ul style="list-style-type: none"> <li>• Functional, programmatic requirements</li> <li>• Information needs</li> <li>• System needs</li> <li>• Interface and matching requirements</li> <li>• Processing and data flow needs</li> <li>• Storage and retrieval requirements</li> <li>• Inputs</li> <li>• Outputs</li> <li>• Workload, projected over time</li> <li>• Validation / internal control needs</li> <li>• Security / Privacy requirements</li> <li>• Emergency response, back-up, and disaster recovery</li> <li>• Accessibility for Disabled</li> <li>• Space and Environment</li> </ul> <p>Alternatives</p> <ul style="list-style-type: none"> <li>• Overview</li> <li>• Ranking Criteria, if used</li> <li>• Description of each alternative, including: <ul style="list-style-type: none"> <li>• Program impacts</li> <li>• Equipment impacts</li> <li>• Software impacts</li> <li>• Information impacts</li> <li>• Organizational impacts</li> <li>• Operational impacts</li> <li>• Developmental impacts</li> <li>• Space and facility impacts</li> <li>• Cost impacts</li> </ul> </li> </ul> <p>[Cost/Benefit Analysis]*</p> <p>[Comparison of Alternatives]*</p> <p>[Recommended Alternative]*</p> <p>* Addressed in the next chapter</p>
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### 3 COST / BENEFIT ANALYSIS

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For each viable alternative developed in the Feasibility Study, the State must develop costs and benefits. The purpose of the cost/benefit analysis is to:

- Document estimated costs and benefits for feasible alternatives;
  - Compare costs and benefits for each alternative; and
  - Determine which alternative is the most economical, providing the greatest benefits relative to its costs.
- 

#### 3.1 Overview

A comprehensive Cost/Benefit Analysis provides managers, users, and designers with the information necessary to evaluate alternative system development, enhancement, or improvement approaches. The analysis provides the estimated costs of developing and operating each feasible alternative and the benefits to be derived from each.

Therefore, Cost/Benefit Analysis is not simply a method of determining the least cost alternative, but a means of determining the most cost effective alternative.

#### 3.2 Cost the Status Quo

Each Cost/Benefit Analysis must begin with the determination of the operational costs of the installed system — the "status quo" alternative. This critical step sets the stage for comparing alternatives against baseline costs.

Costs for the current environment are expressed in terms of total system operational costs, including State costs, *projected over the systems life* in accordance with the approved State plan and previously approved APDs, if applicable. This requires that States measure current costs and project anticipated costs over a period of time matching the systems life of the project.

Most "status quo" cost worksheets will reflect primarily recurring costs, such as systems support personnel and monthly lease expenses.

However, non-recurring costs may also apply. For example, the State may have approval for contract support services to meet special year-end processing demands.

Special problems arise when the status quo is no longer a satisfactory solution. For example, if the State does not redesign the current system for distributed processing, current processing workload growth will require a major systems augmentation (non-recurring capital expenditure for equipment purchase) and new systems facility (either a non-recurring capital expenditure or recurring site lease expenses, or both) — and may still fail to meet Federal program requirements.

In such instances, the status quo reinforces the need to develop new systems. By costing in the capital expenditure on the status quo alternative, the true systems life cost of the status quo is revealed. By claiming the "cost avoidance" as a benefit of the alternatives, achievement of the cost avoidance will later be measured, as the State compares actual to projected costs and benefits.

A State may at times be required to determine whether to characterize an element as a cost or a benefit. If so, the State should consider the following. If a "benefit" can be depicted as directly affecting a cost element of the status quo and can be predicted with virtual certainty to occur, then it should be factored into the cost side of the analysis. An example would be higher staff costs when a reduced personnel ceiling has been approved for the new system.

On the other hand, cost elements to be characterized as benefits are normally costs or savings which are more indirect or hidden, which may or may not accrue, and which must be monitored. Benefits can derive from elements such as greater productivity, reduced training costs, less overtime, and reduced staffing not planned and approved at the time of the cost/benefit analysis.

### **3.3 *Cost Alternatives to the Status Quo***

Following baseline costing, total systems life costs, including State costs, are defined for each alternative of the two to four found viable in the Feasibility Study's alternatives analysis.

For each alternative approach, costs are calculated for both the system developmental and operational stages. Non-recurring costs will dominate the early months and years of the developmental process. However, as the alternative is tested and moves into implementation, recurring costs will again predominate the cost profile.

### **3.4 *Identify and Characterize All Costs***

In order to develop cost profiles, States must first identify all categories of costs that apply to the *status quo and each alternative* in each stage of the development and operational cycles. Cost categories include such diverse expenses as those for equipment, personnel, travel, training, utilities, supplies, conversion, site preparation, space, and overhead.

Next, those costs must be identified as either *recurring or non-recurring costs*.

Recurring costs are those which apply over a range of time — either months or throughout the systems life. Recurring costs will predominate in the "status quo" alternative and in the later years of alternatives as the solutions are implemented.

Non-recurring costs are one-time costs, frequently capital expenditures, expected to occur at a point in the future. Non-recurring costs may be overlooked if future workload growth is not considered. States should be especially careful to consider the effects of rising caseloads and peak transaction volumes on equipment and software capacities, by providing for scheduled upgrades or enhancements to the operational system if required.

(See Tables 3-1 and 3-2 on pages 3-4 and 3-5 for descriptions of recurring and non-recurring costs.)

**Table 3-1: Cost Categories: Non-Recurring**

Cost Category	Description
Site and Facility	Includes the costs of construction of computer rooms, auxiliary spaces, office space, and storage rooms; site preparation; and purchase of office equipment and furniture.
Equipment Purchase / One Time Fees	Includes the purchase of all types of information processing and related equipment, including computer systems and peripherals, auxiliary equipment, data and voice communications equipment, environmental conditioning equipment, security and safety detection equipment. Also includes the costs of bundled software, maintenance, and fees. Covers the costs of any equipment furnished to contractors for use on the project.
Shipping	Covers costs of transporting equipment or other materials, including shipping, delivery charges, rigging and drayage, packing, unpacking, and moving.
Installation	Includes the installation and set up of equipment, software, furniture, and materials.
Software Purchase / One Time Fees	Includes the purchase or one-time licensing of all types of information processing software, including systems programs, operational software, utilities, applications programs, and other commercial software for ADP and telecommunications equipment.
System Testing	Includes all costs over and above normal operational costs expended to test newly installed equipment, including temporary installations of test equipment and parallel operations.
Conversion	Includes one-time costs related to "clean up" and conversion of software, data, information, and media. Includes costs involved in the preparation for conversion, not charged to other categories (such as personnel).
Studies	Covers the cost of one-time studies conducted during the systems design, development, and implementation. [Note that studies may also be costed under personnel expense or project overhead, but should not be costed in more than one place (double counting).]
Procurement	Includes the cost of planning for and conducting procurements. [Note that procurement costs may also be costed under personnel expense or project overhead, but should not be costed in more than one place (double counting).]
Database Preparation	Covers the cost of preparing information for database management systems. [Avoid double counting which can occur by listing the same costs as expenses under personnel, contractor, or project overhead.]
Personnel	Includes apportioned costs of — personnel on staff (salaries, overtime, and benefits) devoted to special projects; non-recurring contract support services staff costs (labor hour, contract G&A costs, and profit) dedicated in full or part to the project; or extraordinary personnel costs such as expenses arising from early retirement, displacement, or relocation.
Travel	Includes one-time travel costs related to in-house personnel or contractors.
Training	Includes one-time costs to train staff on new equipment, software, testing procedures, or operational processes. Includes the cost of developing coursework and training trainers. Also includes study aids, training manuals, workbooks, audiovisual aids, and software products. May include travel, per diem, and lost productivity costs.
Overhead / Indirect Costs	Includes project overhead, management overhead, and contract overhead such as G&A costs and profit. May include lost productivity during transition. [Avoid double counting.]

Table 3-2: Cost Categories: Recurring

Cost Category	Description
Site and Facility	Includes the lease or rental of buildings and space within buildings. May also include recurring fees for building maintenance or services.
Equipment Lease / Maintenance	Includes lease, rental, maintenance, and recurring fees — including central data processing costs — related to all types of information processing and related equipment, including computer systems and peripherals, auxiliary equipment, data and voice communications equipment, telecommunications lines, environmental conditioning equipment, security and safety detection equipment. Also includes the costs of bundled software, maintenance, and similar fees. Covers the recurring costs of any equipment furnished to contractors for use on the project. Includes costs for routine "full service" maintenance charges, as well as estimated monthly allocations to cover per-call charges and maintenance parts
Software Lease / Maintenance	Entails lease, rental, maintenance, and recurring licensing fees for any type of software including systems programs, operational software, utilities, applications programs, and other commercial software for ADP and telecommunications equipment.
Personnel	Includes costs of personnel on staff (salaries, overtime, and benefits) devoted in full or in part to the system. Includes personnel outside of the data processing facility who are involved in the functional application of the system, to the extent that costs or benefits may relate to their work.
Direct Support Services	Includes costs of personnel detailed in support of the system's operation as well as contract support services staff costs (labor hour, contract G&A costs, and profit) dedicated in full or part to the project or system.
Travel	Includes recurring travel costs or monthly travel allocations for in-house personnel or contractors.
Training	Includes regularly scheduled training related to equipment, software, testing, and operational processes, whether initial or refresher. Also includes study aids, training manuals, workbooks, audiovisual aids, and software products. May include travel, per diem, and lost productivity costs. May apply to trainees and trainers.
Supplies	Includes monthly allocations to cover costs of supplies.
Utilities	Includes recurring fees related to heating, air conditioning, water, power equipment, and utility usage costs.
Security	Covers recurring fees related to security, such as monthly monitoring fees. Can include costs related to security staff, if not included under personnel costs (double counting). Applies to primary and back-up facilities, including the costs of contracting for and regularly testing disaster recovery sites.
Overhead / Indirect Costs	Includes recurring costs for overhead such as management overhead and contract overhead. [Avoid double counting.]

Finally, to aid in the development of the recurring cost figures, each cost category should be identified as either a *fixed, adjusted, or variable cost factor*. Adjusted cost factors are those which increase over time, tied (for example) to contractual obligations. Variable factors are those which are volume sensitive.

The Cost Profile Worksheet (page 3-7) can be used to determine cost categories, types, and factors applicable to both the status quo and each feasible alternative. Representative cost categories are included in the worksheet.

Each alternative should be evaluated from the point of view of its *developmental and operational costs*, and separate worksheets prepared.

### **3.5 Determine Whether to Use Constant or Current Dollars**

In projecting future costs, States should determine whether the analysis will be based on constant (real) dollars or current (nominal) dollars.

