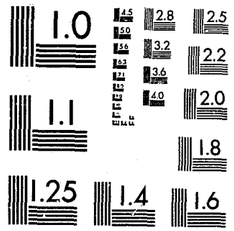

CR. Int
7-14-83

COST-BENEFIT METHODOLOGY FOR EVALUATION OF STATE JUDICIAL INFORMATION SYSTEMS

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A Program of the
Systems Division
National Criminal Justice
Information and Statistics Service
Law Enforcement Assistance Administration
U.S. Department of Justice

NATIONAL CENTER FOR STATE COURTS
State Judicial Information Systems Project

1979

This project was supported by Federal Grant No. 78-SS-AX-007 awarded to the National Center for State Courts, Williamsburg, Virginia, by the Systems Division, National Criminal Justice Information and Statistics Service, Law Enforcement Assistance Administration, U.S. Department of Justice, under the Omnibus Crime Control and Safe Streets Act of 1968, as amended. The State Judicial Information Systems Project is directed by Lynn A. Jensen for the National Center for State Courts and monitored by Arthur H. Fuldner, Jr., for LEAA. Points of view or opinions stated in this document are those of the author and do not necessarily represent the official position or policies of the U.S. Department of Justice.

ISBN 0-89656-033-3
National Center Publication No. F0002

Library of Congress Cataloging in Publication Data
National Center for State Courts. State Judicial Information Systems Project.
Cost-benefit methodology for evaluation of state judicial information systems.

Includes index.
1. Information storage and retrieval systems--Court administration--United States--States--Cost effectiveness. 2. Information storage and retrieval systems--Criminal justice, Administration of--United States--States--Cost effectiveness. I. Title.
KF242.C69N38 029'.9'347731 79-16280

As chairman of the Executive Committee of the State Judicial Information Systems (SJIS) project, and a participant in this project since its inception, I feel that the recently completed fourth phase has been a highly productive one. Typical of the accomplishments of the current SJIS effort is this cost-benefit methodology report. The document will provide state court administrators and their systems personnel with a guide to conducting effective cost-benefit analyses during the systems design and selection procedure.

Most importantly, I would point out that the SJIS project has now been expanded to include all fifty states, the District of Columbia, and the territories of the United States. In addition, the Conference of State Court Administrators has agreed to assume joint policy guidance and control of the project in cooperation with the National Center for State Courts. These two developments attest to the effectiveness of six years of effort and bode well for even greater impact as the program expands to many more of the state court systems.

The completion of this most recent phase of the project has been possible only because of the exceptionally hard work and cooperative spirit of the members of both the National Center's SJIS project staff and the SJIS project committee. All participants very unselfishly donated a great deal of their toil and time.

Larry P. Polansky

Larry P. Polansky
Chairman, Executive Committee
State Judicial Information Systems Project

The Conference of State Court Administrators (COSCA) has recently given its support to the State Judicial Information Systems (SJIS) program to ensure its continued success and to further its long-term goals and objectives. The SJIS program was made a cooperative effort of COSCA and the National Center for State Courts (NCSC) by giving both policy control and direction of the program to an advisory committee of state court administrators appointed by the chairman of COSCA.

During the past year the National Center staff produced this cost-benefit methodology report, which contains a set of procedures that will assist state court personnel to develop and conduct their own well-defined analyses. This added analytical capability will increase the probability that all relevant costs and benefits are fully considered during SJIS system selection procedures.

For state court administrators, the SJIS project has provided a viable source of information and technical expertise that has enhanced statewide information system development. It is expected that the effectiveness of this assistance will greatly increase with the expanded role of COSCA.

Walter J. Kane

Walter J. Kane
Chairman
Conference of State Court Administrators

This Cost-Benefit Methodology for Evaluation of State Judicial Information Systems report is one of four major documents produced by the National Center for State Courts as part of Phase IV of the State Judicial Information Systems (SJIS) project to assist the state judiciaries in their efforts to develop operational statewide information systems.

The report is intended to be a working document to help the individual states conduct cost-benefit analyses by providing guidelines and methodologies for doing these analyses. The document sharpens the focus on the major costs and benefits that are a factor in information system selection, and illustrates the use of these guidelines through the presentation of several thorough case studies.

Through the cooperative efforts of the SJIS project committee and most recently the Conference of State Court Administrators, I feel another major step towards establishing operational information systems within the state courts has been achieved.

The value of the positive control that the state judiciaries can exercise through COSCA towards the continued efforts of this project is self-evident and will be readily recognizable by the reader of this comprehensive document.

Edward B. McConnell

Edward B. McConnell
Director
National Center for State Courts

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NATIONAL CENTER FOR STATE COURTS
BOARD OF DIRECTORS

ACKNOWLEDGMENTS

This report was prepared by the SJIS project staff at the National Center for State Courts with the assistance of the Cost-Benefit/Long Range Plan Subcommittee of the overall SJIS advisory committee. The contributions and advice of the Subcommittee were invaluable in this effort. The Subcommittee consisted of

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Honorable Arthur G. Christean
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In addition, others assisted greatly by reviewing the report and providing constructive suggestions for its improvement. These people, whose assistance is deeply appreciated, include

Edward B. McConnell, Director, National Center for State Courts

Stephen G. Buckles, Assistant Professor, Department of Economics, University of Missouri

Phillip B. Winberry, State Court Administrator, Washington

Dr. Buckles rendered a valuable contribution by developing one of the case studies presented in the first appendix.

Preface

The need to use cost-benefit analyses in the selection of manual or automated systems has grown steadily in recent years. A major reason for this is a continuing trend toward centralized collection and use of management information. The result has been complex management systems with widespread organizational, operational, and financial implications. In selecting systems of such significance, it is important to evaluate accurately the tradeoffs between costs and benefits. Such evaluations are impossible without specific analytical techniques.

Within the past ten years, state judiciaries have joined this move toward centralization by their increasing use of computers to provide management information. The need for cost-benefit analyses has been recognized by several state judiciaries, but they represent only a fraction of the states that might find such analyses helpful. It is suspected that many states have avoided cost-benefit analyses because they are unaware of the importance of the information that results from these analyses and also because they are unsure of the basic analytical procedures.

The purpose of this document is to set forth basic methodology for doing cost-benefit analyses in a courts environment. It is intended to be a working document with emphasis on step-by-step procedures rather than theory.

This document addresses the needs of both the managers in the judiciary (e.g., court administrators) and the analysts who actually perform the analysis. Managers can obtain a summary of this document--including its contents, the use of cost-benefit analyses in the courts, and the methodology--by reading the introductory and management overview sections (Sections I and II). This summary material will also be useful to analysts because it sets the stage for the more detailed discussions of assumptions and system alternatives on which the cost-benefit analysis is based (Section III), the actual cost-benefit methodology (Section IV), and conclusions (Section V). These latter three sections are the focal points of the methodology that will be used by the analysts.

A direct, pragmatic linkage between the methodology and the courts is given in Appendix A, which contains three case studies of cost-benefit analyses conducted in courts environments.

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Section I

Introduction

Overview

The National Center for State Courts (NCSC) is providing coordination and staff support in Phase IV of the State Judicial Information System (SJIS) project. SJIS is a project funded by the Law Enforcement Assistance Administration (LEAA), whereby 23 participating states receive individual grants to develop statewide judicial information systems.

It is apparent that such systems are needed to provide, as a minimum, statewide statistics on caseloads in state courts and, in some situations, operational support for individual courts and statewide administrative support in such areas as personnel and finance. The systems can be manual or automated, although within the SJIS project most of them will be automated.

The SJIS project was initiated by LEAA in 1973 to promote development of state judicial information systems and to provide the judiciary with generated data elements of the Offender-Based Transaction Statistics (OBTS) system and the Computerized Criminal History (CCH) file, both part of the ongoing LEAA Comprehensive Data Systems (CDS) program.

Since 1973, most of the 23 states have received limited funding (a maximum of $200,000 per grant period) to assist in the development of their SJIS projects. Each state that received an initial $200,000 has been guaranteed a follow-up grant of $200,000 to continue its SJIS development effort. Concurrently with this funding for states, LEAA also provided SJIS funding to the Institute for Judicial Administration and SEARCH Group, Incorporated, to accomplish the following broad goals:

—Establish the minimum judicial data elements required for state-level court administration, trial court

management, and research and planning in both criminal and civil areas of law.
—Design a conceptual model for collecting, analyzing, and reporting judicial information and statistics that could be implemented on a manual or an automated basis.
—Develop requirements and functional design specifications for implementation of the model in several states to provide judicial data to the OBTS/CCH modules of the CDS program.

Accomplishments of Phases I-III

The first three phases of the SJIS project:

—Surveyed and documented the state of the art of state judicial information and statistics systems.
—Established the state-level judicial administration information requirements for criminal, civil, juvenile, and appellate court data, and for personnel and financial data.
—Completed the functional system design of a model SJIS that satisfies the aforementioned information requirements as well as the requirements for judicial criminal data specified in the NCIC/CCH working manual and SEARCH Technical Report No. 4 (OBTS).
—Reviewed the grant applications and workplans of over 19 states to develop and implement, on some basis, a state-level judicial information system.
—Developed an SJIS data utilization package for state-level judicial administration.
—Conducted an SJIS data utilization workshop for technical and administrative practitioners in the field of state-level judicial administration.
—Developed documentation requirements for state-level judicial information system transfer.
—Assisted two identified states (Oregon and Missouri) in meeting the documentation requirements.
—Conducted a series of on-site assessments in those participating states where SJIS development had progressed enough for an evaluation to be worthwhile.
—Conducted a series of SJIS assessment meetings to assess the remaining SJIS projects which were not developed enough to warrant an onsite visit.

Phase IV SJIS Aims and Objectives

The current SJIS project is designed to continue to assist the state courts in developing state judicial information systems. Specifically, the project aims to meet the following objectives:

—Assessment: Assess the development of participating states to assist with problems, to ensure compatibility with required data elements, to enhance the accuracy and completeness of data, and to generate information of value for transfer to other courts.

—Technology Transfer: Encourage the initiation of technology transfer between the participating and non-participating project states through (a) the development of an extensive SJIS State of the Art Report 1978 that documents the state of existing SJIS technology and development, and (b) dissemination of this information through the establishment of a judicial information system clearinghouse capability within the NCSC.

—Special Deliverables: Prepare a long-range national plan for coordinating the development and implementation of SJIS; reexamine the need for court-supplied data elements to OBTS/CCH; conduct a preliminary assessment of the compatibility of the Prosecutor's Management Information System (PROMIS) with SJIS; and develop a preliminary cost-benefit methodology suitable for use in evaluating an SJIS.

—Technical Assistance: Provide limited technical assistance to all states to encourage and to facilitate development and implementation of SJIS.

—Coordination: Work closely with other projects to benefit from work already completed and to prevent duplication of efforts.

—Information Transfer: Encourage information transfer activities between the participating and non-participating project states through periodic newsletters in the NCSC Report, through technical assistance, and through dissemination of the four major reports developed under the Special Deliverables section.

—Grant Review: Review applications from SJIS states for LEAA funding.

Cost-Benefit Task

The Phase IV task to develop methodology that will assist state judicial departments to effectively perform cost-benefit analyses is documented herein.

The purpose of a cost-benefit analysis is to relate costs and benefits in a manner that helps explain the choice of a specific manual or automated system. Such an analysis should be conducted prior to system selection because it is needed as a basis for selecting from among two or more system approaches. One of the approaches under consideration will usually be the manual or automated system that is currently in operation.

The analysis should be updated after the selected system has become operational to check the previously determined costs and benefits and to provide a basis for any adjustments that may be necessary.

A cost-benefit analysis must be realistic, and it must not be done simply to justify a decision that has already been made. While the analysis may not be the final determinant in system selection, it is one of the major factors (along with functional and operational requirements, political considerations, structure of state court system, availability of funding, etc.) in this selection process.

Development of a cost-benefit analysis is directly related to planning, since a true evaluation of costs and benefits can only be made relative to the anticipated system life span. It is important for personnel involved in selecting and using the system (i.e., judges, administrators, data processing managers) to participate in the analysis, be aware of and support its results, be able to discern whether these results are positive or negative in terms of the system approaches under consideration, and be apprised of whether the implemented system is performing according to the predictions in the cost-benefit analysis. The analysis should, in summary, be a working document based on reality.

The above requirements imply that the cost-benefit analysis should have the following characteristics:

—All initial conditions, assumptions, steps, and conclusions in the analysis should be clearly, but concisely, described so that prospective readers will know how the conclusions were developed and what the conclusions mean.

—The analytical techniques that are used should be as simple as possible within the constraint that they be of sufficient sophistication to accommodate costs and benefits in the given judicial environment.

—The terminology that is used should be straightforward, well-defined wherever necessary, and consistent.

Cost-Benefit Background

Some state judicial departments have conducted cost-benefit analyses to justify implementation of automated systems or portions thereof. There has been considerable variation in the motivation, level of detail, and usefulness of these analyses.

The most common approach has been to analyze the costs and benefits of a proposed automated system relative to the current manual system. Costs have been computed for the manual system using cost items (e.g., personnel paygrades, courtrooms, documents produced), unit cost for each item type, and number of items. Costs for the automated system have then been derived from the manual system costs by estimating the amount of savings for each cost item. Other than those directly attributable to cost savings in the aforementioned cost computations, benefits have usually not been related to costs because they usually could not be expressed in the same units as costs (e.g., dollars). Any coverage of these benefits has usually been restricted to textual descriptions.

A major problem with many of these analyses is that they do not clearly set forth the steps that were followed in arriving at the conclusions. Also, in many cases, it is unclear how cost and benefit projections over the system life span have been used in the analysis.

Approach Used in this Report

This document sets forth cost-benefit methodology with the intent of providing a framework that an individual state can adapt to its needs. Since the same basic techniques have been used by states in the past to compute costs and describe benefits, and since these techniques are valid in most cases, the approach to developing the methodology is to:

—Use the basic techniques currently employed.

—Provide detailed guidelines for clearly and systematically describing the conditions, assumptions, steps, and conclusions that accompany usage of these techniques.

—Emphasize close coordination between cost-benefit analyses and planned utilization of the system over its life span.

—Indicate methods for integrating the results of analyses of costs and benefits.

It is recognized that, within the context of the SJIS project, cost-benefit analyses are most often used in situations where a manual system is operational and alternate automated systems are being considered. Examples throughout the report are oriented to this situation. The reader should, however, note that other situations can occur. For example, viable alternate systems may be manual or a combination of manual and automated. Or the operational system may be an automated system. The methodology set forth in this report applies to all of these situations.

Content

The document consists of five sections:

Section I.	Introduction.	
Section II.	Management Overview:	Describes basic concepts of courts environment in which cost-benefit analyses are conducted, and terminology and methodology used in cost-benefit analyses.
Section III.	Assumptions and System Alternatives:	Describes types of assumptions and possible system alternatives on which cost-benefit analyses are based.
Section IV.	Methodology:	Sets forth the recommended methodology for use in cost-benefit analyses. This includes the mathematical basis for combining costs and benefits and interpreting the combined results, the actual methodology for cost computations, methodology for describing benefits, and methodology for combining costs and benefits.
Section V.	Conclusions:	Describes general methods for interpreting results of cost-benefit analyses and for appraisal of realistic operational impacts based on results of these analyses.

In addition there are two appendices. The first presents case studies of hypothetical situations to illustrate usage of the alternatives, methodology, and conclusions described in sections III, IV, and V. The second gives references to relevant documents including reports from states that have conducted cost-benefit analyses and other material that presents various approaches to these analyses.

Section II

Management Overview

Introduction

There are certain concepts that pertain to cost-benefit analyses in general and to the methodology set forth in this document in particular. They are described in this section. The concepts and associated terminology are explicitly or implicitly used in remaining sections of this document. They should also provide assistance in reading other cost-benefit documents.

The intent of this section is to give managers a summary of the considerations that pertain to cost-benefit analyses and an overview of the approach to conducting these analyses. It also gives analysts an introduction to the more detailed material that follows.

Cost-Benefit Analysis in the Courts

Even though many aspects of the cost-benefit methodology could apply to general situations, it is necessary to place the methodology in the context of the courts environment whenever possible. The intent of the next few paragraphs is to provide a courts perspective to the material that will be presented in the remaining sections of this document. A more detailed linkage between the methodology and the courts is given in the three case studies in Appendix A.

Need for Cost-Benefit Analysis

The trend towards centralized state-level court administration is a relatively recent development in many states. The structure of state court systems and, therefore, the extent

of centralized administration (i.e., management) vary from state to state. This variation extends to the types of courts that are under centralized control and the types of management functions (e.g., assignment of judges, assignment of other court personnel, allocation of other resources) that are exercised centrally.

In order to manage effectively at any level, accurate and timely information is needed on court caseloads and resources. This will ideally permit assignment of resources based on activity in specific courts as indicated by the volumes and types of caseloads. In most states with central courts administration, the following problems make it difficult to obtain the needed information:

—Nonstandard Caseload Reporting: Caseload data are often reported in a manner that makes them difficult to correlate and combine into statewide statistics.

—Volume and Diversity of Caseload Data: In most states the high volume and the variation of caseload data make it impossible to economically group these data and produce meaningful management reports at the state level.

To at least partially alleviate these problems, many states have instituted standard recordkeeping and reporting procedures throughout their court systems; and they have turned to computers to help process the data and produce meaningful reports. Those that are using computers have found that recordkeeping and reporting, even if they had not been previously standardized, did become standardized (along with almost everything else related to the computer) as a by-product of using the computer.

Adapting a set of procedures to a computer is an extremely complex undertaking that involves decisions on how to obtain necessary computer facilities; how to develop a computer system that will accept data and produce reports in a manner that best accommodates the needs of the state court administrative office, the courts, and other system users; and how to implement the computer system for these users.

These decisions have great impact when they involve a computer system that will affect courts throughout an entire system over an extended period of time. The procedural and organizational structure brought by automation, moreover, will not be easily modified because of the inherent difficulty in changing a computer system.

A cost-benefit analysis will assist in making these decisions because it identifies and relates the costs and benefits of the alternative computer approaches that will

accomplish the needed processing. Among the other factors that may influence the decisions are political considerations, functional and operational requirements, the availability of funding, and the structure of the state court system. Even though, in many situations, the cost-benefit analysis may not be the major factor in the overall decision, the information obtained from such an analysis will help in making what is usually an important and far-reaching decision.

While cost-benefit analyses in the state courts are most often used to investigate various computer alternatives along with existing manual procedures, the analyses are equally applicable to a group of alternative manual procedures or to a combination of manual and automated alternatives.

Success in a Courts Environment

In order for a manual or automated system to be successful, it must be supported by all users and other involved personnel. This is especially true of an automated system because it normally represents a substantial change in existing procedures. It also represents a large and sometimes frightening unknown to many people who will be involved with the system.

Involved People and Groups. In a court environment, the people involved with the system include clerical personnel in various types of courts and in the state court administrative offices, who supply data to the system. Also included are system users such as court clerks, judges and justices, local court and adminitrative office management personnel, and any others who use system reports (e.g., justices of the peace, quasi-judicial officers).

Others who are heavily involved with the system are those in the judicial branch who have authority over all state court activities. This includes the chief justice as well as the judicial council and equivalent groups. It is important to note that many of these people may also be system users, but the involvement noted here refers to their functions as overseers of state court activities.

Additional involved groups may include state legislators and planners, who fund and approve the system, and executive branch personnel, who may run the system on their computer.

Continuing Contact. A major factor in gaining the support of the disparate people and groups who are involved in the system is to have continuing contact with them throughout the system approval and development process. This should be followed by periodic contact when the system becomes operational.

Continuing contact will accomplish two things: First, it will permit a thorough appraisal of what those involved with the system want it to accomplish; second, it will permit them to be apprised of what computers in general and the system in particular can and cannot accomplish. This will promote mutual understanding and minimize the chance of surprises and disappointments when the system becomes operational.

What does continuing contact mean? For the users it means frequent, sometimes daily, contact to identify their requirements and ensure that the developing system meets their needs. For the chief justice it means considerably less frequent contact, although it should be ensured that he/she is as aware of how the system is progressing as he/she needs to be and wants to be. Other people and groups should also be involved in accordance with their needs and desires.

Adherence to Constraints. While the contacts described above are necessary in order for the system to be successful, they will be wasted unless an operational system is produced that meets the functional expectations and is consistent with prevailing conditions in the state court system. This is an illustration of the old cliche that "actions speak louder than words" (although both "actions" and "words" are needed in this instance).

In developing and implementing a computer system, it is obvious that the system should meet the functional requirements to the maximum extent possible. A much more subtle requirement is that it conform to various conditions in the state. These conditions define the environment in which the system must function, and they can impose severe constraints on the overall system or on specific parts of the system approval and development process. These constraints are most likely to involve the following:

—Funding: The system must be planned in accordance with the amount of funding that will be available and the times when this funding will be available. Plans for funding must be coordinated among various funding sources (e.g., state, local, federal) so that adequate funding is available throughout the system life span.

—Court System Structure and Dynamics: This relates to the level within the state courts at which a system can be effectively implemented and operated. It is a particularly strong consideration when the system is automated because of the centralized control that accompanies such a system. The question becomes twofold: To what extent do those who control the state judiciary

(e.g., the judicial council, state court administrator) have statutory power to impose the system? To what extent can they actually exercise this power?

—Operational Procedures: In most situations, the system must achieve a balance between operational requirements at the state and local levels.

It is essential that the cost-benefit analysis allow for constraints such as these, primarily by establishing processing alternatives that are truly viable and by realistically evaluating costs and benefits. For example, suppose a possible processing alternative is to install a distributed processing network with remote minicomputers used for both local trial court processing and for accumulation of statistics that will be periodically sent to a central computer for state-level processing. Suppose further that, because of the trial court processing, part of the cost of procuring and operating the minicomputers will come from the individual trial court budgets. If the budgets cannot accommodate this expense, and if budget modifications are impossible, then this is not a viable alternative despite its technical appeal. Other alternatives must be developed that are consistent with the local budgets.

Another example is a situation in which key personnel in several trial courts refuse to accept an automated system. Typically, many trial court personnel are elected or appointed locally (and therefore immune to centralized control) and are entrenched in existing procedures. In this situation, any processing approach that includes statewide implementation at the outset of the operational life of the system is unrealistic. A better approach is to implement the system gradually, with the courts in question coming last on the list. This is done with the hope that, by the time the system is scheduled for implementation in these courts, the recalcitrant personnel will have either retired or the system will be such a resounding success that they will accept it.

Interactions During the Cost-Benefit Analysis. The initial cost-benefit analysis is part of the system approval process, and it relates directly to the analysis that is done to establish system processing requirements. If the requirements analysis is done properly, extensive interaction with system users will have taken place.

In the cost-benefit analysis, the orientation is toward local court and state-level managers to identify the applicable constraints, to establish viable automated and manual approaches that are within the constraints mentioned above and that meet the processing requirements, and to associate realistic

costs and benefits with each approach. This necessitates contact with the chief justice and judicial council; with local court judges, clerks, and administrators; with state court administrative managers; and possibly with other approval and funding bodies (e.g., state legislators and planners).

Upon completion of the initial cost-benefit analysis, it should be presented separately to each group. Although each will be interested in the overall costs and benefits of the system, each will want to concentrate on different specific information from the analysis.

To the local court judges, clerks, and administrators, the results of the analysis should be described primarily in terms of the benefits they will derive in return for their expenditures in money and effort. This may be difficult, because state-level statistical reporting systems often require more effort at the local level to achieve the somewhat ambiguous goal of better management of the state courts. The key is to be as specific as possible in describing benefits to the various local courts.

It is also important to be sensitive to any constraints that relate to specific local courts and to assure these courts that the constraints have been accommodated to the maximum extent possible. For example, if a local trial court is already automated, its personnel may be concerned that a state-level system will, to some extent, duplicate data recording and entry requirements of their system with no additional benefits. (This, of course, should not occur since the state system should complement the local system.) If such a perception exists, extra care should be taken to desribe the benefits that will be realized by the local court.

The presentation to state-level managers should provide details of the costs and benefits from a statewide perspective. Acceptance of the system is more likely at this level, because these managers will have the total picture of what the system is supposed to accomplish and will often be the major beneficiaries of the system. Once again, however, it is important to assure them that the cost-benefit analysis is consistent with the various constraints.

Unless the chief justice and the judicial council indicate otherwise, the presentation to them should be a summary of the analysis results. This would include summaries of the most cost-beneficial processing approaches, the costs and benefits of each, how each approach relates to any prevailing constraints, and the overall impact (i.e., considering costs, benefits, constraints) of each approach. It may also be appropriate to give a recommended approach.

Terminology

System Phases

There are normally four phases in the life of an automated or manual system:

—Development: Consists of all preliminary analysis, various levels of system design (e.g., conceptual, detail), programming an automated system or "building" an automated system, and system testing to ensure it has been "built" correctly.

—Implementation: Consists of training personnel and turning over the system and associated documentation to the user, as well as changeover from the old system to the new system.

—Operation: This is actual use of the system in an operational environment. There are two facets to the cost of this phase if an automated system is involved. One facet is the cost of computer operations, and the other is the cost to the functional user of the system. For example, in a judicial system at the state level, costs may be incurred by the judicial administrator's department (e.g., for computer operations) and by the clerks' offices in the judicial districts (i.e., the users).

—Maintenance: This includes preventive and remedial maintenance of all hardware and software associated with the system, as well as enhancements to the system.

Variable Costs

These are costs that vary directly with the volume of data being processed by the system. Data volumes are frequently measured in terms of the number of case filings. Variable costs are normally encountered as user costs in the system operations phase.

Fixed Costs

These are costs that are independent of processing volumes. Fixed costs are normally encountered in the system development, implementation, and maintenance phases and in the computer operations part of the system operations phase.

Cost Savings Benefits

There are two types of cost savings benefits: cost displacement and cost avoidance. Cost displacement occurs when personnel, equipment, courtroom space, office space, or supplies are no longer required and the budget is, therefore, actually reduced. Cost avoidance occurs when a new procedure results in the ability to provide more or better service without the increase in personnel, equipment, space, or supplies that would have been required under an old procedure.

Tangible Benefits

These are benefits that can be expressed in terms of specific values placed on enhancements to operational capability or specific savings in personnel, equipment, space, or supplies. Given this information, a dollar value can then be computed for each benefit.

Intangible Benefits

These are benefits that cannot be evaluated without making unsupportable, excessive, or unrealistic assumptions.

Cost Effectiveness

This is a technique used to compare costs of alternative systems when the benefits cannot be quantified in a manner that would permit them to be related to costs or when the benefits of all alternatives are perceived to be identical.

Summary of Methodology

This discussion provides a summary of the cost-benefit methodology that is set forth in the remainder of this document.

Assumptions and Systems Alternatives

Cost-benefit analyses are usually preceded by or done simultaneously with a requirements analysis to confirm that the need for a new automated or manual system actually exists. The requirements analysis will identify, among other things, the purpose of the system; court offices and personnel who supply data to the system, use its output reports, or are otherwise affected by the system; and the general characteristics of the

system inputs and outputs. The assumptions on which the cost-benefit analysis is based are derived from this information.

The basic sequence in developing cost-benefit analyses is to identify various alternatives that will satisfy needs identified in the requirements analysis, to develop costs and benefits for each alternative, and to suggest the most cost-beneficial alternative over the system life span. The alternatives may involve manual procedures, automated procedures, or a combination thereof.

There are two distinct approaches that can be used to identify alternatives. One approach is used when a computer must be procured, and the viable alternatives are drawn from a group of possibilities that includes the feasible types of computer systems (e.g., central computer, central computer with remote display terminals, distributed network) and procurement approaches (e.g., purchase, lease, use of state computer).

The other approach addresses the identification of viable alternatives in an operational courts environment. The alternatives are drawn from such possibilities as how source data (e.g., on cases) are to be gathered and recorded in a manner that least disrupts current operations but facilitates entry into the system, how inputs are to be sent to the computer site (e.g., by mail, by telecommunications) and entered into the computer for file update, and how outputs are to be generated and distributed (e.g., by mail, by telecommunications). This group of possibilities also includes various strategies for achieving ultimate functional capabilities and geographic scope of the system (e.g., whether to implement the full system at the outset, or to plan a phased build-up to full system).

Basics of the Cost-Benefit Analysis

Overall Considerations. The objective of a cost-benefit analysis is to identify, from among a number of system alternatives, the one that seems to offer the best combination of cost and performance over a prescribed period. It is important to note, however, that the analysis portrays the situation at a given point in time, and this situation may change during the period.

Before the beginning of a cost-benefit analysis, an overall plan for conducting the study and interpreting the results should be developed. For different levels of cost and performance, different benefits accrue. The approach in a cost-benefit analysis is to evaluate costs, evaluate benefits, and relate costs and benefits for each system alternative. The results are then compared in order to identify the most cost-beneficial alternative or alternatives.

Costs can be evaluated with relative ease. This evaluation is, of course, expressed in dollars. The most obvious way to relate benefits to costs is to evaluate benefits in dollars and devise a mathematical relationship between costs and benefits. This is often impossible to do in a realistic manner because of the subjective, intangible nature of many benefits and the fact that a major benefit is often cost savings. Although cost savings can be evaluated in dollars, it is often unrealistic to relate them mathematically to costs because they actually are costs expressed in a different manner.

This, then, is the challenge of most cost-benefit analyses: how to evaluate benefits and relate them to costs in the most meaningful way. Throughout the entire analysis, emphasis is placed on systematically developing costs and benefits in a step-by-step fashion and on complete supporting documentation, with text augmented by tables and graphs.

Cost Evaluation. Costs are evaluated over the system life span for each system alternative. This includes data processing costs, user costs, and a composite cost formed by adding data processing and user costs.

Data processing costs are connected with centralized processing of data received from various sources. For example, at state court administrative offices, data may be received from district courts, recorded, stored, and compiled into summary statistical reports; costs associated with these activities would be data processing costs. The processing may be manual, automated, or some combination thereof.

Such costs involve the development, implementation, operation, and maintenance of manual processing and of computer hardware and software for each system alternative. These costs are established for the system life span.

User costs are connected with decentralized processing of source data. For system alternatives that involve caseload reporting, these costs usually include those incurred by court clerks in receiving and recording case data and then sending the data to a central location (e.g., to the state court administrative offices).

The cost item (e.g., clerks) for which costs will be computed and the units (e.g., "man" hours) in which costs will be expressed should be established at the outset. Then costs are computed by forming the product of the dollar rate per unit of cost item and number of cost items. Sometimes rate per unit of cost item and number of cost items are readily available. It is often necessary, however, to obtain one or both of these factors indirectly through intermediate steps. This is particularly true of the number of cost items since it must be projected over the system life span.

In developing a separate set of costs for each alternative, costs for the current (e.g., manual) system are usually developed first. Then costs for the other alternatives are usually developed using the current system costs as a basis and incrementing or decrementing individual cost items as appropriate.

Composite costs are then developed for each system alternative and each year of the system life span by adding data processing and user costs.

Benefit Evaluation. As previously indicated, the ideal way to evaluate benefits is to assign dollar values to them so that they can be mathematically related to costs. This is often impossible to do in a realistic way, because many benefits are either cost savings or unquantifiable items (e.g., increased data accuracy, improved report timeliness, increased user confidence) that are inherently unsuitable for dollar evaluation.

