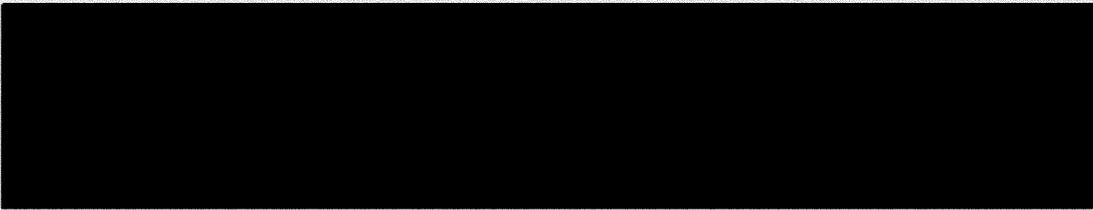
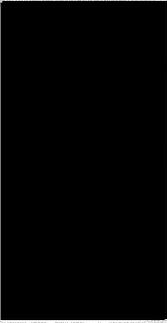


**MANAGEMENT GUIDELINES
FOR
COST ACCOUNTING AND COST CONTROL
FOR AUTOMATIC DATA PROCESSING
ACTIVITIES AND SYSTEMS**



**A Report of Recommendations of the Task Group on
Principles, Standards, and Guidelines for Management
Control of Automatic Data Processing Activities and
Systems submitted to the Director, Financial and General
Management Studies Division, U.S. General Accounting Office**



This report was provided to GAO as part of a program to enhance its knowledge in the area of management control of ADP activities and systems. It is not a GAO report and its contents should not be considered as being indicative of GAO's policies or findings in this area.

September 17, 1975

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FOR AUTOMATIC DATA PROCESSING ACTIVITIES AND SYSTEMS

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Principles, Standards, and Guidelines for Management
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Mr. Donald L. Scantlebury, Director
Financial and General Management
Studies Division
U.S. General Accounting Office

Dear Mr. Scantlebury:

I am pleased to submit this report of recommendations entitled "Management Guidelines for Cost Accounting and Cost Control for Automatic Data Processing Activities and Systems" for the Task Group on Principles, Standards, and Guidelines for Management Control of Automatic Data Processing Activities and Systems. Enclosed with the report is an Executive Brief which summarizes the thrust of this report. Although it is likely that all members might not support a particular sentence or phrase, the report as a whole was unanimously adopted by the Task Group.

The report recommends a set of concepts and guidelines for the improvement of management control of Federal ADP activities and systems through a more systematic application of cost accounting and cost control. The task group unanimously recommends the submission of these concepts and guidelines to agency and public review. It encourages their adoption by the Comptroller General as supplemental guidance in the Policy and Procedures Manual for Guidance of Federal Agencies.

The task group considers its work successfully completed, and respectfully suggests that a new task group be formed for the several future assignments which must be undertaken to fulfill the objective of development of principles, standards, and guidelines for management control of ADP activities and systems.

Sincerely yours,



Carl R. Palmer

Enclosures

EXECUTIVE BRIEF

Computers and their related technologies have provided the U.S. taxpayer wide-ranging benefits through their application by the U.S. Government. Automatic data processing (ADP) activities and systems now consume about \$3 out of every \$100 available to support the Federal budget and all indications point to greater utilization of ADP systems in the future to conserve other resources, to maintain the quality of services, or to enable efficient delivery of new services. It therefore becomes important for the U.S. Government to employ consistent methods for cost accounting and cost control as part of the intelligent and efficient management and direction of these ADP activities and systems.

This report advocates the use of cost information in planning, operating, and billing for ADP activities and systems. It recommends guidelines for adoption by GAO. If they are found acceptable, it is recommended that GAO should promulgate them, or modifications thereof, for use by Government agencies.

The authoritative guidance to the agencies on cost accounting and cost control is established in Accounting Principles and Standards for Federal Agencies (Revised 1972), issued by the Comptroller General. It has become evident, however, that this guidance is not specific enough to provide for the effective management and control of the new technologies embodied in today's ADP and data communications systems. Therefore, the Financial and General Management Studies Division of the GAO formed, in September, 1973, a task group of concerned persons whose backgrounds and responsibilities covered both government and nongovernment organizations. Our Task Group has concluded that the Comptroller General's guidance provides the appropriate baseline for our recommendations. Insofar as we can tell, our guidelines are consistent with the basic guidance provided and we believe they can be used by GAO to elaborate on their principles and standards in dealing with ADP.

We have created a conceptual framework for identifying the major problems now facing the management of ADP functions and for presenting guidelines to resolve such problems through more systematic application of cost accounting and cost control. We have also spelled out some problem areas where further work is required to establish additional guidance and to refine the guidelines into principles and standards which can be officially adopted.

Our Task Group has delineated for the first time the areas to which guidelines should be addressed. The areas to be addressed were selected by the Task Group as the first order of business. Throughout our study, and in contacts with others working on cost accounting for ADP, we have confirmed that our considerations fall into three categories:

- Systems design and development;
- Operations;
- Cost assignment to end user units.

In addition, we defined the total information handling cost of the organization's functional units as an area of interest, but we did not address it.

The conceptual framework, which we evolved to isolate the important problems and to develop the guidelines, embraces:

- Formal planning;
- Life cycle view;
- Resource utilization measurement; and
- Management reporting.

There are 57 guidelines recommended for adoption and implementation. They reflect variations in breadth of scope and importance, but are designed to add up to a consistent whole in each of the three areas addressed. It is expected that the most far-reaching guidelines will be those which cover the following problem areas:

- Identification of all related ADP and data communication costs;
- Collection of full costs;
- Accurate and uniform cost assignment to aid end user management control of ADP services;
- Coordination of ADP resource utilization measurement with the agency accounting system;
- Definition of the useful life of ADP systems;
- Distinction between the cost of systems enhancement and the cost of systems maintenance; and

--Timely and comprehensive reporting to management of planned to actual schedules and costs.