Constant dollar costs and benefits are costs and benefits which reflect the prices of the base year of the systems life. *Constant dollars do not consider the effect of inflation, are normally used in cost/benefit analyses, and do not require justification to ACF.* Constant dollars are then adjusted by present value discounting, described in a following section.

Current dollar costs and benefits are costs and benefits which have been adjusted to reflect the effect of inflation on prices. Current dollars are normally used in budget projections.

The forecasting of future benefits and costs becomes complicated when there has been an appreciable and persistent rise in inflation, significant enough to affect investment considerations. If current dollars are used, a three-step (rather than two-step) approach is required:

- Projecting constant dollar costs and benefits;
- Converting constant dollars to current dollars by factoring in inflation based on price indices, such as the Consumer Price Index or the Producer Price Index; and
- Applying present value to convert future dollars to today's dollars.

**Table 3-3: Cost Profile Worksheet**

Status Quo

Alternative *n*:  
 Developmental  
 Operational

Non-Recurring Costs							
Cost Categories	Fxd			Cost Categories	Fxd		
Site and Facility <ul style="list-style-type: none"> <li>• Purchase</li> <li>• Site Preparation/Modification</li> <li>• Other</li> </ul> Equipment Purchase/One Time Fees <ul style="list-style-type: none"> <li>• ADP</li> <li>• Data Communications</li> <li>• Environ. Conditioning</li> <li>• Security</li> <li>• Other</li> </ul> Shipping Installation Software Purchase/One Time Fees <ul style="list-style-type: none"> <li>• Operating System</li> <li>• Applications</li> <li>• Utilities</li> <li>• Other</li> </ul> System Testing Conversion <ul style="list-style-type: none"> <li>• Data</li> <li>• Software</li> <li>• Services</li> </ul>				Studies Procurement <ul style="list-style-type: none"> <li>• Cost of Planning</li> <li>• Cost of Conducting</li> </ul> Database Preparation Personnel <ul style="list-style-type: none"> <li>• Salaries</li> <li>• Benefits</li> <li>• Contract Support Services</li> <li>• Extraordinary Personnel Costs</li> </ul> Travel Training <ul style="list-style-type: none"> <li>• Development</li> <li>• Trainee Expenses</li> <li>• Trainer Expenses</li> </ul> Overhead / Indirect Costs <ul style="list-style-type: none"> <li>• Project and Technical</li> <li>• Management</li> <li>• Incremental</li> <li>• Lost Productivity</li> </ul>			
Recurring Costs							
Cost Categories	Var	Adj	Fxd	Cost Categories	Var	Adj	Fxd
Site and Facility <ul style="list-style-type: none"> <li>• Lease</li> <li>• Maintenance Fees</li> <li>• Other</li> </ul> Equipment Lease / Maintenance <ul style="list-style-type: none"> <li>• ADP</li> <li>• Data Communications</li> <li>• Environ. Conditioning</li> <li>• Security</li> <li>• Other</li> </ul> Software Lease / Maintenance <ul style="list-style-type: none"> <li>• Operating System</li> <li>• Applications</li> <li>• Utilities</li> <li>• Other</li> </ul>				Personnel <ul style="list-style-type: none"> <li>• Salaries</li> <li>• Benefits</li> </ul> Direct Support Services <ul style="list-style-type: none"> <li>• Contract</li> <li>• Detailed/Tasked</li> </ul> Travel Training Supplies Utilities Security <ul style="list-style-type: none"> <li>• Primary Facilities</li> <li>• Back-up Facilities</li> </ul> Overhead / Indirect Costs			

If a State decides to use current dollars, the decision and the proposed inflation factor should be described and justified in submissions to ACF.

The use of present value analysis, which involves the discounting of cash flows, should not be confused with the treatment of the estimated effects of inflation. Present value considers the effect of *interest* on money over time — not the effect of *inflation* on money over time. Present value is used in cost/benefit analysis, against both constant and current dollars.

### **3.6 *Build each Cost Profile Year by Year***

Once costs have been identified and characterized, the challenge is to quantify the factors. Four methods, or a combination, are typically used:

- Estimation — sometimes referred to as the bottom-up method, in which each organization involved in system development, operation, and use estimates, averages, and projects its costs;
- Comparison — in which current costs on comparable systems are used as a baseline for the new system;
- Simulation — in which the process is analyzed and simulated to obtain costs; and/or
- Observation — in which processes are measured and recorded to provide estimates.

If there is a secret to successfully developing costs, it is to rationally and reasonably identify, apply, and project the costs for each alternative. Not all costs will apply — or apply the same way — to each alternative.

For each alternative (including the status quo) and for each year, costs should be developed using a format such as the Annual Cost Worksheet on page 3-9.

Table 3-4: Annual Cost Worksheet

Status Quo

Year \_\_\_\_\_

Alternative *n*  Developmental or  Operational

Constant Dollars or  Current Dollars

Cost Category		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Non-Recurring Costs:	Site and Facility													
	Equipment Purchase &													
	Shipping													
	Installation													
	Software Purchase													
	System Testing													
	Conversion													
	Studies													
	Procurement													
	Database Preparation													
	Personnel													
	Travel													
	Training													
	Overhead													
Recurring Costs:	Site and Facility													
	Equip. Lease &													
	Software Lease &													
	Personnel													
	Direct Support Services													
	Travel													
	Training													
	Supplies													
	Utilities													
	Security (incl. Back-up)													
	Overhead													
<b>TOTAL PROJECTED COSTS</b>														
<b>PRESENT VALUE FACTOR</b>		N/A												
<b>TOTAL PRESENT VALUE COST</b>		N/A		N/A										
<b>CUM TOTAL PROJ COSTS /</b>		N/A												
<b>CUMULATIVE TOTAL</b>														N/A

### **3.7 Apply Present Value Factor**

The top of the worksheet identifies the alternative, whether the costs are developmental or operational, whether dollars are constant or current, and the year of the cost estimates.

Separate areas in the worksheet provide space for both recurring and non-recurring costs, by month and for the year.

The costs (and later the benefits) of each alternative should be expressed in terms of their "present value." This allows the conversion of benefits and costs occurring at different times in the future to their current (that is, present) value, reflecting the time-value of money. *Present value calculations equalize the comparison of alternatives when expenses are distributed unequally over time.*

Present value calculations deal not with inflation, but with *interest*. Present value discounting is the inverse of compounding interest; it shrinks tomorrow's dollars to today's dollars by the difference of the compounded interest. Present value reflects the opportunity cost of money.

Present value analysis is based on two principals:

- Benefits accruing in the future are worth less than the same level of benefits that accrue now; and
- Costs that occur in the future are less burdensome than costs that occur now.

The current year establishes the time reference point for present value calculations.

Present value is calculated by multiplying costs by a predetermined factor (called discounting) based on the established discount rate and time period. The discount rates are published in tables, which factor in the amount of interest earned by the dollar invested today until the future dollar is spent.

For example, if we assume a 7 percent interest rate, \$107 in estimated costs or projected benefits for next year would be worth \$100 today — the present value.

Therefore, present value calculations discount — that is, reduce — costs or benefits projected to occur in future years to a common point in time so they can be compared.

For consistency in the Federal review and approval processes, ACF requires States to use a 7% present value factor in their submissions.

Table 3-5: Present Value Calculations		
Years Since Initiation	Discount Factor	
	Year-End	Mid-Year
1	.9346	.9667
2	.8734	.9035
3	.8163	.8444
4	.7629	.7891
5	.7130	.7375
6	.6663	.6893
7	.6227	.6442
8	.5820	.6020

The year-end discount factors presented in the table assume end-of-year, lump sum costs and returns. When costs and returns occur in a steady stream, applying the mid-year discount factors may be more appropriate.

### 3.8 *Prepare Systems Life Cost Profiles*

Once the annual costs for each alternative are identified, totaled, and discounted for present value, the systems life cost profiles (page 3-12) can be prepared.

These system life cost profiles are built from the totals calculated on each yearly cost worksheet. Present value totals are inserted: no recalculation is required.

### 3.9 *Identify and Characterize All Benefits*

Once the cost profiles have been developed, the State must identify the categories of benefits that apply to the *status quo* and each feasible alternative over the systems life. In addition, the State should verify that the benefits are properly categorized and are not, in fact, better described as costs.

Benefits should relate directly to the system objectives defined during the Feasibility Study, such as:

- Reduced Error Rates,
- Increased Collections,
- Reduced Costs,
- Reduced Staffing,
- Improved Security, and
- Improved Access or Interface.

**Table 3-6: Systems Life Cost Profile**

Status Quo or  Alternative n

Years \_\_\_\_\_ - \_\_\_\_\_

Constant Dollars or  Current Dollars

Cost Category	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	System Life Total
<b>Non-Recurring Costs:</b>									
Site and Facility									
Equipment Purchase & Fees									
Shipping									
Installation									
Software Purchase									
System Testing									
Conversion									
Studies									
Procurement									
Database Preparation									
Personnel									
Travel									
Training									
Overhead									
<b>Subtotal</b>									
<b>Recurring Costs</b>									
Site and Facility									
Equip. Lease & Maintenance									
Software Lease & Maintenance									
Personnel Salaries/Benefits									
Direct Support Services									
Travel									
Training									
Supplies									
Utilities									
Security (incl. Back-up)									
Overhead									
<b>Subtotal</b>									
<b>TOTAL PROJECTED COSTS</b>									
<b>TOTAL PRESENT VALUE COSTS</b>									
<b>CUMULATIVE TOTAL</b>									N/A

Examples of system objectives are listed in the table on page 2-4.

Benefits, listed for the status quo and for each alternative, should be categorized as either *quantitative or qualitative benefits*. The Benefit Profile Worksheet on page 3-14 may be used. Note that some benefit categories, such as "more timely reporting" are listed under both quantitative and qualitative benefits, both or either of which might apply to a given situation.

### **3.10 Identify and Characterize All Benefits**

Once the cost profiles have been developed, the State must identify the categories of benefits that apply to the *status quo and each feasible alternative over the systems life*. In addition, the State should verify that the benefits are properly categorized and are not, in fact, better described as costs.

Benefits should relate directly to the system objectives defined during the Feasibility Study, such as:

- Reduced Error Rates,
- Increased Collections,
- Reduced Costs,
- Reduced Staffing,
- Improved Security, and
- Improved Access or Interface.

Examples of system objectives are listed in the table on page 2-4.

Benefits, listed for the status quo and for each alternative, should be categorized as either *quantitative or qualitative benefits*. The Benefit Profile Worksheet on page 3-14 may be used. Note that some benefit categories, such as "more timely reporting" are listed under both quantitative and qualitative benefits, both or either of which might apply to a given situation.

#### **Quantify Benefits**

Quantitative benefits are those for which a reasonable valuation may be predicted and projected. For example, the State should be able to calculate the value of reduced staffing or increased collections.