If there are quantifiable benefits that can be mathematically related to costs, the question arises as to whether they are significant enough to make such a relationship worth computing. If the most significant benefits are cost savings and unquantifiable, then numerical relationships between costs and the other benefits (i.e., benefits that are neither cost savings nor unquantifiable) are meaningless.

An alternate method of quantitatively evaluating benefits in a manner that permits them to be mathematically related to costs is to devise a weighting scheme for benefits. This approach is based on the theory that all benefits can be ordered according to their relative importance to a composite group that can include system users, system developers, and those who fund, monitor, and manage the system and related activities. Then, for each system alternative, a rating of how well the alternative provides each benefit is assigned. These values are then used to determine a benefit score for each alternative.

Cost-Benefit Relationship. This is dependent upon whether a mathematical relationship exists between costs and benefits. If quantifiable benefits permit such a relationship, it is usually formed by subtracting costs from benefits. If a weighting scheme is used, the relationship is formed by dividing costs into benefits.

Unquantifiable and, usually, cost savings benefits should not be related mathematically to costs, but various documentation techniques can be devised that permit the reader to easily correlate costs and benefits of each system alternative. For example, benefits could be shown in a table that,

for each system alternative, gives a textual summary (including cost savings for quantifiable benefits) of each applicable benefit juxtaposed with the annual cost of that alternative over the system life span.

Results. Ideally the cost-benefit analysis should identify the single most cost-beneficial system alternative. The "bottom line" will not always be this conclusive, and even when it is, extraneous factors that cannot be included in the analysis (e.g., political considerations, structure of the court system, availability of funding) may influence the result.

What will be gained is an identification of the several most cost-beneficial system alternatives and, by rigorously going through the analytical steps, a deeper insight into the cost-benefit attributes of each alternative. A cost-benefit analysis is, therefore, a prudent step in the development of any automated or manual system.

Section III

Assumptions and System Alternatives

Introduction

The purpose of this document is to set forth methodology that should be used to select the most cost-beneficial system alternative(s) from among a number of alternatives. The methodology, as described in the next section, represents a framework for cost-benefit analyses; the insertion of specific procedures into this framework must be in accordance with the prevailing organizational, budgetary, statutory, and political environment.

To get the best results from the analysis, various preliminary activities must be done. It is important to document all assumptions on which the analysis will be based and to select carefully the system alternatives that will be the subject of the analysis. This section describes some of the assumptions and alternatives to be considered. Although manual systems are sometimes viable alternatives, this discussion will focus on automated alternatives.

Assumptions

To preface the discussion of alternatives and the ensuing cost-benefit analysis, it is assumed that the functions and related properties of the prospective (automated and/or manual) system have been established. This is usually done in a requirements analysis. It involves detailed decisions and supporting documentation in the following areas:

—System Purpose: What is the purpose of the system? Will it provide operational support (e.g., calendars,

dockets, jury notices, subpoenas)? Will it be an information system (e.g., provide summary statistics)? Will it be both?

—Modules in System: What combination of civil, criminal, appellate, financial, personnel, and other modules should be included in the system?

—System Participants: The suppliers of data to the system and users of system reports must be identified. They are normally easily identifiable if the system purpose is known. Usually suppliers of data are clerks in the judicial districts, and they send these data to the state court administrative offices either by mail or by entry into a terminal for transmission over communications lines. Users of system reports are normally personnel in the state court administrative offices and judges in the state court system, and they normally get these reports through interoffice or U.S. mail or through remote computer peripheral equipment (e.g., printers, display terminals) in their offices.

In the cost-benefit analysis, then, primary emphasis is placed on evaluating costs and benefits relative to parts of the state court system that will be significantly affected by the prospective system.

—System Life Span: What is the expected operational life of the system? For most automated systems, it is between five and eight years.

—Levels of Output Information: Will the system provide outputs (e.g., at the case level), summary outputs (e.g., summary statistics), or both?

—Levels of Input Data: Will the system require detailed inputs (e.g., at the case level), summary inputs (e.g., summary of all cases of a given type in a judicial district), or both? (It should be noted that detailed inputs are most prevalent; otherwise clerical personnel are doing summarization tasks that the computer should do.) If detailed inputs are required, will they include all data or predefined subsets of the data (e.g., all cases, a sampling of cases, all cases that exceed a given level of seriousness)? Similarly, will all or only a subset of summary data be required (e.g., summary of all cases or of only certain types of cases)?

—Quantity of Input Data: How much input data are expected annually over the system life span? For example, what are the projected annual case filings over the next 8 years and how are they obtained? It should be noted that the actual quantity of input data is usually higher than the expected quantity.

With these functions known, it is necessary to identify the system alternatives that can perform these functions and are consistent with the organizational, budgetary, statutory, political, etc., environment in which the system must function.

System Alternatives

The possible alternatives can be drawn from combinations of the following categories:

1. Type of computer system.
2. Method of computer system acquisition.
3. Operational approach.
4. Method of software development.
5. Method of system implementation.

These categories are described in the paragraphs that follow. The computer terminology contained in these descriptions has been defined through explanations or examples. One possible area of confusion, however, is use of the terms "remote" and "local" in the context of computer operations or equipment. In computer terminology, "remote" refers to an operation or equipment that is not co-located with a central computer, while "local" refers to an operation or equipment that is co-located with a central computer. For example, the central computer and "local" terminals could be at the state court administrative office with "remote" terminals in local trial courts. In the descriptions that follow, "local" refers to the location of an operation or equipment and not to the type of court.

Type of Computer System

This category addresses the type of computer system that is appropriate for the required processing. Basically, the computer system consists of a central processing unit and main memory, auxiliary storage devices (e.g., disk, tape), peripheral input/output devices (e.g., terminals, card readers, printers), and communications devices (to connect remote input/output devices to the central processing unit and main memory). The computer system also consists of systems software to control the equipment.

Some judiciaries are not confronted with a decision on computer system selection because they already have a computer or must (e.g., according to state statutes) use a computer run by another state agency. However, for those who can select a computer system, the selection is probably the major decision in the entire automation process. This is because the system represents a substantial commitment and investment, which becomes even more costly if the user later discovers that the original computer system did not really fit the need.

There are several possible alternatives:

Totally Centralized. All data processing activities (e.g., data entry, file update, report generation) are performed at a centralized computer site. Typically, in a judicial application, case data are entered on standard forms by clerks in the trial courts and mailed to a computer facility where they are entered into the computer. Similarly, reports are generated at the computer site and distributed by mail to state court administrative office personnel and, if appropriate, to the judicial districts or trial courts.

Several possible alternatives are encompassed in this totally centralized concept. The central computer could be either a large-scale or small-scale (i.e., mini- or small business) computer. Moreover, there could be multiple computer sites performing the same centralized judicial processing around the state.

Centralized Processing with Remote Input/Output. Some input/output (e.g., data entry, on-line query/response) is performed remotely, using terminals in the judicial districts and trial courts, and all remaining processing (e.g., file update, printed report generation) is performed at the centralized computer. This is like the totally centralized concept except that, for example, case data would be entered by the trial court clerks using their terminals and then transmitted over telecommunications lines to the central computer site instead of being sent through the mail.

There are variations of this approach depending on the capabilities of the remote terminals. "Dumb" terminals can perform only preprogrammed data entry and transmission to the central computer. Other terminals can perform sets of functions that vary in complexity depending on the capabilities of the terminal. These capabilities can range from key entry of data onto disk and transmission to the central computer, to remote report printouts, to remote batching of groups of computer "jobs" for subsequent transmission to and processing by the central computer.

In some cases, there may be computers at remote sites that are not part of the "computer system" under consideration as a system alternative. On the other hand, these computers may already contain information and perform processing needed by the "computer system." If this is the case, every effort should be made to use these existing computers because it would probably be economical to transfer the data from the remote computer to the "computer system" instead of reentering data. This transfer could be over telecommunications lines or by mailing a magnetic tape or disk cartridge. For example, if a trial court in a metropolitan area was automated prior to development of a statewide "computer system," case data for that court could be written onto magnetic tape and the tape mailed to the administrative office and read into the statewide "computer system."

Distributed Processing. This increasingly popular concept utilizes the theory that some functions lend themselves to efficient processing at remote computer sites, and some are better processed at a central site. Distributed processing, therefore, involves a central computer joined in a communications network with remote computers. In such a network, some functions are done on the central computer and some functions are done on each of the remote computers.

For example, in a judicial system that provides both operational support and summary statistics, all case data could be entered in each judicial district or trial court and later transmitted to the central site for file update. Some of these data could also be retained in each district or court for production of dockets, indexes, calendars, etc., on the remote computer there. All statistical summary and other statewide reports would be produced from the central computer.

A distributed network consists of central and remote computers. The central computer can either be a large- or small-scale computer, and the remote computers can range from large-scale computers through small-scale computers (e.g., minicomputers) to intelligent terminals. If intelligent terminals are used, they normally provide a comprehensive range of processing capabilities.

As above, every effort should be made to use existing computer facilities in judical districts or trial courts.

Totally Decentralized. A separate computer exists in each major remote site, and all processing for a given site is done there and is independent of the other sites. This approach may be appropriate in a judicial system that provides only operational support for each trial court. Such a system could, for example, produce indexes, dockets, and calendars for

each court, and all processing (e.g., data entry, file update, data files, report generation) would be self-contained in computers in the judicial districts or trial courts.

These computers would normally be small-scale computers (e.g., minicomputers), although some districts or courts that include metropolitan areas would possibly require large-scale computers.

Here again, every effort should be made to use existing computer facilities in judicial districts or trial courts.

Totally Manual. A possible computer system alternative is not to use a computer system (i.e., perform the functions manually).

Summary. In summary, the possible alternatives for type of computer system are these:

—Large-scale centralized computer (single or multiple sites).
—Small-scale centralized computer (single or multiple sites).
—Centralized computer with remote data entry terminals.
—Centralized computer with other types of remote terminals (e.g., key-disk, remote batch).
—Distributed processing with general purpose remote computers.
—Distributed processing with remote intelligent terminals.
—Decentralized computers.
—Totally manual.

Method of Computer System Acquisition

This category addresses methods of acquiring the types of computer systems described above. For some of the computer system types, several methods of acquisition may be appropriate. Moreover, there may be a time-phased acquisition of parts of the computer based on a gradual build-up of system capabilities.

As in the previous discussion, it should be noted that the judiciary may be required (e.g., by state statutes) to use a computer controlled by a state agency. This would, of course, obviate the need for any consideration of computer system acquisition.

In order to properly evaluate methods of acquisition, it is necessary to develop all costs that are directly or indirectly related to computer system acquisition over the judicial system life span. This is the only way that the full

costs of the various purchase, lease, lease-with-option-to-purchase, and service-bureau arrangements can be clearly seen.

In developing these costs, consideration must be given to actual procurement of the computer facilities. Procurement costs can be substantial, particularly for alternatives that involve an on-site computer (i.e., purchase, lease, lease-with-option-to-purchase). This is because detailed procurement specifications must be developed and extensive vendor negotiations must be conducted to ensure that the acquired computer can accommodate all anticipated processing.

Another consideration in the case of an on-site computer is whether staff are available to operate and possibly maintain the computer hardware and systems software. If such staff are unavailable in-house, they must be recruited or obtained through a facilities management contract. In any event, these costs must be considered with acquisition costs over the system life span.

Purchase. It may be advantageous to purchase one of the computer system types. After purchase costs are projected over the judicial system life span, the residual value of the computer system should be included as a final-year value.

Lease. Lease arrangements are common with large-scale computers, small-scale computers, and minicomputers. Intelligent terminals and other terminal devices are usually purchased.

Lease with Option to Purchase. This is a combined lease and purchase where, during some predetermined period, the lessee could exercise an option to apply some of the previously paid rental toward purchase of the computer system.

Commercial Service Bureau. Computer processing time is available from service bureaus in most locations. The general heading of commerical service bureau encompasses commercial batch processing and time sharing services, university data processing facilities, and county or city government data processing facilities.

The basic advantage of this approach is that powerful computers are available without the substantial investments in money and time required for procurement, installation, operation, and maintenance, because costs are distributed among all users. The main disadvantage is lack of complete user control over privacy of data and processing priorities.

Service bureaus normally provide access to large-scale computers at a centralized location. A wide variety of remote terminals can usually interface with the service bureau computer. A user who wanted to develop a distributed processing

network, however, would probably be somewhat inhibited using a service bureau computer, although computer-to-computer interfaces are possible. This means that, for example, if individual judicial districts were automated, case data could be input for district processing and then transferred directly to the service bureau computer.

State Service Bureau. One of the options may be a service bureau run by a state agency that provides data processing services to other state agencies. The same considerations enumerated above for commercial service bureaus apply here, and the cost can range from nothing (i.e., all state agencies support it indirectly in their budgets) to amounts that far exceed costs of commercial service bureaus (i.e., it is a fallacy to assume that state data processing services are cheaper than those available commercially).

Judiciary Computer. In a few cases, the judiciary will already have a computer that is suitable for the planned processing. If this is the case, the in-house computer will probably emerge as the cheapest alternative. Such a computer could provide centralized processing without terminals and, if communications handling facilities exist, with terminals. Depending on the characteristics of the computer and the control exercised over it, a distributed network may also be a possibility.

Summary. In summary, the possible alternatives for computer system acquisition are:

—Purchase.
—Lease.
—Lease with option to purchase.
—Commercial service bureau.
—State service bureau.
—Judiciary computer.

Operational Approach

This category consists of various operational approaches (i.e., on-line remote inputs, batch inputs, batch outputs, etc.) to accomplish the required functions. In the case of a statewide reporting system, any of the following basic operational approaches may be feasible:

Level of input from judicial districts	Method of transmission to administrative office	Method of processing	Level of statistical reports
summary	entered on forms and sent by mail	manual	summary
summary	entered on forms and sent by mail	automated	summary
case	entered on forms and sent by mail	manual	summary
case	entered on forms and sent by mail	automated	summary
case	entered thru terminal and sent via telecomm	automated	summary
case	entered on forms and sent by mail	manual	detail
case	entered on forms and sent by mail	automated	detail
case	entered thru terminal and sent via telecomm	automated	detail

When automation is involved, the operational approach relates closely to the type of computer system category that was described previously. Type of computer system refers to alternatives that would be considered if an entire computer system (or equivalent processing service) were to be acquired. If this is the case, specific computer system alternatives imply specific operational approaches. This inference is so strong, in fact, that operational approaches are seldom listed when alternatives are given in terms of acquiring entire computer systems.

For example, a centralized computer with remote data entry terminals in a system whose purpose is to produce summary statistics implies on-line remote inputs and batch local outputs; these operational implications often are not stated.

On the other hand, computer system acquisition may not be a major consideration--usually because most or all of the computer equipment is already available. Alternatives are frequently given in terms of operational approaches, with any

additional computer equipment (usually terminals) that is required being included as costs, but not as stated integral parts of the alternatives.

For example, the judiciary may be required by law to use a state computer, and there may be several small computers for trial court processing in the more populous judicial districts. This dictates a centralized processing approach with data submissions from each trial court. Since some districts are already automated, an alternative with obvious advantages would be to perform data entry in the trial courts and transmit to the state computer (assuming the equipment can handle this) using telecommunications lines. This would mean that terminals must be acquired for the nonautomated districts, and use of these terminals would be included as an integral part of the basic on-line data entry operational approach.

This example gives rise to another observation: to the maximum extent possible, existing computer facilities in judicial districts and trial courts should be used in a statewide system to reduce redundant data entry and processing.

The specific operational approaches for automated systems are as follows:

Method of Input. Inputs involve two steps. First data are entered and then they are used to update the data files. Entry can be done from a place that is co-located with the computer (i.e., locally) or from a remote location. Entry and update can be done in batch mode or with the computer on-line. The possibilities are:

—Local batch entry and file update.
—Local on-line entry and batch file update.
—Local on-line entry and file update.
—Remote batch entry and batch file update.
—Remote on-line entry and batch file update.
—Remote on-line entry and on-line file update.
—Interface with existing computer system.
—Combinations of the above.

Assume, for example, a centralized state computer is to be used for judicial processing. Assume individual case data are mailed from the judicial districts to the centralized computer site where they are keypunched onto cards and batched for later entry and file update. This would be local batch entry and file update. If the data had been entered at the central site using a display/keyset terminal and then accumulated within the computer and held for later file update, this would be local on-line entry and batch file update. If the data had been entered using the terminal and immediately used to update the file, this would be local on-line entry and file update.

Now suppose that each district has a display/keyset terminal for data entry and that these data can be transmitted to the central computer. If the data are accumulated at the remote terminal (i.e., if there is a remote batch terminal) and later transmitted to the central computer for file update, this would be remote batch entry and batch file update. If the data are entered at the remote terminal, immediately transmitted to the central computer, and accumulated there for file update, this would be remote on-line entry and batch file update. If the data are entered at the remote terminal, immediately transmitted to the central computer, and immediately used for file update, this would be remote on-line entry and on-line file update.

A variation of these examples would be transmission to the central computer of inputs from computers already installed in the judicial districts. These inputs could be used for batch or on-line file updates. The remote computers may be there for judicial processing or they could perform nonjudicial processing, but be capable of providing judicial data. An example of the latter situation would be the Prosecutor's Management Information System (PROMIS), which is installed in some prosecutors' offices, but contains much of the case data that would be used in judicial processing.

Method of Output. In order to produce outputs, the requisite data must be retrieved from storage, compiled into the proper groups for collection of totals and subtotals, and written in the proper output format. The first two steps (i.e., output creation) are done internally by the computer; the third step (i.e., output production) involves a printer, display terminal, or some other type of output device that can be either co-located with the computer or remote from the computer. Outputs can be created and batched for later printing or display, or they can be produced as they are created in an on-line environment. The possibilities are:

—Local batch output production.
—Local on-line output production.
—Remote batch output production.
—Remote on-line output production.
—Combinations of the above.

Assume, for example, a centralized judicial computer is to be used to produce statewide statistical reports on district court caseloads. These reports are produced monthly at the state court administrative office. Voluminous reports such as these are usually batched for off-line printing. This would be local batch report production. Now suppose the system can accommodate inquiries from display/keyset terminals that are

co-located with the computer, as well as from those located at other places in the administrative office and at selected trial court clerks' offices. These inquiries are serviced on-line by the computer and responses (i.e., output production) are generated immediately at the appropriate terminals. This would be both local (from the terminals that are co-located with the computer) and remote (from the other terminals) on-line output production. If the system also provides operational support, it may print documents such as calendars and notices on printers in the trial courts. If these outputs were created and batched for later transmission and printout in the trial courts, this would be remote batch report production.

Summary. The operational approaches may be summarized as shown below.

For inputs:

—Local batch entry and file update.
—Local on-line entry and batch file update.
—Local on-line entry and file update.
—Remote batch entry and batch file update.
—Remote on-line entry and batch file update.
—Remote on-line entry and on-line file update.
—Interface with existing computer system.
—Combinations of the above.

For outputs:

—Local batch output.
—Local on-line output.
—Remote batch output.
—Remote on-line output.
—Interface with existing computer system.
—Combinations of the above.

Method of Software Development

This category consists of the various ways the application software (i.e., programs that comprise the judicial information system) can be acquired. The decision relates directly to such considerations as the systems development (i.e., analysis, design, programming) capabilities of the judiciary and, in the absence of some or all of these judicial capabilities, any statutes or other regulations that require that such work be done through a state data processing agency. The choice is between developing the software in-house (i.e., by judiciary personnel), having it developed by non-judicial state data processing personnel, having it developed by a private

contractor, obtaining preprogrammed software (i.e., software packages), and combinations of the above approaches.

In-House. Sometimes the judiciary has, or plans to build, a data processing staff. This can include people to perform some or all of the following developmental tasks: requirements analysis, cost-benefit analysis, software design, programming, system testing, and user and operator training.

The minimal staff should normally include analysts to perform some or all of the initial tasks in systems development (i.e., requirements analysis, cost-benefit analysis, conceptual design) and to monitor the later tasks in systems development (i.e., detail design, programming, testing, implementation). This would at least ensure direct judicial participation in the stages when judicial systems are being justified and functionally defined, and it would provide adequate monitoring of later stages of systems development.

Beyond this minimal level, the existence of additional data processing personnel in the judiciary normally depends on the need for ongoing systems maintenance and, if applicable, computer operations and maintenance. Such a situation is usually found in a state that has a large and extensive judicial information system planned, in development, and/or in operation. It is also sometimes found in a state with a more limited judicial system, but in which the judiciary has a small-scale computer and a few multi-purpose data processing personnel to design, program, operate the computer, and maintain the system.

If systems designers exist in the judiciary, the analysis and design work will normally be done in-house. Similarly, if the judiciary includes programmers, this work will normally be done in-house.

Non-Judicial State Agency. Often, if the requisite capabilities do not exist in-house, the judiciary may be required by statute to obtain the needed work from a state agency that provides data processing services. If this is the case, programming is most likely to be provided by the state agency; depending on capabilities within the judiciary, system design may also be provided. Sometimes the judiciary is required to obtain programming services from the state agency but can obtain, for example, systems design assistance elsewhere.

If services are needed and no requirement exists that they be obtained from the state agency, the judiciary should closely compare costs of private contractors and state agencies. It is fallacious to assume that a state agency is cheaper than a private contractor; often the opposite proves to be the case.

Private Contractor. These groups specialize in all stages of software development, and they are contracted to augment the in-house data processing staff. This can be in areas where the judiciary has no capability (e.g., programming) or where an objective evaluation would be helpful (e.g., requirements analysis) to guard against possible accusations that the judiciary was biased in its desire to automate.

Software Package. These are preprogrammed, proprietary application programs that are sold or leased by a commercial software vendor. In addition to programs, software packages usually include documentation, installation, and ongoing maintenance.

An example of a software package that can be used in the courts is a version of PROMIS. This version has features that permit it to be tailored to courts applications. In general, PROMIS is designed to assist in performing the operational functions of a criminal justice agency. The system includes software to permit data entry, updating, and retrieval so that such items as arrests, cases, defendants, and witnesses can be tracked. It produces printed outputs such as calendars, forms and reports, witness notifications, and statistical reports. The system can also generate special forms, such as subpoenas, notifications, case jacket labels, disposition reporting forms, manual file cards, and other high-volume forms.

At the present time, there are few other software packages that provide court summary statistics or operational support programs. Packages are more common in the resource areas, such as the various financial operations and personnel. Transfer of design concepts, actual systems design, and possibly programs from other state judiciaries should also be investigated as an important source of cost-effective systems development.

Combinations. The previous four approaches can also be used in combination. For example, it is not uncommon for the preliminary analyses (e.g., requirements, cost-benefit) to be done within the judiciary, the detail system design to be done by a private contractor, and the programming and implementation to be done by a non-judicial state data processing agency.

Method of System Implementation

This category addresses the strategy that will be used to arrive at an operational system that consists of the required modules and achieves the stated purposes. It can be viewed from the standpoint of implementation strategy relative to the geographic scope of the system and relative to the

functional scope of the system. It is important to note that geographical and functional scope are not necessarily mutually exclusive.

Geographic Scope. State judicial information systems are, by definition, usually statewide systems. Assuming this, a decision must be made on how the statewide implementation will be achieved. The strategy may be to implement the system statewide at the outset. It is more common, however, to implement statewide judicial systems more gradually. Two common approaches are to implement the system in a limited geographic region--such as a judicial district that is particularly amenable to automation or a pilot region composed of one or more judicial districts. Then, after fine-tuning the initial or pilot installation, implementation of the system can be incrementally (e.g., by judicial district) extended over the entire state.

Functional Scope. Having previously identified the functional modules and purposes of the system, it is necessary to decide how to achieve this functional capability. Sometimes this is done by implementing a full system at the outset. Alternatively, full capabilities can be achieved through a staged build-up that covers several preliminary levels of reduced capabilities.

For example, in a system that produces summary statewide statistical reports, it would be necessary to decide what level of statistics is ultimately needed. In an incremental build-up to this level, intermediate levels of summary statistics would be identified. The incremental levels could come from the following group:

- —Summary with case type.
- —Summary with case type and number of cases beginning pending, filed, disposed, end pending.
- —Summary with case type; number of cases beginning pending, filed, disposed, end pending; and type of trial (including preliminary hearings).
- —Summary with case type; number of cases beginning pending, filed, disposed, end pending; type of trial; and type of disposition.
- —Summary with case type; number of cases beginning pending, filed, disposed, end pending; type of trial; type of disposition; and amount of time in each stage of litigation.
- —Summary with case type; number of cases beginning pending, filed, disposed, end pending; type of trial; type of disposition; amount of time in each stage of litigation; and sentencing/judgment information.

If, on the other hand, the system provides operational support (i.e., indexing, calendaring, notices) to individual trial courts, it may be necessary to implement these functions on an incremental basis. As the system is implemented in each trial court, for example, it could initially consist of indexing with subsequent incremental expansion to calendaring and generation of notices.

Section IV

Methodology

Introduction

Cost-benefit analyses evaluate two or more sets of manual and/or automated procedures (hereafter called systems). The objective of a cost-benefit analysis is to identify the system that seems to offer the best combination of cost and performance over a prescribed period. Along with other types of information about the situation in a given state, the cost-benefit analysis provides guidance in system selection.

Cost-benefit analyses are based on two factors--cost and performance. Prior to developing a new system, cost and performance criteria must be established. Since these analyses should include cost and performance projections over a prescribed period (e.g., the system life span), the analyses must be accompanied by complete planning of system development, implementation, operation, and maintenance. Cost-benefit analyses are done to identify the system alternative that, at the point in time when the analyses are conducted, seems to best meet these criteria over the projected period.

For different levels of cost and performance, different benefits accrue. The approach in a cost-benefit analysis is to evaluate costs, evaluate benefits, and relate costs and benefits for each system alternative. The results are then compared to identify the most cost-beneficial alternative.

There are major problems inherent in cost-benefit analyses:

—The easiest way to relate costs to benefits is to express benefits in dollars (i.e., in the same units as costs). Many benefits are impossible to realistically express as dollars, so an alternate way to formulate the relationship must be devised.

—Costs and benefits are not necessarily mutually exclusive, because one of the primary benefits is often cost savings. When the cost-benefit relationship involves cost and benefit dollar amounts, care must be exercised to ensure that cost savings are not included twice--once in the cost part of the formula and once in the benefit part of the formula.

Because of these problems, costs and benefits are often covered at different levels of detail and cannot be related in a realistic mathematical formula. In this case, a cost-effectiveness analysis is performed with a separate description of benefits.

Before beginning the cost-benefit analysis, a strategy for conducting the study should be developed. This should identify the types of costs, types of benefits, how costs and benefits will be evaluated, how they will be related, and generally what is expected from the study. For many systems, requirements are separated into mandatory requirements and desirable features. The cost-benefit analysis should encompass at least the mandatory requirements. The way in which the desirable features and the cost-benefit trade-offs associated with those features will be handled should be established at the outset of the analysis.

Since the cost-benefit analysis relates to a given point in time, it should be reviewed and, if necessary, updated 6 to 12 months after the system becomes operational, and annually thereafter. This will show whether the system development, implementation, operations, and maintenance objectives have been met on schedule; how actual and projected cost savings compare; whether additional automated components are required; whether fine tuning of the automated or manual system is needed; and what effect changes in the courts environment should have on the system objectives, plans, costs, and benefits.

The purpose of this section is to present detailed guidelines within which costs and benefits can be established and related to the maximum extent possible. Even though a system life span typically ranges from five to eight years, it is arbitrarily assumed throughout this section to be eight years for ease of reference.

Mathematical Overview

The basic objective of a cost-benefit analysis is to maximize benefits relative to costs. In order to accomplish this mathematically, it is necessary to compute costs and benefits and relate them in a mathematical formula. While this can

be done for costs, it is often impossible to realistically compute all benefits in units (e.g., dollars) that directly relate to costs. Therefore, it is often necessary to either

—Decide whether a sufficient number of significant benefits (i.e., in terms of their importance to a composite group that can include system users, system developers, and those who fund, monitor, and manage the system and related activities) can be directly related to costs, and then apply the formula to costs and these benefits; or
—Devise an alternate means of mathematically relating costs and benefits; or
—Determine that there is no realistic way to mathematically relate costs and benefits, and be satisfied to compute costs, describe benefits, and develop no relationship between them.

The subsections below provide an overview of the cost-benefit relationship in the first two cases. These relationships will be described in more detail later in this section.

Direct Relationship

The most reliable way to relate costs and benefits is with the following formula:

Relationship = benefits - costs

This formula is applied to each system alternative when costs and benefits can be computed in the same units. Then the most cost-beneficial alternative is the one for which the relationship has the highest value.

Devised Relationship

If costs and benefits cannot be computed in the same units, it is possible to devise other mathematical methods to relate the two. A common method is to rate each system alternative relative to the other alternatives, based on how well the given alternative provides the benefits. This provides a relative numerical measurement of benefits for each system alternative. Costs are computed in the normal manner, and the cost-benefit relationship for each system alternative is normally expressed as

$$\text{Relationship} = \frac{\text{benefits}}{\text{costs}}$$

This provides a relative cost-benefit ratio for each alternative, and the most cost-beneficial alternative is the one

with the highest ratio--assuming higher benefit evaluations correspond to higher numerical rankings (two is numerically higher than one).

Costs

The first task in a cost-benefit analysis is to develop cost projections over a predetermined period (e.g., the computer system life span). This includes data processing costs, user costs, and a composite of these cost projections over the period. It should be done for each automated system alternative.

Since costs are evaluated over multiple years, consideration must be given to distortions caused by inflation and other forces that influence prices. These forces can significantly affect multi-year cost comparisons among manual and automated system alternatives. For example, personnel costs generally increase while the costs of computing capability have historically decreased. While the existence of these forces is known, it is difficult to predict how much they will affect costs over the system life span. For example, who can accurately predict the rate of inflation? Since the cost-benefit analysis can be greatly complicated by inclusion of variations caused by these forces, the best approach is probably the following:

—Examine whether inflation and other forces that affect prices will be significant factors in the analysis.
—If they will be significant factors, identify the specific cost items that will be most affected. These will usually be personnel costs (which will increase) and computer equipment costs (which will decrease). The computer equipment costs must be examined closely, however, because what may appear to be decreased costs may be offset by increased costs caused by revised pricing policies in related equipment or in software.
—For those cost items that will be affected, assign a rough annual value to each item over the system life span. For example, an approximate annual increment to personnel costs can be established based on current and anticipated policy in the judiciary of adjusting salaries for inflation.
—Evaluate those cost items that will not be significantly affected (or all costs if inflation and other forces will not be significant factors) as if they were incurred in the current year (i.e., assume a zero rate of inflation over the system life span). It should be reiterated that this approach is satisfactory for comparing these costs, but it may not be an accurate reflection of actual costs over the system life span because it excludes inflation.

More details on interpreting the cost and benefit evaluations produced by the analysis are given in Section V.

Data Processing Costs

These are costs connected with the centralized processing of data (e.g., at the state court administrative office) received from various sources (e.g., judicial districts throughout the state). The costs include the development, implementation, operation, and maintenance of the manual procedures and/or computer hardware and software in each automated system alternative. These costs are established for the system life span, and they are usually displayed for each automated system alternative as shown in Figure IV-1. The display should be supported by textual descriptions for each cost item. The costs are mostly fixed, and they include both one-time and recurring costs. It may, therefore, be helpful to produce two versions of Figure IV-1: one for one-time costs and one for recurring costs; or a single table with a footnote to indicate whether each individual cost item is one-time or recurring.