Implementation of our recommended guidelines will require careful attention at all management levels. In effect, we started with an ill-defined set of current practices, which we have molded into what we believe is a framework of acceptable practices. Within this framework, individual agencies should be free to adapt the guidelines to their special and unique operating requirements.

Accounting for and control of ADP activities and systems is an integral function of all agencies or enterprises. In this context, care should be taken to avoid establishing accounting procedures for which there are no management requirements or other benefits to the organization's overall effort.

While our work reflects existing policies, we anticipate that testing and refining the recommended guidelines will raise issues requiring clarification or revision of some current policies. For example, it may be some time before the relevant technologies stabilize enough to determine recommended approaches to capitalization, depreciation, and amortization, similarly, there is little cost incentive to encourage system portability and interagency exchange of software. As the Government's investment in software grows, we anticipate that new policies may be needed to spur the transfer of technologies between agencies.

The Task Group has found its assignment a challenging one. Our work has been assisted substantially by the support of the GAO headquarters staff and of the GAO regional offices in Boston, Dallas, and Detroit. We particularly commend the three regions for their comprehensive survey of current practices in 54 organizations drawn from the Federal establishment, State and local government agencies, and private firms. Many of our guidelines reflect knowledge gained from this GAO survey.

We respectfully recommend that the Comptroller General submit our proposed guidelines to formal review and encourage their adoption at the earliest possible date.

PREFACE

Objective

The Task Group was convened* to make recommendations to the General Accounting Office (GAO) on principles, standards, and guidelines for the management control of automatic data processing (ADP) activities and systems, including their data communications linkages. The initial emphasis was on cost accounting and cost control.

Expected Benefit

We expect that GAO implementation of our recommendations will create many benefits throughout the Federal government. Such benefits shall accrue to general managers, functional managers, ADP managers, and evaluators by:

- Providing guidance for planning and controlling ADP activities and systems;
- Promoting practices which improve the efficiency, economy, and effectiveness of the use of ADP resources;
- Providing guidance to the managers who must make investment and operating decisions regarding ADP activities and systems; and
- Providing criteria for management audits, reviews, and evaluations, including post-implementation evaluations, of ADP activities and systems.

Our Basic Position

We have taken a basic position, after much consideration, that the management principles and practices applicable to non-ADP activities, programs, and functions in most organizations are applicable in the main to ADP activities within these organizations. However, these principles and practices are largely unstated and implicit in practice. They are partially stated, and in too variegated a vocabulary in the many texts and journal articles on the subject. We found, however, that the Comptroller General's statement of Accounting Principles and Standards for Federal Agencies (Revised 1972), including its section on the Joint Financial

*See Appendix B: Background.

Management Improvement Program, contains many statements of proven principles and standards of financial management and accounting. Further, it is authoritative and referenced throughout the Federal establishment, and particularly relevant to our present subject of cost accounting and cost control for management control of ADP activities and systems.

We believe that the guidelines recommended in this report are consistent with this overall guidance.

Contents of this Report

The overall thrust of this report is summarized in the accompanying Executive Brief. Chapter I contains our statements of the concepts and management problems affecting cost accounting and cost control for ADP activities and systems. Chapter II contains our recommendations of guidelines for ADP systems design and development activities. Chapter III contains our recommendations of guidelines for ADP operations activities including data communications. Chapter IV contains our recommendations of guidelines for the assignment of the costs of these activities to end user units of an organization. And, finally, Chapter V contains a summary of the concepts and guidelines, our conclusions and recommendations, and some problem areas requiring further work.

Evolutionary Approach

There has been a steady evolution of concern and action with respect to improving the management of ADP in the Federal establishment. This evolution is similar in many respects to that of the private sector and the State and local governments. We view this first effort of our Task Group as another step forward in that evolution. We do not yet see a clear definition or rigorous process for achieving an optimal level of accounting and control. Rather, we have found that current practices embrace such a wide range that selection of specific practices as "best" is not supportable. Our recommendations should not wait for a perfect solution and are formally contributed now for consideration by GAO and the Federal establishment. We believe they have much to recommend them to State and local levels of government as well to the Federal establishment. We also recommend a structure for applying the guidelines to ADP activities and systems. In the long run, we anticipate that widespread adoption of these guidelines will evolve to a specific set of evaluation measures for both effectiveness and efficiency in the use of ADP systems.

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CHAPTER I

NEED FOR COST ACCOUNTING AND COST CONTROL OVER AUTOMATIC DATA PROCESSING SYSTEMS

Introduction

The purpose of the Task Group is to provide guidance to the General Accounting Office (GAO) to assist in improving management control of automatic data processing (ADP) activities and systems. It is important to emphasize that the modern ADP system with its associated data communications linkages is a unique, significant, and pervasive resource in accomplishing almost all Federal agency purposes. ADP activities are not always understood and frequently do not receive adequate attention from either operating management or top management. Yet, efficient and effective management of this resource is fundamental to successful end results.

There is an urgent need to develop a comprehensive set of principles, standards, and guidelines for the effective management control of ADP activities and systems. However, the breadth and scope of such an undertaking are large and the subject is technically complex. The building block (or phased) approach is the best means of achieving meaningful results and successful implementation. Our initial effort addresses the cost accounting and cost control processes as a critical central element of management control. We consider these processes essential to any serious review and evaluation of the plans, programs, and end results of an organization.

Concepts

There are several important and proven concepts basic to the issues surrounding cost accounting and cost control to support management control of ADP activities and systems. Four of the most important concepts are:

Formal planning: Maintaining current formal plans and budgets for ADP activities and systems, which are related to organizational objectives, and which view the future to the point where objectives and investment benefits could be realized. It includes financial and operational expressions of these plans and budgets, with stated measurable accomplishments; annual and lesser period plans and budgets; project and system life cycle plans and budgets; period and accomplishment-related reviews; and a process for maintaining currency.