The objective of the benefit valuation process is to document the State's experience (the status quo), develop assumptions (such as average overpayment), and present a reasoned prediction of the value of the benefit to the State and Federal governments.

**Table 3-7: Benefit Profile Worksheet**

Status Quo

Alternative *n*

QUANTITATIVE		
Category	√	Description
<b>COST / RESOURCE</b> Reduced Costs Controlled Costs Reduced Staffing Improved Staffing Utilization Increased Productivity Fewer Manual Functions Increased Resources Other		
Reduced Error Rate Increased Caseload Capacity Increased Collections Improved Management Information Improved Controls Interface / Matching Less Data Redundancy Other		
<b>TECHNICAL</b> Faster Record Retrieval More Timely Reporting Less Processing Time Improved Access Improved Security Increased Automation Other		
QUALITATIVE		
Category	√	Description
<b>LEGISLATIVE</b>		
<b>SOCIO-POLITICAL</b> Integrated Benefits Automation Improved Public Assistance Increased Worker Satisfaction Other		
Improved Management Information Improved Controls Interface / Matching Other		
<b>TECHNICAL</b> More Timely Reporting Expanded Capability / Flexibility Improved Access Improved Security Increased Automation Other		

*The standard of analysis and documentation should be to analyze, develop, substantiate, and present a logical argument supporting the apparent validity of the predicted value of the benefit — sufficient so that the worksheets would be capable of convincing a third party that the prediction is justified and meritorious.*

Quantifying benefits is usually more difficult than estimating and predicting costs. Four methods, or a combination, are typically used:

- Estimation — in which each organization involved in system development, operation, and use estimates and projects the value of benefits, using averaging to reduce the potential for error;
- Comparison — in which current benefit values on comparable systems are used as a baseline;
- Simulation — in which the anticipated benefit is analyzed and simulated to obtain costs and values; and/or
- Observation — in which benefit processes are measured and recorded to provide estimates.

If there is a secret to valuing benefits, it is to rationally and reasonably identify, breakdown, apply, and project the costs and values for each alternative. Not all costs and values will apply — or apply the same way — to each alternative.

*States will make their most effective arguments for Federal funding through quantified costs and benefits.*

The Annual and Systems Life Quantified Benefits Worksheets on page 3-16 and 3-17 may be used to document the value of quantifiable benefits. Note that space has been allotted on the worksheets for the results of three critical determinations:

- Assumptions — on which the numbers and predictions are based;

**Table 3-8: Quantified Benefits Worksheet: Annual**

Constant Dollars or  Current Dollars

Year \_\_\_\_\_

BENEFIT CATEGORY / DESCRIPTION											
<b>Benefit Number:</b>											
<b>Description:</b>											
STATUS QUO BENEFIT VALUE											
<b>Assumptions:</b>											
Numbers			Basis					Source			
Current Measure/Volume:											
Projected Increase/Decrease Over Time:											
Current Value:											
Annual Benefits Profile: Status Quo											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ALTERNATIVE <i>n</i> BENEFIT VALUE											
<b>Assumptions:</b>											
Numbers			Basis					Source			
Measure/Volume at Implementation:											
Projected Increase/Decrease Over Time:											
Initial Value at Implementation:											
Annual Benefits Profile: Alternative <i>n</i>											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

**Table 3-9: Quantified Benefits Worksheet: Systems Life**

Constant Dollars or  Current Dollars

BENEFIT CATEGORY / DESCRIPTION								
<b>Benefit Number:</b>								
<b>Description:</b>								
STATUS QUO BENEFIT VALUE								
<b>Assumptions:</b>								
<b>Numbers</b>			<b>Basis</b>			<b>Source</b>		
Current Measure/Volume:								
Projected Increase/Decrease Over Time:								
Current Value:								
System Life Benefits Profile: Status Quo								
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
ALTERNATIVE <i>n</i> BENEFIT VALUE								
<b>Assumptions:</b>								
<b>Numbers</b>			<b>Basis</b>			<b>Source</b>		
Measure/Volume at Implementation:								
Projected Increase/Decrease Over Time:								
Initial Value at Implementation:								
Systems Life Benefits Profile: Alternative <i>n</i>								
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total

- Basis for numbers — such as average value of overpayments during the last complete fiscal year; and
- Source for numbers — which specifies the documents (and their locations) from which numbers or predicted increases or decreases were pulled or calculated.

In most cases, addendum sheets should be attached with narrative and numbers explaining in more detail the origin, derivation, and calculation of the actual and predicted values. In addition, critical documents on which the numbers and predictions are based should be attached to the State's master copy of the Cost/Benefit Analysis.

Since the State is now required by regulation to accrue actual costs and benefits over time and since ACF will oversee cost/benefit actuals, care should be taken to document the process in full. The documentation should be sufficiently detailed so that personnel changes will not affect the State's ability to accrue, measure, and explain costs and benefits.

Once the State has prepared a set of benefit worksheets, the calculated benefits for the status quo and each alternative can be listed on the Annual Benefits Worksheet (see page 3-19).

### **3.11 *Apply Present Value Factors***

As with costs, benefits of each alternative should be expressed in terms of their present value. Present value is calculated by multiplying the benefit values by a factor based on the established discount rate and time period. (See page 3-11 for a discount factor table based on 7%.)

### **3.12 *Prepare Systems Life Benefits Profiles***

Once the annual benefit values for each alternative are identified, totaled, and discounted for present value, the system life benefit profiles can be prepared. (See page 3-20.) These benefits profiles are built from the totals calculated on each yearly benefit worksheet. Present value totals are inserted: recalculation is not required.

**Table 3-10: Annual Benefits Worksheet**

Status Quo

Year \_\_\_\_\_

Alternative *n*

Constant Dollars or  Current Dollars

Benefit Number and Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Benefit 1: Short Description													
Benefit 2: Short Description													
Benefit 3: Short Description													
etc.													
<b>TOTAL PROJECTED BENEFITS</b>													
<b>PRESENT VALUE FACTOR</b>	N/A												
<b>TOTAL PRESENT VALUE BENEFITS</b>	N/A												
<b>CUM. TOTAL PROJ. BENEFITS / PRIOR YEAR</b>	N/A												
<b>CUMULATIVE TOTAL PROJECTED BENEFITS</b>													N/A

**Table 3-11: Systems Life Benefits Profile**

Status Quo

Year \_\_\_\_\_

Alternative *n*

Constant Dollars or  Current Dollars

Benefit Number and Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Benefit 1: Short Description									
Benefit 2: Short Description									
Benefit 3: Short Description									
etc.									
<b>TOTAL PROJECTED BENEFITS</b>									
<b>TOTAL PRESENT VALUE BENEFITS</b>									
<b>CUMULATIVE TOTAL PROJECTED BENEFITS</b>									N/A

### **3.13 Avoid Common Errors**

Errors commonly made in analyzing benefits and costs include double counting, counting sunk costs, omitting costs, and applying cost categories unevenly.

Double counting occurs when the same expense is charged to more than one category. This could occur, for example, if the same or overlapping expenses to "clean up" and convert information and software were charged to the categories of conversion, studies, and in-house and contract personnel.

Including sunk costs is also an error in calculating cost/benefits. "Sunk costs" represent money already spent and such costs have no bearing on the analysis. Cost/benefit analysis addresses current and future costs, not past expenditures.

Omitting costs is a common error which can occur from overlooking overhead costs or hidden costs. Overhead costs may include charges for space, electricity, personnel benefits, and project or management overhead. Hidden costs are usually indirect costs or support activities existing elsewhere in the organization and sometimes charged at a standard rate by an internal billing system.

The error of uneven application of cost categories occurs when costs are applied to one alternative and not another to which it applies. For example, if an upgrade to accommodate workload growth is applied to the status quo — but not to the alternatives also needing additional future capacity — an error has been made.

### **3.14 Identify Qualitative Benefits**

Despite the preponderant weight given quantified benefits, qualitative benefits are also important in the evaluation of alternatives, gaining weight as the cost differential between alternatives narrows.

Contrasted to the ease of valuing such benefits as reduced staffing, assigning values to the benefits of improved security against unauthorized access or improved access to system information may lead to numbers which are far from unassailable.

*If numbers cannot be reasonably defended, they should not be set forth as quantified benefit values. Instead, the State should acknowledge the benefits as qualitative — sometimes called intangible — benefits.*

Qualitative benefits are linked to factors other than numbers. For example, qualitative benefits may be coupled with legislative mandates, socio-political edicts, or technical, functional, or programmatic considerations.

Benefits associated with legislative mandates are the most powerful. For example, an alternative which would modify a child support management information system to achieve enhanced "compatibility among the systems of different jurisdictions to permit periodic screening" would support the objectives of Public

Law 96-265, which amended the Social Security Act with respect to provisions related to AFDC and Child Support programs.

Qualitative benefits, identified previously on Benefit Profile Worksheets (see page 3-14) for each alternative and the status quo, should now be:

- Listed in order of their relative importance,
- Linked to system objectives, and
- Assessed as to the measure of effectiveness of the benefit in meeting the system objective.

For example, the benefit of PC-based distributed systems might fulfill the "access to information" system development objective more effectively than

a terminal-to-mainframe link. Note that in this example the State might derive quantitative benefits, based on access and wait times. However, qualitative benefits — such as increased worker satisfaction and enhanced access — may apply as well.

The State may use the Qualitative Benefits Worksheet on page 3-24 to develop the intangible benefits profile for the status quo and each alternative.

Four levels of effectiveness are included on the worksheet: very effective, effective, minimally effective, and not effective.

The latter is included so that the State has the option of pairing benefits and objectives in standard sets against which the alternatives can be measured. For example, the status quo might be rated "not effective" in the benefit/objective combination of work satisfaction/access to information.

Since the State's actual benefits will be monitored and measured against projected benefits, it is critical:

- Ed???? prediction of benefits' values.

After the initial cost/benefit profiles have been developed, the State should assign an independent team of reviewers to critique the profiles and to propose measurement and monitoring strategies.

The first step in comparing alternatives is to develop a Cost/Benefit Profile (see page 3-26) for the status quo and each alternative. The profile builds on information already developed during the analysis, including sections for:

- System Life Cost Profile,
- System Life (Quantitative) Benefits Profile,
- Cumulative Costs and Benefits, and
- Qualitative Benefits.

### **3.15 *Verify Benefit Categories And Projections***

### **3.16 *Develop Cost/Benefit Profiles***

**Table 3-12: Qualitative Benefits Worksheet**

<input type="checkbox"/> Status Quo		<input type="checkbox"/> Alternative <i>n</i>			
<b>BENEFITS*</b>	<b>RELATED SYSTEM OBJECTIVES</b>	<b>MEASURE OF EFFECTIVENESS</b>			
		Very Effective	Effective	Minimally Effective	Not Effective

\*Ranked in Descending Order of Importance

The profile aggregates information on systems life and cumulative costs and benefits used in the next stage of analysis — the comparison of alternatives. The system life and cumulative costs and benefits derive from the systems life profile worksheets (pages 3-12 and 3-20), while the qualitative benefits derive from the Qualitative Benefits Worksheet (page 3-24).