The specific cost items include:

Computer Equipment Procurement. Purchase or lease of all computer hardware. A separate analysis is usually done to determine whether purchase or lease will be most advantageous. If the hardware is purchased, this is a one-time charge. In a lease, it is a recurring cost.

Computer Service Bureau. Rental of computer time from a commercial service bureau or another government agency. This is normally considered as an alternative to computer equipment purchase or lease, and it should be considered within the constraints of separate judicial processing. It is a recurring cost.

Communications. Purchase and/or lease of computer terminals, communications lines, interfacing units, and any other hardware/software necessary to provide the required security and privacy for judicial data. Purchases are one-time costs; leases are recurring costs.

System Software. Installation and maintenance of all software necessary to control the computer hardware. It is frequently provided with the hardware, but some system software

Figure IV-1

DATA PROCESSING COST PROJECTIONS

Cost Item	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8	Totals
Computer Equipment Procurement									
Computer Service Bureau									
Communications Procurement									
System Software									
Applications Software Development									
Equipment Maintenance									
Applications Software Maintenance									
Computer Operations									
Site Preparation									
Utilities									
Supplies									
Furniture									
Office Space									
System Implementation									
Miscellaneous									
TOTALS									

is offered at separate cost. In the latter case, the software is usually leased and is a recurring cost.

Applications Software Development. Development of all software used to perform the judicial functions included in the system. The software may be developed by in-house personnel or by contractor personnel. It includes systems analysis, systems design, programming, and documentation. It is usually a one-time cost incurred during the first year of the system.

Equipment Maintenance. Recurring costs for remedial and preventive maintenance of all computer and communications equipment. For most equipment approximate down time rates are known, and these can be used to derive average remedial maintenance costs. Preventive maintenance costs can be easily obtained, since this type of maintenance is done on a periodic basis.

Applications Software Maintenance. Periodic costs to maintain and enhance applications software. This will become progressively less during the six months that immediately follow system implementation. Then it will probably be negligible thereafter except during system enhancements. Although specific future enhancements are usually unknown at the time the cost-benefit analysis is conducted, a rough approximation of the required funding may be incorporated into all plans in order to provide accurate cost estimates. Enhancements should, however, be undertaken with extreme caution, because an ill-conceived enhancement could degrade system performance and nullify existing system benefits. Depending on the periodicity of software maintenance, it may be a recurring cost or a collection of one-time costs.

Computer Operations. Recurring costs for operation of all data processing equipment that is run by data processing personnel. This may exclude terminals operated by user personnel such as display terminals in user spaces that provide on-line data entry and query/response capabilities. For example, operation of terminals for data entry by personnel in the clerk's office is normally included in user costs (to be discussed later in this section).

Site Preparation. One-time costs for construction and conversion of facilities to house computer equipment. This includes preparation of data processing and user space relative to size, electrical connections, air conditioning, humidity control, lighting, floors and ceiling, security requirements, etc.

Utilities. Recurring costs for electricity, heating, telephone, etc., in spaces specifically dedicated to housing data processing equipment. This excludes costs for spaces that are primarily to house user personnel but have, for example, computer terminals installed for use by those personnel.

Supplies. Recurring costs for supplies used by data processing personnel. This includes office supplies, photocopying, etc.

Furniture. One-time costs for office furniture used by data processing personnel.

Office Space. Recurring charges for rental of office space used by data processing personnel.

System Implementation. One-time costs for training and start-up operations so that data processing and user personnel can become effective users of the system. A major part of start-up costs usually goes for conversion of data from the current system to a format that can be used by the new system. This is particularly significant if manual files must be converted to computer-readable media, because the conversion of court records and historical data can be costly.

Miscellaneous. Costs that cannot be placed in any of the above categories. This category should be used only as a last resort. It could include such items as administration, management, and travel although, in general, these items should be embedded in the other cost items.

User Costs

These are operational costs connected with the decentralized processing of source data. The included costs are those incurred by the court offices (e.g., in judicial districts throughout the state) that will be affected by the prospective system. The costs are mostly recurring, variable costs, and they should be developed for each alternative.

The cost items (e.g., clerks) for which costs will be computed and the units (e.g., "man" hours) in which costs will be expressed are established at the outset. Then costs are computed for each item according to the formula: $C = R \times N$, where

C = cost.
R = rate per unit per cost item.
N = number of cost items.

In some cases, the factors (i.e., cost parameters) in this equation can be obtained directly. It is often necessary, however, to obtain some of the factors indirectly through intermediate steps.

In developing a separate set of costs for each alternative, costs for the current system are usually developed first, based on experience with this system. Then costs for the other alternatives are usually developed using as a basis the current system costs and incrementing or decrementing individual cost items as appropriate.

When the current system is used as a basis in this manner, it will provide a better standard for measurement if it is functioning efficiently. Otherwise, the current system costs will be unrealistically high and the analysis will give a distorted picture of the benefits of alternative systems.

The discussion below is presented to expand on these basic concepts in user cost development.

Applicable Offices and Procedures. Cost projections are developed for all court offices that will be significantly affected (relative to costs and cost-related benefits) by a system alternative. This approach is normally carried a step further in that emphasis is placed on the office procedures that will be affected by the system alternative.

For example, it may be apparent that the system will primarily affect the indexing, calendaring, docketing, and management report generation procedures in the clerk's office. User costs, therefore, would be restricted to these clerk's office procedures.

It is important to note that emphasis is placed on offices that will be significantly affected relative to the overall effect of the system. In terms of the above example, this means that, if the cumulative effect on the judges, personnel, and accounting offices was comparable to the effect on the clerk's office, cost projections would be developed for all of these offices.

It is, therefore, necessary to identify these offices and procedures at the outset of the cost analysis. This should be obvious from an examination of the purpose of the system and the functions that it is intended to perform.

Basic Approach. A basic approach must be established for developing cost projections for each system alternative. In particular, the decision must be made whether to follow the normal practice of developing cost projections for the current system and using these as the basis for the cost projections of the other system alternatives. Optional approaches are: to

use this same approach with another system alternative substituted for the current system as the cost basis, or to develop each cost projection independently.

The decision on an approach to cost projection should be based on the situation and the available cost-related data. The current system is frequently used as a basis because there is usually more and better information about it and, hence, more reliable current system cost projections can be developed.

Cost Items. It is necessary to define the cost items for which costs will be computed. Within the cost projection for a given system or for a given procedure, multiple cost items can be used. The most common cost items are various levels of court personnel, but this is definitely not the only cost item that is used. Other than personnel, examples of cost items are courtrooms, cases or filings, continuances, reports, and almost anything else that fits the needs of a given situation.

Units. It is necessary to define the units in which the cost items are counted for costing purposes. With personnel, this is usually "man" hours, "man" days, "man" weeks, etc. Other types of cost items are usually counted by the individual item, so the unit is "each."

Rate. This is the cost rate for a unit of each cost item. For personnel it should consist of base pay plus such items as fringe benefits and, if applicable, overhead. (Overhead should be included only for overhead costs that are directly attributable to the system.)

Number of Cost Items. This is the quantity of each cost item included in the cost estimate.

Evaluation. The task of obtaining the required rate and number-of-cost-item values can take on varying degrees of complexity. In most cases, current and prior-year values can be obtained directly from the available information. Projections of these values, however, often cannot be established directly, and an indirect evaluation approach must be used.

The most common parameter involved in indirect evaluation is number of cost items, and the methodology used can consist of several steps.

Suppose, for example, that cost projections are being developed with the following available information:

—Annual salary of clerical personnel.
—Filings over the previous five years.
—Staff levels of clerical personnel.

In order to determine the required parameters, it is first necessary to project filings over the system life span. This can be done using various mathematical techniques. Next, using prior-year filings and staff levels, the average number of filings that can be handled during a year by a single clerk can be computed. This average can then be divided into the filing projections to compute the number of clerks required during each year of the system life span.

This yields the required parameters as follows:

—Cost item = clerks.
—Units = "man" year.
—Rate = annual salary for clerks.
—Number of clerks = computed value as described above.

The process can be made more specific and accurate if it is refined to account for different types of filings (e.g., criminal, civil, etc.) and the effect that each type has on the clerical functions. In this case, a preliminary step may be appropriate to establish a weight for each type of filing. The weight reflects the amount of clerical activity associated with each filing type. For example, the weights corresponding to civil, criminal, and probate filings may be 37.98, 39.17, and 46.41 respectively. These weights are multiplied by filings in each category to produce a group of weighted filings. The process then continues as described above, using weighted filings instead of filings.

If current or prior-year data cannot be obtained directly, an indirect approach must be used to compute these values.

Cost Totals. The cost parameters are used to compute cost totals. As described above, this is normally done by calculating the product of rate and number of cost items. The methods used to compute cost totals over the projected period should be clearly described in text and in a table similar to Figure IV-2.

If appropriate, the table should be subdivided or supplemented with additional tables to show cost breakdowns by office or procedure. For example, if the cost analysis comprises clerical supervisors and clerks doing indexing, docketing, and calendaring, the table (or tables) would contain major headings of indexing, docketing, and calendaring. Within each major heading, the table would show costs for clerical supervisors and clerks.

Supplementary text and tables must also be used, if appropriate, to clearly describe methods used to determine cost parameters. This is particularly true of parameters that have been evaluated indirectly.

Figure IV-2

TABLE OF BASIC COSTS

System Alternative _____

Year	Cost Item	Number of Items	Rate/Unit	Dollar Amount
Totals				

Derived Costs. As noted above, the basic approach in evaluating user costs is frequently to develop one set of costs (e.g., for the current system) and then derive other costs (i.e., for each manual or automated system alternative) from the basic costs. If this approach is used, costs are derived according to previously established methodology. This normally involves incrementing or decrementing specific basic cost parameters (e.g., rate, number of cost items) either directly or by applying percentages.

Suppose, for example, that the cost analysis comprises clerical supervisor and clerk activities and that an automated system is contemplated as a replacement for a current manual system. Suppose further that estimated time savings for the clerical supervisor and clerks are five and ten hours per week respectively. These reductions in time requirements would then be used to decrement the number of cost items (i.e., supervisor, clerks), and the basic costs would be changed accordingly to yield costs for the automated system alternative.

If, in the previous example, it is estimated that the automated system will save 10 percent of the supervisor and clerk time, then this is applied to time requirements from the basic cost analysis to obtain hourly (or some other time unit) savings. The steps described in the previous example are then followed to yield the automated system costs.

The method used to compute derived costs over the projected period should be clearly described textually and in tables similar to Figure IV-3. The particular table shown in Figure IV-3 is oriented to the above example in which the only parameter that changes is number of cost items. Similar tables could be developed to show other situations, such as when the rate changes and the number of items is constant or when both of these parameters change.

Composite Costs

Having established data processing and user costs, the analyst can now combine them into a composite cost over the projected period for each system alternative. This yields the cost values that were introduced at the beginning of this section.

Composite cost is usually computed by adding the two cost categories for each alternative and each year, and entering these totals into a table similar to Figure IV-4 with a brief supporting textual description. If a more complex procedure is used to determine composite cost, it should be accompanied by a correspondingly detailed textual description and, if necessary, a more illustrative table.

Figure IV-3

TABLE OF DERIVED COSTS

System Alternative _____

Year	Cost Item	Number of Items			Rate/Unit	Cost		
		Manual System	Automated System	Difference		Manual System	Automated System	Difference
Totals								

Figure IV-4

TABLE OF COMPOSITE COSTS

System Alternative _____

Category	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8	Totals
Data Processing									
User									
Totals									

An objective of the cost analysis is to compare costs of each system alternative over the projected period. It is important to examine the timing of projected costs for each alternative to establish the best method for cost comparisons. These methods can range from comparison of total costs over the system life span to comparison of costs that have been time-adjusted to a common year. A more complete description of comparison methods is given in Section V.

Along with a textual description and summary table, a graph is usually helpful in this comparison. When the comparison is between a manual system and an automated system, the graph results in curves similar to those shown in Figure IV-5. This graph is especially important because it shows the patterns in manual versus automated system costs--initially higher automated system costs and steadily increasing manual system costs that theoretically, after two or three years, exceed the automated system costs. The actual situation is that automated system costs may also steadily increase and, in extreme cases, may never be less than manual system costs. If the situation approximates this, benefits must be examined closely to see if they offset the absence of cost savings in automation.

The pattern of high initial automated system costs is due to the cost of procurement and installation of computer hardware and systems software, development and implementation of applications software, and overall automated system start-up costs. If an extensive conversion is involved, the period of high initial costs may be longer than is shown on the graph, depending on the size and complexity of the conversion and the time required to accumulate historical data in the new system.

Knowledge of this pattern will prevent unnecessary alarm when high initial costs are incurred for an automated system.

Benefits

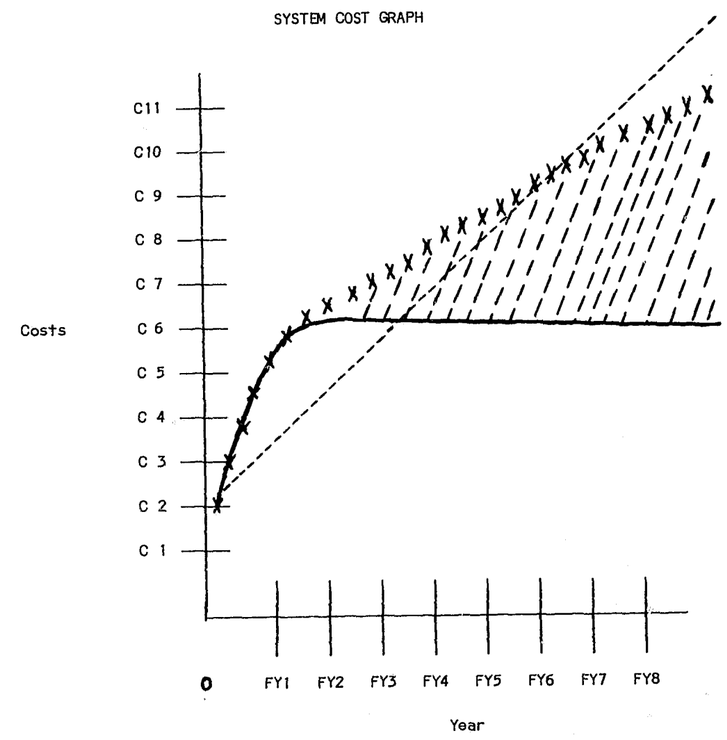
There are several ways to address benefits, and the method selected is usually dictated by the nature of the benefits in a given situation.

The most desirable way is to assign a dollar value to each benefit in a manner that will permit benefits to be considered on the same basis as costs. It is, however, unlikely that all benefits will be quantifiable in this manner.

In a situation in which there are unquantifiable benefits, the following question arises: Are the unquantifiable benefits of such importance that they overshadow the quantifiable benefits and make it meaningless to mathematically relate quantifiable benefits to costs? This is frequently the case.

Figure IV-5

SYSTEM COST GRAPH



Legend

--- Manual System

___ Automated System Composite Cost (theoretical pattern)

XXX Automated System Composite Cost (actual pattern)

/// Area of Possible Variation in Automated System Costs

It is, therefore, often necessary to devise other methods to obtain a numerical picture of benefits, and various benefit-weighting schemes will accomplish this and permit the benefits to be related to costs.

Even though benefits may eventually be combined with costs to form an overall cost-benefit picture of each system alternative, the benefit analysis should be separate from the cost analysis. Moreover, if benefits are addressed in more than one way (e.g., quantifiable, unquantifiable), these should be covered separately. This breakdown is essential, because it is important for the reader to be able to distinguish costs from benefits and to distinguish between the different ways benefits are considered.

Quantifiable

Quantifiable benefits are those that can be evaluated numerically (e.g., by assigning dollar values). Two common categories of quantifiable benefits are covered below.

Cost Savings. The most common quantifiable benefit is cost savings, and this reflects comparisons of the costs for equivalent capabilities in two system alternatives. Cost savings are computed either from the cost analysis or by using methods similar to those used in the cost analysis.

When cost savings are computed from the cost analysis, it is inappropriate to relate them (as benefits) to costs in a mathematical formula because both are costs expressed in different ways. If the formula did contain these cost savings as benefits, it would reflect costs twice: once as costs and once as benefits (this is called double counting of benefits).

On the other hand, cost savings are sometimes computed for procedures that are not included in the cost analysis. It is appropriate to include these cost savings (as benefits) in a cost-benefit relationship.

In summary, cost savings must appear only once in the relationship--either as costs or as benefits.

As an example of cost savings, a benefit of a particular system alternative may be automated case indexing. The dollar value (i.e., savings) of this benefit may be determined from the cost analysis by calculating the totals of the cost items that comprise indexing for both the automated and manual systems and then taking the difference between these totals. Other benefits may be automated calendaring and docketing, and each would be handled in a manner analogous to indexing. This situation is shown in Figure IV-6, which would contain data relative to the breakdown in the "Procedure and Cost Item" column.

Figure IV-6

QUANTIFIABLE BENEFITS

System Alternative

Year	Procedure & Cost Item	Number of Items			Rate/Unit	Cost		
		Manual System	Automated System	Difference		Manual System	Automated System	Difference
	Indexing							
	Cost item 1							
	Cost item 2							
	•							
	•							
	•							
	Calendaring							
	Cost item 1							
	Cost item 2							
	•							
	•							
	•							
	Docketing							
	Cost item 1							
	Cost item 2							
	•							
	•							
	•							
	etc.							

This tabular presentation should be accompanied by a textual description of each benefit and its evaluation method.

Even though it may be inappropriate to relate these evaluations to costs, a discussion of them in the cost-benefit analysis is useful because it shows cost savings in terms of court functions.

Additional Capabilities. A given system alternative can sometimes provide capabilities in excess of those provided by another alternative. For example, an automated system alternative can usually produce a greater variety of useful information than a manual system. These differences in capabilities represent a benefit of a specific system alternative and can frequently be evaluated and related mathematically to costs.

To illustrate the considerations in performing the evaluation, assume that the only alternatives are the current manual system and a single automated alternative. Assume further that the only noncorresponding items are certain printed reports produced by the automated system but not by the manual system. The question is: What quantifiable benefits are realized from these reports?

A common method of evaluating these benefits is to derive a value from the information contained in the reports. Some examples of this are as follows:

—In many courts, the workload prohibits timely manual monitoring of due dates for fine payments and bond forfeitures. An automated system can produce a report that shows information on the payments and forfeitures that are, or soon will be, due. This should increase court revenue, and the increase in revenue could be evaluated by using either in-house estimates or data from similar courts that had experienced an increase in revenue following automation. In any event, this would represent a quantifiable benefit derived from having timely payment and forfeiture information.

—An automated system will normally provide information that permits better visability over court caseloads and, therefore, better capabilities to assign personnel to the various courts based on their caseloads. This means that personnel can be used more efficiently throughout the court system, and it will probably result in a reduced need for additional judges and other court personnel. The value of this benefit would be based on the savings caused by more efficient personnel allocation.

—In many courts with manual systems, the workload makes it impossible to have an effective policy on continuances. One of the primary manifestations of this is an inability to give timely notification to all participants when a continuance occurs. This can result in large expenditures for jurors, witnesses, and other participants who appear unnecessarily because they were not aware a case had been continued. An automated system can provide information that will permit timely identification of continuances and notification of participants. The value of this benefit would be based on the savings that result from fewer unnecessary appearances for continued cases.

(The last two examples show that benefits derived from additional capabilities can reflect cost savings. It is usually valid to consider these cost savings as benefits either directly or, as in the two examples, indirectly because the cost savings typically reflect by-products of a system and not costs that are part of the cost analysis).

Unquantifiable

These are intangible benefits that cannot be accurately evaluated. It is better not to attempt evaluations (e.g., in dollars) of these benefits, since the evaluations could be easily misinterpreted and given an improper amount of credence. Such benefits should, however, each be given a full textual description because, even though they cannot be evaluated, it is important for the reader to be aware that they exist.

Benefits that are often unquantifiable include the following:

—Increased data accuracy and completeness.
—Increased information control.
—Improved report timeliness.
—Computer-generated warnings when action is required.
—Increased systemization of manual/automated procedures with resultant operational efficiency.
—Increased user confidence.

Weighted Benefits

When a mathematical relationship between costs and benefits is desired, the use of evaluations of quantifiable benefits that are cost savings will often be inappropriate (because of double counting). Since this is frequently the source of quantifiable benefit evaluations—and since unquantifiable benefits, by definition, have no evaluations—it is often necessary to use a weighting scheme to measure benefits and relate them to costs.

This approach is based on the theory that all (i.e., quantifiable and unquantifiable) benefits can be ordered according to their relative importance to a composite group of those involved with the system (e.g., system users and developers; those who fund, monitor, and manage the system and related activities). Then, for each sytem alternative, a rating of how well the alternative provides each benefit is assigned. These values are then used to determine a score for each alternative. Sometimes a benefit threshold is established to identify alternatives that meet or exceed certain levels of performance. The cost analysis is then applied to all or selected system alternatives to identify the most advantageous alternative.

Since this measure of benefits is inherently subjective, the opinions of several people from the group of those involved with the system should be consolidated into an overall set of weights and ratings and an overall benefit threshold.

Basically, the procedure is as follows:

—List all benefits.

—Assign a weight to each benefit based on the need for it in the system (i.e., its importance to those involved with the system).

—Develop a matrix shell as shown in Figure IV-7, with benefits and weights listed horizontally and system alternatives listed vertically (enter nothing inside the matrix where ratings and weighted summations are shown). The following rules apply:

Weights should be established so that their sum is a predetermined value (usually a convenient total such as 1, 10, or 100); mathematically, assuming 1 is the total that is used, this is expressed as

$$1 = \sum_{i=1}^{m} (\text{weight } \#i)$$

Sub-benefits can be shown under any benefit, and, for any sub-benefit, the sum of all sub-weights should be equal to the weight associated with the benefit; mathematically, for benefit #1, this is expressed as

$$\text{Weight } \#1 = \sum_{i\,=\,a,b} (\text{sub-weight } \#1_i)$$

—Establish a range for the ratings that will be entered in the matrix. The endpoints of the range (i.e., its size) will be determined by the degree of variation that is anticipated. For relatively little variation, a range of 1 to 5 would probably suffice; a range of 1

Figure IV-7

WEIGHTED BENEFITS

Threshold Value _____

System Alternative \ Benefit (Weight)	Benefit #1 (Weight #1)		Benefit #2 (Weight #2)		Benefit # m (Weight #m)	Weighted Summation
	Sub-benefit #1a (Sub-weight #1a)	Sub-benefit #1b (Sub-weight #1b)				
Alternative #1	$rating_{1,1a}$	$rating_{1,1b}$	$rating_{1,2}$		$rating_{1,m}$	$\sum$ (wt. x rating) wts. & sub wts.
Alternative #2	$rating_{2,1a}$	$rating_{2,1b}$	$rating_{2,2}$	. . .	$rating_{2,m}$	$\sum$ (wt. x rating) wts. & sub wts.
. . .						
Alternative #n	$rating_{n,1a}$	$rating_{n,1b}$	$rating_{n,2}$		$rating_{n,m}$	$\sum$ (wt. x rating) wts. & sub wts.

NOTES: 1. Weight # 1 is the weight assigned to benefit # 1, weight # 2 is the weight assigned to benefit # 2, etc.

2. Rating $_{1,1a}$; rating $_{2,1a}$;...; rating $_{1,1b}$;...; rating $_{n,m}$ can take on any value over the allowable range (e.g., 1 to 10 with 10 indicating the highest rating).

to 10 would provide more flexibility. It must be decided which end of the scale represents a high rating and which represents a low rating. For example, a rating of one may indicate the poorest benefit correlation and five may indicate the best correlation. Typically, higher importance is associated with higher numeric values in the minds of readers, so a range of 1 to 10 would suggest that 10 indicates the highest possible rating.

—If it is desirable to select a limited number of system alternatives based on their benefits, it may be appropriate to establish a threshold for system alternative acceptance or rejection. Such thresholds are highly subjective reflections of minimal acceptable benefit levels as indicated in the weights and ratings. Each alternative would be accepted or rejected based upon whether its weighted summation is above or below the threshold. For example, if the range was from 1 (poor) to 5 (good) and the sum of the weights was 1, the weighted summations could take on values from 1 to 5. Therefore, the midpoint of these possible values (i.e., 3) could be established as the threshold.

—For Alternative #1, assign a rating within the prescribed range for each benefit based on the degree to which the alternative provides the benefit. Enter these ratings in the matrix on the line for Alternative #1. Repeat this process for each alternative.

—For Alternative #1, compute

$$\text{Weighted Summation} = \left[\sum_{i = a,b} (\text{sub wt. \#1i}) \times (\text{rating}_{1,\,1i})\right] + \left[\sum_{j = 2}^{m} (\text{wt \#j}) \times (\text{rating}_{1,j})\right]$$

Repeat this process for each alternative.

An example of this method is shown in Figure IV-8, which shows four system alternatives and five benefits with one of the benefits (Varied Reports) having two sub-benefits. The weights are shown in parentheses, and the ratings range from 1 (poor) to 5 (good). Assume a threshold is desired and has been set at 3.5. The weighted summations are computed using the weights and ratings as follows:

Current Manual: (.1x1) + (.2x1) + (.3x1) + (.2x3) + (.1x2) + (.1x2)= 1.6

Summary Reporting (batch): (.1x2) + (.2x2) + (.3x2) + (.2x4) + (.1x1) + (.1x2) = 2.3

Figure IV-8

WEIGHTED BENEFITS EXAMPLE

Threshold Value 3.5

System Alternative \ Benefit (Weight)	Single Data Input (.1)	Centralized Data Storage (.2)	Rapid Data Access (.3)	Varied Reports (.3)		Systematized Manual/ Automated Procedures (.1)	Weighted Summation
				Summary Statistical (.2)	Case Data (.1)		
Current Manual	1	1	1	3	2	2	1.6
Summary Reporting (batch)	2	2	2	4	1	2	2.3
Case Reporting (batch)	5	5	3	4	5	3	4.0
Case Reporting (batch & on-line)	5	5	5	4	5	4	4.7

Case Reporting (batch): (.1x5) + (.2x5) + (.3x3) + (.2x4) + (.1x5) + (.1x3) = 4.0

Case Reporting (batch and on-line): (.1x5) + (.2x5) + (.3x5) + (.2x4) + (.1x5) + (.1x4) = 4.7

This means that only the last two alternatives are acceptable. Their weighted summations and cost analysis results should then be used to select the best alternative. Since there is a significant difference in their weighted summation, the Case Reporting (batch and on-line) alternative would be the desirable selection if the cost is not prohibitively higher than the cost of the Case Reporting (batch) alternative.

If a weighting scheme is used, it should be thoroughly documented to permit the reader to determine precisely how the evaluation was developed.

Other Methods of Benefit Evaluation

There are other ways to evaluate benefits in specific situations. They include the following:

Consideration of Disadvantages. It is sometimes appropriate to consider both benefits and disadvantages. Often called "disbenefits," disadvantages are characteristics associated with a system alternative that adversely affect its performance or cause problems. They are, in effect, negative benefits and should be handled as such.

An example of a "disbenefit" is a system alternative that costs more than the current system. Suppose that the current system is manual, that this system and two automated alternatives are under consideration, and that costs are being evaluated relative to manual system costs. If one of the automated alternatives represented an annual cost savings of $50,000 and the other cost $20,000 more annually than the manual system, the first would be a benefit and the second a "disbenefit" or negative benefit. This can be seen by the algebraic expressions of cost savings: + $50,000 for the first alternative and -$20,000 for the second alternative.

Another example of a "disbenefit" would be a debilitating loss of morale in a state court system in which the clerical personnel were extremely apprehensive over perceived reduced personnel levels caused by automation. In this situation, there would be an unquantifiable "disbenefit" associated with any automated system alternative.

Modeling Approach. A possible method of obtaining an insight into the impact of unquantifiable benefits is to set up a simple cost-benefit model. This type of approach can be used by analysts in order to better understand the relationship of unquantifiable benefits to possible outcomes of the cost-benefit analysis. Costs and quantifiable benefits would be computed for each system alternative as in a normal situation, and the mathematical formula (e.g., benefits minus costs) to be used to relate costs and benefits would be established. Then, for each unquantifiable benefit and each system alternative, a dollar range or various dollar values would be hypothetically established. This model would be "run" using each hypothetical dollar value to investigate what the quantitative cost-benefit relationship would be for all combinations of these dollar values.

Since this is simply a model to obtain insight into the impacts of the unquantifiable benefits, it should not be used to assign dollar values to unquantifiable benefits for use in the actual cost-benefit evaluation.

Composite Benefits

Composite benefits can be expressed in various ways, ranging from textual descriptions to a highly integrated table of weighted benefits.

Quantifiable benefits can be summarized into composites by adding the value of each benefit for each system alternative and each year. If the ultimate intention is to relate these benefits to costs, the benefits that were attributed to cost savings and included in the cost evaluation should be identified so that they will not be included in any formula involving costs. This summary can be divided into benefits accrued by various court offices and agencies (e.g., clerks' offices, judges' offices).

Depending on the timing of quantifiable benefits over the system life span, it may be necessary to time-adjust them to permit a valid comparison of the costs and benefits of each alternative. A more complete description of comparison methods is given in Section V.

Unquantifiable benefits are described textually, so it is impossible to develop a composite. It is helpful, however, to cover the benefits in a meaningful order (e.g., by court office).

A table that results from the benefit weighing/ranking exercise is, by definition, a composite when a benefit weighting scheme is used.

Cost and Benefits

Summarization

As described at the beginning of this section, the most cost-beneficial alternative is ideally the one for which the difference between benefits and costs has its greatest value. It was noted that it may be impossible to realistically form this mathematical relationship, so it may be necessary to consider other possibilities. In whatever way costs and benefits are related, the identification of system alternatives in a cost-benefit analysis must be tempered by consideration of factors relating to the environment in which the system will operate.

If quantifiable (i.e., in dollars) benefits are to be mathematically related to costs in a given cost-benefit analysis, then the formula

Relationship = benefits - costs

is used for each system alternative. This provides a comparison of costs and benefits in easily understood units (e.g., dollars), and it is usually the most reliable method to relate costs and benefits. It does not, however, allow for the magnitude of the cost and benefit values.

Consider the following example:

Cost of alternative A: $10,000
Benefits of alternative A: $14,000

Cost of alternative B: $5,000
Benefits of alternative B: $8,000

Then using the above formula, the cost-benefit relationships are:

Alternative A: $14,000 - $10,000 = $4,000
Alternative B: $8,000 - $5,000 = $3,000

This means that alternative A is more cost-beneficial, but note that it costs twice as much as B. In view of this funding difference and the fact that both alternatives yield substantial benefits, it is entirely possible that alternative B would be the better choice based on the funding that is available.

Cost-benefit relationships using the subtraction formula can be summarized as shown in Figure IV-9.