Life cycle view: The expected life cycle of critical components (such as expensive hardware and software) influences an expected overall system life cycle, recognizing that there will be changes in requirements, technology, and priorities. The four major phases of the system life cycle are 1) design, 2) development, 3) operations, and 4) evolution (which continues to termination or replacement of the application). Cost accounting and control methodology is required to measure efforts and accomplishments in each of the phases consistent with a view of the total expected life cycle.

Resource utilization measurement: This concept embraces measuring, relating, and reporting resource availabilities and uses in terms of objectives served, results achieved, and management responsibilities for ADP systems, projects, and functions. It involves specific measurement and recording, relating, and reporting of the supply and consumption of physical, financial, personnel, and other resources in financial and operational terms meaningful to ADP management and to top management.

Management reporting: Reporting is required in financial terms meaningful to management and to end users of ADP services of the benefits, costs, and accomplishments relatable to their responsibilities, decisions, and actions. Such reports require specific emphasis on comparing actual to planned accomplishments and the related resource utilization, including the accountability for investment decisions in the context of organizational objectives over the life cycle of an ADP system.

The worth and benefits of all information processing activities, including ADP activities and systems, can only accrue through their usefulness in supporting the achievement of some set of end results and objectives. Thus, it is our premise that end users and their management are principally responsible for the effectiveness of all of these activities in fulfilling their organizational objectives. The management of information processing and ADP activities, however, play a key role in supporting user management in achieving such effectiveness. They are principally responsible for the efficiency and economy of the information processing and ADP activities and the successful development and operation of information systems.

Thus, in summary, we view:

- ADP systems design and development activities as principally aimed at achieving successful operation of a set of information processing and ADP systems;
- ADP operations activities as principally aimed at successful achievement of an agency's functional objectives;
- The end measure of the benefits from these activities as their contribution to the achievement of agency end results and objectives.

This leads us to the view that the planning and budgeting of the information processing activities and systems must be developed with direct and identifiable relationships to an agency's goals and objectives.

We consider it appropriate to quote here the relevant paragraph from Section 6, chapter 2 of Accounting Principles and Standards for Federal Agencies (Revised 1972).

"Accounting is not an end in itself but is an important part of each agency's management control system. Satisfactory accounting systems are necessary to provide essential and reliable information to management officials for use in achieving efficient and economical operations and to enable them to satisfactorily report on the custody and use of resources under their management."

Management Identification of Problems and Requirements

In arriving at a set of guidelines useful to management, it is imperative to consider the problems and requirements that management must face in arriving at a workable system of cost accounting and control for its particular organization. The factors which management must consider are: scale, complexity, how responsibilities are to be delegated, objectives and policies, past and future development, legal and organizational environment, and the budgeting and financing structure. These factors along with the overall concepts form the framework from which the set of guidelines were developed by the Task Group.

The key to cost accounting and control system design is management's identification of the specific problems and requirements that can be addressed through cost control and cost accountability. To this end, the guidelines provide management with the means of assessing whether the cost accounting and cost control system covers all important factors and areas requiring management control that the organization must take into account.

This chapter highlights some of the problems and requirements that management must consider in developing its cost accounting and cost control system in terms of the guidelines in chapters II-IV. Those chapters will develop the guidelines in detail, and show how they will be useful to management in designing and in assessing the effectiveness of its cost accounting and cost control system.

These management problems are discussed under the same five headings used in the subsequent chapters: general, formal planning, life cycle view, resource utilization measurement, and management reporting.

General

a) Size and complexity.

As the size of an activity becomes larger it may become more decentralized in control and management. In addition, the complexity of operation or interactions of decisions grows with scale, as does the risk of significant or catastrophic errors in operational or development cost estimates. As size and complexity increase, there is a need for more precise and comprehensive cost accounting and cost control.

b) Delegation of decision and planning responsibilities.

Clarity is needed in delegating decision and planning responsibilities to individuals or groups within the organization to effectively accomplish essential cost monitoring and control. Without this focus there is no way to assess the performance of these individuals or groups and no proper basis for the cost accounting and cost control system. Nor is there an opportunity to learn systematically from previous difficulties, adapt to a changing environment, or relate decisions to the measure of accomplishments.

- c) The appropriate level of cost accounting and cost control.

The extent to which cost information by operational cost centers, projects, work functions, units of work, etc. should be accumulated must be determined in the light of the situation to which they apply. Consideration of the scale and complexity of operations and the uses of cost information in planning and controlling the operations and in evaluating performance must be made primarily by agency management. In the final analysis, the cost of carrying out the cost accounting and cost control work must show a satisfactory return.

- d) Relationship to accounting principles and standards for Federal agencies

An agency's ADP cost accounting and cost control system must be in accord with the Comptroller General's statement of Accounting Principles and Standards for Federal Agencies (Revised, 1972). The guidelines we recommend are designed to supplement and amplify this requirement.

Formal planning

The guidelines address the following problems associated with the ADP planning process:

- a) The need for a formal, long-range ADP plan and the problems of relating it to the long-range plans of the agency.
- b) The scope of the ADP plan, its development process, and criteria for modification to insure flexibility.
- c) The importance of financial measures in the long-range plan.
- d) Relationships between the long-range plan and period plans and budgets.
- e) Setting of priorities based upon projections of workloads.
- f) Relationships between ADP plans and (1) existing cost-based budgetary and control reports, and (2) statutory reporting requirements.

- g) Relating the long-range plan to actual costs and accomplishments through a review process.
- h) The use of cost assignment methods to promote the overall objectives of the plan.

Life cycle view

The life cycle view of ADP systems is presented and the following problems associated with it are addressed:

- a) Its relationship to the formal planning process.
- b) Determination of the useful life of an ADP system or its critical components and allowance for variations from that expected life.
- c) Desirable content of life cycle plans, and the scope of their applicability.
- d) Updating, audit and review, and relationships to experienced costs and accomplishments.
- e) Separation of maintenance costs from the costs of enhancements.
- f) Adequacy of life cycle estimates to support capitalization of major expenditures.