The Cost/Benefit Profile provides on a single sheet the most essential data pertinent to that alternative.

### **3.17 Compare Quantitative Factors**

The State is now ready to compare the systems life cost and benefit values for the status quo and each alternative, transferring the key information from each Cost/Benefit Profile (page 3-26) to the Comparison of Alternatives worksheet (page 3-27).

Three methods are typically used by the States to compare alternatives:

- Net Benefit (Cost),
- Benefit/Cost Ratio, and
- Breakeven or Payback.

Net Benefit (Cost) is calculated for the status quo and each alternative by subtracting the total present value costs from the total present value benefits. Where benefits exceed costs, the result will be a positive number, which is, of course, preferable. However, for the status quo and perhaps some alternatives, costs may exceed benefits and result in a negative number, suggesting no (quantifiable) payback on the alternative.

Net Benefit (Cost), sometimes referred to as Net Present Value, is the most straightforward comparison, showing which alternative is the most economical based on present value dollars.

**Table 3-13: Cost / Benefit Profile**

<input type="checkbox"/> Status Quo		<input type="checkbox"/> Constant Dollars or <input type="checkbox"/> Current Dollars					<input type="checkbox"/> Alternative <i>n</i>			
<b>SYSTEM LIFE COST PROFILE</b>										
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total	
Non-Recurring Costs										
Recurring Costs										
Total Projected Costs										
Total Present Value Costs										
<b>SYSTEM LIFE BENEFITS PROFILE</b>										
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total	
Total Projected Benefits										
Total Present Value Benefits										
<b>CUMULATIVE BENEFIT / COST PROFILE</b>										
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total	
Cumulative Total Projected Benefits									N/A	
Cumulative Total Projected Costs									N/A	
<b>QUALITATIVE BENEFITS</b>										
Benefits	Related System Objectives				Measure of Effectiveness					
					Very Effective	Effective	Minimally Effective	Not Effective		

**Table 3-14: Comparison Of Alternatives**

Constant Dollars or  Current Dollars

<b>QUANTITATIVE FACTORS</b>				
<b>Description</b>	<b>Status Quo</b>	<b>Alternative 1</b>	<b>Alternative 2</b>	<b>Alternative 3</b>
Total Present Value Benefits				
Less Total Present Value Costs				
Net Benefit (Cost)				
Benefit/Cost Ratio				
Breakeven (Months)				
<b>QUALITATIVE FACTORS</b>				
Description:				

Benefit/Cost Ratio is calculated for the status quo and each alternative by dividing the total present value benefits by the total present value costs. Where benefits equal costs, the ratio will be 1. For benefits exceeding costs, the ratio will be more than 1, again preferable. In fact, the larger the number (within reason), the more attractive the alternative. On the other hand, where costs exceed benefits, the ratio will be less than 1. Breakeven will not be reached.

The Benefit/Cost Ratio provides a relative measure of an alternative's value — that is, a measure of the benefits obtained per dollar spent. If the ratio calculated for an alternative is 1.08, then for each dollar spent, the State estimates a return of \$1.08 in benefits.

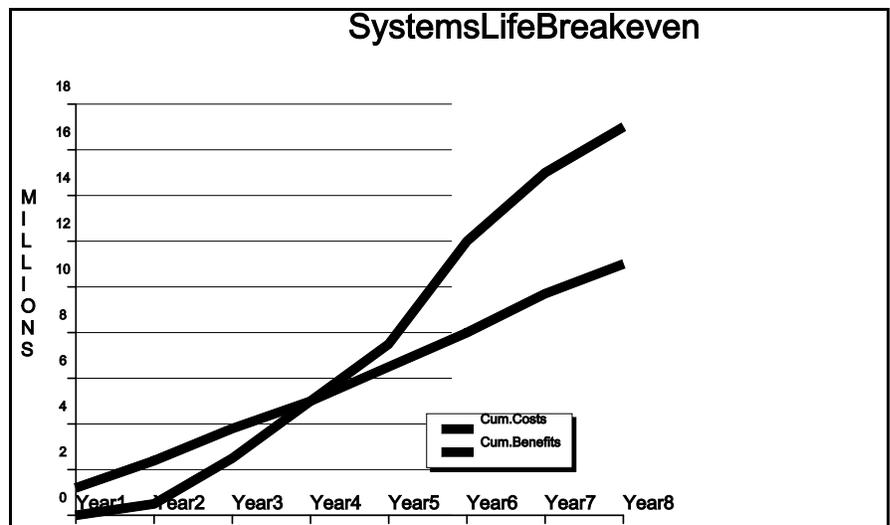
Therefore, the Benefit/Cost Ratio shows which alternative provides the largest return relative to the costs — as does the Net Benefit factor.

Breakeven or Payback is the calculation of how many months it will take for cumulative benefits to equal (then exceed) cumulative costs. These may be presented in two ways, numerically and graphically.

In the mathematical calculation, cumulative total costs are compared against cumulative total benefits to determine the month of breakeven or payback. Note that projected, cumulative numbers — not present value numbers — are used.

The breakeven point can be determined from the worksheets by a two-step process. First, the year of breakeven is determined by comparing the cumulative total projected costs and benefits on the system life worksheets. Then, the month of breakeven is established by comparing the cumulative total projected costs and benefits on the annual worksheets of the breakeven year.

Table 3-15: Graph: Systems Life Breakeven



In the graph above, the cumulative benefits breakeven at \$5,000,000 each in the fourth year. This is readily apparent from the chart. When cumulative costs are equal to cumulative benefits, the lines intersect — the more cumulative benefits exceed cumulative costs, the wider the gap

after intersection.

In some cases, it may be important to recover the initial costs of a project as quickly as possible. In those instances, the breakeven calculation may become the most important. Note, however, that alternatives which deliver the earliest breakeven may not have the most favorable benefit/cost ratio and net present value benefit.

The Comparison of Alternatives worksheet (page 3-27) is used to set the numbers side-by-side for the status quo and each alternative. Space is provided for:

- Total present value benefits,
- Total present value costs,
- Net benefit (cost),
- Benefit / Cost ratio, and
- Breakeven.

Breakeven should be stated in terms of months, as discussed above, based on the cumulative figures from the Annual Cost Worksheet (page 3-9) and the Annual Benefits Worksheet (page 3-19). *Note that breakeven is based on projected costs — not present value costs.*

### **3.18 Compare Alternatives: Quantitative and Qualitative**

Now that all quantitative facts about each alternative are side-by-side, the art of cost/benefit analysis comes into play. The term "art" is used because *cost/benefit analysis is not simply a mathematical formula which dictates a decision, but a managerial decision-making tool.*

Therefore, the decision should not be limited to an exercise of dividing or subtracting to determine which alternative has the highest net benefit, largest benefit/cost ratio, or the shortest breakeven period. In fact, an analysis which results in an unusually low breakeven should be cause for concern rather than excitement. Such a payback would be unlikely to occur, and payback must be monitored by the State.

Therefore, the first step in comparing alternatives should be assessing the range in the numbers among the alternatives. The manager / analyst should consider such questions as:

- How close are the numbers? Do they make sense?
- Is there an apparent winner? Does it seem a sensible selection?
- Do the results suggest that the assumptions and projections are reasonable?
- If the numbers are close, should the assumptions be reassessed and the numbers checked for validity?
- If the range is wide, should the assumptions be reassessed and the numbers checked for validity?
- Do I believe this payback will occur?

Next, the numbers — or quantitative part of the analysis — should

be checked against the qualitative or intangible benefits. The Cost/Benefit Profiles should be placed side-by-side. For the qualitative part of the analysis, the manager / analyst should consider similar questions:

- How close are the benefit profiles? Are there appreciable differences among them?
- Is there an apparent winner, based on qualitative factors? Does it also win in numbers?
- If the benefits are close, should the assumptions be reassessed?
- If the benefits vary widely, should the assumptions be reassessed?
- Do I believe these benefits will occur?

Significant differences in qualitative benefits, which require consideration in the final analysis, should be noted on the Comparison of Alternatives worksheet. In fact, the manager can develop an evaluation scheme for the qualitative factors to aid in the analysis. Techniques include:

- Ranking — which involves ranking benefits by their relative importance and determining the degree to which each alternative achieves the benefits, and
- Weighting — which involves scoring each alternative on the extent of benefits projected or assigning values to benefits.

With these methods, numbers are assigned in the form of ranks or scores. *Although this lends the appearance of a quantified process, the determinations are, by their nature, subjective.*

Once this is done, the State should "step back and look at the big picture." This process should test the validity of the numerical results in light of the benefits. For example, if there is a very low cost differential between two alternatives, offset by a very large intangible benefits differential, then the alternatives certainly deserve a closer examination. Questions to be asked include:

- Would I select the same alternative considering quantitative and qualitative factors separately?
- Can I attach a value to a benefit that I was unable to cost before?
- If I am unable to quantify the benefit, can I prepare a reasonable justification that the superior benefit is worth the expense?
- Can I apply probability analysis to refine my determination?

If serious questions arise, the cost and benefit worksheets, beginning with the assumptions and including all ensuing calculations, should be redone.

The reconsideration of assumptions is sometimes referred to as "sensitivity analysis" — that is, testing the sensitivity of the results to changes in the assumptions. Such analysis considers how vulnerable the results are to a change in assumptions.

Generally, sensitivity analysis centers on the factors expected to have the most effect on the net present value determination. Such factors can include:

- Cost estimates,
- Workload projections,
- Project implementation schedule, or
- Offsetting benefit values.

There are four steps in testing the sensitivity of a factor and its effect on the cost/benefit determination:

- Select the factor to be tested;
- Hold all other factors in the analysis constant;
- Rework the analysis, varying the estimates for the factor under consideration; and
- Check the results to see if the ranking of alternatives is materially affected.

**3.19 Maintain  
perspective:  
quantitative and  
qualitative factors**

Qualitative benefits are subjective determinations and balance the objective determinations related to quantified benefits. Both objective and subjective determinations contribute to effective decision-making.

*Simply because a benefit is listed as a qualitative factor does not mean that it lacks cost implications. It simply means a different logical approach is needed, because the value is either unpredictable or difficult to establish and defend.*

For example, suppose in comparing two alternatives, a manager determines that a \$10,000 cost differential separates two alternatives. But the more costly alternative delivers enhanced compatibility between State benefits systems, improved public assistance, improved management information, and improved security. Although the manager could not directly apply values to those benefits earlier in the analysis, the manager may now be in a position to argue that the \$10,000 cost differential is worth the increased benefits. In fact, at this point, some calculations and assumptions might be made to support the decision.