An alternative method of relating quantifiable benefits to costs is to compare the ratios of benefits to costs. For

CONTINUED

1 OF 3

Figure IV-9

COSTS AND QUANTIFIABLE BENEFITS

Alternative & Value		FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8	Totals
# 1	Costs Benefits									
	Benefits-Costs									
# 2	Costs Benefits									
	Benefits-Costs									
	∘ ∘ ∘									
# n	Costs Benefits									
	Benefits-Costs									

each system alternative, the following relationship would be established:

$$\text{Relationship} = \frac{\text{benefits}}{\text{costs}}$$

(In a given situation, either the subtraction formula would be used for all system alternatives or the ratio would be used for all system alternatives.) If a measurement is made of all benefits and costs for a variety of projects and there is no practical funding limitation, it would be reasonable to undertake those projects for which the ratio is greater than one. Since this is seldom the situation in the courts, the ratio formula is generally not a useful technique to relate quantifiable benefits and costs in a courts environment.

Quantifiable benefits that are not to be mathematically related to costs (e.g., costs savings) and unquantifiable benefits should be shown in a table that, for each system alternative, gives a textual summary (including cost savings for that type of quantifiable benefit) of each applicable benefit, juxtaposed with the annual cost of that alternative over the system's life span.

When a weighting scheme is used, the weighted benefit summation is used with annual costs for each system alternative as shown in Figure IV-10. The weighted benefit summation is a composite representation of the benefits provided for each alternative. This summation is mathematically related to costs by the formula:

$$\text{Relationship} = \frac{\text{benefit summation}}{\text{costs}}$$

This indexed cost-benefit relationship is more meaningful here than a subtraction formula, because benefits are not expressed in units such as dollars.

There are some pitfalls in using the ratio, because it may not yield the same result as the subtraction formula. (The reader should note that this is largely a theoretical comparison because the weighting scheme is normally used as an alternative to the subtraction formula when benefits cannot be quantified in dollars.) As a simple illustration, consider the same two alternatives used in the example above, and assume the weighted benefit summations are proportional to the dollar values of the benefits that were given in the example. Assume this gives the following benefit summations:

Alternative A: 140

Alternative B: 80

Figure IV-10

COSTS AND WEIGHTED BENEFITS

Alternative and Ratio		Benefits Weighted Summation	Costs								
			FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8	Totals
# 1	Costs										
	Benefit/Cost Ratio										
# 2	Costs										
	Benefit/Cost Ratio										
# 3	Costs										
	Benefit/Cost Ratio										
# N	Costs										
	Benefit/Cost Ratio										

Using costs expressed in thousands, the following benefit scores result:

$$\text{Alternative A: } \frac{140}{10} = 14$$

$$\text{Alternative B: } \frac{80}{5} = 16$$

Hence, alternative B appears to be more cost-beneficial using a weighted summation and ratio. The situation is almost identical to the one in the previous example (i.e., same costs, proportional benefits), and it would be reasonable to expect the same results. But alternative A emerged as the most cost-beneficial in the previous example using the subtraction formula.

The ratio formula should, therefore, be used with some caution, although it can provide valuable guidance in identifying the most cost-beneficial alternatives.

Section V

Conclusions

Introduction

At this point, the cost-benefit analysis should have produced evaluations of costs and benefits and some type of relationship between costs and benefits. These results must next be interpreted and their impact appraised.

Interpretation of Results

The results of the cost-benefit analysis should be interpreted in a manner that, ideally, will identify the most cost-beneficial system alternative. This ideal situation may be impossible to realize, but it should be approached to the maximum degree possible. The considerations are as follows:

Use of Cost and Benefit Patterns

A table or graph (for the purpose of this discussion assume it is a graph) should be developed with a separate cost and benefit (if benefits are quantifiable) curve for each system alternative or subset of the most cost-beneficial alternatives. These curves would be similar to those shown earlier for costs in Figure IV-5. The curves will show the cost and benefit patterns of each alternative, and, based on these, the method used to evaluate costs and benefits can be chosen.

It is first necessary to examine the cost curves to see whether they all follow the same basic cost pattern. A similar examination of the benefit curves should be conducted. If all the cost curves follow the same pattern and all the benefit curves follow the same pattern, a relatively simple comparison of alternatives will probably be possible using the actual

yearly cost and benefit projections over the system life span. More typically, the cost curves and benefit curves do not follow the same patterns, and this will probably necessitate a more complicated comparison in which costs and benefits are projected to a common base year to allow for different values of money at different times. These two possibilities are described in the next paragraphs.

Similar Cost and Benefit Curves

If the curves for automated alternatives follow the same basic cost and benefit patterns, the cost-benefit relationships for the system life span can be examined using graphs and cost-benefit totals. Since the benefits are assumed to be quantifiable and can be mathematically related to costs, another set of curves can be developed to show the quantitative cost-benefit relationship for each viable alternative. It is also valid to consider total costs, total benefits, and a total that reflects the cost-benefit relationship over the system life span. Then the most cost-beneficial alternative can be selected.

If the benefits are unquantifiable and/or are cost savings derived from the cost evaluation, the process becomes more subjective. The cost curves and total costs can be used to identify the most cost-effective alternative, but a qualitative measurement of benefits must be made and superimposed over the cost evaluation. This can modify the alternative that may emerge as the best when based only on cost criteria. What frequently happens is that the choice is narrowed to two or three alternatives, based on quantitative cost and qualitative benefit evaluations.

Dissimilar Cost and Benefit Curves

If all of the curves do not follow the same basic cost and benefit patterns, the patterns for each alternative should be examined to see how they can be brought into a common framework that will permit comparison.

This is necessary because the techniques used when the curves are similar do not yield reliable and useful information when the variation of either costs or benefits is non-uniform over the system life span. The curves themselves yield little cumulative information because of their variation. Consideration of total costs and benefits can be deceptive because they do not allow for the effect that the timing of costs and benefits has on the various system alternatives.

The basic costs and benefits, however, can be adjusted to permit comparison. The usual approach is to employ present

value techniques to express cumulative costs and benefits in terms of current-year funding requirements for each system alternative. This can be done by applying an appropriate discount rate to costs and benefits for each year (or month, if the situation warrants) of the system life span in order to translate all costs and benefits to the current year and then adding costs and adding benefits for each system alternative. Present value methods and tables for these calculations are available in standard business textbooks[1] or in books of mathematical tables.[2]

Present value reflects the amount of money that would be needed in the current year to finance a system over its life span. It does not realistically reflect actual (on a cash-flow basis) annual costs and benefits over this period. It assumes funds will be available in advance (sometimes many years in advance) of when they are actually needed, and this is also unrealistic when viewed relative to a single system alternative.

The present value approach becomes more meaningful, however, when applied uniformly to several system alternatives. What present value does, therefore, is provide current-year evaluations of cumulative costs and cumulative benefits based on when funds will be needed, and these evaluations can be used for cost-benefit comparisons among several alternatives.

Present value is based on two things:

—The discount rate, which is indicative of the interest rate that could be obtained if the current amount (i.e., present value) were invested until needed to meet costs.
—The time (typically number of years or months) until the money will be needed to meet costs.

As a simplified example of this principle, suppose a minicomputer could be purchased any time in the next 8 years for $120,000. If it was bought in the current year, the net cost would be $120,000. On the other hand, at nine percent interest compounded, any investment will double in approximately

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[1] In particular, present value methods and tables can be found in any textbook on engineering economy and capital budgeting such as Principles of Engineering Economy by Eugene L. Grant and W. Grant Joeson (New York, New York: Ronald Press Co., 1964).

[2] C.R.C. Standard Mathematical Tables (Cleveland, Ohio: Chemical Rubber Publishing Co.).

8 years. If, therefore, $60,000 was invested at nine percent, the investor would have $120,000 after 8 years. This means that a purchase of the minicomputer at the end of the eighth year could be made at a net cost of $60,000 because of the interest accrued over the period.

This discussion assumes that benefits are quantifiable. Unquantifiable and cost savings benefits are evaluated qualitatively and used with the quantitative present value for costs to provide the best possible cost-benefit evaluation for each alternative.

While present value is a precise way to compare the costs and benefits of various system alternatives, it is often not used by the judiciary for the following reason: from a practical standpoint, it is a difficult concept to accept because a system is never funded at the outset for its entire life span. Many judiciaries, therefore, use less precise methods to compare system alternatives. The most common approach is to compare total costs and benefits (if benefits are quantifiable) over the system's life span.

Summary

Ideally the cost-benefit analysis will identify the single system alternative that is clearly the one that should be adopted. In many instances, this ideal situation may not be realized. One reason for this is that the cost-benefit analysis reflects the situation at the time the analysis is conducted, and this situation may change over the system's life span. Another reason is that it may be unrealistic to identify a single alternative as the most cost-beneficial. And even when a single alternative emerges as most cost-beneficial, other considerations (e.g., structure of the state court system, political considerations, and availability of funding) may dictate that other alternatives remain in contention.

Excluding these other considerations, the cost-benefit analysis should at least reduce the choices to the two or three most cost-beneficial alternatives.

If several alternatives are identified in this manner, the selection among them becomes a more subjective process into which the other considerations must once again be interjected. In a situation such as this, the top two or three alternatives may be forwarded to the appropriate group (e.g., the legislature or supreme court), with a discussion of positive and negative points for each alternative.

Another benefit derived from the cost-benefit analysis is that the rigorous development of cost and benefit evaluations forces the judiciary to focus on the cost-benefit attributes of each system alternative. As a result, the alternatives

will probably be viewed from a somewhat different perspective than would have been possible if the analysis had not been done. This should greatly enhance the credibility of the judiciary in the selection process as well as the selection process itself, and it should produce a greater cost-benefit payoff over the system's life span.

Appraisal of Impacts

Upon completion of a cost-benefit analysis, costs and benefits will have been identified over the system's life span for a limited number of system alternatives (usually three or less). It is important to represent realistically the results of the analysis in order to allay false expectations of immediate benefits and to appraise accurately the full impact of system costs. Virtually nothing is more damaging to a new system than to create false impressions of its benefits and costs, because it will soon be perceived that the system is not performing up to expectations or is costing too much.

This is especially important in the case of an automated system in view of the normal pattern of costs and benefits--costs that, at least initially, are high because of computer system development and installation, and benefits that often are not realized until some point in the future. Unfortunately, this pattern of costs and benefits presents the "worst of both worlds," and readers of the cost-benefit analysis must be properly apprised.

A typical situation is for the predominant benefits to be in the form of cost avoidance. An actual budget reduction is not realized in this situation; cost savings can only be seen by examining projected costs with and without the system.

Since court operations are labor intensive (i.e., heavily dependent on court personnel), cost savings are usually directly related to personnel levels. While a reduction in staff in the courts may, therefore, be theoretically justified when a cost-beneficial alternative is implemented, it may be unlikely that any substantive reduction in staff will actually occur. For example, removing 10 percent of the court workload is unlikely to result in the immediate elimination of positions. This means that the only way to realize cost savings may be by deferring the creation of new positions. A true representation of benefits, therefore, can only be obtained by an analysis that covers the entire system life span.

The above scenario is shown in Figure V-1, which shows a reduction of actual personnel requirements when a computer is installed. Actual manning, however, remains constant until the workload "catches up." Even though no absolute savings in court personnel are realized, automation makes it unnecessary

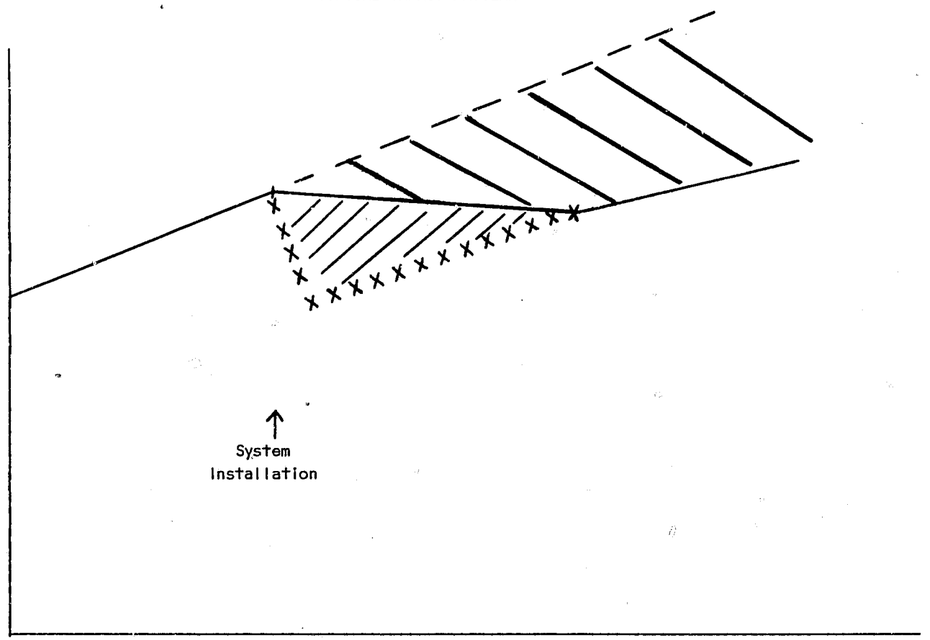
to steadily increase personnel as would be required in a continued manual environment.

Moreover, as shown in Figure V-1, court personnel are freed to perform other tasks. Even this can be somewhat deceptive, because the cost savings brought about by removal of some portion of an individual's workload are difficult to estimate in the working environments that often prevail. For example, it may be impossible to realize savings associated with the elimination of 10 percent of the work of a single clerk/typist in a small court.

These are typical of the considerations that should be reflected in the cost-benefit analysis so that those who use its results (e.g., members of the supreme court and legislature) will not be disenchanted at high initial costs and the absence of an immediate payoff.

Figure V-1

TYPICAL IMPACT PATTERN



Legend (after system installation)

- - - Personnel Level (without automation)
——— Personnel Level (with automation)
X X X Personnel Requirements (with automation)
///// Freed Personnel Time
\\\\\ Personnel Savings

Appendices

Appendix A: Case Studies

Three case studies are contained in this Appendix. The cases have been formulated to illustrate three different situations in which the need for cost-benefit analyses could arise. In each situation, the application of the methodology is different.

The first case illustrates a situation in a small, predominantly rural state where the judiciary has decided to automate the state-level production of statistical reports. The cost-benefit analysis is done to provide guidance in the procurement of computer facilities. Five procurement approaches are identified, and costs and benefits are evaluated for each approach. A weighting scheme is used in the benefit evaluation.

The second case illustrates a situation in which a medium-sized state is experiencing increasing difficulty producing meaningful statewide judicial statistics because of increasing caseloads. The study covers seven manual and automated processing alternatives that would address this problem. It is the only one of the three case studies in which benefits are quantified and mathematically related to costs. It also illustrates the use of present value computations to evaluate costs and benefits.

In the third case, a computer system is contemplated to provide operational support to trial courts throughout a large, relatively urbanized state. The system would also produce statistical reports at the state level. Three manual and automated processing alternatives are considered, and weighted caseload figures are used to estimate court workloads. For illustrative purposes, benefits are assumed to be unquantifiable and are considered in two ways. First, a judgmental assessment is made of the benefits. Second, they are evaluated using a weighting scheme. Then the results obtained from using these two approaches in the cost-benefit analysis are compared.

Case 1: Middlesex District Court Docketing System

Middlesex is the name of a state. Obviously it is not a real state, nor is the information about its courts and docketing system real. While the case is fictional, the material is based on observations in state court systems and thus it may be fairly characterized as a composite of those observations.

The case describes the preparation of a cost-benefit analysis, the focus of which is the evaluation of five alternatives selected by court policy makers for automating the docketing system. The first two are the purchase or lease of a small computer with program development by court staff; the other three involve the use of a large executive branch computer with program development by court staff, a private firm, or executive branch staff. After covering background information and describing the projected docketing system and the five alternatives, the case follows the suggested order of analysis preparation, beginning with computation of cost data, moving to the identification and measurement of the benefits, and concluding with a comparison of the costs and benefits and a discussion of the results.

It is important to note at the outset that a good deal of controversy swirls around the use of cost-benefit analysis.[1] In some analyses, primarily in health and education fields, a dollar value has been set on the value of human life, which has sparked a heated debate on the appropriateness of such an assignment. Other commentators see the concentration on costs resulting in the replacement of the elegant with the functional in, for example, the construction of new buildings. Supporters point to huge dollar savings in the procurement of

[1]For an interesting exchange of views, see Robert Anthony and Regina Herzlinger, Management Control in Profit Organizations (Homewood, Illinois: Richard Irwin, 1975) and Ida Hoos, Systems Analysis in Public Policy (Berkley: University of California Press, 1972). Harvard Business School professors Anthony and Herzlinger argue for the use of cost-benefit analysis, while pointing out its limitations. A social scientist at the University of California at Berkley, Professor Hoos believes that cost-benefit is an inappropriate means of arriving at public policy decisions.

weapons systems in the Department of Defense and to other savings in a wide variety of public and private sector organizations. The intent in this case study is to proceed in a methodical manner in the compilation of costs and benefits and then to rank the five alternatives; the final recommendations, however, will depend partly on the cost-benefit ranking, partly on the spread among the alternatives, and partly on other judgmental factors, such as the local political climate and the availability of competent staff.

Background

Middlesex is a small, predominantly rural state, although four of its cities have populations greater than 50,000. The population as recorded by the 1970 census was 3,420,000--up 300,000, or about 10% from 1960. It is generally thought of as a progressive state in most political circles.

The trial courts have evolved rapidly over the past 10 years with a four-tiered system--district, county, family and probate, each with statewide jurisdiction--giving way in progressive steps to a single, one-district court system in 1976 (Figure 1). While judge assignments in the district court continue to be based to some extent on experience, with the lower court judges still being assigned by and large to traffic and small claims matters, all of the judges of this court receive the same salary, some $45,000 per year. In enacting a single pay scale for all trial judges, the legislature believed that over a period of time the judiciary would evolve into a group of generalists, with each being able to adjudicate a broad range of cases.

As shown in Figure 2, case filings over the past 18 years, 1960-1978, have continued to grow, although at a somewhat diminished rate since 1970. The growth of civil actions under $10,000, generally small claims, has outstripped all other types of cases by doubling to a level of 60,000 in this 18-year span. The rise in criminal cases seems to be tapering off, with the increase in felonies and misdemeanors over the past 8 years at 7.5% and .6%, respectively.

As part of the overall reorganization of the court system, the Supreme Court of Middlesex has adopted and is supporting a number of initiatives in administration, one of which is the upgrading of its information systems. The office of court administration at the direction of the supreme court has made a substantial and continuing commitment to the standardization of recordkeeping at the trial court level, including the consolidation of 350 outstanding forms down to 86, the adoption of data items for case monitoring based on the results of a national

Figure 1. STRUCTURE OF THE STATE OF MIDDLESEX COURTS IN 1966 AND 1976

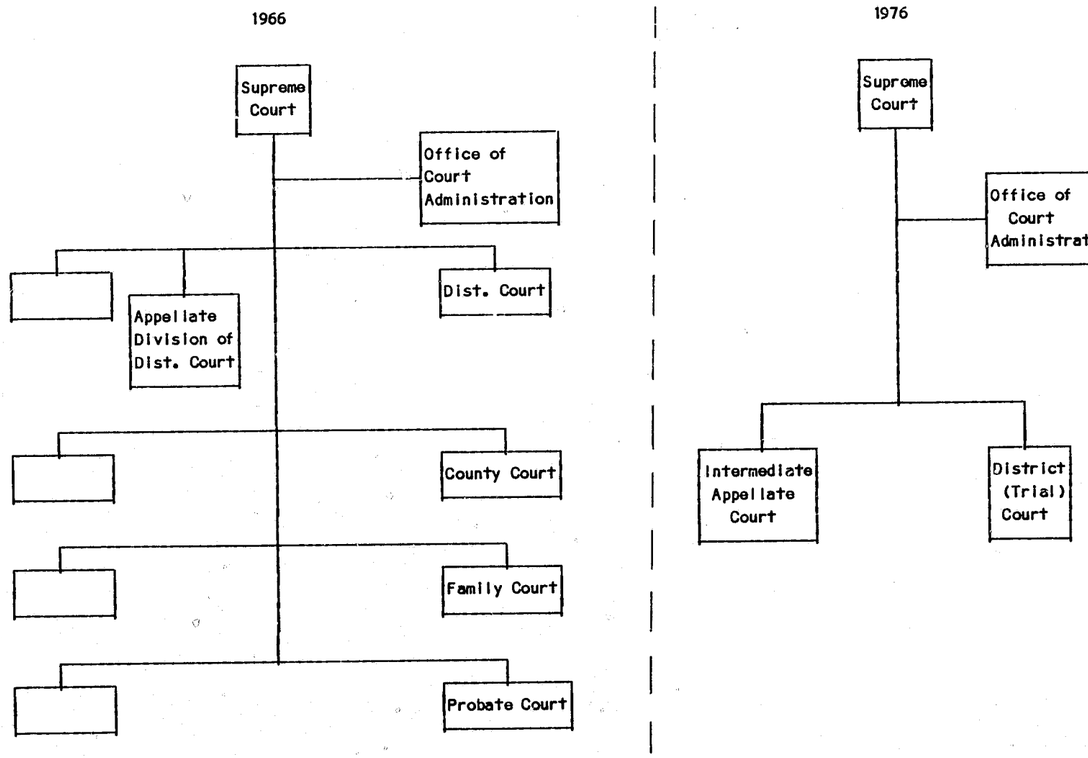


Figure 2 THE STATE OF MIDDLESEX CASE FILINGS (1960, 1970, 1978)

Court	1960 Filings	1960 % increase over filings of 10 years ago	1970 Filings	1970 % increase over filings of 10 years ago	1978 Filings	1978 % increase over filings of 8 years ago
Supreme	102	14.1	115	12.7	126	9.6
Intermediate Appellate[1]	1,759	173.2	2,801	59.2	3,312	18.2
District Court						
Felonies	15,322	22.8	18,211	18.9	19,579	7.5
Civil Actions over $10,000	17,869	16.7	19,321	8.1	20,811	7.7
Probate[2]	5,261	19.1	5,561	5.7	5,611	.9
Family[3]	25,211	26.3	30,161	19.6	36,099	19.7
Misdemeanors[4]	91,011	31.6	93,621	2.9	94,211	.6
Civil Actions under $10,000[4]	32,222	73.8	45,351	40.7	63,789	40.6
TOTAL	188,757	35.6	215,142	14.0	243,538	13.2

[1]The intermediate appellate court was established in 1968; prior to that time, appeals, other than those decided by the supreme court, were adjudicated by the appellate division of the district court.

[2]Prior to 1974, these cases were heard in the probate court; at the time, this court was merged into the district court.

[3]Prior to 1969, these cases (domestic relations, divorce, custody) were heard in the family court; at that time, this court was merged with the district court.

[4]Prior to 1976, these cases were heard in the county courts; at that time, these courts became part of the district court.

survey, and the adoption of standardized docketing forms for major criminal and civil cases. As with other work involving a significant commitment of resources, the administrative office officials meet regularly with legislative committees and individually with key legislators to discuss the financial and other aspects of the reorganization effort.

The majority of the docketing work is performed at the trial court level, where the new forms are prepared by clerks, who retain a copy for their own use and forward another copy, from which statistics are compiled, to the state administrative office. Having successfully implemented a manual system from 1975 through 1977, the administrative office engaged a team of court information system experts to review the manual system and identify alternatives for the future. Composed of the deputy administrator of a large urban court system, a manager of a neighboring state's information services department, and a staff member of a national court organization, the team gave the manual system high marks but felt the system would be more responsive to court needs if it were automated. This substantiated the feelings of the administrative office staff, the supreme court, and others within the state.

Such a preliminary review is a critical step, for changes to manual practices can often yield as high, or even higher, gains in productivity as the execution of an automated system. It should also be noted that the administrative office used the expertise of outside people who have relevant experience. It is highly recommended that this be done whenever possible, because the advice of these experienced people can be invaluable in such activities as computer procurement and systems development, implementation, and operation.

Continuing its policy of modernizing at a measured, deliberate pace, the administrative office decided to automate only the processing at the state office and leave the manual procedures in place at the trial court level. The alternatives are covered in the system alternatives, Section C.

Computer processing of case filings and terminations will be limited to felony cases and civil actions over $10,000. It is not anticipated that traffic and minor filings will be automated within the next five years, so that this area of the caseload will not be a factor in the analysis. While no firm plans have been made as to appellate case processing, the prevalent feeling is that if all goes well, this part of the caseload will be computerized in two or three years after the initial implementation.

Description of System

Felony cases and civil actions over $10,000 are heard in twelve courthouses, which are fairly evenly distributed across the state. Replacing hand-prepared 20" by 30" docket books, the docketing system in current use requires entry in a much smaller, two-part form, maintained in looseleaf-type binders. The bottom part of the form serves as a permanent record of transactions, while the top is broken into five parts which can be torn off and forwarded to the administrative office at the time of a transaction. A simplified version of the forms is shown in Figure 3.

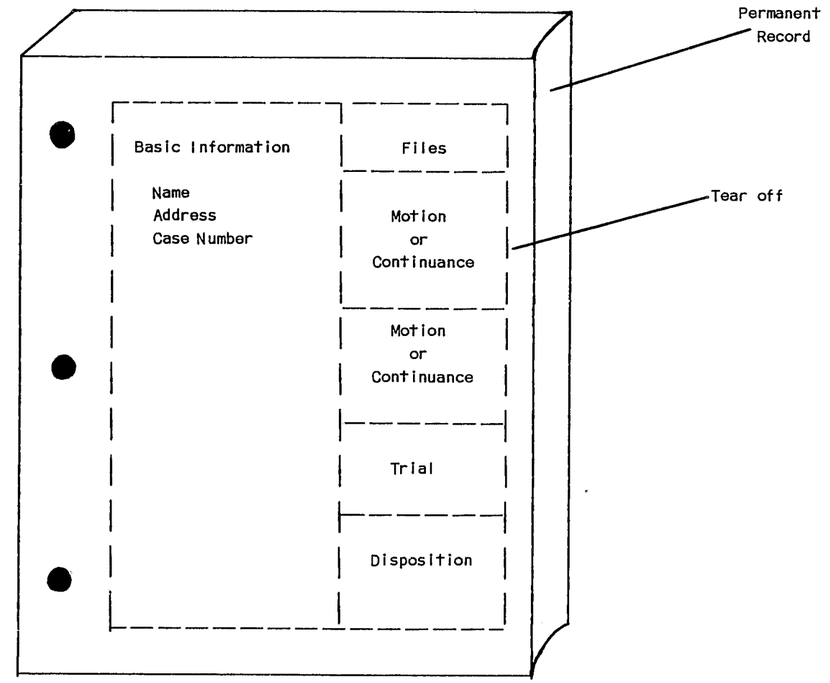
The "tear-offs" are batched, that is, stored until the end of the week, and then mailed to the administrative office. Currently, because of the large volume--about 90,000 transactions per year--court staff compiles all filings and dispositions but only samples the volume of the other "tear offs." Firm figures on filings and dispositions result from this analysis, but sampling yields only an indication of the processing times from filing to trial and from trial to disposition, of frequency of continuances, and of other items. The computer system is to remedy this situation by maintaining data on all aspects of all cases; when it is fully implemented it will produce the following reports:

—Weekly, monthly, and yearly filings by court (currently, only monthly and yearly figures are compiled).
—Weekly, monthly, and yearly dispositions by court (currently, only monthly and yearly figures are compiled).
—Monthly delay report, listing overdue criminal and civil cases (not currently reported).
—Case inventories, listing each case in the system by processing stage, e.g., awaiting trial (not currently reported).
—Yearly report on filing to disposition time by judge (not currently reported).
—Various system housekeeping reports, indicating the number of transactions, the data entry clerk responsible for the entry, etc. (not necessary nor present for current operations).

System Alternatives

The team of experts identified eight alternatives, which were reduced to the following five after review by court policymakers.

Figure 3 A SIMPLIFIED VERSION OF MIDDLESEX DOCKETING FORM



—Small Computer Purchase: The small computer, often termed "minicomputer" by experts in the field, would be outfitted with two video terminals (to be used for data entry and machine operation, but not for data retrieval purposes), a printer, and two flexible disk units, called "floppys." When working as planned, the system operates on one 8 AM to 5 PM shift and would be running at 60% of capacity. Data entry would be done exclusively in the administrative office and not in any of the trial court locations. Program development would be undertaken by court staff, requiring the establishment of a small court information system department. It would be composed of a manager, two system analyst programmers, two data entry operators, and one computer operator.

—Small Computer Lease: This option would be exactly the same as the preceding one except that the computer would be leased.

—Use Large Executive Branch Computer, with Court Staff Developing Programs: Under this arrangement, court staff would develop the necessary programs as would be the case with options 1 and 2. Once developed, the system along with others from a wide variety of other state government systems, would be run on a large executive branch computer. The court would be billed for only the time it "clocked" on the computer. The data would be entered on key to diskette units in the administrative office, and the diskettes would be carried to the data center for processing. With this alternative, there would be no need for a computer operator; but for that, staffing would be the same as for options 1 and 2.

—Use Large Executive Branch Computer, Contract with Private Organization for Program Development: As with option 3, the court would rent time on a large executive branch computer. Program development would be executed by the letting of a contract for the work to a private organization that specializes in this work. This option and the following one require the least number of court staff: a manager, one system analyst/programmer, and two data entry operators.

—Use Large Executive Branch Computer for Program Development and Computer Services: The only difference

between this option and the previous one is that the executive branch would also undertake to develop the computer programs.

Costs

Following the methodology in Section IV, costs are divided into two broad categories, data processing and user. As shown in the tables accompanying this description, the data processing portion is further subdivided into development, or one-time costs, and yearly operating, or continuing costs. This is done to facilitate further financial analysis, relating to the funding of the system.

Often LEAA funds the development of court computer systems, while a local government unit--either state, county, or municipal--pays for continuing operating costs.[2] Adequate funding is the bedrock on which the system should be built, for without it even a superior development effort may be delayed and in the end destroyed. It is, therefore, advisable to inform funding authorities of the financial requirements and if possible to secure funding commitments from them. Over the past three years, most state court systems have established judicial planning committees (JPCs) which, among other things, decide how LEAA funds will be used.[3] Working closely with the committee may help resolve financial problems.

Data Processing Development Costs

Personnel Costs. Personnel costs make up a part or all of a significant number of items in the main working papers of the cost portion (Figures 4 through 9) of the analysis, which will be covered in detail later in this section. In order to make these entries, preliminary computations of personnel costs are necessary because salaries are apportioned among a number of cost items. Figure 4 shows the allocation of personnel costs by administration, programming activity, and other work items for alternative 1, the purchase of a small computer system. These personnel costs are not prepared in table form for the other four alternatives, because only two cost items differ

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[2]For a more detailed discussion of this subject matter, see Conte, S., Popp, W., and Steelman, D., "The Lessons of PJIS", State Court Journal, Summer, 1978.

[3]See National Center for State Courts, Planning in the States: Trends and Developments 1976-1978, Fall, 1978.