Resource utilization measurement

The guidelines address the measurement of all resources associated with ADP: personnel, equipment, communications, facilities, and contracts. Among the management problems considered are:

- a) The scope of measurement, i.e., items to be included.
- b) Units of measure.
- c) Degree of timeliness, accuracy, and level of detail required.
- d) The relationship between resource utilization measurement and various methods of accumulating and aggregating costs, i.e., object class accounts, cost pools, project accounts, jobs, product and service categories, and organizational cost centers.

- e) The value of information versus the cost of obtaining it.
- f) Use of standard and/or predetermined rates.
- g) Treatment of variances from standard rates.
- h) The desirability of differential rates for different levels of service.

Management reporting

The following problems associated with the design of an ADP management reporting structure are addressed by the guidelines:

- a) Identification of responsibilities.
- b) Scope of ADP costs to be included in reports.
- c) Levels of reporting, and corresponding levels of reported detail.
- d) Usefulness of reports to ADP management and to non-ADP management.
- e) Desirability of assigning reported costs to end users both on a full-cost and directly-variable-cost basis.

The guidelines do not specify precisely how to solve all these ADP cost accounting and cost control problems. They do, however, recommend approaches to solving the problems that have been identified in a GAO survey of current practices and found effective in the experience of the Task Group members. Chapter V provides suggestions for implementing systems based on these guidelines. In the future, the accumulation of agency experience with ADP cost accounting and cost control systems should make more specific guidelines possible.

The guidelines are intended to provide a high degree of flexibility so as to take into account varying circumstances. We suggest that they be employed with discretion, governed primarily by the criterion that the value of the cost information or control measure must outweigh the costs.

In summary, we have defined a set of four concepts and the associated problems that are currently visible within each of the concepts. We assume that managers of Federal agencies will be required to consider the overall guidance of the GAO on accounting policy and procedures, and we set forth in the next three chapters those supplemental guidelines which appear needed to insure proper cost accounting and cost control for ADP activities and systems. We urge GAO to adopt these guidelines and to promulgate them, or modifications thereof, for use by Government agencies.

CHAPTER II

ADP SYSTEMS DESIGN AND DEVELOPMENT ACTIVITIES

General

Modern ADP systems are highly complex, often taking years to design and develop. They can be enormously expensive to bring to a successful operating mode. Thus, they should be economically justifiable, technically feasible, and operationally desirable. These factors combined with advances in technology and the cost of modern information systems have led to a movement in ADP system design philosophy toward large-scale integrated design of ADP systems. This movement has led to a recognition of the need for a more formal and comprehensive planning system. In this chapter we discuss a number of recommended guidelines to improve management control of ADP systems design and development activities.

Formal Planning

The formal planning and budgeting for ADP systems design and development activities, accompanied by periodic and milestone management reviews, are essential to manage and control ADP resources. All comprehensive planning of ADP systems must be developed with broad representation from the entire organization. Direct participation of employees from many levels of the organization and across the organization will help in assuring continuity and success as the agency moves from the planning stage into actual design and development, and into operation.

Top management guidance on agencywide goals, objectives, and priorities will measurably improve the planning and decision processes. Clear assignments of responsibility, authority, and accountability for resources to be controlled, organizational units to be managed, and end results and accomplishments to be achieved, will also improve the efficiency, economy, and effectiveness of achieving the agency's goals and objectives.

Flexibility in the planning process is desirable and often essential. The formal planning system should as a minimum include:

- Formal, long-range, comprehensive plans, with supporting budgets for ADP systems that encompass the related activities of systems design and development, data processing, and data communications, and provide for evolutionary changes and modifications over the proposed life cycle of each ADP system. The long-range planning horizon should view the future to the point where basic directions can be set, major resource requirements categories established, and objectives and investment benefits could be realized. It should provide management with the life cycle economic impact for all important investment decisions. To fulfill present congressional needs for program approval and to prepare proper agency budgets, a minimum of five years is appropriate for the long-range planning period.
- Short-range plans of annual and lesser duration should identify specific projects, efforts, and functions involved in the design and development of ADP systems. Short-range plans should provide information summarizing all projects including such overhead functions as management, administrative and support personnel, training, etc., which are essential to maintaining the productive capacity of a systems design and development activity.
- Specific project plans should encompass the life cycle of an ADP system and identify the work required to deliver a system within a specified time frame meeting defined quality characteristics. The projects should be laid out in a timephased and orderly progression of stages with supporting analysis of work functions and resource requirements, including user organization personnel.
- Annual and more frequent management reviews, including milestone reviews, should compare actual accomplishments with the agency's priorities, goals, and objectives and with the assumptions expressed in the long-range and other plans.

All long-range, project, and time-period planning requires financial expression as a common denominator for

management decisions and reviews. Appropriate quantitative (or parametric) detail is also needed for reviews, analyses, and other evaluations and for expression of these plans as work plans in operational terms at the supervisory and project management levels.

Interfacing the formal ADP plans with other organizational activities and planning and reporting systems is necessary for coordinating and integrating systems design and development activities within the agency. The formal planning system also should provide for reviews and updates annually and at major milestones to help top management maintain control of systems activities.

Project plans and supporting budgets must have specific measurable accomplishments and should be stated in responsibility-related tasks, phases and stages with quantitative detail essential to the responsible supervisory personnel and project managers. To be useful in the measurement, identification, and comparison of actual to planned resource consumption and cost, the task, phase, and stage classifications of the plans should be consistent with the management reporting system.

Formal Planning Guidelines

- I. Formal written plans with supporting budgets and resource requirements by project and function are essential to management and control.
- II. The formal planning horizon should be sufficient to provide management with the total economic impact for its important investment decisions. To fulfill present Congressional needs and to prepare proper agency programs and budgets, a minimum of 5 years with appropriate updates is required.
- III. Planning requires integration of all projects and and a summation of the supporting and maintaining functions.
- IV. All formal planning requires financial expression as a common denominator of management control.
- V. Intelligent use of experienced cost data will enhance the quality and usefulness of the plans and supporting budgets.