*The point is — qualitative benefits have values, but they cannot be analyzed in the same manner as quantified benefits.*

Nonetheless, States should keep in mind — the more objective (quantified) the profile, the easier the decisions for States in

selecting systems alternatives and for ACF in approving Federal funding support.

**3.20 *Verify Analysis and  
Select Alternative***

After analyzing both the quantitative and qualitative factors, the results of the analysis should be formally verified, and the best alternative selected. Finally, the decision-making process — especially the basis for selection of the chosen alternative — should be thoroughly described and documented.

## 4 COST / BENEFIT ANALYSIS FOR INTEGRATED SYSTEMS

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If the State is seeking approval for integrated benefits systems which will be approved and funded by more than one Federal benefit program, the cost/benefit information must be shown for each program. This will require that the State

- Distribute costs among the funding entities;
- Identify benefits associated with *each* Federal benefit program; and
- Develop cost/benefit profiles and measures for each Federal benefit program and for the integrated benefits system as a whole.

Although these determinations and calculations will be highly dependent on each State's proposed approach, this chapter suggests some considerations and provides examples of worksheets that may be of assistance.

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### 4.1 *Overview*

When the State is proposing the development and implementation of an integrated information system which requires approval from more than one Federal benefit program, extra steps must be taken during the Cost/Benefit Analysis.

### 4.2 *Basis for Approval*

Before Federal approval can be granted, States must demonstrate that the proposed system project is:

- Cost beneficial overall on the merits of the integrated information system, and
- Cost beneficial from the perspective of each approving Federal program.

This requires the State to break each system down into costs and benefits attributable to each program.

### 4.3 *Allocating Costs*

Costs are usually developed and projected by the States for the integrated system as a whole, following processes such as those set forth in Chapter 3. Yet at the same time the overall costs are developed, the State must consider how to distribute costs.

Specifically, States are required to develop their Cost/Benefit Analysis prior to submission of the Implementation APD. Concurrently, States are also preparing the estimates of prospective cost allocation to the various State and Federal funding sources.

Just as actual costs must be allocated to Federal programs for system design and implementation, projected costs and benefits must be "allocated" or distributed to programs in the Cost/Benefit Analysis. The former is linked to payments, the latter to paper documentation required for Federal approval.

The cost distribution used in the Cost/Benefit Analysis should:

- Conform with the State's prospective cost allocation plans for development and operation, and
- Be explained in the Cost/Benefit Analysis.

States should keep in mind, however, that the Cost/Benefit Analysis and the Cost Allocation Plan are separate documents with separate purposes and approval processes. They are linked only in that the State should be consistent in the approach to cost distribution presented in the Cost/Benefit Analysis and the Cost Allocation Plan.

Normally, costs will be distributed for the purposes of the Cost/Benefit Analysis based on a measure such as program-specific costs or workloads and be calculated in terms of a percentage of the whole. The Cost Distribution Profile worksheet on page 4-3 can be used to calculate the proposed cost distribution for the Cost/Benefit Analysis.

Once percentages are derived, they can be applied to the costs developed for the integrated system during the analysis described in Chapter 3. Specifically, data developed in the worksheets for the integrated system are distributed to the specific programs. The worksheets on pages 4-4 and 4-5 suggest how this might be done. Note that percentages are applied against projected — not present value — costs.

**Table 4-1: Cost Distribution Profile**

Cost / Benefit Analysis: Cost Distribution		
Basis:		
Federal Program	Distribution	
	Measure	Percentage
AFDC	<i>n</i>	<i>n%</i>
Child Support	<i>n</i>	<i>n%</i>
JOBS	<i>n</i>	<i>n%</i>
Child Care	<i>n</i>	<i>n%</i>
Foster Care	<i>n</i>	<i>n%</i>
Child Welfare Services	<i>n</i>	<i>n%</i>
Refuge Resettlement	<i>n</i>	<i>n%</i>
Medicaid	<i>n</i>	<i>n%</i>
Food Stamps	<i>n</i>	<i>n%</i>
Subtotal	<i>n</i>	<i>n%</i>
State Program	Distribution	
	Measure	Percentage
General Assistance	<i>n</i>	<i>n%</i>
Other:	<i>n</i>	<i>n%</i>
Subtotal	<i>n</i>	<i>n%</i>
<b>GRAND TOTAL</b>	<i>n</i>	100%

**Table 4-2: Annual Cost Profile: by Program**

<input type="checkbox"/> Constant Dollars or <input type="checkbox"/> Current Dollars							Year _____	
Cost Category	AFDC	Child	JOBS	Medicaid	Food	Other*	General	Totals
<b>Non-Recurring Costs:</b>								
Site and Facility								
Equipment Purchase & Fees								
Shipping								
Installation								
Software Purchase								
System Testing								
Conversion								
Studies								
Procurement								
Database Preparation								
Personnel								
Travel								
Training								
Overhead								
<b>Subtotal</b>								
<b>Recurring Costs</b>								
Site and Facility								
Equip. Lease & Maintenance								
Software Lease & Maintenance								
Personnel Salaries/Benefits								
Direct Support Services								
Travel								
Training								
Supplies								
Utilities								
Security (incl. Back-up)								
Overhead								
<b>Subtotal</b>								
<b>TOTAL PROJECTED ANNUAL</b>								

\* Specify other programs, such as Child Care, Foster Care, Child Welfare Services, Refuge Resettlement

**Table 4-3: Systems Life Cost Profile: by Program**

Constant Dollars or  Current Dollars

Cost Category	AFDC	Child Support	JOBS	Medicaid	Food Stamps	Other*	Gen Assistance	System Life
<b>Non-Recurring Costs:</b>								
Site and Facility								
Equipment Purchase & Fees								
Shipping								
Installation								
Software Purchase								
System Testing								
Conversion								
Studies								
Procurement								
Database Preparation								
Personnel								
Travel								
Training								
Overhead								
<b>Subtotal</b>								
<b>Recurring Costs</b>								
Site and Facility								
Equip. Lease & Maintenance								
Software Lease & Maintenance								
Personnel Salaries/Benefits								
Direct Support Services								
Travel								
Training								
Supplies								
Utilities								
Security (incl. Back-up)								
Overhead								
<b>Subtotal</b>								
<b>TOTAL PROJECTED SYSTEM LIFE COSTS</b>								

\* Specify other programs, such as Child Care, Foster Care, Child Welfare Services, Refuge Resettlement

#### **4.4 Define Program Specific Benefits**

Unlike costs which can be broken down from a total, most benefits must be developed separately for each program — that is, built up to a total. Costs are normally calculated top-down, benefits bottom-up.

Benefits vary between programs in terms of both type and extent. For this reason, most benefits should be developed on program specific worksheets.

Modified worksheets — identical to those in Chapter 3 except that space is provided to identify the program — can be used. The same process would be followed, namely:

- Identify benefits by program for the status quo and each viable alternative (Benefit Profile Worksheet: Program X)(page 4-8);
- Quantify benefits by program for the status quo and each viable alternative (Quantified Benefits Worksheets: Program X)(pages 4-9 and 4-10);
- Project annual benefits by program for the status quo and each viable alternative (Annual Benefits Worksheet: Program X)(page 4-11); and
- Develop systems life benefits by program for the status quo and each viable alternative (Systems Life Benefits Profile: Program X) (page 4-12).

For benefits which will be shared by all programs — that is, common benefits — States may distribute benefits in essentially the same manner as costs, using a top-down approach. The distribution scheme may be the same as the cost distribution (page 4-3) used in the Cost/Benefit Analysis or be based on other reasonable measures developed and justified by the State. The Benefits Distribution Profile worksheet on page 4-13 may be used.

#### **4.5 Develop Program Specific Cost/Benefit Profiles**

Once costs and benefits have been developed for each program in the integrated system, as well as for the system as a whole, cost/benefit profiles can be developed. Program specific Cost/Benefit Profiles for the integrated system (page 4-14) can be developed using essentially the same process as that presented in Chapter 3.

*Finally, once the program-specific and integrated profiles are developed, the alternatives can be compared. Alternatives are only compared, for the purpose of selection, on the basis of the integrated system profile — so that the best solution overall may be chosen and funded.*

Choice of an alternative should not be dominated by a single program's costs; however, each program must have a net benefit. From the State's perspective in analysis, selection of an alternative should be based on lowest overall system costs.

*States will not be required to submit program-specific costs and benefits for all alternatives — just for the status quo and selected alternative.*

**Table 4-4: Systems Life Cost Profile: by Program**

Status Quo

Alternative *n*

QUANTITATIVE		
Category	√	Description
<b>COST / RESOURCE</b> <ul style="list-style-type: none"> <li>• Reduced Costs</li> <li>• Controlled Costs</li> <li>• Reduced Staffing</li> <li>• Improved Staffing Utilization</li> <li>• Increased Productivity</li> <li>• Fewer Manual Functions</li> <li>• Increased Resources</li> <li>• Other</li> </ul>		
<b>FUNCTIONAL/PROGRAMMATIC</b> <ul style="list-style-type: none"> <li>• Reduced Error Rate</li> <li>• Increased Caseload Capacity</li> <li>• Increased Collections</li> <li>• Improved Management Information</li> <li>• Improved Controls</li> <li>• Interface / Matching</li> <li>• Less Data Redundancy</li> <li>• Other</li> </ul>		
<b>TECHNICAL</b> <ul style="list-style-type: none"> <li>• Faster Record Retrieval</li> <li>• More Timely Reporting</li> <li>• Less Processing Time</li> <li>• Improved Access</li> <li>• Improved Security</li> <li>• Increased Automation</li> <li>• Other</li> </ul>		
QUALITATIVE		
Category	√	Description
<b>LEGISLATIVE</b>		
<b>SOCIO-POLITICAL</b> <ul style="list-style-type: none"> <li>• Integrated Benefits Automation</li> <li>• Improved Public Assistance</li> <li>• Increased Worker Satisfaction</li> <li>• Other</li> </ul>		
<b>FUNCTIONAL/PROGRAMMATIC</b> <ul style="list-style-type: none"> <li>• Improved Management Information</li> <li>• Improved Controls</li> <li>• Interface / Matching</li> <li>• Other</li> </ul>		
<b>TECHNICAL</b> <ul style="list-style-type: none"> <li>• More Timely Reporting</li> <li>• Expanded Capability / Flexibility</li> <li>• Improved Access</li> <li>• Improved Security</li> <li>• Increased Automation</li> <li>• Other</li> </ul>		