Figure 4: ALLOCATION OF PERSONNEL COSTS BY COST CATEGORY FOR ALTERNATIVE 1.
(Middlesex district court computer-based docketing system)

Staff[1]	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Manager (30,000 salary multiplied by 1.35 for fringe benefits and overhead 40,500)									
Administration	15,500	17,500	20,000	20,000	25,000	25,000	25,000	25,000	173,000
Applications Prog. Development	25,000	25,000	14,500	10,000	—	—	—	—	74,500
Applications Prog. Maintenance	—	—	10,000	16,500	24,000	26,500	29,000	31,500	137,500
	40,500	42,500	44,500	46,500	49,000	51,500	54,000	56,500	385,000
Senior System Analyst (25,000 34,000)									
Applications Prog. Development	34,000	35,500	17,500	19,500	20,000	—	—	—	126,500
Applications Prog. Maintenance	—	—	20,000	20,000	21,500	43,500	45,500	48,000	198,500
	34,000	35,500	37,500	39,500	41,500	43,500	45,500	48,000	325,000
System Analyst (20,000 27,000)									
Applications Prog. Development	27,000	20,000	—	—	—	—	—	—	47,000
Applications Prog. Maintenance	—	8,500	30,000	31,500	33,000	34,500	36,500	38,500	212,500
	27,000	28,500	30,000	31,500	33,000	34,500	36,500	38,500	259,500
Computer Operator (15,000 20,000)									
Computer Operations	20,000	21,000	22,000	23,000	24,000	25,500	27,000	28,500	191,000
Data Entry Clerks [(2) 10,000 27,000]									
Applications Prog. Development	13,500[2]	5,000	5,000	5,000	5,000	—	—	—	33,500
Data Entry	—	23,500	25,000	26,500	28,000	34,500	36,500	38,500	212,500
	13,500	28,500	30,000	31,500	33,000	34,500	36,500	38,500	246,000
TOTALS	135,000	156,000	164,000	172,000	180,500	189,500	199,500	210,000	1,406,500

[1]Staff salaries are all computed at 135% of the actual rate to account for fringe benefits of 25% and overhead of 10% and are projected to rise at a rate of 5% per year (data have been rounded to the nearest $500).

[2]One of the two projected data entry persons will be hired during the first year; as the operations work begins in the second year, the second operator will be added to staff.

among all five alternatives and they are discussed in the text. Still, to ensure completeness and to provide an audit trail, it is suggested that in an actual analysis, this table be prepared for all alternatives.

In preparing personnel figures, it is important to take into account the costs of fringe benefits (hospitalization, vacation, disability, etc.) and overhead (space, use of telephone, clerical supplies). Fringe rates start about 20% of salary and go up from there; in this analysis a rate of 25% is used. A commonly used federal rate for overhead is 10% and that convention is adopted here. So for a staff member earning $25,000, the costs to the state would be $25,000 times 35% of the salary ($8,750), yielding a total cost of $33,750. All of the personnel costs in Figure 4 are portrayed at the full cost figure (i.e., the $33,750 figure as opposed to the $25,000 figure).

Alternative 1 will require the services of a manager, two system analyst/programmers, one of whom should be at a senior level, a computer operator, and two data entry clerks. Under alternative 2, there is no change in this staff composition.

For the remaining alternatives, modifications to this staff would be necessary. For alternatives 3, 4, and 5, the executive branch agency will supply its own computer operators, eliminating the need for the court to employ one. For alternatives 4 and 5, the senior systems analyst is dropped from staff; this is because the development work is performed by either a private firm or the executive branch state agency.

After the personnel information is prepared, it should be reviewed. The simple display of personnel projections in table form often points to developments which would not otherwise be obvious. For instance, as shown in Figure 4, the information systems manager, after devoting most of his work effort during the first two years to program development, gradually spends more of his time in administration. This table also points out the gradual shift of the system analyst responsibilities from program development to program maintenance. In both cases, the changes require a significant shift of funds from development to operations, which may be of interest to policymakers.

The next step is to transfer the cost items in Figure 4 to the appropriate categories in Figure 5. For example, the entries in Figure 4 under FY 1 for time development of application programs ($25,000, $34,000, $27,000, and $13,500) are totaled and an entry of $99,500 is made in Figure 5. Similar entries must be made for all of the items with a personnel component in Figures 5 through 9.

Figure 5: ITEMIZED COSTS FOR ALTERNATIVE 1, PURCHASE A SMALL COMPUTER

Cost Item	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development									
Equipment procurement or long-term lease	150,000	—	—	—	—	200,000	—	—	350,000
Applications programs									
Personnel (staff or other party)	99,500	85,500	37,000	34,500	25,000	—	—	—	281,500
Computer time	—	—	—	—	—	—	—	—	—
Site preparation	3,500	—	—	—	—	5,000	—	—	8,500
Furniture	5,000	—	—	—	—	—	—	—	5,000
Conversion	—	7,000	10,000	—	—	—	—	—	17,000
Contingencies	15,000	—	—	—	—	20,000	—		35,000
Subtotal	273,000	92,500	47,000	34,500	25,000	225,000	—	—	697,000
Operations									
Administration	15,500	17,500	20,000	20,000	25,000	25,000	25,000	25,000	173,000
Computer time	—	—	—	—	—	—	—	—	—
System software rental	2,500	2,500	2,500	2,500	2,500	3,500	3,500	3,500	23,000
Equipment maintenance	10,000	10,000	10,000	10,000	10,000	15,000	15,000	15,000	95,000
Applications program maintenance	—	8,500	60,000	68,000	78,500	104,500	111,000	118,000	548,500
Computer operations, supplies	25,000	26,000	27,000	28,000	29,000	32,500	34,000	35,500	237,000
Data entry	—	23,500	25,000	26,500	28,000	34,500	36,500	38,500	212,500
Office space rental, utilities	6,000	6,000	6,000	7,000	7,000	7,000	8,000	8,000	55,000
Miscellaneous	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Subtotal	60,000	95,000	151,500	163,000	181,000	223,500	234,500	245,000	1,353,500
TOTAL	333,000	187,500	198,500	197,500	206,000	448,500	234,500	245,000	2,050,500

Other Costs. The preparation of the other cost figures, by and large, does not require such a preliminary step in order to enter them into Figures 5 through 9. They are covered below, starting at the top of the list of cost items on Figure 5 and working toward the bottom.

To estimate equipment procurement costs for alternatives 1 and 2 (Figures 5 and 6), quotations should be solicited from computer manufacturer representatives. If assistance is needed in the selection of potential vendors, it can be requested from a neighboring court system, an organization in the court field, a representative from industry, or a combination of the three. The highest numbers quoted should be used. Figure 5 shows substantial costs in the first and sixth fiscal year, representing the typical computer procurement pattern, i.e., replace your system at 5-year intervals. Vendor representatives will also provide purchase or leasing costs. Leasing costs generally run about 30% of the purchase cost on a yearly basis. So, if the computer is kept for 5 years, it pays to buy. The high leasing cost is due to rapid obsolescence of computing equipment.

Long-term lease expenses, as shown in Figure 6, are placed in this first category of development cost as well. The reason is that the lease being considered contains a provision giving the court the option of applying 70% of the rental cost toward the purchase of the system. Others would argue that lease costs should be included with the other broad category of costs, operations. The court fiscal officer should be consulted in this classification decision. For alternatives 3, 4, and 5, the only procurement cost would be for the key-diskette machine at the administrative office (see Figures 7, 8, and 9).

For the next category, applications programs, personnel costs for alternatives 1 and 2 can be taken from Figure 4 for entry on Figures 5 and 6. Except for the omission of the computer operator's cost, alternative 3 can be constructed in the same manner on Figure 7. For alternatives 4 and 5, both a senior system analyst and a computer operator have been cut from the staff listed in Figure 4. (Computer operator costs are mentioned here for completeness although they appear in Figures 5 through 9 under operations costs.) Figures 8 and 9, however, reflect sharply higher costs. This is because the cost of systems and programming work by either a private firm or executive branch staff, $125,000 in each of the first two fiscal years of the projection, is added to department personnel costs.

For alternatives 1 and 2, the costs for development computer time should be low or nonexistent, because the purchased or leased computer will provide this service. For the other three alternatives, this cost could be significant. A

Figure 6: ITEMIZED COSTS FOR ALTERNATIVE 2, LEASE A SMALL COMPUTER

Cost Item	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development									
Equipment procurement or long-term lease	45,000	45,000	45,000	45,000	45,000	60,000	60,000	60,000	405,000
Applications programs									
Personnel (staff or other party)	99,500	85,500	37,000	34,500	25,000	—	—	—	281,500
Computer time	—	—	—	—	—	—	—	—	—
Site preparation	3,500	—	—	—	—	5,000	—	—	8,500
Furniture	5,000	—	—	—	—	—	—	—	5,000
Conversion	—	7,000	10,000	—	—	—	—	—	17,000
Contingencies	15,000	—	—	—	—	20,000	—	—	35,000
Subtotal	168,000	137,500	92,000	79,500	70,000	85,000	60,000	60,000	752,000
Operations									
Administration	15,500	17,500	20,000	20,000	25,000	25,000	25,000	25,000	173,000
Computer time	—	—	—	—	—	—	—	—	—
System software rental	2,500	2,500	2,500	2,500	2,500	3,500	3,500	3,500	23,000
Equipment maintenance	10,000	10,000	10,000	10,000	10,000	15,000	15,000	15,000	95,000
Applications program maintenance	—	8,500	60,000	68,000	78,500	104,500	111,000	118,000	548,500
Computer operations, supplies	25,000	26,000	27,000	28,000	29,000	32,500	34,000	35,500	237,000
Data entry	—	23,500	25,000	26,500	28,000	34,500	36,500	38,500	212,500
Office space rental, utilities	6,000	6,000	6,000	7,000	7,000	7,000	8,000	8,000	55,000
Miscellaneous	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Subtotal	60,000	95,000	151,500	163,000	181,000	223,500	234,500	245,000	1,353,500
TOTAL	228,000	232,500	243,500	242,500	251,000	308,500	294,500	305,000	2,105,500

Figure 7: ITEMIZED COSTS FOR ALTERNATIVE 3, USE LARGE EXECUTIVE BRANCH COMPUTER, PROGRAM DEVELOPMENT BY COURT STAFF

Cost Item	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development									
Equipment procurement or long-term lease	5,000	5,000	5,000	5,000	5,000	7,500	7,500	7,500	47,500
Applications programs									
Personnel (staff or other party)	99,500	85,500	37,000	34,500	25,000	—	—	—	281,500
Computer time	20,000	20,000	20,000	—	—	—	—	—	60,000
Site preparation	—	—	—	—	—	—	—	—	—
Furniture	5,000	—	—	—	—	—	—	—	5,000
Conversion	—	7,000	10,000	—	—	—	—	—	17,000
Contingencies	15,000	—	—	—	—	20,000	—	—	35,000
Subtotal	144,500	117,500	72,000	39,500	30,000	27,500	7,500	7,500	446,000
Operations									
Administration	15,500	17,500	20,000	20,000	25,000	25,000	25,000	25,000	173,000
Computer time (high-low range)	25,000-75,000	25,000-75,000	25,000-75,000	25,000-75,000	25,000-75,000	30,000-90,000	30,000-90,000	30,000-90,000	215,000-645,000
System software rental	—	—	—	—	—	—	—	—	—
Equipment maintenance	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Applications program maintenance	—	8,500	60,000	68,000	78,500	104,500	111,000	118,000	548,500
Computer operations, supplies	5,000	5,000	5,000	5,000	5,000	7,000	7,000	7,000	46,000
Data entry	—	23,500	25,000	26,500	28,000	34,500	36,500	38,500	212,500
Office space rental, utilities	6,000	6,000	6,000	7,000	7,000	7,000	8,000	8,000	55,000
Miscellaneous	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Subtotal (high-low range)	53,500-77,500	87,500-137,500	143,000-193,000	153,500-203,000	170,500-220,500	211,000-271,000	220,500-280,500	229,500-289,500	1,269,000-1,699,000
Total (high-low range)	198,000-248,000	205,000-255,000	215,000-265,000	193,000-243,000	200,500-250,500	238,500-298,500	228,000-288,000	237,000-297,000	1,715,000-2,145,000

Figure 8: ITEMIZED COSTS FOR ALTERNATIVE 4, USE LARGE EXECUTIVE BRANCH COMPUTER, CONTRACT WITH PRIVATE ORGANIZATION FOR PROGRAM DEVELOPMENT

Cost Item	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development									
Equipment procurement or long-term lease	5,000	5,000	5,000	5,000	5,000	7,500	7,500	7,500	47,500
Applications programs									
Personnel (staff or other party)	190,500	175,000	19,500	15,000	5,000	--	--	--	405,000
Computer time	20,000	20,000	20,000	--	--	--	--	--	60,000
Site preparation	--	--	--	--	--	--	--	--	--
Furniture	5,000	--	--	--	--	--	--	--	5,000
Conversion	--	7,000	10,000	--	--	--	--	--	17,000
Contingencies	15,000	--	--	--	--	20,000	--	--	35,000
Subtotal	235,500	207,000	54,500	20,000	10,000	27,500	7,500	7,500	569,500
Operations									
Administration	15,500	17,500	20,000	20,000	25,000	25,000	25,000	25,000	173,000
Computer time (high-low range)	25,000-75,000	25,000-75,000	25,000-75,000	25,000-75,000	25,000-75,000	30,000-90,000	30,000-90,000	30,000-90,000	215,000-645,000
System software rental	--	--	--	--	--	--	--	--	--
Equipment maintenance	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Applications program maintenance	--	8,500	50,000	58,000	67,000	71,000	75,500	70,000	400,000
Computer operations, supplies	5,000	5,000	5,000	5,000	5,000	7,000	7,000	7,000	46,000
Data entry	--	23,500	25,000	26,500	28,000	34,500	36,500	38,500	212,500
Office space rental, utilities	6,000	6,000	6,000	7,000	7,000	7,000	8,000	8,000	55,000
Miscellaneous	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Subtotal (high-low range)	53,500-103,500	87,500-137,500	133,000-183,000	143,500-193,500	159,000-209,000	177,500-227,500	185,000-245,000	181,500-241,500	1,120,500-1,550,500
Total (high-low range)	289,000-339,000	294,500-344,500	187,500-237,500	163,500-213,500	169,000-219,000	205,000-265,000	192,500-252,500	189,000-249,000	1,690,000-2,120,000

Figure 9: ITEMIZED COSTS FOR ALTERNATIVE 5, USE LARGE EXECUTIVE BRANCH COMPUTER, PROGRAM DEVELOPMENT BY EXECUTIVE BRANCH AGENCY

Cost Item	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development									
Equipment procurement or long-term lease	5,000	5,000	5,000	5,000	5,000	7,500	7,500	7,500	47,500
Applications programs									
Personnel (staff or other party)	190,500	175,000	19,500	15,000	5,000	--	--	--	405,000
Computer time	20,000	20,000	20,000	--	--	--	--	--	60,000
Site preparation	--	--	--	--	--	--	--	--	--
Furniture	5,000	--	--	--	--	--	--	--	5,000
Conversion	--	7,000	10,000	--	--	--	--	--	17,000
Contingencies	15,000	--	--	--	--	20,000	--	--	35,000
Subtotal	235,500	207,000	54,500	20,000	10,000	27,500	7,500	7,500	569,500
Operations									
Administration	15,500	17,500	20,000	20,000	25,000	25,000	25,000	25,000	173,000
Computer time (high-low range)	25,000-75,000	25,000-75,000	25,000-75,000	25,000-75,000	25,000-75,000	30,000-90,000	30,000-90,000	30,000-90,000	215,000-645,000
System software rental	--	--	--	--	--	--	--	--	--
Equipment maintenance	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Applications program maintenance	--	8,500	50,000	58,000	67,000	71,000	75,500	70,000	400,000
Computer operations, supplies	5,000	5,000	5,000	5,000	5,000	7,000	7,000	7,000	46,000
Data entry	--	23,500	25,000	26,500	28,000	34,500	36,500	38,500	212,500
Office space rental, utilities	6,000	6,000	6,000	7,000	7,000	7,000	8,000	8,000	55,000
Miscellaneous	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	9,500
Subtotal (high-low range)	53,500-103,500	87,500-137,500	133,000-183,000	143,500-193,500	159,000-209,000	177,500-227,500	185,000-245,000	181,500-241,500	1,120,500-1,550,500
Total (high-low range)	289,000-339,000	294,500-344,500	187,500-237,500	163,500-213,500	169,000-219,000	205,000-265,000	192,500-252,500	189,000-249,000	1,690,000-2,120,000

rule of thumb used by some in the field is to solicit estimates from the selected data center and then to at least double them.

Vendor representatives will supply site preparation costs; again the highest figures should be used. Furniture costs can be obtained from most office supply businesses.

The cost of conversion is a key item and is often underestimated. Conversion to the new system occurs when the system is weakest; although it presumably has been tested thoroughly, latent bugs in procedures or in the program logic itself show themselves at this time. While the system is in this condition, all of the case-in-progress records must be transformed into a form the computer understands; this can be done by entering the information on punch cards or directly into the system through the use of a video or another kind of terminal. To make the estimate, it is first necessary to determine the work volume, then translate it into clerical requirements, and finally state the weeks required in cost terms. Present cases-in-progress total 62,000; using an estimate of 2.05 transactions per case, the total number of conversion entries comes to 127,000. To be on the safe side, another 10% was added to bring the total to about 140,000. Using 355 transactions per person work day as a standard, the total requirement comes to roughly 400 person days. Our plans call for the conversion to be completed in 6 months (120 work days), requiring 3 full-time members of staff and 1 part-timer. Building in another safety factor, the requirement was upped to 4. The work can be done by court personnel or a private firm, but since no court employees could be spared for this purpose, a decision was made to contract with a private organization for this service. Prior to reaching agreement with this private organization, it was ensured that all security and privacy requirements associated with the data would be met; the necessary security and privacy provisions were included in the contract.

Few computer systems are brought in within time or budget estimates. It is therefore advisable to include a budget item for contingencies; these funds would be used to deal with such items as the impact of a programmer leaving to take another position at a crucial point in development. It is suggested that 5% of the total development budget be set aside for this purpose.

Data Processing Operations Costs

These costs recur for each year of operations. Administrative expenses are made up completely of personnel costs; hence this entry can be made by transferring the relevant data from Figure 4 to Figures 5 through 9.

There is no computer time operations cost for alternatives 1 and 2; by buying or leasing a computer, the court has eliminated the need for renting computer time. With the executive branch computer, alternatives 3, 4, and 5, the cost of renting computer time is an important item and should be estimated carefully. Start with the basic workload unit of this court: cases. Combined case filings in 1978 for civil actions over $10,000 and felonies were at 40,000 level; assuming a combined growth rate of 5%, filings should grow to somewhat under 60,000 in the next 8 years. Plans are for the system to maintain three years of data, so the system files must be capable of storing about 180,000 case records 8 years hence. Estimates put the number of transactions, basic "tear-offs" and others, at 3.2 per filing. So in the first year of operation, the court information system department can expect to handle some 130,000 transactions, and 8 years later about 200,000 transactions. All those figures should be recorded in a document, along with transaction size, record size, and number/size of output reports, and submitted to the computer center, requesting an estimate of computer time costs. As with the development computer time estimates, these figures should also be doubled or tripled. Thus, the estimates submitted by the computer center of $25,000 for each of the first 5 years of operation and $30,000 for each year thereafter are upped to $75,000 and $90,000 respectively, with the 8-year cost estimate coming to $645,000. This is $430,000 higher than the one based on the original estimates. The substantial difference poses a dilemma. If the high estimate is used, it may inflate the alternatives cost by roughly 25%; if, on the other hand, the low figures are used, the costs may be understated. If the difference between the estimates were not large, the issue is best resolved in our opinion by using the higher number. But with the difference standing at $430,000, the fairest portrayal is the use of both the high and low figures, creating a range of numbers for this category.

System software rental costs apply only to alternatives 1 and 2; the costs can be obtained from vendor representatives.

The next cost category, equipment maintenance, represents the charge by vendors for service of their machinery. Coverage for alternatives 1 and 2 includes the computer and its accessories, part of which are the batch entry stations; for alternatives 3, 4, and 5, only the data entry stations are involved. These costs generally can be readily obtained from vendor representatives.

Application program maintenance costs have been taken directly from Figure 4 for alternatives 1, 2, and 3 (Figures 5, 6, and 7). For alternatives 4 and 5 (Figures 8 and 9) the senior system analyst costs have been deleted, but the remaining

costs have been increased slightly to allow for assistance from contractors or the executive branch agency. Program maintenance costs tend to run high, often much higher than expected. On the surface, it would seem that once development work is completed and cutover to the automated system takes place, there would be little or no need for system analyst involvement. This is almost never the case. Consumers of the information want new or revised reports, files must be expanded or reconfigured to accommodate expansion, and updates to other functions are often required, all of which translates into a significant amount of work. Another aspect of maintenance is that computer systems and programs are often poorly documented and the program logic is often unnecessarily complicated and difficult to follow. The allowance for program maintenance in Figure 4 may appear high, but in light of experience in both the private and public sectors, it is realistic.

Computer operations costs include the computer operator's salary, plus fringe benefits and overhead (see Figure 4), and supplies--computer tapes, disk storage cabinets, etc. As mentioned earlier, the two computer acquisition options, alternatives 1 and 2, dictate that a computer operator be part of staff; with the other three options there is no such need. Supply costs can be estimated accurately following discussions with manufacturer representatives.

The next category is data entry costs. Included here are only the salaries, fringe benefits, and overhead for the two data entry clerks. The costs can be taken from the personnel costs shown in Figure 4.

The calculation of office space rental cost is a straightforward exercise, requiring the use of either current commercial real estate rates or the actual costs. Costs for utilities are small and estimates can be obtained from vendor representatives.

The unexpected occurs in all organizations, but with greater frequency in one where development is an important component of the work. Thus, it is advisable to have available a small miscellaneous reserve, usually no more than 5% of the operating budget, to deal with such matters. In this instance, 2% was used.

User Costs

For each system alternative in this case study, user costs (i.e., costs incurred in the district courts) are identical to costs of the current manual system because trial court procedures will remain unchanged. It is, nevertheless, worth mentioning a few things about them. First, personnel costs account for either all or the greatest portion of these costs.

Second, the focus of this analysis is usually the net savings to the court in changing from a manual to a computer system, that is, the investment in computer machinery and personnel will pay for itself in staff productivity gains. Typically, in the user cost category the data entry must be strengthened, either by adding to staff or transferring others to this work.

Section IV of the cost-benefit analysis, Methodology, reviews one means for estimating these costs; the exercise requires some thought, but it is not difficult. The difficulty lies with the other side of the cost equation. Court jobs are often an important source of political patronage, and automated system or not, staff reductions or even reduced hiring are likely to meet with stiff resistance in some quarters. Another aspect is that the computer development is often the first systematic look at court practices, and while the computer makes improvements, it often points to other areas requiring considerable rethinking of the current approach. Before making a final judgment as to these costs, consider reviewing them with those who have knowledge of similar efforts and think carefully and realistically about future staffing levels.

Overall Costs

Figure 10 shows total costs for each alternative over the 8-year period.

Benefits

Categories and Weights

Administrative office personnel in Middlesex carefully considered an extensive list of benefits and concluded that, other than cost differentials among the five alternatives, there were no benefits that could be quantified in dollar amounts. Since cost savings are reflected in the previously described cost computations, it was decided to use a weighting scheme to evaluate benefits and relate them to costs.

Choosing the benefit categories requires a substantial amount of judgment. The goal is to identify the factors that are of the greatest importance to all concerned with the decision. Technical staff may believe that the availability of a wide variety of program languages is a key item, while judges and other court policymakers may have only a passing knowledge of this area and may believe another factor is of prime importance. Thus, it may be worthwhile to submit for consideration a list of "candidate" benefit categories to the appropriate management group within the judiciary. In many states, a data

Figure 10: COMPARISON OF EIGHT-YEAR COSTS FOR FIVE ALTERNATIVES FOR THE IMPLEMENTATION OF MIDDLESEX DISTRICT COURT COMPUTER-BASED DOCKETING SYSTEM

Alternative	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL[1]
1. Purchase a small computer									
Development	273,000	92,500	47,000	34,500	25,000	225,000	--	--	697,000
Operations	60,000	95,000	151,500	163,000	181,000	223,500	234,500	245,000	1,353,500
TOTAL	333,000	187,500	198,500	197,500	206,000	448,500	234,500	245,000	2,050,500
2. Lease a small computer									
Development	168,000	137,500	92,000	79,500	70,000	85,000	60,000	60,000	752,000
Operations	60,000	95,000	151,500	163,000	181,000	223,500	234,500	245,000	1,353,500
TOTAL	228,000	232,500	243,500	242,500	251,000	308,500	294,500	305,000	2,105,500
3. Use executive branch computer; program developed by court staff									
Development	144,500	117,500	72,000	39,500	30,000	27,500	7,500	7,500	446,000
Operations	53,500-103,500	87,500-137,500	143,000-193,000	153,500-203,500	170,500-220,500	211,000-271,000	220,500-280,500	229,500-289,500	1,269,000-1,699,000
TOTAL	198,000-248,000	205,000-255,000	215,000-265,000	193,000-243,000	200,500-250,500	238,500-298,500	228,000-288,000	237,000-297,000	1,715,000-2,145,000
4. Use executive branch computer; program developed by private organization									
Development	235,500	207,000	54,500	20,000	10,000	27,500	7,500	7,500	569,500
Operations	53,500-103,500	87,500-137,500	133,000-183,000	143,500-193,500	159,000-209,000	177,500-227,500	185,000-245,000	181,500-241,500	1,120,500-1,550,500
TOTAL	289,000-339,000	294,500-344,500	187,500-237,500	163,500-213,500	169,000-219,000	205,000-265,000	192,500-252,500	189,000-249,000	1,690,000-2,120,000
5. Use executive branch computer; program developed by executive branch agency									
Development	235,500	207,000	54,500	20,000	10,000	27,500	7,500	7,500	569,500
Operations	53,500-103,500	87,500-137,500	133,000-183,000	143,500-193,500	159,000-209,000	177,500-227,500	185,000-245,000	181,500-241,500	1,120,500-1,550,500
TOTAL	289,000-339,000	294,500-344,500	187,500-237,500	163,500-213,500	169,000-219,000	205,000-265,000	192,500-252,500	189,000-249,000	1,690,000-2,120,000

[1]Since costs for these five alternatives do not follow the same pattern over the system's life span, use of discounted costs and present value would provide a more precise representation of costs for comparison of the alternatives. Total costs are used in this case study because this represents the approach that is most often used (and most likely to be used) in the courts. Please see the second case study for an example of present value usage.

processing advisory group has been created by the supreme court or judicial council and given authority to make decisions such as this. In other states, this authority is retained by the chief justice or judicial council. Whatever the situation, the support of such a group is absolutely essential for long-term computer system success, and any reasonable investment in time to help build support for the venture usually pays large dividends.

The benefits for this case and their weights, in parenthesis, are listed below.

—Software quality (2.0).
—Hardware quality and versatility (1.5).
—Reliability (1.0).
—Manageability of the department (3.0).
—Adequate financing (2.5).

Any number of benefits can be used, but it is suggested that the number be kept small to prevent the analysis from becoming unduly complex. Whatever the number of benefits, the total of the benefit weights should equal either 1, 10, or 100; the above weights sum to exactly ten.

Each alternative was rated from 1 (poor) to 10 (good) for each benefit category. To obtain the total benefit score, the benefit weights were multiplied by the ratings for each alternative and then the five intermediate results were added together. For example, as shown on Figure 11, the total benefit score for alternative 2, lease a small computer, was obtained by multiplying the weight for software quality (2.0) by its rating for that alternative (7) for a score of 14.0; by repeating the same procedure for the other four benefit categories; and by summing each of the scores to a total benefit score.

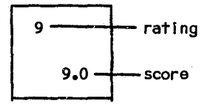
The first of the benefit categories, software quality, reflects the ability of the software that is provided with the computer system to meet the developmental and operational requirements. This covers characteristics of systems and support software such as programming languages (e.g., COBOL, BASIC, RPG) that can be accommodated; the quality of these languages on each computer; the programming aids (e.g., debugging, sorting) that can be accommodated to minimize program errors; the file structures that can be accommodated to reduce processing time; the ease with which the computer software can be used or at least understood; and the types of peripheral equipment (e.g., display terminals, remote job entry stations) that can be accommodated without highly complex programming. Another factor is the availability of this systems and support software to each system user. In many cases, the services of a computer specialist should be obtained to define how these considerations apply to the planned system.

Figure 11

A COMPARISON OF THE BENEFITS FOR FIVE DEVELOPMENT OPTIONS
(MIDDLESEX DISTRICT COURT COMPUTER BASED DOCKETING SYSTEM)

Alternatives	Software Quality (2.0)	Hardware Quality and Versatility (1.5)	Reliability (1.0)	Manageability of the Department (3.0)	Adequate Funding (2.5)	Total Benefit Score
1. Purchase a Small Computer	7 14.0	9 13.5	9 9.0	8 24.0	6 15.0	75.5
2. Lease a Small Computer	7 14.0	9 13.5	9 9.0	8 24.0	6 15.0	75.5
3. Use Large Executive Branch Computer, Program Development by Court Staff	6 12.0	7 10.5	8 8.0	7 21.0	6 15.0	66.5
4. Use Large Executive Branch Computer, Program Development by Private Organization	6 12.0	7 10.5	8 8.0	8 24.0	8 20.0	74.5
5. Use Large Executive Branch Computer, Program Development by Executive Branch Agency	4 8.0	7 10.5	8 8.0	6 18.0	8 20.0	64.5

Explanation of alternative 1 reliability score



[weight (1.0) times rating (1)]

While it is desirable to have the strongest software capability possible, a much more important consideration is the quality of the actual application programs. Program development by court staff has been of mixed quality; a key problem area is the ability of some courts to attract and maintain first-rate personnel. Executive branch data centers have staffs of about the same caliber as do the courts. Private programming firms generally nave more technically capable staffs, but they have exhibited a tendency to deliver a system that is first-rate from a technical point of view, but which does not meet court needs.

These issues have barely been touched on, but it is not the purpose of this document to cover issues comprehensively. Further information can be obtained from a large and growing quantity of literature on software; among the periodicals to consult see Datamation, Computer Digest, and Computerworld. Auerbach and Datapro, among others, publish more detailed reference services on all aspects of computer technology. It may prove helpful to have a computer professional oversee the work leading to the rating for the category; at absolute minimum, a professional should review the work.

In the Middlesex study software quality was assigned a medium weight of 2.0. It was rated above reliability (1.0) and hardware quality and versatility (1.5) because programmer productivity will have an important bearing on the pace of the development work and because, most importantly, the computer programs will reflect the court procedures of the future. It was not rated as highly as manageability of the department (3.0) and adequate funding (2.5) because with inadequate funding or poor management the system is not likely ever to reach fruition.

In assessing hardware quality and versatility, a computer professional's participation is again essential. Items to consider are the overall processing capability of the configuration; its upward compatibility (i.e., the flexibility to expand the system in modular steps); its compatibility with other manufacturer's often less-expensive equipment; and the variety of available peripheral equipment. It was assigned a weight of 1.5, or fourth highest in a field of five.

The reliability of computing equipment can be predicted with a fair degree of accuracy. Like all electronic equipment, it tends to be unstable when first put in place, becomes highly reliable over a period of time, often 5 to 10 years, and then becomes progressively more unreliable. Manufacturer's representatives can supply "downtime" figures; these should be checked by consulting with those who actually use the equipment. Much more difficult to assess as to reliability is the performance of a data center, which depends in about equal

parts on equipment capability and staff ability. Users should be queried in an attempt to find out what the grapevine has to say about the center.

Reliability was given the lowest weight of all the benefit categories, a 1.0. The score reflects not so much the category's lack of importance as the competition among the categories for limited weighting points. Judgments must be made, reflecting policymaker priorities.