- VI. Consistency of priorities and assumptions must be maintained between project and/or period and long-range plans.
- VII. Identifiable milestones must be established which permit comparisons of actual to planned cost and resource consumption in terms of specific accomplishments.

Life Cycle View

Many aspects of the discussion and comments within this chapter are framed in terms of the life cycle of the ADP system and its central components. Our basic premise is that the life cycle of the ADP system is a vital concept in comprehensive planning, budgeting, costing and controlling of the design, development, operation, and evolution of ADP systems. The useful life of an ADP system should be based on realistic assessments and projections from experience with like systems to the extent possible, and should be consistent with long-range and annual plans.

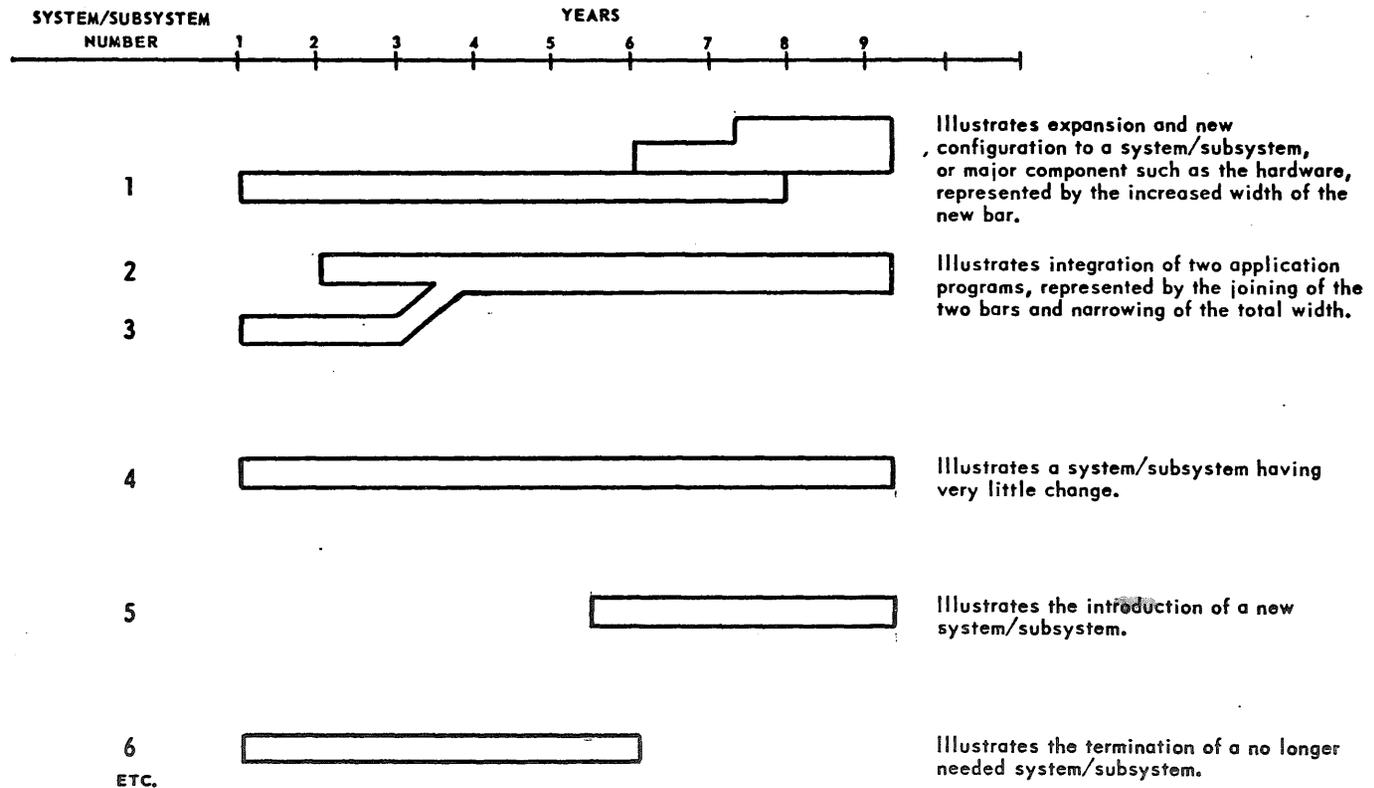
Carefully devised life cycle financial plans, reviewed and revised at meaningful time points, are essential to both long-range planning and operating management control. The financial plan includes both requirements and accomplishment statements and financial control information developed from the life cycle cost estimates.

The life cycle of an ADP system begins with a management decision to proceed with the design and development of an ADP system. This decision to proceed is ideally made in the context of approval of a long-range ADP plan. The life cycle of a proposed system ends on the date that system operations are expected to terminate. Figure 1 illustrates the manner of viewing a number of overlapping system/subsystem life cycles for a period approximately the nominal length of an agency long-range ADP plan.

For most organizations there are several ADP systems, with life cycles beginning, under enhancement, continuing, and ending in any given period. The orderly integration of these life cycles is a basic facet of planning for all of the ADP activities. There is multiplicity and thus a need for integration of the system life cycles evident in planning for computer system equipment which is intended to service the

FIGURE 1

THE LIFE CYCLE CONCEPT



The concepts illustrated are that:

- (a) ADP activities are concerned with a number of different life cycles at any point in time.
- (b) Each system life cycle may (or may not) be different from that of another. By life cycle we include the complete series of stages through which a system (or subsystem) passes during its lifetime. For our purposes the period extends from the time work is first started or costs are charged to a system to the time when it is no longer used or financially supported. The staggered life cycles for 6 different systems and the events that can occur during those life cycles are shown above.

operational needs of several ADP systems. There is an evident need to plan carefully for the design, development, and enhancement stages of the several systems in terms of the capabilities, resource availabilities, and productivity of the ADP systems design and development activities.