**Table 4-5: Systems Life Cost Profile: by Program**

Constant Dollars or  Current Dollars

Year \_\_\_\_\_

BENEFIT CATEGORY / DESCRIPTION											
<b>Benefit Number:</b> <b>Description:</b>											
STATUS QUO BENEFIT VALUE											
<b>Assumptions:</b>											
Numbers			Basis				Source				
Current Measure/Volume:											
Projected Increase/Decrease Over Time:											
Current Value:											
Annual Benefits Profile: Status Quo											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ALTERNATIVE <i>n</i> BENEFIT VALUE											
<b>Assumptions:</b>											
Numbers			Basis				Source				
Measure/Volume at Implementation:											
Projected Increase/Decrease Over Time:											
Initial Value at Implementation:											
Annual Benefits Profile: Alternative <i>n</i>											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

**Table 4-6: Systems Life Cost Profile: by Program**

Constant Dollars or  Current Dollars

BENEFIT CATEGORY / DESCRIPTION								
<b>Benefit Number:</b>								
<b>Description:</b>								
STATUS QUO BENEFIT VALUE								
<b>Assumptions:</b>								
Numbers			Basis			Source		
Current Measure/Volume:								
Projected Increase/Decrease Over Time:								
Current Value:								
System Life Benefits Profile: Status Quo								
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
ALTERNATIVE <i>n</i> BENEFIT VALUE								
<b>Assumptions:</b>								
Numbers			Basis			Source		
Measure/Volume at Implementation:								
Projected Increase/Decrease Over Time:								
Initial Value at Implementation:								
Systems Life Benefits Profile: Alternative <i>n</i>								
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total

**Table 4-7: Systems Life Cost Profile: by Program**

Status Quo

Year \_\_\_\_\_

Alternative *n*

Constant Dollars or  Current Dollars

Benefit Number and Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Benefit 1: Short Description													
Benefit 2: Short Description													
Benefit 3: Short Description													
etc.													
<b>TOTAL PROJECTED BENEFITS</b>													
<b>PRESENT VALUE FACTOR</b>	N/A												
<b>TOTAL PRESENT VALUE BENEFITS</b>	N/A												
<b>CUM. TOTAL PROJ. BENEFITS / PRIOR YEAR</b>	N/A												
<b>CUMULATIVE TOTAL PROJECTED BENEFITS</b>													N/A



**Table 4-9: Systems Life Cost Profile: by Program**

Cost / Benefit Analysis: Common Benefits Distribution		
Basis:		
Federal Program	Distribution	
	Measure	Percentage
AFDC	<i>n</i>	<i>n%</i>
Child Support	<i>n</i>	<i>n%</i>
JOBS	<i>n</i>	<i>n%</i>
Child Care	<i>n</i>	<i>n%</i>
Foster Care	<i>n</i>	<i>n%</i>
Child Welfare Services	<i>n</i>	<i>n%</i>
Refuge Resettlement	<i>n</i>	<i>n%</i>
Medicaid	<i>n</i>	<i>n%</i>
Food Stamps	<i>n</i>	<i>n%</i>
Subtotal	<i>n</i>	<i>n%</i>
State Program	Distribution	
	Measure	Percentage
General Assistance	<i>n</i>	<i>n%</i>
Other	<i>n</i>	<i>n%</i>
Subtotal	<i>n</i>	<i>n%</i>
<b>GRAND TOTAL</b>	<i>n</i>	100%

**Table 4-10: Systems Life Cost Profile: by Program**

<input type="checkbox"/> Status Quo		<input type="checkbox"/> Constant Dollars or <input type="checkbox"/> Current Dollars				<input type="checkbox"/> Alternative <i>n</i>			
<b>SYSTEM LIFE COST PROFILE</b>									
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Non-Recurring Costs									
Recurring Costs									
Total Projected Costs									
Total Present Value Costs									
<b>SYSTEM LIFE BENEFITS PROFILE</b>									
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Total Projected Benefits									
Total Present Value Benefits									
<b>CUMULATIVE BENEFIT / COST PROFILE</b>									
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Cumulative Total Projected Benefits									N/A
Cumulative Total Projected Costs									N/A
<b>QUALITATIVE BENEFITS</b>									
Benefits	Related System Objectives			Measure of Effectiveness					
				Very Effective	Effective	Minimally Effective	Not Effective		

## 5 MEASURING ACTUAL COSTS AND BENEFITS

Once the State has approval to proceed with the selected alternative, measuring actual costs and benefits begins. The purpose of this requirement — in addition to complying with regulation — is to:

- Determine if predicted costs and benefits are being realized;
  - Identify unanticipated costs and benefits;
  - Calculate the effect of the actual costs and benefits — whether predicted or not — on the cost-effectiveness of the system design, development, and implementation; and
  - Enable management to take appropriate action.
- 

### 5.1 *Overview*

The purpose of the Cost/Benefit Analysis is to make a reasonable estimate of future events and provide a baseline against which to measure actual costs and benefits. Measurement provides the means to determine if the implementation remains cost-effective. Hence, the full value of the Cost/Benefit Analysis is not realized until the approach has been measured, monitored, and controlled by management and the solution is cost-effectively implemented.

### 5.2 *Objectives*

The purposes of monitoring actual costs and benefits are to:

- Comply with Federal regulations;
- Determine if actual costs and benefits are reasonably consistent with those predicted and if the system's projected savings are achieved;
- Calculate the effect of the actual costs and benefits on the cost-effectiveness of the system design, development, implementation, and operations; and
- Determine if corrective action is required.

A comparison of the actual figures to the projections enables the manager to determine if there are variances from expectations which warrant investigation. If costs are higher or benefits are lower than expected, the manager may decide a change is required.

This does not suggest that the State should consider scrapping the selected alternative in favor of another identified originally in the Cost/Benefit Analysis. After all, the circumstances would be quite different once system design had begun.

However, the State may determine, for example, that an unanticipated benefit is resulting in significant cost savings and will result in an earlier breakeven. Or the State may determine that developmental costs are escalating rapidly and require closer monitoring.

### 5.3 *Management Tool*

Just as the Cost/Benefit Analysis is a management tool, so is the measurement and monitoring of costs and benefit values. The

purpose is to assure that the goals and objectives of the project are achieved economically, efficiently, and effectively — and *in general as projected*.

To meet the monitoring requirements, costs and benefits — whether projected or unanticipated — need to be regularly evaluated. Yet, the purpose of identifying unanticipated or unrealized costs is not to level criticism at the original study or the analysts associated with it, but to develop for management a complete profile of actual costs. This enables management to take appropriate steps based on the circumstances of the day.

If necessary, corrective steps should be initiated by the State to keep the project on target, so that ACF is not required to intervene. The alternatives likely to arise from project reassessment include proceeding, stopping, downsizing, or redirecting.

#### **5.4 Identify All Costs**

As in the initial cost/benefit study, the first step is to identify all costs incurred (actuals) in the design, development, and implementation of the systems project and then to compare those cost categories to the costs projected for the project.

The Cost Measurement Worksheet on page 5-4 outlines the cost categories with columns for actual and projected. By this means, project managers and analysts can determine if any costs bear on the new system that were not anticipated and projected during the original analysis — or if any costs were projected that did not occur.

#### **5.5 Build the Cost Profile Year by Year**

Once all cost categories are identified, actual costs should be monitored and recorded. As in the cost/benefit analysis, worksheets are provided to record, total, and roll-up costs. Both the Annual Cost Measurement Worksheet (page 5-6) and the Systems Life Cost Measurement Profile worksheet (page 5-7) include spaces for recording:

- Total (actual or realized) costs,
- Total projected costs (from the Cost/Benefit Analysis), and
- The difference between them.

If actual costs are higher than projected costs, a positive number will result — the implementation is costing more than projected. If actual costs are less than projected costs, a negative number will result — the implementation is costing less than projected.

*Note that the Cost/Benefit Analysis document's present value figures are not used. Discounted costs — projected costs to which the present value factor has been applied — are of no use in monitoring actual costs.*

#### **5.6 Identify All Benefits**

Just as a reassessment is needed to list all incurred costs, each benefit being realized through the new system should also be identified. Then the accrued benefits should be compared against those projected for the project.

**Table 5-1: Cost Measurement Worksheet**

Non-Recurring Costs					
Cost Categories	Actl	Proj	Cost Categories	Actl	Proj
Site and Facility <ul style="list-style-type: none"> <li>• Purchase</li> <li>• Site Preparation/Modification</li> <li>• Other</li> </ul> Equipment Purchase/One Time Fees <ul style="list-style-type: none"> <li>• ADP</li> <li>• Data Communications</li> <li>• Environ. Conditioning</li> <li>• Security</li> <li>• Other</li> </ul> Shipping                     Installation                     Software Purchase/One Time Fees <ul style="list-style-type: none"> <li>• Operating System</li> <li>• Applications</li> <li>• Utilities</li> <li>• Other</li> </ul> System Testing                     Conversion <ul style="list-style-type: none"> <li>• Data</li> <li>• Software</li> <li>• Services</li> </ul>			Studies                     Procurement <ul style="list-style-type: none"> <li>• Cost of Planning</li> <li>• Cost of Conducting</li> </ul> Database Preparation                     Personnel <ul style="list-style-type: none"> <li>• Salaries</li> <li>• Benefits</li> <li>• Contract Support Services</li> <li>• Extraordinary Personnel Costs</li> </ul> Travel                     Training <ul style="list-style-type: none"> <li>• Development</li> <li>• Trainee Expenses</li> <li>• Trainer Expenses</li> </ul> Overhead / Indirect Costs <ul style="list-style-type: none"> <li>• Project and Technical</li> <li>• Management</li> <li>• Incremental</li> <li>• Lost Productivity</li> </ul>		
Recurring Costs					
Cost Categories	Actl	Proj	Cost Categories	Actl	Proj
Site and Facility <ul style="list-style-type: none"> <li>• Lease</li> <li>• Maintenance Fees</li> <li>• Other</li> </ul> Equipment Lease / Maintenance <ul style="list-style-type: none"> <li>• ADP</li> <li>• Data Communications</li> <li>• Environ. Conditioning</li> <li>• Security</li> <li>• Other</li> </ul> Software Lease / Maintenance <ul style="list-style-type: none"> <li>• Operating System</li> <li>• Applications</li> <li>• Utilities</li> <li>• Other</li> </ul>			Personnel <ul style="list-style-type: none"> <li>• Salaries</li> <li>• Benefits</li> </ul> Direct Support Services <ul style="list-style-type: none"> <li>• Contract</li> <li>• Detailed/Tasked</li> </ul> Travel                     Training                     Supplies                     Utilities                     Security <ul style="list-style-type: none"> <li>• Primary Facilities</li> <li>• Back-up Facilities</li> </ul> Overhead / Indirect costs		

The Benefit Profile Measurement Worksheet on page 5-8 outlines the benefit categories with columns for actual and projected. Project managers and analysts can determine if any benefits bear on the new system that were not anticipated and projected during the original analysis — or if benefits which were anticipated did not develop.