Manageability of the department measures mainly the ability of court officials to control system development, maintenance, and day-to-day computer operations. To many, the computer is a double edged sword. A sizable group of private and public information system executives hold that the computer has brought with it not only an enhanced management capability but also lots of headaches. Because of the wide-open job market, computer professionals tend to be a fickle and mercenary lot. The allure of more money, better working conditions, a greater technical challenge, or simply the desire for change has been sufficient enticement for many professionals to take new positions. The upshot of this activity is a rapid turnover rate, leaving many organizations without a key system analyst or programmer at a critical point in development. Turnover is not the only problem. Because the profession is new, fast paced, and without standards, the skills of its members are quite varied. Selecting high-quality staff from this pool has proved difficult for many organizations, especially those new to the field. In light of these problems, the following questions should be carefully considered: Can the court control computer system development adequately? Are the court's salaries high enough to attract and keep quality professionals? What size staff is the most manageable? What are the advantages and disadvantages of using internal versus external processing personnel?

Representing its importance in the eyes of project staff, manageability of the department was assigned the highest weight, 3.0, three times higher than reliability and twice as high as software quality. The establishment of a computer department is an important milestone in the development of an administrative office and its success or failure will have significant bearing on the future of the office.

Often, financial considerations are given short shift in the rush to acquire a computer capability. In some cases, the guiding thought has been to acquire enough funds for the first year of operation and to worry about the future when it arrives. By preparing the first part of the analysis, the 8-year cost projection, court staff has already taken a significant step to avoid the pitfalls of a budget squeeze. It is

important also to identify the potential sources of funds and likelihood of continued support from them.

This category was assigned a weight of 2.5, only exceeded by manageability of the department at 3.0. Poorly prepared financial analyses of past court computer projects have contributed to serious technical and operational problems, some of which have culminated in the discontinuance of system operations.

Ratings

The ratings for each alternative are considered next and were shown in Figure 11.

For alternative 1, the purchase of a small computer, software quality was rated a better than average score of 7. On the positive side, the small computer vendors offer systems and support software that, while not so sophisticated as software available for the large computer, was nevertheless judged adequate. The location of the computer in court offices is an important consideration. Programming should have unlimited access to the machine and its terminal, allowing for uninterrupted development of programs. Hardware quality and versatility was rated highly at 9, because national studies indicate the candidates for selection are quite reliable and because, more importantly, by virtue of the computer location in the administrative office, the court would be able to control access to the machine and the scheduling of work. Reliability was also rated at 9; again the rating was based on national surveys of computing equipment. Manageability of the department was not quite as high at 8. All data processing staff and activities would be part of the administrative office, a characteristic judged to be a plus. On the negative side, the salary structure is slightly lower than the national average, causing a worry as to whether the court can attract and hold competent personnel. Adequate funding was rated slightly better than a midpoint score, being accorded a 6. The reason was recent correspondence with the state planning agency, the state-level agency responsible for the administration of LEAA grants, indicating that support would be forthcoming for all positions, save one of the system analyst/programmer jobs. As the state had not yet made a commitment to fund the extra position, it was a cause for court concern. Receiving an overall benefit score of 75.5, the purchase of a small computer system tied with alternative 2 in receiving the highest rating among the alternatives.

Alternative 2, lease a small computer, was exactly the same as option 1, but for the fact that the computer is leased

instead of purchased. This characteristic results in different overall costs for alternative 2, but has no effect on the benefits.

Using a large executive branch computer to process the system's information with program development by court staff, alternative 3, was rated slightly better than average, a 6, as to software quality. While the executive branch's computer has a strong software capability, it was unclear what its availability would be to court development and operation efforts because of the demands of other data center users. Hardware quality and versatility was rated one point higher at 7 because, while the computing machinery is close to the best commercially available, the court would have little or no say over its evolution. Reliability was rated at 8, which is one point lower than the rating of 9 for alternatives 1 and 2. This was because, while the computer system is certainly at least as reliable as a small computer, the court would have a small voice in selecting data center operations personnel who would be responsible for scheduling, performing, and delivering court computer work. Manageability of the department was rated somewhat lower, at 7, than the rating of 8 for alternatives 1 and 2. This was because any limitation in the court's ability to schedule computer time for development and to control computer operations would make it difficult to control staff work and report production schedules. Adequate funding received the same rating as for alternatives 1 and 2 for the same reason--the uncertain status of the second system analyst/programmer position. All told, this alternative received a benefit score of 66.5, fourth in a field of five.

Alternative 4 is different from alternative 3 in two important respects. Program development would be contracted to a private software development firm, and the court information systems department would be staffed with one less individual; because program development would be done by an outside firm, there is no need for a senior systems analyst/programmer to guide the docketing system's development. Software quality was rated a 6 because, while preparation, assembly, and final program products are likely to be superior, there was a concern that the firm would not take the time necessary to consider the special needs of the courts, e.g., practical, easy-to-understand procedures consistent with court traditions and the law. If realized, the problem would be akin to a writer submitting a manuscript crafted in a beautiful prose style but substandard in content because of a lack of intimate knowledge of the subject. Both style and substance are necessary. Both hardware quality and versatility, and reliability, rated at 7 and 8, respectively, were the same as for alternatives 3 and 5; this is because all three involve the use of the same data

center. Manageability of the department was rated at 8 because the court will have complete control of its own staff and can include in the programming contract adequate provisions for monitoring this work. This category was rated higher than alternative 3 (8 versus 7) because control over the contractor was balanced by decreased concern over turnover of key court personnel (i.e., the nonexistent senior analyst/programmer). Adequate funding was rated an 8, a rating also given to alternative 5, because there is no cause for concern over a firm funding commitment for the second system analyst/programmer position, as this position does not exist under this alternative. Overall, this alternative received a high score, 74.5, just one point under alternatives 1 and 2.

Like alternatives 3 and 4, alternative 5 specifies that the Middlesex district court's computer-based docketing system be run on a large executive branch computer. With this alternative, program development would be performed by an executive branch agency, presumably the same one that operates the data center where the system would be run. Aside from this characteristic, this alternative is the same as alternative 4. Hardware quality and versatility, reliability, and adequate funding, with ratings of 7, 8, were the same as those for alternative 4. Software quality and manageability of the department were rated at 4 and 6 respectively, both 2 points lower than alternative 4 ratings. Software quality was rated as it was because of the wide variation in quality of technical staff employed by state data centers and because the court would have little control over the hiring and firing of these personnel. Manageability of the department was rated lower because of the feeling that if program development does not proceed according to schedule, the court has limited leverage to remedy the situation. In fact, a conflict between the two branches of government over program development could spill over into other areas, possibly causing an adverse reaction to the yearly court budget submission.

Cost-Benefit Comparison and Conclusion

This section deals with the next step of the analysis, a comparison of costs and benefits and the interpretation of the results. The cost-benefit ratio provides a means for reconciling differences in costs and benefits. To illustrate its use, let us compare the costs and benefits of alternative 2--$2,105,500 and 75.5 benefit score--against those of a hypothetical alternative A with values of $1,800,000 and 60.7. On a cost basis, alternative A is the superior one, being some $300,000 less costly than its competitor. Alternative 2,

however, has a higher benefit score, 75.5, versus 60.7. Because the proportional difference between benefits, as shown below, is greater than between costs, alternative 2 has the better cost-benefit ratio.

	Cost	Benefit	Cost-Benefit Ratio
Alternative A	1,800,000	60.7	33.7
Alternative 2	2,105,500	75.5	35.9

Interpretation is quite varied. It can range from the use of the ratio as an absolute guide to policy decisions, to using it as a guide in eliminating unacceptable alternatives, to not using the ratio at all. The majority of those who do cost-benefit analyses take a position somewhere between the two extremes.

Figure 12 shows, for each of the five alternatives, an 8-year cost projection, benefit ratings, and two cost-benefit ratios. The two ratios stem from the split in the cost projection for alternatives 3, 4, and 5. The dual cost could be dealt with by computing a single ratio based on the high, low, midpoint, or other cost figures, or by computing multiple ratios. A conservative approach is taken, computing one ratio based on the mid-point cost figure and the other on the high figure. For alternative 3, for instance, dividing the benefit score of 66.5 by the high figure, $2,145,000, yields a cost-benefit ratio of .0000310 or 31.0 (because the spread among alternatives is not affected by a decimal shift, it can be moved six places to the right to improve readability). To compute the other ratio, the cost figure of $1,715,000 and $2,145,000 are averaged: $3,860,000 divided by 2, yielding $1,930,000; this number in turn is divided into 66.5, giving a ratio of 34.4. Given a constant benefit score of 66.5, a lower cost produces a higher cost-benefit ratio. The low cost figure for alternative 3, $1,715,000, was not converted into a cost-benefit ratio because only under the best of circumstances will the costs prove accurate; thus, the resulting ratio would not be comparable to the others, which are based on much firmer estimates.

A worthwhile exercise, once the computations are complete, is to attempt to find flaws in the analysis framework. Were five benefit categories too many or too few? Were the categories the right ones? Should some be narrowed or expanded in scope? Were there any important costs omitted? Did the exercise identify or highlight items not obvious before doing it? If weakness is detected, it should be corrected, even if this involves a significant amount of recomputation. Each incidence of lack of precision or clarity or inadequate

Figure 12

A COMPARISON OF THE COST AND BENEFITS FOR FIVE DEVELOPMENT OPTIONS
(MIDDLESEX DISTRICT COURT COMPUTER-BASED DOCKETING SYSTEM)

	Costs	Benefits						Cost-Benefit Ratios[1]	
	8-Year Projection (000's)	Software Quality	Hardware Quality and Versatility	Reliability	Manageability of the Department	Adequate Funding	Total Benefit Score	Highest Cost[2]	Mid-Point Cost[3]
1. Purchase a Small Computer	2,050	14.0	13.5	9.0	24.0	15.0	75.5	36.8	36.8
2. Lease a Small Computer	2,105	14.0	13.5	9.0	24.0	15.0	75.5	35.9	35.9
3. Use Large Executive Branch Computer, Program Development by Court Staff	L 1,715- MP 1,930 H 2,145	12.0	10.5	8.0	21.0	15.0	66.5	31.0	34.4
4. Use Large Executive Branch Computer, Program Development by Private Organization	L 1,690- MP 1,905 H 2,120	12.0	10.5	8.0	24.0	20.0	74.5	35.1	39.1
5. Use Large Executive Branch Computer, Program Development by Executive Branch Agency	L 1,690- MP 1,905 H 2,120	8.0	10.5	8.0	18.0	20.0	64.5	30.4	33.8

[1] Decimal point mark 6 places to the right to improve readability: e.g., for option 1, 75.5/2,050,500 = .0000368 or 36.8.

[2] Ratio based on the costs of options 1 and 2 and the highest costs of the other three options: 1, 2050; 2, 2105; 3, 2145; 4, 2120; 5, 2120. Sample calculation, option 3: (66.5/2145 = 34.4).

[3] Ratio based on the cost for options 1 and 2, 2050 and 2105, and the midpoint costs for option 3, 4 and 5 (1930, 1905 and 1905). Sample calculation, option 3: 66.5/[1715 + 2145/2] = 34.4.

substantive coverage lessens the prospect of the analysis' being accepted by court leaders as a policy instrument.

The final step is to select the most cost-effective alternative. Our approach was to eliminate the less desirable alternatives, leaving a few or possibly one best option. A review of Figure 12 suggested that alternative 5 be the first candidate for elimination. It had the lowest benefit score and the lowest range of cost-benefit ratios; on the plus side, its costs were low, ranging from $1,690,000 to $2,120,000, the average being $1,920,000. Because the costs for alternative 4 were the same, why consider alternative 5 when alternative 4 showed greater benefits? As mentioned earlier, the only difference between the two alternatives was the organization that would execute the software development work; because earlier analysis indicated that the prospects were for better quality work from the private firm, alternative 4 was preferable. Thus, alternative 5 was eliminated from further consideration.

Alternative 3 had the next lowest benefit score and hence should be considered next. The cost spread among all five alternatives was small; using the mid-point range figure for alternatives 3, 4, and 5, it went from roughly $1,900,000 to $2,100,000--about a 10% difference. Nevertheless, alternative 3 was at the high end of the cost spectrum. This fact, coupled with the relatively low across-the-board benefit ratings, was sufficient reason for elimination.

Like alternatives 3, 4, and 5, alternatives 1 and 2 (the purchase and lease of a small computer respectively) had similar characteristics. The relationship was even closer because, to someone not acquainted with financing, the two options are exactly the same. As the cost for leasing is higher than for purchase, the only reason for choosing leasing would be to buy more flexibility in the event the court wanted to leave open the option of moving to another system. This was not a major concern to court policymakers in Middlesex; thus, the lease alternative 2 was also eliminated.

Thus, two candidates remained: the purchase of a small computer, alternative 1, and the use of an executive branch computer with program development by private firm, alternative 4. Both scored well in the cost-benefit comparison. The basis for the scores differed, however. The purchase of a small computer, alternative 1, rated higher as to software because this alternative would provide the court with more control in these areas. In manageability of the department, the two were rated even. The use of executive branch computer with software development by a private firm, alternative 4, had an edge as to adequate funding. The range of cost projection for alternative 4 somewhat clouded the cost issue, but the costs were roughly

equivalent. The small computer offered more control; the data center less financial risk. These issues should be considered by court policymakers.

To sum up, the preparation of the analysis has required a significant amount of work. In our judgment, it points to two superior alternatives and identifies a key issue for deciding between them.

Case 2: Atlantis Statistical Reporting System

This is the second of three case studies. It illustrates a situation in which a medium-sized state, called Atlantis, is experiencing increasing difficulty producing meaningful statewide judicial statistics because of increasing caseloads. The study covers seven manual and automated alternatives that would address this problem. It is the only one of the three case studies in which benefits are quantified and mathematically related to costs. It also illustrates the use of present value computations to evaluate costs and benefits.

Background

The state of Atlantis is a medium-sized state, population in 1978 of 5,100,000, with one major metropolitan area, population in 1978 of 1,550,000. The remainder of the state is primarily rural with several other urban areas. The state court system has been unified at the appellate and district (i.e., general jurisdiction) court levels for five years.

During the first year of unification, the state court system (known as the judicial department) was directed by the supreme court to standardize recordkeeping in the district courts and to implement uniform reporting of case data from these courts to the judicial department. This recordkeeping and reporting system has been fully operational statewide for three and one-half years. The system involves primarily introduction of standard criminal and civil docket forms that are completed by the district court clerks, with the original retained there and a copy sent by mail to the judicial department. This occurs at case initiation and termination. The judicial department produces monthly, quarterly, and annual summary statistical reports showing numbers of criminal and civil cases filed, pending, and disposed of for each district court. A similar system exists for the appellate courts.

This current system is entirely manual, and it has been improved several times in its three and one-half years of operation. The judicial department staff are constantly looking for ways to improve the system, and they are now convinced that the current system is functioning at its maximum efficiency.

The district court system disposed of 135,000 civil, criminal, and juvenile cases during 1978. The metropolitan

court was responsible for 52,000 of those dispositions. There are 30 district courts in the state. The metropolitan district court has 61 judges, while another 70 judges are in the remaining 29 district courts. Six of those 29 courts are located in urban areas and have relatively large caseloads.

Problem

The efficiency of the current manual reporting system has been offset by an increasingly heavy district court caseload throughout the state. The increase has been particularly dramatic in criminal cases in the metropolitan and urban areas. The growth has inundated the judicial department with case data and made the compilation of statistics time-consuming. This has resulted in incomplete and delayed reports in several instances.

The judicial department has conducted a requirements analysis and recognizes that data processing is a possible solution to the problem. Moreover, an added benefit of an automated system would be a wider variety of reports that would provide the judicial department more precise data on case-processing activities in the district courts. The chief justice is reluctant to request funds from the legislature until his staff has examined the alternatives and he is presented with data showing that a data processing approach will provide the most efficient solution.

Three factors are pertinent to the situation. First, the judicial department is required by statute to utilize a state computer controlled by the executive branch for all of its data processing (it currently has nothing automated), and all state agencies are assessed a portion of their budget for this service whether they use it or not. Second, the major metropolitan district court already has an automated trial court system that could, with minor modifications, provide case data on magnetic tape. Finally, since current caseload problems apply only to district courts, the appellate court reporting system will remain manual at this time.

Alternatives

Since the judicial department suspects that automation may solve the caseload problems, this case study involves consideration of the selection of an alternative from among several manual and automated operational approaches.

We have assumed that user costs are directly available from known clerical time requirements and pay scales and that

almost all benefits can be evaluated in dollars. Any automated system must (by statute) be run on a state computer controlled by the executive branch, and the metropolitan automated trial court system could be modified to provide case data on magnetic tape for that district court only. All automated alternatives will produce additional reports (described in Figure 1) that cannot realistically be produced with a manual system. There is no other automation existing or planned (except for vague plans for analogous automation of appellate courts) in the judicial department.

The alternative approaches to be considered are as follows:

—Alternative 1: The current manual system with more personnel to accommodate increasing caseloads.

—Alternative 2: The use of a large-scale centralized shared computer at a single site run by the non-judicial state agency that provides data processing services to other state agencies. All cases will be reported by mail to the judicial department where they will be validated and entered on a display terminal for batch file update and batch report generation on the shared computer. The terminal will be provided by the state data processing agency.

—Alternative 3: The use of a large-scale centralized shared computer at a single site run by the non-judicial state agency that provides data processing services to other state agencies. Sampling will be used to select cases that are reported by mail to the judicial department. The sample cases will be validated and entered on a display terminal for batch file update and batch report generation on the shared computer. The terminal will be provided by the state data processing agency.

—Alternative 4: The use of a large-scale centralized shared computer at a single site run by the non-judicial state agency that provides data processing services to other state agencies. All cases will be validated and entered on a purchased display terminal in each district court clerk's office. The batch file update and report generation will be on the shared computer.

—Alternative 5: The use of a large-scale centralized shared computer at a single site run by the non-judicial state agency that provides data processing

Figure 1
PROCESSING SCOPE

FUNCTION	CURRENT MANUAL SYSTEM	AUTOMATED ALTERNATIVES
Input	Case data recorded on standardized forms and mailed weekly to judicial department and recorded; data show case initiation and termination	Case data recorded on standardized forms identical to manual system; can be either mailed to judicial department for key entry or entered on terminal in district clerk's office; in any case, data entry clerk validates data prior to entry; data edited and entered onto transaction file for later batch file update; metropolitan area system can provide data on magnetic tape for edit and transaction file update; data show case initiation, termination, and other significant events while case is active
Processing	Manually compute and record statistics	Store data and compute statistics
Output	Monthly, quarterly, annual reports showing cases beginning pending, filed, disposed, end pending for each district court; distributed internally within judicial department and by mail to district courts	Same as manual system plus monthly reports expanded to include summary by case type beginning pending, filed, disposed, end pending, trial type, disposition, time in each stage of litigation for each district court; also exception reports when time thresholds in each stage of litigation are exceeded for cases in each district court

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services to other state agencies. All cases will be validated and entered on a purchased display terminal in each district court clerk's office in those seven judicial districts with the largest caseloads. In the 23 smaller judicial districts, all cases will be reported by mail to the judicial department where they will be validated and entered on a display terminal provided by the state data processing agency. The batch file update and report generation will be on the shared computer.

—Alternative 6: The use of a large-scale centralized shared computer at a single site run by the non-judicial state agency that provides data processing services to other state agencies. All cases will be validated and entered on a purchased display terminal in each district court clerk's office except for the metropolitan judicial district court. That district court will provide inputs on magnetic tape with the tape mailed to the central computer facility. The batch file update and report generation will be on the shared computer.

—Alternative 7: The use of a large-scale centralized shared computer at a single site run by the non-judicial state agency that provides data processing services to other state agencies. For the seven judicial districts with higher caseloads, all cases will be validated and entered on a purchased display terminal in each district court clerk's office except for the metropolitan judicial district court. That district court will provide inputs on magnetic tape with the tape mailed to central computer facility. For the 23 smaller judicial districts, all cases will be reported by mail to the judicial department where they will be validated and entered on a display terminal provided by the state data processing agency. The batch file update and report generation will be on the shared computer.

Figure 2 summarizes each of these alternatives.

Costs

Projected costs for each of the alternative approaches are presented in Figures 3 through 9. The tables show components of and the total of data processing costs, the user cost,

Figure 2

ALTERNATIVE APPROACHES

1. Manual system.

2. Courts mail in case reports, all analyzed and put on computer.

3. Courts mail in a sample of case reports, sample analyzed and put on computer.

4. Terminals installed in each court for entry of case reports.

5. Terminals installed in large (7) courts for entry of case reports; small courts (23) mail in case reports.

6. Terminals installed in all but metropolitan court for entry of case reports; tape used in metropolitan court for submission of case data.

7. Terminals installed in all large courts for entry of case reports except metropolitan court; tape used in metropolitan court for submission of case data; small courts mail in case reports.

NOTE: Alternatives vary only in method used for data submission and entry; batch file update and report generation applies to all alternatives except the first alternative.

and the total cost for the 8-year planning period. The costs of each of the alternatives are described below.

Alternative 1 (Figure 3)

There are currently four individuals processing the data received from the district courts. In order for the judicial department to process the reports efficiently and speedily, two full-time individuals will need to be added. The cost of the two individuals the first year will be $24,000, including fringe benefits. It is estimated that those two individuals, along with the four employees currently working, will be able to process reports throughout the 8-year period. It is also estimated that the salaries and fringe benefits of the two new employees will increase by seven percent per year. There are no other projected costs.

There will be no new user costs associated with this alternative.

Alternative 2 (Figure 4)

There will be no computer equipment procurement expenses because the centralized computer services will be provided by the responsible state agency. There is sufficient excess capacity on the computer to process the case reporting system, and there will be no additional cost for the computer services since the judicial department is assessed for the services anyway.

The design of the system will require consultants to provide the basic structure and programmers to prepare the programs. It is estimated that the cost will be 130 working days, eight hours per day, at $30 an hour, including salary and fringes, for the consultants; and 120 working days, eight hours per day, at $20 an hour, including salary and fringes, for the programmers. Thus, the applications software development cost will be $50,400 the first year and zero during every other year.

In the judicial department three people will be needed to process forms and enter the data on the computer. Salary and fringe benefits will be $12,000 for each. A half-time supervisor and planner will be needed at an $18,000 full-time annual salary, including fringe benefits. Thus, the computer and system operations cost will be $45,000 for the first year. It is estimated that no additional new personnel will be needed during the planning period, but salaries and fringe benefits will increase at an annual rate of seven percent.

There will be no new user costs associated with this alternative.

Figure 3

ALTERNATIVE 1

COST PROJECTIONS

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Computer Equipment Procurement	--	--	--	--	--	--	--	--
Applications Software Development	--	--	--	--	--	--	--	--
Computer and Systems Operations	24,000	25,680	27,478	29,401	31,459	33,661	36,018	38,539
Total Data Processing Cost	$24,000	$25,680	$27,478	$29,401	$31,459	$33,661	$36,018	$38,539
Total User Cost	--	--	--	--	--	--	--	--
Projection of Total Cost	$24,000	$25,680	$27,478	$29,401	$31,459	$33,661	$36,018	$38,539

Figure 4

ALTERNATIVE 2

COST PROJECTIONS

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Computer Equipment Procurement	--	--	--	--	--	--	--	--
Applications Software Development	50,400	--	--	--	--	--	--	--
Computer and Systems Operations	45,000	48,150	51,520	55,130	58,990	63,110	67,530	72,257
Total Data Processing Cost	$95,400	$48,150	$51,520	$55,130	$58,990	$63,110	$67,530	$72,257
Total User Cost	--	--	--	--	--	--	--	--
Projection of Total Cost	$95,400	$48,150	$51,520	$55,130	$58,990	$63,110	$67,530	$72,257

Alternative 3 (Figure 5)

The costs of alternative 3 are the same as the costs of alternative 2 with one exception. Because a sample of cases will be analyzed and entered on the computer, fewer persons will be needed to process the case data. Instead of three full-time individuals at $12,000 a year and one half-time supervisor, two full-time individuals and one half-time supervisor will be needed. Thus the computer and system operations cost will be $33,000 during the first year. Again it is assumed that no additional new persons will be needed and that salaries and fringe benefits will increase at an annual rate of seven percent.

There will be no new user costs associated with this alternative.

Alternative 4 (Figure 6)

Computer equipment procurement cost will consist of the cost of the terminals to be installed in each district court. It is estimated that the cost of each terminal will be $3,000. (It is assumed that the terminals will be purchased, they will function for eight years, there are no new costs for telephone lines, there are no maintenance costs, and the central site computer can accept the terminal input with no additional costs. All of these factors would need to be considered in an actual study.) Thus the equipment cost is $90,000 during the first year and zero for every other year during the planning period.

Applications software development cost will be $50,400 during the first year, as in alternative 2.

Computer and system operation costs will consist of a half-time person to analyze data from the computer and prepare the reports for distribution. It is estimated that the necessary full-time salary would be $18,000 during the first year. Thus, operation costs would be $9,000.

User costs are interpreted to mean costs that will be incurred by the district courts themselves. This alternative will require district courts to assign personnel to enter the case data into the terminal for transmission to the central site computer. It is estimated that this activity will require one-quarter of a person's time at an annual salary including fringe benefits of $9,000 in all of the courts (29) except the metropolitan court, and half of one person's time at a salary of $11,000 in the metropolitan court. Thus total user cost for the first year will be $70,750. It is estimated that salaries and fringe benefits will increase at an annual rate of seven percent. (Throughout this case study, it is assumed that when

Figure 5

ALTERNATIVE 3

COST PROJECTIONS

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Computer Equipment Procurement	--	--	--	--	--	--	--	--
Applications Software Development	50,400	--	--	--	--	--	--	--
Computer and Systems Operations	33,000	35,310	37,782	40,426	43,256	46,284	49,524	52,991
Total Data Processing Cost	$83,400	$35,310	$37,782	$40,426	$43,256	$46,284	$49,524	$52,991
Total User Cost	--	--	--	--	--	--	--	--
Projection of Total Cost	$83,400	$35,310	$37,782	$40,426	$43,256	$46,284	$49,524	$52,991

Figure 6

ALTERNATIVE 4

COST PROJECTIONS

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Computer Equipment Procurement	90,000	--	--	--	--	--	--	--
Applications Software Development	50,400	--	--	--	--	--	--	--
Computer and Systems Operations	9,000	9,630	10,304	11,025	11,797	12,623	13,507	14,452
Total Data Processing Cost	$149,400	$ 9,630	$10,304	$11,025	$11,797	$ 12,623	$ 13,507	$ 14,452
Total User Cost	70,750	75,703	81,002	86,672	92,739	99,231	106,177	113,609
Projection of Total Cost	$220,150	$85,333	$91,306	$97,697	$104,536	$111,854	$119,684	$128,061

a one-half or one-quarter-time individual is needed, only that portion of the salary is charged to the alternative. This can be interpreted as assuming that the individual devotes the remainder of the time to other activities or is only employed for that portion of the time. In reality, this may not be the case. What will be done with the remaining time should be considered. It may be appropriate to bill the cost of a full-time individual to the project.)

Alternative 5 (Figure 7)

Computer equipment procurement costs are the costs of terminals in the seven larger courts. Applications software development cost is $50,400 in the first year as in alternative 2. Computer and systems operations costs consist of two individuals ($12,000 each) to process case data that are mailed in from the 23 smaller courts, and one-half of a position at $18,000 a year to supervise and prepare reports for distribution. User costs will include one-fourth of a person at $9,000 in six of the larger courts and one-half of a person at $11,000 in the metropolitan court.

Alternative 6 (Figure 8)

Computer equipment procurement costs will include costs of terminals for all of the district courts except the metropolitan court ($3,000 x 29 courts). Application software development costs will consist of two components in the first year: first, the $50,400 cost of designing and programming the system at the central site computer; and second, a $2,000 cost of conversion to tape for reporting from the metropolitan district court. This latter cost includes $1,500 of programming assistance from a consultant and $500 of rental computer time. Computer and system operation costs will be $9,000, one-half of an individual's time to analyze data from the computer and prepare reports for distribution. Similarly to alternative 4, user costs will consist of one-fourth of an individual's time at an annual salary of $9,000 in each of the 29 courts with terminals.

Alternative 7 (Figure 9)

Computer equipment procurement costs are $18,000 for six terminals. Applications software development costs include the $50,400 for system design and $2,000 for conversion to tape for reporting from the metropolitan court. Computer and system operations costs include a one-half time person to analyze data

Figure 7

ALTERNATIVE 5

COST PROJECTIONS

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Computer Equipment Procurement	21,000	--	--	--	--	--	--	--
Applications Software Development	50,400	--	--	--	--	--	--	--
Computer and Systems Operations	33,000	35,310	37,782	40,426	43,256	46,284	49,524	52,991
Total Data Processing Cost	$104,400	$35,310	$37,782	$40,426	$43,256	$ 46,284	$ 49,524	$ 52,991
Total User Cost	19,000	20,330	21,753	23,276	24,906	26,648	28,514	30,510
Projection of Total Cost	$123,400	$55,640	$59,535	$63,702	$ 68,162	$ 72,932	$ 78,038	$ 83,501

Figure 6

ALTERNATIVE 6

COST PROJECTIONS

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Computer Equipment Procurement	87,000	--	--	--	--	--	--	--
Applications Software Development	52,400	--	--	--	--	--	--	--
Computer and Systems Operations	9,000	9,630	10,304	11,025	11,797	12,623	13,507	14,452
Total Data Processing Cost	$148,400	$ 9,630	$10,304	$11,025	$11,797	$ 12,623	$ 13,507	$ 14,452
Total User Cost	65,250	69,818	74,705	79,934	85,529	91,516	97,923	104,778
Projection of Total Cost	$213,650	$79,448	$85,009	$90,959	$ 97,326	$104,139	$111,430	$119,230

Figure 9

ALTERNATIVE 7

COST PROJECTIONS

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Computer Equipment Procurement	18,000	--	--	--	--	--	--	--
Applications Software Development	52,400	--	--	--	--	--	--	--
Computer and Systems Operations	33,000	35,310	37,782	40,426	43,256	46,284	49,524	52,991
Total Data Processing Cost	$103,400	$35,310	$37,782	$40,426	$43,256	$ 46,284	$ 49,524	$ 52,991
Total User Cost	13,500	14,445	15,456	16,538	17,696	18,934	20,260	21,678
Projection of Total Cost	$116,900	$49,755	$53,238	$56,964	$ 60,952	$ 65,218	$ 69,784	$ 74,669

and prepare reports for distribution (first year, one-half of $18,000), and two individuals at $12,000 per year in the first year to compile and enter mailed reports from the smaller courts. User costs are the individuals required to enter data into the terminals (first year, one-quarter of $9,000 in six courts).

Projected total costs for each alternative are collectively shown in Figure 10.

Benefits

It is possible in this case study to estimate a substantial portion of the benefits of each alternative in terms of dollar amounts. (There are, of course, additional, unquantifiable benefits which will be discussed below.) In this case there are two types of quantifiable benefits.