We believe there are at least four critical decision points in the life cycle of an ADP system:

- The design decision, the point of initiating the design stage;
- The development decision, the point of initiating the development stage;
- The installation decision, the point of initiating the the operation stage; and
- The evolution decision, the point of initiating the the redesign and enhancement of an ADP system.

These decisions should always include consideration of the null alternative (or the alternative of not proceeding) and should always be overtly (or explicitly) made. They should be made in the context of the probable commitment of resources not only for the specific stage of a project under consideration but also in view of the implied larger commitment to the completion of the life cycle. One important system design objective is machine independence. Consequently, changes to the agency computer system equipment should not necessarily affect the life cycle of the ADP system.

The use of life cycle cost estimates and economic analysis techniques and the need for integrating project and effort planning through long-range and annual planning deserve special emphasis. The commonness of underestimation of effort, time, resources, and the complexity of design, development, installation, and operations warrants management review of all projects at regular intervals.

The life cycle view should provide responsibility and accountability over the life of the ADP system for both the investment and the operating costs. Therefore, careful distinction between modification (or enhancement) and maintenance is essential to clearly distinguish costs for that which enhances the ADP system, or extends the useful life of the system, and costs for that which is necessary to simply maintain the capabilities of the system.

Life Cycle View Guidelines

- VIII. Life cycle cost estimates of expected costs based on adequate records of experience are essential to management decisions, plans, and controls.
- IX. Analysis of past experience and useful lives of similar ADP systems will assist in the estimation of the life cycle time period.
- X. Any well-defined and structured view of the life cycle will suffice, so long as it provides a useful framework for planning, reviewing, and controlling.
- XI. The life cycle view and estimate should be structurally flexible to cope with the reality of possible foreshortened life or prolonged life through evolution.
- XII. Imprecision in the outer years of the estimated life cycle will be cured by the periodic updating and extending of the plans as the life cycle progresses.
- XIII. Explicit expression of tasks, phases, and stages is essential for providing cost and resource use information for management's critical decisions.
- XIV. Integrating project planning into long-range and annual planning is essential to sound life cycle estimates.

Resource Utilization Measurement

Resource utilization measurement implies systematic measuring and reporting of what resources have been used, what they were used for, when, and by whom. Every expenditure of resources, whether currently acquired or from past development or acquisition, should be conceived as a cost of some essential planned activity. To facilitate review, control, comparisons, projections, and evaluations, the classification of planned and actual costs must follow a like pattern. This standard is especially appropriate for systems design and development activities.

Systems design and development activities should be an accountable entity within an agency or organization regardless of how it is organized. It should include the resource commitments to any change or innovation in either systems software or applications software, including task related work.

Resource Utilization Measurement Guidelines

- XV. The consumption of physical, financial, and personnel resources (including contractual, inter-agency, and intraagency goods and services) should be measured and related to specific stages, phases, tasks, and accomplishments of individual projects and efforts.
- XVI. Efficiency and economy should be the principal considerations in determining the scope and level of detail of resource utilization measurement.
- XVII. The measurement system should be in sufficient detail to detect trends in efficiency at the lowest level of resource utilization.
- XVIII. Cost information should be accumulated by natural object of expenditure classification, financing source, major organizational unit, budget function, and program categories.
- XIX. Cost information should be aggregated into categories of project, effort, and work function to the extent useful to management planning and control functions. Stages and tasks within projects and efforts should be aggregated by either a) actual cost accounting, or b) predetermined rate (including standard cost methods) cost accounting with account reconciliation and suitable disposition of variances.
- XX. Cost information relating to resource measurement units should be available to both project managers and supervisory employees.
- XXI. Resource utilization should be reported on a time scale sufficient to be meaningful in evaluating performance and making decisions.

Management Reporting

All costs of design and development activities should be reported to management in financial terms and related to the benefits and accomplishments within a manager's responsibility. This reporting must be timely to be usable. It should be current, complete, and consistent.

Responsibility reporting should be by cost control centers with consistent financial plan and control classifications. The data should be presented in a manner that promotes comparison of actual to planned accomplishments, and indicates variances and needs for management action. The cost information should be accumulated at a meaningful level of detail by object of expenditure classification, financing source, organizational unit, budget function, and program categories. It should be aggregated into meaningful categories of project, effort, unit, work function, and stages and tasks within projects and efforts.

Responsibility Centers

Within systems design and development activities there are commonly five concepts of responsibility centers that are most useful:

- 1) Organizational centers;
- 2) Financing centers;
- 3) Project centers;
- 4) Effort centers, and
- 5) Work function centers.

Organizational Centers and Financing Centers: The organizational center is used throughout most organizations to assign responsibilities for the work of specific personnel. The financing center is used for fund or appropriation responsibilities. Accounting for these centers should be guided by the appropriate provisions of the Comptroller General's statement of Accounting Principles and Standards for Federal Agencies (Revised 1972).

Project Centers: The project is a responsibility center for the delivery of an ADP system, or modification thereof, through the design, development, test, and installation stages. It is used to define managerial responsibility, and its accountability, for work required to deliver an end-item ADP system within a specified period at a defined quality level.

Effort Centers: The effort is a responsibility center for the delivery of a set of modifications to two or more systems or one very complex system. It would be a useful way of defining the work effort necessary to install privacy and security safeguards across several systems.

Work Function Centers: The work function center concept is used to define managerial responsibility (and accountability) for any significant classes of work within a systems design and development activity that may be useful to management. For example, it may be used to define responsibility for software maintenance or system software programming. All employees coming under the definition of a particular work function fall within that responsibility center.