Again, the purpose of identifying unanticipated factors is not to level criticism at the original study or the analysts associated with it, but to develop for management a complete profile of actual benefits. It

could be that unanticipated benefits will result in a quicker breakeven or that unrealized benefits may require management action to attain them.

Although the purpose of the measurement and monitoring is directed primarily at quantitative factors, unanticipated intangible benefits may have developed that affect the management of the system. The more relevant data is available to management, the more effective management can be.

## **5.7 Build the Benefit Profile Year by Year**

Once all benefit categories are identified, actual benefit values should be monitored and recorded. As in the cost analysis, worksheets are provided to record, total, and roll-up values. For example, the Quantified Benefits Measurement Worksheets (pages 5-10 and 5-11) provide space to record the projected values for a benefit *and the actual or revised values*.

Note that these worksheets can be used anytime during design, development, or implementation. It may be that an assumption is proven wrong or circumstances change, affecting the actual or probable value to be derived from the benefit. The change can be recorded, the effect on the projected benefit value analyzed, and new calculations derived.

Both the Annual Benefits Measurement Worksheet and the Systems Life Benefits Measurement Profile (pages 5-12 and 5-13) include spaces for recording:

- Total (actual or realized) benefit values,
- Total projected benefits (from the Cost/Benefit Analysis), and
- The difference between them.

**Table 5-2: Annual Cost Measurement Worksheet**

Developmental or  Operational

Year \_\_\_\_\_

Cost Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
<b>Non-Recurring Costs:</b>													
Site and Facility													
Equipment Purchase & Fees													
Shipping													
Installation													
Software Purchase													
System Testing													
Conversion													
Studies													
Procurement													
Database Preparation													
Personnel													
Travel													
Training													
Overhead													
<b>Recurring Costs</b>													
Site and Facility													
Equip. Lease & Maintenance													
Software Lease & Maintenance													
Personnel Salaries/Benefits													
Direct Support Services													
Travel													
Training													
Supplies													
Utilities													
Security (incl. Back-up)													
Overhead													
<b>TOTAL COSTS (Actuals)</b>													
<b>TOTAL PROJECTED COSTS</b>													
<b>DIFFERENCE</b>													
<b>CUM. TOTAL COSTS / PRIOR</b>	N/A												
<b>CUMULATIVE TOTAL COSTS</b>													N/A

Table 5-3: Systems Life Cost Profile: by Program

Years \_\_\_\_\_ - \_\_\_\_\_

Cost Category	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	System Life Total
<b>Non-Recurring Costs:</b>									
Site and Facility									
Equipment Purchase & Fees									
Shipping									
Installation									
Software Purchase									
System Testing									
Conversion									
Studies									
Procurement									
Database Preparation									
Personnel									
Travel									
Training									
Overhead									
<b>Subtotal</b>									
<b>Recurring Costs</b>									
Site and Facility									
Equip. Lease & Maintenance									
Software Lease & Maintenance									
Personnel Salaries/Benefits									
Direct Support Services									
Travel									
Training									
Supplies									
Utilities									
Security (incl. Back-up)									
Overhead									
<b>Subtotal</b>									
<b>TOTAL COSTS (Actuals)</b>									
<b>TOTAL PROJECTED COSTS</b>									
<b>DIFFERENCE</b>									

Table 5-4: Benefit Profile Measurement Worksheet

<b>QUANTITATIVE</b>			
Category	Actual	Projected	Description
<b>COST / RESOURCE</b> <ul style="list-style-type: none"> <li>• Reduced Costs</li> <li>• Controlled Costs</li> <li>• Reduced Staffing</li> <li>• Improved Staffing Utilization</li> <li>• Increased Productivity</li> <li>• Fewer Manual Functions</li> <li>• Increased Resources</li> <li>• Other</li> </ul>			
<b>FUNCTIONAL/PROGRAMMATIC</b> <ul style="list-style-type: none"> <li>• Reduced Error Rate</li> <li>• Increased Collections</li> <li>• Improved Management Information</li> <li>• Improved Controls</li> <li>• Interface / Matching</li> <li>• Less Data Redundancy</li> <li>• Other</li> </ul>			
<b>TECHNICAL</b> <ul style="list-style-type: none"> <li>• Faster Record Retrieval</li> <li>• More Timely Reporting</li> <li>• Less Processing Time</li> <li>• Improved Access</li> <li>• Improved Security</li> <li>• Increased Automation</li> <li>• Other</li> </ul>			
<b>QUALITATIVE</b>			
Category	Actual	Projected	Description
<b>LEGISLATIVE</b>			
<b>SOCIO-POLITICAL</b> <ul style="list-style-type: none"> <li>• Integrated Benefits Automation</li> <li>• Improved Public Assistance</li> <li>• Increased Worker Satisfaction</li> <li>• Other</li> </ul>			
<b>FUNCTIONAL/PROGRAMMATIC</b> <ul style="list-style-type: none"> <li>• Improved Management Information</li> <li>• Improved Controls</li> <li>• Interface / Matching</li> <li>• Other</li> </ul>			
<b>TECHNICAL</b> <ul style="list-style-type: none"> <li>• More Timely Reporting</li> <li>• Expanded Capacity / Flexibility</li> <li>• Improved Access</li> <li>• Improved Security</li> <li>• Increased Automation</li> <li>• Other</li> </ul>			

If actual benefits are higher than projected benefits, a positive number will result — the implementation is delivering more value than projected. If actual benefits are less than projected benefits, a negative number will result — the implementation is delivering less value than projected.

*As before, the Cost/Benefit Analysis document's un-discounted, projected values are used. Present value figures are not used — discounted benefits are of no use in monitoring actual benefits.*

## **5.8 Compare the Cost/Benefits Achieved to those Projected**

The final worksheet, the Cost/Benefit Measurement Profile (page 5-14), has space for all relevant measures applying to the new system. It includes:

- System Life Cost Profile — which includes total non-recurring and recurring costs, total system life costs (actuals), total projected costs, and the difference between the actual and projected figures;
- System Life Benefits Profile — which includes total system life benefit values (actuals), total projected benefit values, and the difference between them;
- Cumulative Benefit / Cost Profiles — which accumulates the actual benefits and costs over the systems life; and
- Quantitative Measurement Profile — which includes the actual measures for net benefit (cost), benefit/cost ratio, and breakeven — and includes the projected measures for benefit/cost ratio and breakeven.

*[Note that the Cost/Benefit Analysis study's projected net benefit is not used because it is based on present value factors, not comparable to actual measures.]*

Table 5-5: Quantified Benefits Measurement Annual Worksheet

	<b>Annual Worksheet</b>	Year _____									
<b>BENEFIT CATEGORY / DESCRIPTION</b>											
<b>Benefit Number:</b>											
<b>Description:</b>											
<b>PROJECTED BENEFIT VALUE</b>											
<b>Assumptions:</b>											
<b>Numbers</b>	<b>Basis</b>	<b>Source</b>									
Projected Measure/Volume At Implementation:											
Projected Increase/Decrease Over Time:											
Projected Value at Implementation:											
<b>Projected Annual Benefits Profile</b>											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>ACTUAL OR REVISED BENEFIT VALUE</b>											
<b>Assumptions or Conditions:</b>											
<b>Numbers</b>	<b>Basis</b>	<b>Source</b>									
Actual Measure/Volume At Implementation:											
Actual or Revised Increase/Decrease:											
Initial Value at Implementation:											
<b>Annual Benefits Profile: <input type="checkbox"/> Actual or <input type="checkbox"/> Revised Projected</b>											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Table 5-6: Quantified Benefits Measurement: Systems Life Worksheet

<b>BENEFIT CATEGORY / DESCRIPTION</b>								
<b>Benefit Number:</b>								
<b>Description:</b>								
<b>PROJECTED BENEFIT VALUE</b>								
<b>Assumptions:</b>								
<b>Numbers</b>		<b>Basis</b>				<b>Source</b>		
Projected Measure/Volume At Implementation:								
Projected Increase/Decrease Over Time:								
Projected Value at Implementation:								
<b>Projected System Life Benefits Profile</b>								
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
<b>ACTUAL OR REVISED BENEFIT VALUE</b>								
<b>Assumptions or Conditions:</b>								
<b>Numbers</b>		<b>Basis</b>				<b>Source</b>		
Actual Measure/Volume At Implementation:								
Actual or Revised Increase/Decrease:								
Initial Value at Implementation:								
<b>Systems Life Benefits Profile: <input type="checkbox"/> Actual or <input type="checkbox"/> Revised Projected</b>								
Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total

Table 5-7: Annual Benefits Measurement Worksheet

Year \_\_\_\_\_

Benefit Number and Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Benefit 1: Short Description													
Benefit 2: Short Description													
Benefit 3: Short Description													
etc.													
<b>TOTAL BENEFIT VALUE (Actuals)</b>													
<b>TOTAL PROJECTED BENEFITS</b>													
<b>DIFFERENCE</b>													
<b>CUM. TOTAL BENEFITS / PRIOR YEAR</b>	N/A												
<b>CUMULATIVE TOTAL BENEFITS</b>													N/A

Table 5-8: Systems Life Benefits Measurement Profile

Years \_\_\_\_\_

Benefit Number and Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Benefit 1: Short Description									
Benefit 2: Short Description									
Benefit 3: Short Description									
Etc.									
<b>TOTAL SYSTEM LIFE BENEFITS (Actuals)</b>									
<b>TOTAL PROJECTED BENEFITS</b>									
<b>DIFFERENCE</b>									

Table 5-9: Cost / Benefit Measurement Profile

<b>SYSTEM LIFE COST PROFILE</b>									
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Non-Recurring Costs *									
Recurring Costs *									
Total System Life Costs *									
Total Projected Costs									
Difference									
<b>SYSTEM LIFE BENEFITS PROFILE</b>									
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Total Benefit Values *									
Total Projected Benefits									
Difference									
<b>CUMULATIVE BENEFIT / COST PROFILE</b>									
Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Total
Cumulative Benefit Values *									N/A
Cumulative Costs *									N/A
<b>QUANTITATIVE MEASUREMENT PROFILE</b>									
Description	Actual					Projected			
Total Benefits *						N/A			
Less Total Costs *						N/A			
Net Benefit (Cost) *						N/A			
Benefit/Cost Ratio									
Breakeven									

\* Actuals

## **APPENDIX A: REFERENCES**

- A Guide for Requirements Analysis and Analysis of Alternatives. U.S. General Services Administration, Information Resources Management Service. January 1990.
- A Project Manager's Guide to Benefit/Cost Analysis of Information Technology Investments. U.S. Department of the Interior, Office of Information Resources Management. January 1989.
- AAPIRS Guide: Title IV-A Statewide Automated Application Processing and Information Retrieval System Guide. U.S. Department of Health and Human Services / Social Security Administration. Revised July 1, 1983.
- Analysis of Benefits and Costs (ABC's) Guideline: Volume 1: A Manager's Guide to Analysis of Benefits and Costs. U.S. Department of Energy, Office of the Assistant Secretary for Management and Administration. June 1988.
- Analysis of Benefits and Costs (ABC's) Guideline: Volume 2: An Analyst's Handbook for Analysis of Benefits and Costs. U.S. Department of Energy, Office of the Assistant Secretary for Management and Administration. June 1988.
- Automated Systems for Child Support Enforcement: A Guide for States Seeking Enhanced Funding. U.S. Department of Health and Human Services, Office of Child Support Enforcement. Revised July 1987.
- Benefits/Cost Analysis Guideline: A Manager's Guide to Benefit/Cost Analysis. U.S. Department of Commerce, Office of the Secretary. September 1991.
- DHHS Information Systems Life Cycle Management Guidance. U.S. Department of Health and Human Services. (Draft prepared by Synectics for Management Decisions, Inc., March 1991.)
- Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase. U.S. Department of Commerce, National Bureau of Standards, FIPS PUB 64. August 1, 1979.
- Information Systems Review Guide. U.S. Department of Health and Human Services, Administration for Children and Families. (Draft prepared by Synectics for Management Decisions, Inc., November 1991.)
- Requirements Analysis and Analysis of Alternatives for Acquisition of FIP Resources. U.S. Department of Health and Human Services, Office of Information Resources Management. June 1991.