The first is a cost savings which results from the new automated system alternatives relative to the existing manual system. Currently, there are four individuals (two at an annual salary, including fringe benefits, of $8,000 and two at $12,000) in the judicial department assigned to the task of organizing, analyzing, and preparing caseload reports. Under alternative 1, two or more positions are added and there is no cost savings. Under each of the other alternatives (2-7), those four positions are eliminated. Thus, in the first year each of the other alternatives generates benefits equal to $40,000. Given the projection that salaries and fringe benefits will increase by seven percent each year during the planning period, the estimated cost savings for alternatives 2 through 7 increase from $40,000 in the first year, to $42,800 in the second, and finally to $64,200 in the eighth year. (It is interesting to note that this is an instance in which cost savings can be considered as a quantifiable benefit and mathematically related to costs. This is because the four individuals at the judicial department were not included in any cost computations since they are costs that already exist. There is, therefore, no redundancy between costs and cost savings benefits in this instance.)

The second type of quantifiable benefit results from the enhanced ability of the judicial department to transfer judges and court reporters to courts that are experiencing increasing backlogs and delay and to use temporary judges in special-problem district courts when needed. The judicial department has estimated, on the basis of the past history of filings and on projections of increases in caseloads, that the information provided by the case reporting systems will result in the reduction of the need for new district judges and for

Figure 10

TOTAL COST PROJECTIONS FOR ALL ALTERNATIVES

	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Alternative 1	24,000	25,680	27,478	29,401	31,459	33,661	36,018	38,539
Alternative 2	95,400	48,150	51,520	55,130	58,990	63,110	67,530	72,257
Alternative 3	83,400	35,310	37,782	40,426	43,256	46,284	49,524	52,991
Alternative 4	220,150	85,333	91,306	97,697	104,536	111,854	119,684	128,061
Alternative 5	123,400	55,640	59,535	63,702	68,162	72,932	78,038	83,501
Alternative 6	213,650	79,448	85,009	90,959	97,326	104,139	111,430	119,230
Alternative 7	116,900	49,755	53,238	56,964	60,952	65,218	69,784	74,669

new court reporters. Some of the alternatives do provide more complete, accurate, and timely information and thus result in greater efficiencies. It should be kept in mind, however, that these projected benefits are estimates and are subject to error.

It is estimated that improvements to the existing manual system as reflected in alternative 1 will reduce the need for new judges and court reporters by one in the first year through the fifth year and by two in the sixth year through the eighth year. The current district judge's salary and fringe benefits are $46,000 per year, and the court reporter's salary and benefits are $20,000. It is expected the judge's salaries and benefits will increase to $57,000 in year 5 and court reporters' salaries and benefits to $25,000 in year 5. Thus, the benefits in years 1 through 4 are $66,000, $82,000 in year 5, and $164,000 in years 6 through 8.

Alternative 2 will enable the judicial department to provide additional reports as described in the Processing Scope in Figure 2 and to produce all of the reports more rapidly. More efficient allocation and transfer of judges will result. The judicial department estimated that one judge (and one court reporter) will be saved in the first year; two, in the second and third years; three, in the fourth and fifth years; four, in the sixth year; five, in the seventh year; and six, in the eighth year. The resulting savings (incorporating the projected increase in salaries and fringe benefits) are $66,000, $132,000, $132,000, $198,000, $246,000, $328,000, $410,000 and $492,000, respectively, for each year.

Alternative 3 will result in less timely and complete information because of the nature of the sample. The estimated benefits, however, are greater than those resulting from alternative 1. The estimated reductions in additional judges (and court reporters) are one judge in the first, second, and third years, two judges in the fourth and fifth years, three judges in the sixth and seventh years, and four judges in the eighth year.

Alternatives 4, 5, 6, and 7 will provide the same type of reports, just as timely, as alternative 2 and will thus result in the same benefits.

The cost-saving benefits and the benefits resulting from reduction in the need for additional judges and reporters are added and totals are presented in Figure 11.

As mentioned above, some of the benefits resulting from these alternative approaches are not quantifiable. In this case, the unquantifiable are estimated to be minor when compared to the quantifiable results. They should be taken into account only if two or more of the alternatives result in identical or nearly identical net benefits. These unquantifiable

CONTINUED

2 OF 3

Figure 11

QUANTIFIABLE BENEFITS

Alternative	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
1	$66,000	$66,000	$66,000	$66,000	$82,000	$164,000	$164,000	$164,000
2	106,000	174,800	177,800	247,000	298,400	384,100	470,000	556,250
3	106,000	108,800	111,800	181,000	216,400	302,100	306,000	392,200
4	106,000	174,800	177,800	247,000	298,400	384,100	470,000	556,250
5	106,000	174,800	177,800	247,000	298,400	384,100	470,000	556,250
6	106,000	174,800	177,800	247,000	298,400	384,100	470,000	556,250
7	106,000	174,800	177,800	247,000	298,400	384,100	470,000	556,250

benefits include a general increased confidence in the statistical reporting of the judicial department as a result of all of the alternatives, particularly the automated alternatives; an increased public respect for the creative efforts of the judicial department to deal with increasing caseloads as a result primarily of alternatives 4 through 7; and an increased legislative receptivity to judicial department proposals as a result of efforts to increase efficiency, particularly as a result of alternatives 2 through 7.

Costs and Benefits

Costs of each alternative in each of the years in the planning period were presented in Figures 3 through 9. Estimates of the quantifiable benefits of each alternative in each of the years were presented in Figure 11. Given that in this case study costs and benefits are quantifiable (those unquantifiable benefits being minor), cost-benefit analysis is an appropriate tool to use in decision-making.

Before costs and benefits of the alternative approaches can be compared, significant adjustments must be made. Because both costs and benefits occur in different time periods, direct comparisons cannot be made of costs and of benefits for the seven alternatives. Ten thousand dollars in costs during the first year is not the same as $10,000 in costs during the eighth year. The $10,000 cost in the eighth year is smaller. If one chooses between two projects that yield identical benefits, where one costs $10,000 now, while the other costs $10,000 eight years from now, one would rationally choose the latter. The first project would cost you $10,000 now. The second project could be purchased for about $6,750 now if that money were placed in a bank and earned five percent interest for eight years.

It is a common device to correct for these differences by valuing future benefits and costs in terms of today's dollars. Rather than simply totaling all costs and all benefits, each year's costs and each year's benefits are discounted to today's values and then are added. The discount rate used in this case study is ten percent.

The totals of the discounted costs and discounted benefits are presented in Figure 12.

The net benefits of each alternative approach are shown in column three of Figure 12. The net benefit of an approach is the present value of the benefits minus the present value of the costs of the approach. The judicial department is attempting to make a rational decision about which of seven possible alternatives is the best. Benefit-cost analysis suggests that

Figure 12

COSTS AND BENEFITS

Alternative	(1) Total Discounted Costs	(2) Total Discounted Benefits	(3) Net Benefits (2) - (1)	(4) Net Benefit Ranking	(5) Benefit-Cost Ratio (2)/(1)	(6) Benefit-Cost Ratio Ranking
1	$174,594	$564,544	$389,960	7	3.23	5
2	$377,764	$1,589,997	$1,212,233	1	4.21	1
3	$290,467	$1,142,365	$851,898	6	3.93	2
4	$720,712	$1,589,997	$869,285	5	2.21	7
5	$449,688	$1,589,997	$1,140,309	3	3.54	4
6	$679,551	$1,589,997	$910,446	4	2.34	6
7	$408,675	$1,589,997	$1,181,322	2	3.89	3

the best, most efficient alternative, when choosing one among all possible alternatives, is that approach that maximizes net benefit. The ranking of each alternative according to net benefit appears in column 4 of Figure 12. The alternatives are ranked from the highest net benefit to the lowest.

An alternative method of comparing benefits and costs of potential projects is to compare the ratios of benefits to costs. (In an actual situation, only one of these methods of comparing benefits and costs would normally be used.) A benefit-cost ratio greater than one indicates that the present value of the benefits is greater than the present value of the costs. Such a ratio means that a project should be undertaken from the point of view of an individual, firm, government, or society. If a court system accurately measured all benefits and costs of a variety of projects, and the system were not practically limited by funding, it would be rational for the system to undertake those projects for which the benefit-cost ratio is greater than one.

In the present case study, seven alternative approaches to the same problem are being considered. The benefit-cost ratio for each alternative is greater than one. (See column 5 of Figure 12.) It would not, however, make sense to undertake all of the alternatives, since each alternative solves similar problems and the adoption of more than one would be redundant. A ranking of the benefit-cost ratios (column 6) provides guidance to the proper choice of an alternative approach if only one is to be chosen when the costs of each alternative are the same. With identical costs, the alternatives with the highest benefit-cost ratio will provide the greatest net benefit.

Alternative 2, the alternative with the largest net benefit, happens to have the greatest benefit-cost ratio. Alternative 3 with the second highest benefit-cost ratio, however, has next to the lowest amount of net benefit. Using the benefit-cost ratios as a guide to selection in a solution such as the one considered here will not result in consistent, rational choices.

Recommendations

The Atlantis Judicial Department should choose that alternative approach to its case reporting problem that maximizes the net benefits accruing to the system. As Figure 12 shows, that choice is alternative 2 with a net benefit of $1,212,233. It is interesting that alternative 2 also has the highest benefit-cost ratio, although this uniformity will not always exist.

Under certain circumstances, such a choice might not be the best alternative. Alternatives 7 and 5 each provide almost as great a net benefit as alternative 2. If the judicial department found that alternatives 2 and 7, for example, had no unquantifiable benefits, but that alternative 5 had relatively significant benefits that happen to be unquantifiable, it might be rational to choose alternative 5. Such a choice might result in the maximizing of net benefits even though it would not be possible to measure the benefits.

A second circumstance would suggest another choice. If the judicial department were limited in the amount of funding the department would get during the planning period, it might have to eliminate some of the choices as possibilities, or phase in the optimal choice over a longer period. If phasing in an alternative were not possible, and the judicial department knew that it could not receive more than $90,000 in the first year for the case reporting system changes, the only possible choices would be alternatives 1 and 3. (See Figures 3 through 9.) Confronted with these conditions, the judicial department should choose alternative 3.

A final circumstance would be one in which it was advantageous from a political and public relations standpoint to use existing trial court systems and to have some data entry terminals in district courts. This would lead to a choice of alternative 7.

Case 3: Sequoia District Court Information System

This is the third and final case in a series illustrating the application of cost-benefit techniques to the selection of a computer system. It is set in a nonexistent state, Sequoia, where the courts have recently begun to use computers in the processing of court work. As in Case 1, Middlesex District Court Docketing System, the Sequoia material is based in part on actual court experiences.

In comparison with Middlesex, Sequoia is larger in both area and population. Both court systems are of horizontal structure; that is, the cohesion among the courts within one statewide tier of the system, the district courts, is stronger than the bond among the municipal and county-level courts. Weighted caseload figures are used in this case to estimate the courts' workload, whereas this information was not available to Middlesex court officials. While benefits are rated with numbers in both cases, a judgmental assessment is also included in this case.

Background

Sequoia's population is the sixteenth largest in the nation. About half of the state's citizens, numbering 7,400,000, live in two metropolitan areas. The economy of one of the cities revolves around a large electronics firm and a group of private and public universities. The other city lacks an economic focus, being made up of light industry, some agricultural-related industries, a few corporate industries, and other activities common to all cities. Downstate, as the balance of the state is commonly called, is dominated by agricultural activity, mainly corporate and family farms. The small communities dotting the landscape serve as storage depots for the vegetables and other products; local merchants are geared to supply these farms. Covering 21,500 square miles of land, Sequoia is the eighteenth largest state in that respect. Aside from the two metropolitan areas and a large centrally located lake, the state is mainly rolling farmland interrupted only briefly in the western region by a small mountain range.

The chief justice personifies the court system. Justice Rustett took his law degree at the state university and after graduation managed the family farm for five years. About

twenty years ago he entered politics, running first for district attorney in his home county. At that time, the Sequoia court system was locally oriented, with the elected judges subject to a limited number of rules and even fewer centrally administered directives. Ten years ago, John Rustett was elected to the district court bench, about the same time that key judicial and state leaders were discussing the desirability of unifying the court system.

Once the idea was put into motion, unification came with a rush. Convened six years ago, a constitutional convention recommended that courts be totally unified, a position that was strongly opposed by the city and municipal court judges. A compromise was struck whereby the appellate, district (general jurisdiction), and juvenile courts were recommended for unification. In return for their support of this provision, the municipal courts remained somewhat independent under the new constitution. Within one year after the new constitution was passed by the voters, unification was fully executed. Staffed by 32 professionals, the newly established administrative office of the courts spearheaded the effort. Where once district court judges established their own courtroom procedures, subject to common law traditions, hired court staff, and dealt personally with the county commissioners on budget matters, now the adjudication process is governed by two bound volumes of rules, and budget and personnel matters are covered by procedures manuals. In December of the same year that the new constitution was approved by Sequoia citizens, Judge Rustett was appointed Chief Justice of the Supreme Court. Unlike his predecessor, the new Chief Justice takes an active interest in court reform, as illustrated by his weekly schedule, which is equally divided between judicial and court administrative matters.

Like other court systems throughout the nation, Sequoia courts have experienced a sharp rise in their caseload over the past twenty years. As shown in Figure 1, which for the convenience of the reader is repeated as Figure 3 later in the case, civil cases in the 30 district courts increased between 1960 and 1978 from 23,000 to 80,000, a rise of 250%. Criminal cases too have shown a dramatic increase, going from 40,000 to 120,000 (200%).

City and municipal courts have been leaders in the computer sphere. Faced with an exploding civil and criminal caseload in the 1950's and 60's, both of the large cities in Sequoia executed computer-based case tracking systems, which have been moderately successful, but which are now in need of modernization. Since unification, there has been a great deal of interest on the part of the administrative office in extending

Figure 1: EIGHT-YEAR FORECAST OF SEQUOIA DISTRICT COURT CASELOAD AND STAFF REQUIREMENTS FOR MANUAL AND AUTOMATED ALTERNATIVES (IN PERSON DAYS).

		1960	1970	1978	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Civil												
Matrimonial and Child Support	Cases	10,321	26,614	38,318	40,000	42,500	45,000	47,500	50,000	53,000	56,000	59,000
	Manual (1.21)	--	--	--	48,400	51,400	54,500	57,500	60,500	64,100	67,800	71,400
	Automated (0.90)	--	--	--	36,000	38,300	40,500	42,800	45,000	47,700	50,400	53,100
Automobile Tort	Cases	7,321	14,891	25,113	27,000	28,000	29,000	30,500	32,000	34,000	36,000	38,000
	Manual (1.83)	--	--	--	49,400	51,200	53,100	55,800	58,600	62,200	65,900	69,500
	Automated (1.51)	--	--	--	40,800	42,300	43,800	46,100	48,300	51,300	54,400	57,400
Other Civil	Cases	5,431	12,119	17,318	20,000	22,000	24,000	26,500	29,000	31,500	34,000	36,500
	Manual (1.49)	--	--	--	29,800	32,800	35,800	39,500	43,200	46,900	50,700	54,400
	Automated (1.09)	--	--	--	21,800	24,000	26,200	28,900	31,600	34,300	37,100	39,800
Subtotal	Cases	23,073	53,624	80,749	87,000	92,500	98,000	104,500	111,000	118,500	126,000	133,500
	Manual	--	--	--	127,600	135,400	143,400	152,800	162,300	173,200	184,400	195,300
	Automated	--	--	--	98,600	104,600	110,500	117,800	124,900	133,300	141,900	150,300
Criminal												
Class A Felony	Cases	105	255	351	400	440	500	550	600	650	700	750
	Manual (5.11)	--	--	--	2,000	2,200	2,600	2,800	3,100	3,300	3,600	3,800
	Automated (3.91)	--	--	--	1,600	1,700	2,000	2,200	2,300	2,500	2,700	2,900
Other Criminal	Cases	16,311	31,361	37,019	38,000	40,000	42,000	47,000	46,000	45,000	50,000	52,000
	Manual (1.91)	--	--	--	72,600	76,400	80,200	89,800	87,900	86,000	95,500	99,300
	Automated (1.63)	--	--	--	61,900	65,200	68,500	76,600	75,600	73,400	81,500	84,800
Subtotal	Cases	16,416	31,616	37,370	38,400	40,440	42,500	47,550	46,600	45,650	50,700	52,750
	Manual	--	--	--	74,600	78,600	82,800	92,600	91,000	89,300	99,100	103,100
	Automated	--	--	--	63,500	66,900	70,500	78,800	77,300	75,900	84,200	87,700
TOTAL	Cases	39,489	85,240	118,119	125,400	132,940	140,500	152,050	157,600	164,150	176,700	186,250
	Manual	--	--	--	202,200	214,000	226,200	245,400	253,300	262,500	283,500	298,400
	Automated	--	--	--	162,100	171,500	181,000	196.600	202,200	209,200	226,100	238,000

to other courts the use of the computer in the statistical and case processing areas. In 1975, the administrative office drafted an information system plan, which called for giving first priority to the automation of case tracking and statistical systems in the district courts. This would be followed by a similar computerization on a statewide basis of the juvenile and appellate courts and eventually of judicial budget, accounting, and personnel functions.

Description of System

Current System

Typical of counterparts in other states, the current district courts information system is made up of a summary statistical report and an assortment of other documents that record a case's progress through the court. Shown in Figure 2, the summary report is hand prepared by the district court clerks. Two years ago the administrative office issued preparation guidelines for the district court statistical reports; however, it is widely believed that only a handful of clerks follow the manual. An even more pervasive belief is that the summary reports, whatever the method of preparation, vary as to their accuracy. One rumor has it that two clerks in the southern part of the state consistently inflate the caseload figures in order to justify additional judges, clerks, and other resources.

These reports are submitted on a monthly basis to the administrative office, where they are summarized and where the information is used to prepare monthly, quarterly, and annual statistical reports. On occasion, the administrative office relies on these data to compile special reports for citizen groups and legislators. At the end of the court year, these figures are used to compile the court's yearly caseload statistics for inclusion in the annual report.

In the clerk's offices, case recordkeeping is centered on the docket book. Costing $450 each, the district court docket books are 20-by-30-inch, canvas-bound volumes. The pages are line ruled for entry of information. The date of filing and disposition is uniformly recorded throughout the state; practice as to the entry of motion, continuance, and other case information varies from court to court, resulting in wide gaps in the quantity and quality of information. Some uniformity, however, is maintained because of two current practices. Courts tend to purchase the books from the same manufacturer and entry procedures are generally adhered to because

Figure 2: SEQUOIA DISTRICT COURT SUMMARY STATISTICS REPORT

Type Cases	Current Month	YTD Previous Year	YTD Current Year	Change	Percent Change
Civil					
Matrimonial					
Child Support					
Automobile Tort					
Condemnation					
Equity					
Other					
Total					
Criminal					
Class A Felony [1]					
Class B Felony [2]					
Class C Felony [3]					
Class D Felony [4]					
Driving Under the Influence of Alcohol					
Other Traffic Offenses					
Total					
Grand Total					

[1]Class A Felonies: murder, 1st, 2nd or 3rd degree, manslaughter.

[2]Class B Felonies: armed robbery, and other crimes against the person, save Class A felonies.

[3]Class C Felonies: e.g., breaking and entering, 25 other lesser crimes defined in District Court Information System Preparation Manual.

[4]Class D Felonies: all other felonies; in general the least serious of the four classes; a list is contained in the District Court Information System Preparation Manual.

they are the regular subject of discussion at clerks' conferences and conventions.

The district clerk or his deputy generally prepares the calendar of court cases. Most clerks, in preparing the document, take into account judges' working habits, lawyers' preferences, case priorities, and a wide variety of other factors. For example, one clerk gives high priority to the adjudication of child support actions, while another confers the same priority on criminal matters.

For cross reference, the case number and name are also recorded on 3-by-5-inch index cards, which are maintained in alphabetic order by case name. Monthly reports point out overdue cases at various stages of the trial process. The level of detail varies from court to court.

Planned System

The first phase of the Sequoia Courts Information System Plan calls for the automation of current district courts recordkeeping practices. Case data will continue to be recorded in the docket books, but will also be entered at video terminals located in the clerks' offices. The information will be forwarded over telephone lines to another location for further processing and storage; the specific computer configuration will hinge on the results of the cost-benefit analysis.

Small printers located next to the video terminals will produce calendars and index cards. In addition, clerks and other court personnel will be able to use the video terminals to inquire as to the status of cases.

The computer will produce the administrative office's statistical reports; while the form of the reports will remain the same, some improvement as to content is expected, if for no other reason than that preparation will be standardized.

Still, the overall goal is not, at this point in time, to enhance the information content of the output documents; it is rather to create an accurate, complete, workable information base, the keystone for future improvements.

The pivotal event leading to this automation strategy was, undoubtedly, the release of the Mossing Electronics and Gram's Corporation (MEGA) report. At the time of unification, MEGA offered to study court productivity at no cost to the courts. The Sequoia courts accepted the offer and MEGA spent the next two and one-half years completing the study. The final value of the study was placed at $600,000. The centerpiece of the project was a weighted caseload analysis, which measured the amount of work at each stage of case processing. Assuming the continuation of present practices, MEGA used the figures to forecast a doubling of the district courts' workforce in the

next twenty years. In its key recommendations, MEGA advocated the adoption of computer methods to effect productivity gains. The corporation felt this step would significantly reduce future personnel requirements. As a first step, MEGA recommended the automation of current district court manual methods. (MEGA and weighted caseload will be covered more fully later because they have an important bearing on the preparation of the cost figures.)

Alternatives

District court automation was the main topic of a recent court administrative office planning session. It was a wide-ranging discussion, with virtually all aspects of the system coming under scrutiny. Progress was made on two issues. A tentative decision was made to use the University of Sequoia computer, if at all possible. The close proximity of the computer to the administrative office and the obvious fact that both the administrative office and the university were part of state government played a role in the decision. Chief Justice Rustett has close personal ties with the chancellor of the university, and it was felt the bond might work to the courts' favor. It was also agreed that, if all went as planned, the courts would outgrow the university computer in roughly 10 years and would then purchase their own equipment (i.e., when juvenile, appellate, budget, accounting, and personnel modules, in addition to the district court module, are operational).

Court officials also identified seven alternatives which should be subject to a cost-benefit evaluation.

—Video display and printer terminals located at each district court clerk office and in the administrative office; units directly connected to University of Sequoia computer; purchased equipment; incremental implementation beginning with districts with the heaviest caseload.

—Same as alternative 1 but for the addition of an extensive pilot test before phased implementation would be undertaken.

—Video display and printer terminals located at each district court clerk's office and in the administrative office; units connected to a distributed network of minicomputers, which would be connected to the University of Sequoia computer; purchased equipment; incremental implementation.

—Same as alternative 3 except for the substitution of leased instead of purchased equipment.

—Same as alternative 3 except for leased instead of purchased equipment, and the addition of a pilot test.
—Same as alternative 3 except for the addition of a pilot test.
—Continuation of manual practices.

After conferring with the chief justice, the state court administrator assigned the preparation of the cost-benefit analysis to the planning unit. While the unit did not have a strong technical orientation, this characteristic was more than offset by its impartiality. The planning director as the first matter of business decided to review the alternatives to determine if any could be eliminated. He reasoned that fewer alternatives would make the differences and similarities of each come into sharper focus. In looking at the above seven alternatives, he saw it was obvious that if the lease-versus-purchase and pilot-site-versus-phased-implementation issues were resolved, the alternatives would be reduced to three:

—Video terminal and printers in each clerk's office and in the administrative offices, directly connected to the university computer (either purchase or lease; either pilot or phased implementation).
—Video terminals and printers in each clerk's office and in the administrative office, tied to a distributed minicomputer network which in turn would be connected with the University computer (purchase or lease; either pilot or phased implementation.)
—Continuation of manual practices.

The lease-versus-purchase decision was easy. Planning staff researched the question and found strong arguments for both points of view. In favor of leasing was the rapid change in the world of computers, where each new generation of equipment replaces the preceding one at more closely spaced intervals. Leasing allowed the user to switch to another configuration at any point in the life of the system without concern for disposal of existing machinery. Purchase was of course less costly, but it involved a substantial initial outlay of funds. A practical consideration made the course of action clear. Through the grapevine, it became known that the regional planning unit, the local administrative agency that distributed federal Law Enforcement Assistance Administration (LEAA) funds, would be able to expend a large amount of funds in the current fiscal year. Discussion with local officials confirmed this fact, and thus it was decided to purchase the needed equipment.

Planning staff began to research the pilot-versus-incremental-implementation issue. They asked: Of what duration was the pilot test? What level of resources would be committed to it?

Staff knew that the more difficult an implementation is expected to be, the more it makes sense to choose the pilot approach, but they wanted to know with more precision what return could be expected from a given investment. Again, a practical consideration intervened. In a telephone conversation, the presiding chief justice of one of the most progressive district courts volunteered his court as the pilot site and as the initial site for actual implementation. It was quickly agreed to accept the judge's offer because in its early critical and often tenuous life, the system would thus be assured of a favorable environment.

Weighted Caseload

Personnel costs were by far the highest costs in each of the three alternatives. Because the weighted caseload figures were central to the personnel cost projections, this area is discussed before dealing with the compilation of the costs for each alternative. Figure 3 shows civil and criminal case statistics for 1960, 1970, and 1978, and case projections for 8 years into the future. It also indicates daily clerical work requirements for each of the case types. For example, current processing of a matrimonial and child support case required, on the average, 1.21 days of work; MEGA's report estimated that the time could be reduced to .90 with the introduction of computer methods. The weighted caseload figures are the products of multiplying the caseload by the work requirement number; matrimonial and child support for the first year of the projection, 40,000, would result in the manual weighted caseload of 48,400 (1.21 x 40,000) and the automated weighted caseload of 36,000 (.90 x 40,000). The weighted caseloads are simply the overall staff requirements under the manual and automated options.

Figure 4 takes these figures one step further, converting the daily needs to yearly staff requirements and portraying graphically the difference between the manual and automated options. The yearly staff requirement is obtained by dividing the weighted caseload by 220, the standard for the number of days worked by staff per year. For instance, dividing the total manual weighted caseload for the first year of the forecast on Figure 3, 202,200, by 220 yields 919, the figure used in Figure 4.

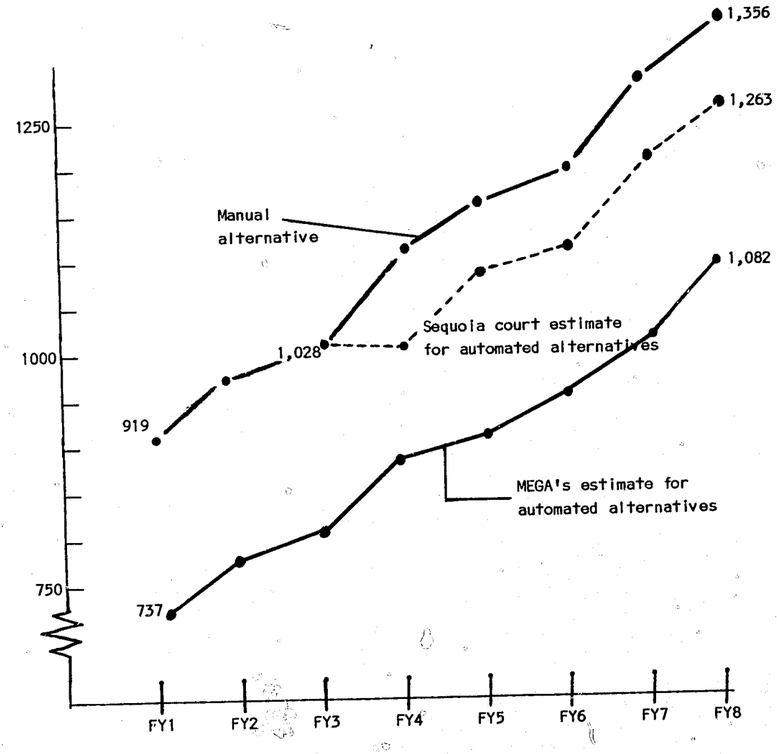
All of the information contained in Figures 3 and 4, save the historical statistics and the Sequoia court staff-requirements estimate with automation, are based on MEGA work in one of the district courts, which took place over a 14-month

Figure 3: EIGHT-YEAR FORECAST OF SEQUOIA DISTRICT COURT CASELOAD AND STAFF REQUIREMENTS FOR MANUAL AND AUTOMATED ALTERNATIVES (IN PERSON DAYS).

		1960	1970	1978	FY 1	FY 2	FY 3	FY 4	FY 5	FY 6	FY 7	FY 8
Civil												
Matrimonial and Child Support	Cases	10,321	26,614	38,318	40,000	42,500	45,000	47,500	50,000	53,000	56,000	59,000
	Manual (1.21)	--	--	--	48,400	51,400	54,500	57,500	60,500	64,100	67,800	71,400
	Automated (0.90)	--	--	--	36,000	38,300	40,500	42,800	45,000	47,700	50,400	53,100
Automobile Tort	Cases	7,321	14,891	25,113	27,000	28,000	29,000	30,500	32,000	34,000	36,000	38,000
	Manual (1.83)	--	--	--	49,400	51,200	53,100	55,800	58,600	62,200	65,900	69,500
	Automated (1.51)	--	--	--	40,800	42,300	43,800	46,100	48,300	51,300	54,400	57,400
Other Civil	Cases	5,431	12,119	17,318	20,000	22,000	24,000	26,500	29,000	31,500	34,000	36,500
	Manual (1.49)	--	--	--	29,800	32,800	35,800	39,500	43,200	46,900	50,700	54,400
	Automated (1.09)	--	--	--	21,800	24,000	26,200	28,900	31,600	34,300	37,100	39,800
Subtotal	Cases	23,073	53,624	80,749	87,000	92,500	98,000	104,500	111,000	118,500	126,000	133,500
	Manual	--	--	--	127,600	135,400	143,400	152,800	162,300	173,200	184,400	195,300
	Automated	--	--	--	98,600	104,600	110,500	117,800	124,900	133,300	141,900	150,300
Criminal												
Class A Felony	Cases	105	255	351	400	440	500	550	600	650	700	750
	Manual (5.11)	--	--	--	2,000	2,200	2,600	2,800	3,100	3,300	3,600	3,800
	Automated (3.91)	--	--	--	1,600	1,700	2,000	2,200	2,300	2,500	2,700	2,900
Other Criminal	Cases	16,311	31,361	37,019	38,000	40,000	42,000	47,000	46,000	45,000	50,000	52,000
	Manual (1.91)	--	--	--	72,600	76,400	80,200	89,800	87,900	86,000	95,500	99,300
	Automated (1.63)	--	--	--	61,900	65,200	68,500	76,600	75,000	73,400	81,500	84,800
Subtotal	Cases	16,416	31,616	37,370	38,400	40,440	42,500	47,550	46,600	45,650	50,700	52,750
	Manual	--	--	--	74,600	78,600	82,800	92,600	91,000	89,300	99,100	103,100
	Automated	--	--	--	63,500	66,900	70,500	78,800	77,300	75,900	84,200	87,700
TOTAL	Cases	39,489	85,240	118,119	125,400	132,940	140,500	152,050	157,600	164,150	176,700	186,250
	Manual	--	--	--	202,200	214,000	226,200	245,400	253,300	262,500	283,500	298,400
	Automated	--	--	--	162,100	171,500	181,000	196,600	202,200	209,200	226,100	238,000

Figure 4 COMPARISON OF ESTIMATED SEQUOIA DISTRICT COURT STAFF REQUIREMENTS FOR MANUAL AND AUTOMATED ALTERNATIVES*

	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8
Manual	919	973	1,028	1,115	1,151	1,193	1,289	1,356
Sequoia Court automation estimate	919	965	1,028	1,018	1,073	1,113	1,203	1,263
MEGA automation estimate	737	780	823	894	919	951	1,028	1,082



*Staff requirements are calculated by dividing the person days requirements listed on Table 3 by 200 (working days per year).

period. The historical statistics came from administrative office records, as did the Sequoia automation estimate because of skepticism over the accuracy of the MEGA estimate for staff requirements, as will be explained shortly.