Management Reporting Guidelines

- XXII. Project (or effort) control and reporting systems and should be standardized to the extent possible but flexible in order to fit them to the scale, scope, and complexity of the project (or effort) at an economical cost.
- XXIII. Responsibility reporting for all cost control centers is required in terms of the established milestones to provide actual to planned comparisons and to identify variances.
- XXIV. The formality and extent of detail of project (or effort) control should be established consistent with the scale, complexity, and risk of the undertaking.
- XXV. Project (or effort) cost aggregation must separate the cost of modifications from the cost of maintenance in order to maintain accountability.

- XXVI. Management cost reporting should be structured in classifications which directly reflect classifications of the long-range and other financial plans.
- XXVII. Timeliness, relevancy, and consistency should be emphasized in the management reporting system. Data reliability should be maintained through periodic reviews.
- XXVIII. Management reporting should at least reflect the minimal set of decision reviews of projects and efforts at the points of proceeding with design, development, and implementation.

CHAPTER III

ADP OPERATIONS ACTIVITIES

General

The visible end product of the planning, design, and development efforts, normally started several years earlier, is first seen as a hard product in the operation activities. It may consist of sheets of paper, lines of print, graphic symbols, or some other information bearing product. The successful operation and management of ADP systems that provide this output requires current, complete, and accurate cost accounting data. In this chapter we discuss the need for cost accounting and cost control procedures for ADP activities and propose guidelines which we believe must be implemented to achieve management control.

We view the ADP operations activities as consisting of all personnel, financial, and physical resources, including contractual, interagency, and intraagency goods and services, that are applied to:

- maintenance of computer programs and automated data systems;
- preparing, encoding, communicating, editing, storing, updating, retrieving, inquiring, extracting, compositing, printing or displaying of data; and
- distributing data messages and reports;

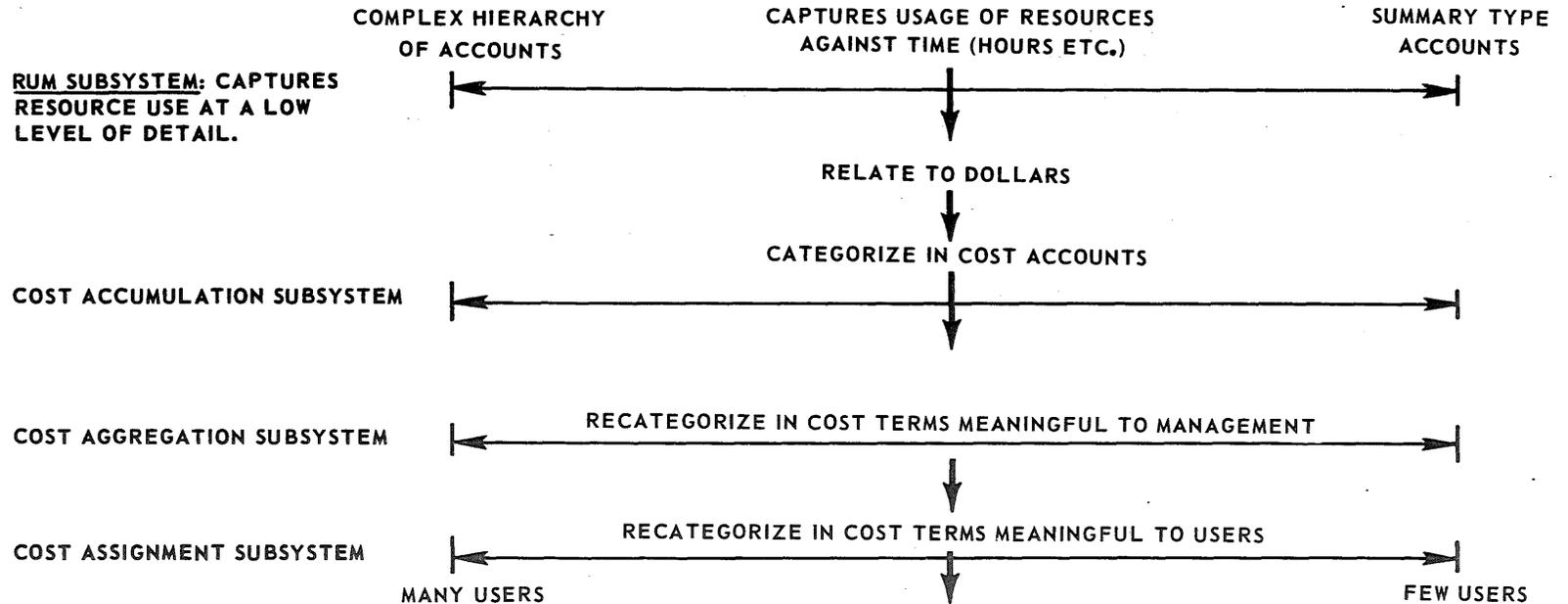
that are involved with or based on computer system processing.

Figure 2 presents the conceptual framework of resource utilization measurement (RUM) and cost accounting subsystems that originate, classify, and report ADP operations data. A resource utilization measurement subsystem captures the use of ADP resources and attributes that use to purposes. This resource utilization is then expressed in dollars and classified in the organization's cost accounts, initially by object class. Then it can be recategorized by work function, organizational unit, job or task, project, ADP system, and financing source.

A data base is thus created which is a major input for managerial decisions made by ADP planners, ADP operations managers, ADP users, and other organization managers who

FIGURE 2

A CONCEPTUAL RELATIONSHIP BETWEEN THE RESOURCE UTILIZATION MEASUREMENT (RUM) SUBSYSTEM AND THE COST ACCOUNTING SUBSYSTEMS USED IN THE ADP OPERATIONS ACTIVITIES



NOTE: THE RESOURCE UTILIZATION MEASUREMENT SUBSYSTEM PROVIDES INPUT TO THE OTHER COST ACCOUNTING SUBSYSTEMS. ALL ARE INTERRELATED AND SEQUENTIALLY DEPENDENT. IN TURN, THESE SUBSYSTEMS PROVIDE COST INFORMATION TO THE RESPONSIBILITY CENTERS ILLUSTRATED IN FIGURE 3, P. 27, AND DISCUSSED ON PP. 26 AND 28.

are affected by ADP activities. Costs can be aggregated for multiple managerial uses such as budget performance in the ADP center, system capacity analysis, application system evaluation, to get total ADP costs and other purposes. The assignment of costs is discussed in chapter IV. All of these subsystems are interrelated and sequentially dependent.