## APPENDIX B: GLOSSARY

- Adjusted costs** — Costs that increase over time, tied (for example) to contractual obligations or to approved cost-of-living adjustments.
- Alternatives** — The different courses of action, means, or methods by which objectives may be attained.
- Alternatives analysis** — An analysis which considers the alternatives available for automation, such as transferring another State's system or enhancing an existing system. Sometimes included as part of the feasibility study.
- Assumptions** — Judgements concerning unknown factors and the future which are made in analyzing alternative courses of action. Assumptions are made to support and reasonably limit the scope of the analysis.
- Base Year** — The time period used to determine the base for dollar calculations — normally the first year of the analysis.
- Baseline** — A term used to describe (1) use of status quo costs and benefits as a basis for developing costs and benefits for alternatives during the cost/benefit analysis and, *more importantly*, (2) *use of costs and benefits projected for the selected alternative during the cost/benefit analysis as a basis for comparing actual costs and benefits during cost/benefit measurement*. When using the term "baseline," ACF normally means the selected alternative's projected costs and benefits used in cost/benefit measurement.
- Benefits** — Quantitative and qualitative improvements expected or resulting from a systems investment.
- Benefit/cost ratio** — An economic indicator of cost-effectiveness, computed by dividing present value benefits by present value costs. Indicates the amount of benefits returned for each dollar invested.
- Breakeven analysis** — A procedure for evaluating alternatives to determine when cumulative benefits will equal cumulative costs. (Projected, not present value, costs are used.)
- Breakeven point** — The point in time at which non-discounted, cumulative costs and non-discounted, cumulative benefits are equal.
- Comparison** — A method of quantifying costs or benefits in which current costs or benefits on comparable systems are used as a baseline for the new system.
- Constant Dollars** — Dollars which reflect the prices of the base year of the systems life. Constant dollars do not consider the effect of inflation and are normally used in cost/benefit analysis. Constant dollars are always associated with a base year — such as, Fiscal Year 1994 constant dollars — normally the first year of the analysis. (Constant dollars are sometimes referred to as *real dollars*.)
- Constraints** — Constraints are factors that lie outside — but have a direct impact on — the system design effort. Constraints may relate to laws and regulations or technological, socio-political, financial, or operational factors.
- Cost Avoidance** — Benefits realized by avoiding a relatively certain future expenditure, although the projected expenditure has not been budgeted or obligated. Cost avoidance is more speculative than cost savings and requires more rigorous justification.

- Cost Savings** — Benefits realized by eliminating a planned expenditure, such as a budgeted or contractual expense.
- Cost-beneficial** and **Cost-effective** — Descriptors for alternatives that effectively balance costs and benefits, delivering maximum benefits for the investment costs.
- Cost/Benefit Analysis** — Detailed evaluation of the costs and benefits of selected alternatives identified during the alternatives analysis. Includes costs of current and projected operations as a baseline for (1) determining which alternative to select for automation *and* (2) measuring costs and benefits of the implemented and operational system over time. Costs are normally expressed in dollars, but benefits may be expressed in dollars or in other quantitative (such as time reduction) or qualitative (such as improved security) measures. Cost/benefit analysis determines the most cost-effective solution, not simply the least cost solution. Can be included as part of the Feasibility Study or Alternatives Analysis — or stand as a separate document.
- Cost/Benefit Measurement** — Measurement of costs and benefits of the implemented and operational system over time *and comparison of actuals to those projected for the chosen alternative during the cost/benefit analysis.*
- Current Dollars** — Dollars which have been adjusted to reflect the effect of inflation on prices. Current dollars are normally used in budget projections. (Current dollars are sometimes referred to as *nominal dollars.*)
- Discount Factor** — The multiplication factor that converts a projected cost or benefit in a future year into its present value. Discount factors are computed based on the selected discount rate. Mathematically, a discount factor is equal to  $1/(1 + r)^n$ , where  $r$  is the discount rate and  $n$  is the number of years since the base year.
- Discount Rate** — A rate used to relate present and future dollars. Discount rates are expressed as a percentage and are used to reduce the value of future dollars in relation to present dollars. This equalizes varying streams of costs and benefits, so that different alternatives can be compared. Discount rates reflect the time value of money.
- Discounted Costs or Benefits** — Future years' costs or benefits that have been multiplied by a discount factor to convert them to their present value — also called present value costs or benefits.
- Double Counting** — An error which occurs when costs or benefits are counted twice.
- Estimation** — A method of quantifying costs or benefits, in which each organization involved in system development, operation, and use estimates, averages, and projects its costs. Sometimes referred to as the bottom-up method.
- Feasibility Study** — A preliminary study to determine (1) whether it is sufficiently probable that effective and efficient use of ADP equipment or systems can be made to warrant the substantial investment of staff, time, and money being requested and (2) whether the plan is capable of being accomplished successfully.
- Fixed cost** — Costs that do not vary over time.
- Inflation** — A persistent rise in the general level of prices over time.
- Investment** — An expenditure of funds to acquire a new capability or capacity.
- Life Cycle** — The time from the beginning of the systems project to the replacement of the system. This includes the time that the system will be operational as well as the time needed to develop and implement the system.

- Life Cycle Cost** — The total cost of acquisition and ownership of a system over its full life, including the cost of planning, development, acquisition, operation, support, and disposal.
- Net Benefit or Cost** — The result of subtracting the total present value costs from the total present value benefits. Where benefits exceed costs, the result is a positive number, referred to as a net benefit. Where costs exceed benefits, the result is a negative number, referred to as a net cost. See also *net present value*.
- Net Present Value** — The result of subtracting the total present value costs from the total present value benefits. Also referred to as net benefit or net cost.
- Nominal Dollars** — A synonym for *current dollars*.
- Non-recurring Costs** — Costs that occur on a one-time basis — distinguished from recurring costs. Non-recurring costs are often capital expenditures.
- Objectives** — Goals, results, or program improvements that the decision-maker wants to attain. Objectives should be independent of the solution and stated in a manner that does not preclude alternative approaches.
- Observation** — A method of quantifying costs or benefits in which processes are measured and recorded to provide estimates.
- Present Value** — The estimated current worth of future benefits or costs — derived by discounting the future values using a selected discount rate and factor.
- Real Dollars** — A synonym for *constant dollars*.
- Realized Benefits** — A benefit that has occurred. If benefits resulted prior to the new project, they are *not* considered in the cost/benefit analysis. (See also *Sunk Costs*.) Benefits realized *after* new project implementation *are* counted during cost/benefit measurement.
- Recurring Costs** — Those costs which are continuing costs based on the operation of a present or proposed system. Recurring costs apply over a range of time — either months or throughout the systems life.
- Sensitivity Analysis** — A technique of assessing the extent to which changes in assumptions or input variables will affect the ranking of alternatives.
- Simulation** — A method of quantifying costs or benefits in which the process is analyzed and simulated to obtain costs.
- Sunk Costs** — A non-recoverable cost expended prior to the start of the project. Because sunk costs have been irrevocably expended or committed, they are not considered in the cost/benefit analysis. (See also *Realized Benefits*.)
- Systems Life** — The time required to plan, design, acquire, and implement the system *plus* its operational life.
- 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 interest costs.
- Undiscounted Costs or Benefits** — Future years' costs or benefits that have *not* been multiplied by a discount factor to convert them to their present value — in other words, projected costs or benefits.
- Variable Costs** — Costs that are volume sensitive: for example, charges for computer services are often volume sensitive.

## APPENDIX C: EVALUATION, COMMENTS, AND SUGGESTIONS

### Evaluation, Comments, and Suggestions

This Appendix contains a form to use when evaluating, commenting on, and making suggestions about this guide.

This optional guide was developed to support State and ACF professionals in the development, review, and approval of feasibility studies, alternatives analyses, and cost/benefit analyses.

Comments were requested and received from both ACF central and regional office staff and were incorporated, wherever possible, in this guide. Yet, the true test of any manual is how well it supports analysts in the performance of their assigned tasks and whether it remains relevant and useful. In this sense, the final test of this guide by the ultimate users — the States — remains.

This guide seeks to establish a standard analytical approach, develop a framework for analysis and documentation, and provide worksheets to support the State during analysis and comparison of alternatives. Even with these aids, we do not underestimate the difficulty of the analysis, judgement, and determinations required of the individuals conducting feasibility, alternatives, and cost/benefit analyses. However, this guide does not attempt to provide a "cookbook" approach or a set of solutions. Although use of this guide is encouraged — to ease and expedite Federal review and approval — the guide is not mandatory.

ACF welcomes suggestions from those using this guide. An *Evaluation, Comments, and Suggestions* form is included at the right. This form or any other written comments may be sent to:

Department of Health and Human Services  
Administration for Children and Families  
Director, Office of Information Systems Management  
370 L'Enfant Promenade, SW  
Washington, DC 20447-0001

## Feasibility, Alternatives, and Cost/Benefit Analysis Evaluation, Comments, and Suggestions

Questions	Excellent	Very Good	Good	Poor
How do you rate this Guide overall?				
In terms of clarity?				
Organization?				
Usability?				
Contents?				
Length?				
How can this Guide be improved?				
What should be added?				
What should be deleted?				

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