MEGA forecast court cases using linear regression, one of many statistical techniques the corporation evaluated for use on the Sequoia project. This is reflected by the manual projections in Figure 4. The results point to a continuation of the past sharp rise in caseload, requiring an equally sharp increase in clerical staff.

Such figures should, however, be scrutinized very carefully. In the Northeast, criminal caseloads have peaked and in many jurisdictions are starting to decline. To be sure, there are wide variations in caseloads throughout the nation. Still, if perceptions differ from the estimate, it should be questioned, asking that underlying assumptions of the mathematical technique be discussed in lay terms. The mathematics should not intimidate the user. Some forecasting techniques place more emphasis on the most recent event while others assign all historical data the same weight. It is important to know the characteristics of the prediction techniques.

The second factor in the weighted caseload arithmetic is the clerical time necessary to process each case. Generally, the estimates for manual processing are reliable, for they are based on actual observations, although there may be some efficiencies with the growth of the workload. Less reliable are the automation estimates, for they are based on a number of assumptions. The most elementary one is that the computer system will work reasonably well. A successful implementation requires, among other things, an able staff, hard work, and policymaker support—not always given by any means. Another assumption, often not articulated, is that the court will hire additional staff only if necessary. In other words, staff levels will be frozen at certain points if productivity gains make it possible for existing staff to cope with additional work. This is often not the case, especially in urban areas, for many pressures exist to the contrary. In many cities, court jobs are important sources of patronage, and the expectation of an increase in jobs is often a substantial part of the reason for the creation of them. Another assumption has to do with the mix and level of staff needs. For example, computer support needs are often underestimated. Thus, like case projections, workload estimates should be reviewed carefully.

As a result of the court planning department's research on MEGA's work (shown as the Sequoia court automation estimate on Figure 4), the consulting firm's personnel cost-savings projections were discarded completely for the first 3 years and reduced substantially for the balance of the 8-year period. Two

factors were important. First, MEGA's work at the test court was plagued with troubles. Responsibility was vested in three different managers in a 14-month period. Court staff complained of rude treatment and arbitrary decisions. Among the most respected members of court staff there was a consensus that MEGA fell behind in its work and cut corners in order to make up ground. Second, other courts have not realized the level of savings forecast by MEGA.

It is not the intent to imply that such projections are inherently inaccurate. The court's decision was based on the specifics of MEGA's work. All such reports, however, should be subject to careful investigation.

Costs

This section describes the cost calculations for the three alternatives. These costs include one-time and continuing costs, and continuing costs include data processing and user costs.

User costs for alternatives 1 and 2 are based on the Sequoia court staff-requirements automation estimate as shown in Figure 4; the elements of these costs are represented in Figure 5, a user cost worksheet. The total staff line in Figure 5 matches exactly the Sequoia court automation estimate in Figure 4, going from 919 to 1,263 over the 8 years of the forecast. The mix of clerks, supervisors, senior and junior clerks, and other support staff is based on a synthesis of the MEGA report and current staff perceptions. User costs include salary, plus 30% of salary for fringe benefits, and overhead; the rate was obtained from the court's chief fiscal officer. Salaries are expected to rise at a rate of 5% yearly. Figure 5 costs are transferred without modification to tables that describe costs for each alternative.

Computer personnel costs would also be developed in detail in the same manner as in the Middlesex case study. Because the basic process would be the same for Sequoia (although the actual costs are different), it is not repeated here.

Alternative 1, Full Computer Support from the University of Sequoia

The costs for this alternative are shown in Figure 6; similarly the costs for the other two alternatives are displayed in Figures 7 and 8, which will be covered later in this section. Figure 9 summarizes this information. The cost will be discussed in order of presentation, moving from the top to the bottom of each table.

Figure 5: USER COST WORKSHEET FOR ALTERNATIVES 1 AND 2

	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	Total
Clerk: staff	30	30	30	30	30	30	30	30	-
salary plus f & o	30,000	32,000	33,000	35,000	36,000	38,000	39,000	41,000	-
total cost	900,000	960,000	990,000	1,050,000	1,080,000	1,140,000	1,170,000	1,230,000	8,520,000
Supervisor: staff	88	93	100	100	105	108	115	124	-
salary plus f & o	25,000	26,000	28,000	29,000	30,000	31,000	33,000	34,000	-
total cost	2,200,000	2,418,000	2,800,000	2,900,000	3,150,000	3,348,000	3,795,000	4,216,000	24,827,000
Senior Clerk: staff	179	188	195	195	210	217	234	244	-
salary plus f & o	22,000	23,000	24,000	25,000	26,000	28,000	29,000	30,000	-
total cost	3,938,000	4,324,000	4,680,000	4,875,000	5,460,000	6,076,000	6,786,000	7,320,000	43,459,000
Junior Clerk: staff	268	280	300	295	310	325	354	370	-
salary plus f & o	15,000	16,000	17,000	18,000	18,000	19,000	20,000	21,000	-
total cost	4,020,000	4,480,000	5,100,000	5,310,000	5,580,000	6,175,000	7,080,000	7,770,000	45,515,000
Other Support Staff: staff	354	374	403	398	418	433	470	495	-
salary plus f & o	10,000	11,000	11,000	12,000	12,000	13,000	13,000	14,000	-
total cost	3,540,000	4,114,000	4,433,000	4,776,000	5,016,000	5,629,000	6,110,000	6,930,000	40,548,000
Total staff	919	965	1,028	1,018	1,073	1,113	1,203	1,263	
Total Cost	14,598,000	16,296,000	18,003,000	18,911,000	20,286,000	22,368,000	24,941,000	27,466,000	162,896,000

NOTE: These cost data include salary, plus 30% of salary for fringe benefits and overhead, and are projected to rise at a rate of 5% per year (data have been rounded to the nearest $1,000 except for occasional minor adjustments to reduce rounding error in totals.

At the top of Figure 6, $80,000 is set aside for the purchase of 60 video and printer terminals in FY 1, to be distributed according to volume in the 30 district courts, plus one video and one printer in the administrative office. It is assumed the equipment will be replaced at 5-year intervals, requiring an allocation of $100,000 for this purpose in FY 6.

System development and maintenance will be done internally by administrative personnel. Therefore, costs for computer professional staff at the administrative office allow for a manning level of a manager and four others rising to eight plus the manager over the 8-year projection period. This is spread among the application programs (personnel) development cost item and the administration and program maintenance continuing cost items. Applications programs costs rise from $95,000 to $115,000 over the first 3 years of the projection, fall to $100,000 in the fourth year and after that rise continually to $160,000 in the eighth year. This pattern reflects a belief that the initial (i.e., district court) system will be in place and working well after 4 years of operations, and substantial system upgrades will begin and continue to be executed after that point in time.

The computer system will be developed as well as run on the University of Sequoia computer, a large time-shared computer manufactured by one of the leaders in the industry. Under applications programs, computer time costs parallel those for personnel, rising slightly in the second year, falling back in the third year, and rising again in years 5 through 8. Again, this reflects two cycles: first the initial implementation, then a substantial improvement to the system.

Site-preparation and furniture-costs estimates were obtained from vendors; Case 1 covers these categories in somewhat more detail.

As to costs of converting from manual records to computerized ones, it has been the experience of many organizations that initial estimates prove too low. As court records and recordkeeping practices vary a great deal, it may take as much as three to four times longer to convert the records of one court than those of another with the same caseload volume. Prudence calls, then, for generous estimates; adding 50% to the original one often provides the necessary cushion.

Emergencies of one sort or another seem to be the rule rather than the exception in computer work, making the forecasting process hazardous. To provide an extra margin of safety, 5% of development costs should be budgeted to a contingency item. The consequences of low and high estimates should be considered. Extra funds can be used to shore up weak points in the system or to add a new feature; if no worthwhile use can be found, the funds will revert to the state. On the other hand,

Figure 6: EIGHT-YEAR COST FOR ALTERNATIVE 1, FULL COMPUTER SUPPORT FROM UNIVERSITY OF SEQUOIA

	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development (one-time) Costs									
Equipment Procurement	80,000	—	—	—	—	100,000	—	—	180,000
Applications Programs									
Personnel	95,000	105,010	115,000	100,000	135,000	140,000	150,000	160,000	1,000,010
Computer Time	80,000	85,000	50,000	—	40,000	80,000	100,000	50,000	485,000
Site preparation	5,000	—	—	—	—	—	—	—	5,000
Furniture	5,500	—	—	—	—	—	—	—	5,500
Conversion	38,000	41,000	—	—	10,000	45,000	50,000	—	184,000
Contingencies	12,500	—	—	—	—	15,000	—	—	27,500
Subtotal	316,000	231,010	165,000	100,000	185,000	380,000	300,000	210,000	1,887,010
Continuing Costs									
Data Processing Operations:									
Administration	30,000	32,000	34,000	36,000	38,000	41,000	44,000	47,000	302,000
Computer Time	35,000	70,000	185,000	190,000	195,000	220,000	225,000	230,000	1,350,000
Communications	10,000	30,000	75,000	85,000	90,000	100,000	115,000	125,000	630,000
Software Rental	—	—	—	—	—	—	—	—	—
Equipment Maintenance	10,000	10,010	10,010	10,000	10,000	15,000	15,000	15,000	95,020
Program Maintenance	—	25,000	50,000	55,000	60,000	65,000	70,000	75,000	400,000
Computer Operations	—	—	—	—	—	—	—	—	—
Data Entry	150,000	490,000	720,000	755,000	790,000	825,000	860,000	905,000	5,495,000
Miscellaneous	5,000	5,000	5,000	5,000	5,000	10,000	10,000	10,000	55,000
Subtotal	240,000	662,010	1,079,010	1,136,000	1,188,000	1,276,000	1,339,000	1,407,000	8,327,020
User:									
Clerk	900,000	960,000	990,000	1,050,000	1,080,000	1,140,000	1,170,000	1,230,000	8,520,000
Supervisor	2,200,000	2,418,000	2,800,000	2,900,000	3,150,000	3,348,000	3,795,000	4,216,000	24,827,000
Senior Clerk	3,938,000	4,324,000	4,680,000	4,875,000	5,460,000	6,076,000	6,766,000	7,320,000	43,459,000
Junior Clerk	4,020,000	4,480,000	5,100,000	5,310,000	5,580,000	6,175,000	7,080,000	7,770,000	45,515,000
Other Support Staff	3,540,000	4,114,000	4,433,000	4,776,000	5,016,000	5,629,000	6,110,000	6,930,000	40,548,000
Subtotal	14,598,000	16,296,000	18,003,000	18,911,000	20,286,000	22,368,000	24,941,000	27,466,000	162,869,000
Total	15,154,000	17,189,020	19,247,010	20,147,000	21,659,000	24,024,000	26,580,000	29,083,000	173,083,030

a budget overrun can have much more serious impact. The additional funds will have to be drawn from another activity, often causing dismay in that quarter. Significant overruns have resulted in the termination of responsible staff and the discontinuance of the project.

The first category under continuing costs, administration, covers the data processing manager salary, fringe benefit, and overhead costs plus other administrative costs. The salary portion of this cost category is projected to rise at a rate of 5% a year.

Computer time costs for current operations are high, rising from $35,000 and $70,000 for the first and second years to a new plateau of $185,000 in the third year and from there rising steadily to $230,000 in the eighth year. The substantial rise in the third-year costs reflects the belief that implementation on a statewide basis will be completed in that year. The University of Sequoia submitted estimates of computer time, and these were doubled to obtain these estimates. This was done because of an awareness of a problem common to computer management: computer time estimates that fall far short of their mark.

Communications costs cover the expense of the rental of telephone lines and 60 modems, the units that convert terminal entries into a form acceptable for telephone lines and vice versa. Data communication at low speeds, about the speed of data entry, is a relatively straightforward discipline, not requiring specific skills in the area. The technical complexity increases at about the same rate as the transmission speed, so that high-speed transmissions of data might require specially conditioned communication lines. As the court could not budget for a data communication expert, who would be paid about the same as the chief justice, it chose the low-speed option. It based its estimates on the experience of an adjacent state court system, making sure again to provide for cushions in case of unforeseen contingencies.

Software rental would not apply because the computer center would bear this cost.

Equipment maintenance costs for the video and printer terminals are straightforward, running about 10%-15% of purchase price. Vendors will supply these costs.

Another category of costs that are often underestimated, program maintenance, represents the expense of staff making repairs and adjustments to existing programs. Advice should be solicited from those with experience in this area and allowance made for unexpected needs.

Like software rental costs, those for computer operations are borne by the university data center. Generally,

these costs cover computer operator salaries and the purchase of disks or tapes and other computer supplies.

Data entry costs, like those for computer time and communications, reflect two years of low but increasing activity, the attainment of a plateau with full implementation in the third year, and after that a gentle rise upward. Over the 8-year period, data entry personnel will increase from 12 to 61.

The miscellaneous category, budgeted from $5,000 to $10,000 per year, will cover small unexpected expenses, such as the need for another data entry operator for a short period of peak work.

User costs are transferred without modifications from Figure 5 to Figure 6, as described at the beginning of the cost section.

Alternative 2, Distributed Minicomputer Network

To most court personnel, this alternative would not appear any different from the previous one. With both alternatives, the data would be entered and printed out on the same terminals. Under this alternative, however, the data would be forwarded to one of three minicomputers, an intermediate step, before being sent to the University of Sequoia computer; the "mini's" and the university computer would share the processing work.

Figure 7 shows the costs for this alternative. As might be expected, these costs parallel closely those of the other automation alternative; hence, only the cost categories with significant differences are discussed.

The minicomputer equipment purchase will push the cost category some half million dollars higher than for alternative 1. Computer time for both development and operations is lower, because of the lessened reliance on the university computer. The minicomputers require software, maintenance, and operators, thus making higher entries necessary for these costs. User costs are exactly the same under both alternatives.

Equipment vendor cost estimates should be checked with reliable personnel. In fact, the overall technical approach should be the subject of careful review, certainly within the court and preferably by outsiders as well. After all, a salesperson's job is to "peddle the iron" and a degree of exaggeration is to be expected. In a world of brightly painted canvases, how many are likely to buy the bland but accurate ones? Accordingly, it is prudent to seek out competent reviewers and listen to their advice.

Figure 7: EIGHT-YEAR COST FOR ALTERNATIVE 2, DISTRIBUTED MINICOMPUTER NETWORK

	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development (one-time) Costs									
Equipment Procurement	295,000	—	—	—	—	325,000	—	—	620,000
Applications Programs									
Personnel	95,000	105,000	115,000	100,000	135,000	140,000	150,000	160,000	1,000,000
Computer Time	40,000	45,000	25,000	—	20,000	40,000	50,000	25,000	245,000
Site preparation	10,000	—	—	—	—	—	—	—	10,000
Furniture	5,500	—	—	—	—	—	—	—	5,500
Conversion	38,000	41,000	—	—	10,000	45,000	50,000	—	184,000
Contingencies	20,000	—	—	—	—	25,000	—	—	45,000
Subtotal	503,500	191,000	140,000	100,000	165,000	575,000	250,000	185,000	2,109,500
Continuing Costs									
Data Processing Operations:									
Administration	30,000	32,000	34,000	36,000	38,000	41,000	44,000	47,000	302,000
Computer Time	25,000	50,000	155,000	160,000	165,000	195,000	200,000	200,000	1,150,000
Communications	10,000	30,000	75,000	85,000	90,000	100,000	115,000	125,000	630,000
Software Rental	7,000	7,000	7,000	7,000	7,000	12,000	12,000	12,000	71,000
Equipment Maintenance	20,000	20,000	20,000	20,000	20,000	25,000	25,000	25,000	175,000
Program Maintenance	—	25,000	50,000	55,000	60,000	65,000	70,000	75,000	400,000
Computer Operations	—	60,000	64,000	68,000	72,000	77,000	82,000	87,000	510,000
Data Entry	150,000	490,000	720,000	755,000	790,000	825,000	860,000	905,000	5,495,000
Miscellaneous	5,000	5,000	5,000	5,000	5,000	10,000	10,000	10,000	55,000
Subtotal	247,000	719,000	1,130,000	1,191,000	1,247,000	1,350,000	1,418,000	1,486,000	8,788,000
User:									
Clerk	900,000	960,000	990,000	1,050,000	1,080,000	1,140,000	1,170,000	1,230,000	8,520,000
Supervisor	2,200,000	2,418,000	2,800,000	2,900,000	3,150,000	3,348,000	3,795,000	4,216,000	24,827,000
Senior Clerk	3,938,000	4,324,000	4,680,000	4,875,000	5,460,000	6,076,000	6,786,000	7,320,000	43,459,000
Junior Clerk	4,020,000	4,480,000	5,100,000	5,310,000	5,580,000	6,175,000	7,080,000	7,770,000	45,515,000
Other Support Staff	3,540,000	4,114,000	4,433,000	4,776,000	5,016,000	5,629,000	6,110,000	6,930,000	40,548,000
Subtotal	14,598,000	16,296,000	18,003,000	18,911,000	20,286,000	22,368,000	24,941,000	27,466,000	162,869,000
Total	15,348,500	17,206,000	19,273,000	20,202,000	21,698,000	24,293,000	26,609,000	29,137,000	173,766,500

Alternative 3, Continuation of Manual Practices

As shown in Figure 8, except for the entry for administration, these costs represent the expense of user personnel. Administration is used as a catch-all category to cover the costs of an additional person in the administrative office for data analysis and handling and to produce the summary statistical reports. User personnel levels are based on the weighted caseload figures, contained in Figure 3. Although the detailed procedure for converting these figures is not shown, they can be ascertained by examining Figure 5, which provides the basis for determining user personnel in alternatives 1 and 2 (Figures 6 and 7).

Cost Summary

Figure 9 shows costs for each of the three alternatives over the 8-year system life.

Benefits and Conclusions

In assessing benefits of the three alternatives, the subject matter is treated in two ways, with and without the use of numerical ratings. First, benefit items are identified and dealt with in text form and then, as in case 1, are numerically rated. Equally or perhaps more important is the focus of the assessment--what benefits to concentrate on. A suggested way to make this decision is to prepare a list of possible benefits, discuss them, revise the list, and continue the process until a consensus is reached with court policymakers.

Rating the Benefits without Numbers

After preliminary review and discussion, it was agreed by the planning department and the policymakers to concentrate on the following four benefit items.

--Timeliness: Finding the proper name for this benefit required some discussion. Responsiveness was considered because it measures the adequacy of the time period from the request for a display until it flashes on the screen of the video terminal. Industry standards specify a response time of three seconds. Responsiveness was rejected as the category name because it did not measure as well the promptness of report generation and dissemination. Timeliness was the

Figure 8: EIGHT-YEAR COST FOR ALTERNATIVE 3, CONTINUATION OF MANUAL PRACTICES

	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
Development (one-time) Costs									
Equipment Procurement									
Applications Programs									
Personnel									
Computer Time									
Site preparation									
Furniture									
Conversion									
Contingencies									
Subtotal									
Continuing Costs									
Data Processing Operations:									
Administration	25,000	30,000	32,000	35,000	40,000	43,000	45,000	48,000	298,000
Computer Time									
Communications									
Software Rental									
Equipment Maintenance									
Program Maintainance									
Computer Operations									
Data Entry									
Miscellaneous									
Subtotal	25,000	30,000	32,000	35,000	40,000	43,000	45,000	48,000	298,000
User:									
Clerk ($30,000; 30--30)	900,000	960,000	990,000	1,050,000	1,080,000	1,140,000	1,170,000	1,230,000	8,520,000
Supervisor ($25,000; 88--)	2,200,000	2,418,000	2,800,000	3,045,000	3,360,000	3,596,000	4,125,000	4,522,000	26,066,000
Senior Clerk ($22,000; 179--)	3,938,000	4,324,000	4,680,000	5,300,000	5,850,000	6,524,000	7,250,000	8,010,000	45,876,000
Junior Clerk ($15,000; 268--)	4,020,000	4,480,000	5,100,000	5,742,000	6,048,000	6,612,000	7,620,000	8,316,000	47,938,000
Other Support Staff ($10,000; 332--)	3,540,000	4,114,000	4,433,000	5,076,000	5,376,000	6,058,000	6,539,000	7,420,000	42,556,000
Subtotal	14,598,000	16,296,000	18,003,000	20,213,000	21,714,000	23,930,000	26,704,000	29,498,000	170,956,000
Total	14,623,000	16,326,000	18,035,000	20,248,000	21,754,000	23,973,000	26,749,000	29,546,000	171,254,000

Figure 9: COMPARISON OF EIGHT-YEAR COSTS FOR DISTRICT COURT AUTOMATION ALTERNATIVES ($000,000's)

	FY1	FY2	FY3	FY4	FY5	FY6	FY7	FY8	TOTAL
1. Full computer support from University of Sequoia	15.1	17.2	19.2	20.1	21.7	24.0	26.6	29.1	173.1
2. Distributed minicomputer network	15.3	17.2	19.3	20.2	21.7	24.3	26.6	29.1	173.8
3. Continuation of manual practices	14.6	16.3	18.0	20.2	21.8	24.0	26.7	29.5	171.3

compromise. While the majority agreed that it did not convey precisely the intended meaning of this item, it was the best of the available choices.

—Accuracy: This item measures the degree to which the computer or manual files, reports, or displays are free from error.

—Organizational Impact: What is the likely effect of the three alternatives on employee morale and productivity? If one of the computer alternatives is selected, who will be the winners and losers in terms of the shift of power and control? In what areas will the shifts take place? These and similar questions define the scope of this item.

—Technical Quality: During the review and discussion, a number of benefit lists were prepared. The first and second lists contained software and hardware quality, items measuring various abstruse technical aspects of the system. Generally, only technical staff fully understand these areas, but few of those with different backgrounds were willing to make this admission. The issue may not have surfaced at all but for a particularly heated exchange at one of the planning sessions on the subject matter by a computer analyst and a judge. Justice Rustett, throwing up his arms in frustration, addressed these remarks to a former colleague on the district court bench, "John, you may understand all this, but very frankly, I don't." With the ice broken, the issue was faced frankly, and it was decided to consolidate all of the related issues under one heading, technical quality. To insure impartiality, the group further decided to have an independent organization make the assessment as to this item for the two computer alternatives.

Timeliness was skipped over and dealt with later in order to facilitate the pairing of benefit items with alternatives.

Accuracy was a plus for both of the computer alternatives. All courts would receive the same reports, removing much of the variation in the current information system. It was recognized that in the early years of operation the quality of data would vary from court to court. The automated system should, however, point to varying practices among courts which may have remained hidden under manual systems. Because of

start-up problems, the automated alternatives cannot be expected to yield as accurate information over the first 2 years of operation as would the manual practices. Barring unforeseen difficulties thereafter, an automated system should become by far the more accurate of the two means of processing court information.

The two computer alternatives should have virtually the same impact in the courts. Both are terminal oriented, both have the same data entry procedures, and both produce the same reports and other materials. If successful, the computer system would soon become the central nervous system of the district courts. Because the administrative office would control the administrative machinery that shapes the system, it would be the recipient of more control over court operations. Should it be known clearly that a court was falling behind in its work, the administrative office could take corrective action; with the manual system and its questionable statistics, the mandate for action is often less clear.

Another point about organizational impact is that the computer system would, for better or worse, codify court information system practices in a more formal structure. In much the same manner that the erection of cinderblock walls to separate offices inhibits further change, the computer systems are, because of their internal coherence, resistant to change. It is true that individual routines and programs can be updated. It is quite difficult, however, to change the overall framework. The results of the first generation of court computer efforts have demonstrated that the computer, instead of streamlining paperwork, has made permanent all of the special procedures in some of the courts. In some cases, the courts are worse off for the experience.

In contrast to their similar evaluations as to accuracy and organizational impact, the two computer alternatives in Sequoia were shown to differ significantly as to the other two benefit items. Under alternative 1, the court terminals would be connected directly to the University of Sequoia computer, thereby making the system performance completely dependent on it. Typically, a multi-user, terminal-oriented computer system starts its life cycle in a leisurely manner, under capacity, with few users and fast response times. In time, the system acquires more users and more applications; existing terminals are used more extensively and users find opportunities for the employment of new terminals. Terminals beget terminals until the system requires enlargement, thus beginning a new cycle. With increasing frequency, public agencies are facing budget rollbacks. As often as not, the system upgrade is a victim of the budget process. With or without expansion, current use patterns continue, and normal increases of volume combine to

place additional pressures on the system. Unless capacity is increased, what typically results is a sluggish system, with 2 to 3 minutes average response time, which cuts data entry productivity significantly. Hence, under alternative 1, the court would run a significant risk. Should the court be subject to poor terminal response times over an extended period, it would certainly require additional staff, possibly making a computer-based operation more costly than a manual one. To the extent that the minicomputer network, alternative 2, reduces the dependency on the university computer, it would reduce the risk. Although the impact of this potential problem was greatest in data entry, it could also affect query/response timeliness. For both alternatives 1 and 2, the printed reports were expected to be produced by the university computer (although output on remote printers). Thus, for this aspect of timeliness, the two computer alternatives were rated even.

The technical quality report, executed by a nationally known consulting firm, recommended minor changes in the minicomputer network. It suggested a different rate of transmission speed, but spoke favorably overall about the two computer alternatives. In the consultants' eyes, the decision was a matter of organizational style. The minicomputer network offered many organizational and technical advantages—more computer power under the direct control of the court, considerable flexibility because each of the three minis were interchangeable with one another, insurance against a terminal response time problem, and additional computing power which would accommodate all anticipated expansion. To reap these advantages, the court would have to invest more heavily in computer machinery and in a computer operations staff. Using the experience of other organizations as a guide, these actions signal an ever-increasing organizational commitment to computer use. Alternative 1 was a less intense technological approach, calling for a smaller commitment, but promising less in return.

Overall, then, the manual alternative 3 offered no surprises—accuracy and timeliness of information as well as organizational structure would remain the same as they are now. The computer alternatives pointed to improvements in accuracy and timeliness, and for control to shift from the local courts to the administrative office. Alternative 2, the minicomputer network, promised larger payoffs but required a larger organizational commitment to the use of the computer.

Figure 10 summarizes the costs and benefits without numeric benefit ratings. The costs fall in a tight range, with the most expensive, alternative 2, at $173,800,000 being only 1% greater than the least expensive, alternative 3, at $171,300,000. While 8-year costs for all three alternatives were high, with a small spread among them, projected personnel

Figure 10: COMPARISON OF COSTS AND BENEFITS WITHOUT NUMERIC BENEFIT RATINGS

	8-year costs ($000,000's)	Comments
1. Full computer support from university	$173.1	The manual system represents a continuation of past practices. Both computer alternatives point to improvement in accuracy and timeliness and a shift of information system control from the local courts to the administrative office. Poor terminal response time is a significant risk under alternative 1, and greater technical advantages are offered by alternative 2.
2. Minicomputer network	$173.8	
3. Manual System	$171.3	

savings for the computer alternatives were cut back sharply, and a terminal response problem could push the full-support university computer (alternative 1) costs to a significantly higher plateau. The choice of computer, then, would have a pivotal role as to costs. As less than one half of one percent separates the two computer alternatives, the prospect of higher benefits and less risk spoke clearly for the minicomputer alternative.

While the manual system costs were lowest, the gap between them and those of the computer alternatives will narrow over the last half of the projection, as indicated in Figure 9. If the projection were pushed further into the future, eventually the computer alternatives would become the cheaper options. Moreover, the computer has vast potential for producing cost savings in other areas and strengthening the administrative system. Accordingly, the manual alternative was eliminated, making the minicomputer, alternative 2, Sequoia's selection.

Rating the Benefits with Numbers

As shown in Figure 11, this assessment also focused on timeliness, accuracy, organizational impact, and technical quality. Using this type of approach, the higher the weight, the higher the importance attached to the benefit category. The same for the ratings: the higher the rating, the more highly the alternative is regarded. Multiplying the weight by the rating for each alternative and summing them yielded the total benefit score. (Section IV of the cost-benefit report describes the mathematics in more detail, and case 1 shows a detailed application to an actual problem.) Figure 12 compares the costs and benefits for each of the three alternatives; the last column shows the cost-benefit ratio, an overall measure of the quality of the alternative, which is calculated by dividing the benefit score by overall costs.

Organizational impact was assigned the highest weight, 3.0, reflecting court policymakers' commitment to fundamental change in court operations—more control from the top. Timeliness and technical quality were assigned medium weights of 2.5. While recognizing the importance of these two items, policymakers felt they should not be accorded parity with organizational impact. Accuracy's weight of 2.0 was a casualty of having to choose from a limited number of points, 10.0. The weight does not mean that accuracy of information is not important; it is essential to the operations of the court. It is simply that the other benefits carried higher priorities.

Figure 11: COMPARISON OF BENEFITS FOR THE THREE ALTERNATIVES

Alternatives	Timeliness 2.5	Accuracy 2.0	Organizational Impact 3.0	Technical Quality 2.5	Overall Benefit Score
1. Full computer support from the University of Sequoia	7 17.5	9 18.0	8 24.0	7 17.5	77.0
2. Minicomputer network, connected to university computer	8 20.0	9 18.0	8 24.0	9 22.5	84.5
3. Continuation of manual practices	6 15.0	7 14.0	6 18.0	5 12.5	59.5

Weights are shown directly below benefit categories. They total to 10.0.

Going from 1 to 10, the ratings are given just above the benefit scores. The overall score is obtained by adding the court alternative benefit scores together.

Figure 12: COMPARISON OF COSTS AND BENEFITS WITH NUMERIC BENEFIT RATINGS

	8 year costs ($000,000's)	Benefit scores	Cost-benefit ratio
1. Full computer support from university	$173.1	77.0	44.5
2. Minicomputer network	$173.8	84.5	48.6
3. Manual system	$171.3	59.5	34.7

As with the earlier benefits assessment, the two computer alternatives were rated even as to accuracy and organizational impact. The two benefits were rated at 8 and 9 respectively, high scores in a scale of 1 to 10. The two alternatives were given different marks for the other two benefits. The minicomputer alternative 2 was rated higher as to timeliness, 8 versus 7, again principally because of the potential response time problem with direct connection to the university computer. Alternative 2 scored two points higher as to technical quality, 9 versus 7. This rating is interesting. In the prior assessment the level of technical quality was described as a matter of style; for better or worse, rating with numbers forces a choice. With an overall score of 84.5, the minicomputer alternative was rated highest, followed by the other computer alternative with a 77.0. The manual system alternative 3, with lower scores across the board, was rated lowest with a score of 59.5.

Because the costs were closely spaced, the cost-benefit scores for the three alternatives correspond closely to the benefit scores, with alternative 2 at 48.6 the leader, alternative 1 at 44.5 in second place, and alternative 3 at 34.7, far behind the two automation alternatives. Like the previous evaluation, this one pointed to the minicomputer system as the best of the alternatives.

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