Formal Planning

Formal planning for the ADP operations including data communications should be tied directly to the long-range planning for the organization it serves. The organization plans set out goals and objectives which have explicit and implicit impacts on future ADP service requirements. Historical costs based on past workloads should be used whenever relevant.

The greater the accuracy of the system life cycle estimate and its associated workload projections the more accurate will be the planning estimate of operations costs.

Long range plans for ADP operations should focus on:

- a) Workload projections;
- b) System capacity;
- c) Data communications;
- d) Physical facilities;
- e) Acquisition of the ADP and data communications equipment and associated systems software;
- f) Development or acquisition of applications software and aids;
- g) Identification of required specialized services;
and
- h) Information needed for the annual operating budget requirements.

This information along with an understanding of the user requirements provide the basis for structuring the operations activities.

The short-range ADP plan translates organization objectives contained in the long-range plan into specific function

oriented tasks, quantitative dollar (or other resource-based) terms and output product descriptions. Because of the specificity and the quantitative aspects of the short-range plan it is often used as the operations budget.

Life Cycle View

From the perspective of the manager for the overall ADP operations activities, knowledge of the expected life cycle for each component of the ADP system is essential for year-to-year estimation of workload and for allocation of his current budget resources. A planning framework which carefully selects the life cycle for each component and an overall ADP system life cycle that identifies all the major categories of operations costs will:

- a) Provide management with an understanding of the balance between investments in systems design and development and operations;
- b) Assist management to understand and control the extensions to a system's life on a cost-effective basis;
- c) Improve investment accountability over the life cycle; and
- d) Facilitate post implementation reviews of the benefits, costs, and utility of the ADP system.

In addition to the RUM and cost accounting subsystems providing input for operations decisions it is necessary for the cost accounting and control procedures in the ADP operations area to provide feedback for the ongoing evaluation of each ADP system. By accumulating costs from the cost accounting subsystems, as illustrated in Figure 2, the updated life cycle costs are available at any time for evaluating progress toward the original ADP system objectives.

Resource Utilization Measurement

Quantitative measurement of resource utilization (i.e., personnel, equipment, materiel, etc.) is needed for effective management control. All levels of management control are dependent upon timely, organized resource utilization information and unit cost information, with actual-to-planned comparisons and variance identification. Surfacing the deviations

from planned performance is an important basis for a manager's response to and control of his operations. Accomplishment reporting and direct measures of resource consumption against plans in like terms is the most appropriate form of control information. Acquisition of this resource data is commonly from two primary sources, (1) a personnel time recording activity and (2) an equipment performance measurement activity. Most ADP equipment manufacturers have resource utilization measurement software either built into or attachable to their equipment which can provide some or all of this resource data on equipment use. While varying in quality and quantity these measurements represent a valid source of basic data which can be developed into management reports.

In Figure 2 we illustrated the relationship of the resource utilization measurement (RUM) subsystem to the cost accounting, cost aggregation, and cost assignment subsystems. The RUM subsystem encompasses sets of procedures, equipment, and computer software which gather, sum, analyze, and provide reports on the minute-by-minute (for equipment), hourly, and daily use of all ADP resources. The large number and variety of resources it captures includes specific functions in support of the ADP operations, such as: management, secretarial services, training, professional development, library services, tape and disc handling by the operator, maintenance programming, documentation, scheduling, and reports control functions. The equipment usage by several application software systems concurrently in multiprogramming- and timesharing-capable computer systems is also measured.

These resource usage measurements can be used as a basis for applying predetermined rates to establish costs for data processing activities. A predetermined rate is an established cost per unit of measure based on historical as well as planned costs for a specific function. Use of such rates can provide for immediate costing of ADP activities performed. When this approach is used, the predetermined rates should be reviewed periodically to account for differences, if any, between the estimated and actual costs involved.

Using the RUM subsystem itself is a cost item. Determining its size, scope, frequency of operation and the reports desired all merit the same cost-effectiveness analysis, and level of planning, design, and development effort that management invests in other ADP systems of comparable size and importance.

Management Reporting

Cost accounting information for the ADP systems and operations activities provides the basis for managerial decisions on cost control and performance measurement. Responsibility accounting has as its primary objective the assignment of cost to the manager responsible for the control of that cost. The control of an ADP system's cost requires that managers be aware of cost behavior patterns, of the cost implications of their decisions and actions, and of their spending authority and responsibility at each organization level. Integrated with cost control is performance measurement and its efficiency implications. Performance measurement is needed to evaluate:

- a) ADP management;
- b) ADP operating personnel;
- c) the acquisition and use of hardware; and
- d) the acquisition, development, enhancement, and use of software systems and application programs.

The cost accounting system needed to classify costs initially should be detailed enough to:

- a) Capture all direct and indirect costs associated with ADP activities;
- b) Relate to the resource utilization measurements;
- c) Allow aggregation of costs to meet later managerial, analytical, and decision-making needs;
- d) Permit identification of costs with the responsible managers involved; and
- e) Provide a basis for cost assignment to end users.

In capturing ADP cost and resource utilization information within non-ADP activities an individual's time and cost, and that of any equipment used, should be identified as an ADP cost and use to the extent it is related to an ADP function or operation. Where there is evidence of the involvement of a substantial amount of an individual's time (25 percent or more) or the material use of other resources in what is essentially an ADP function or operation, it should be

identified as an ADP cost, regardless of the individual's job series classification or the property management responsibility of the equipment.

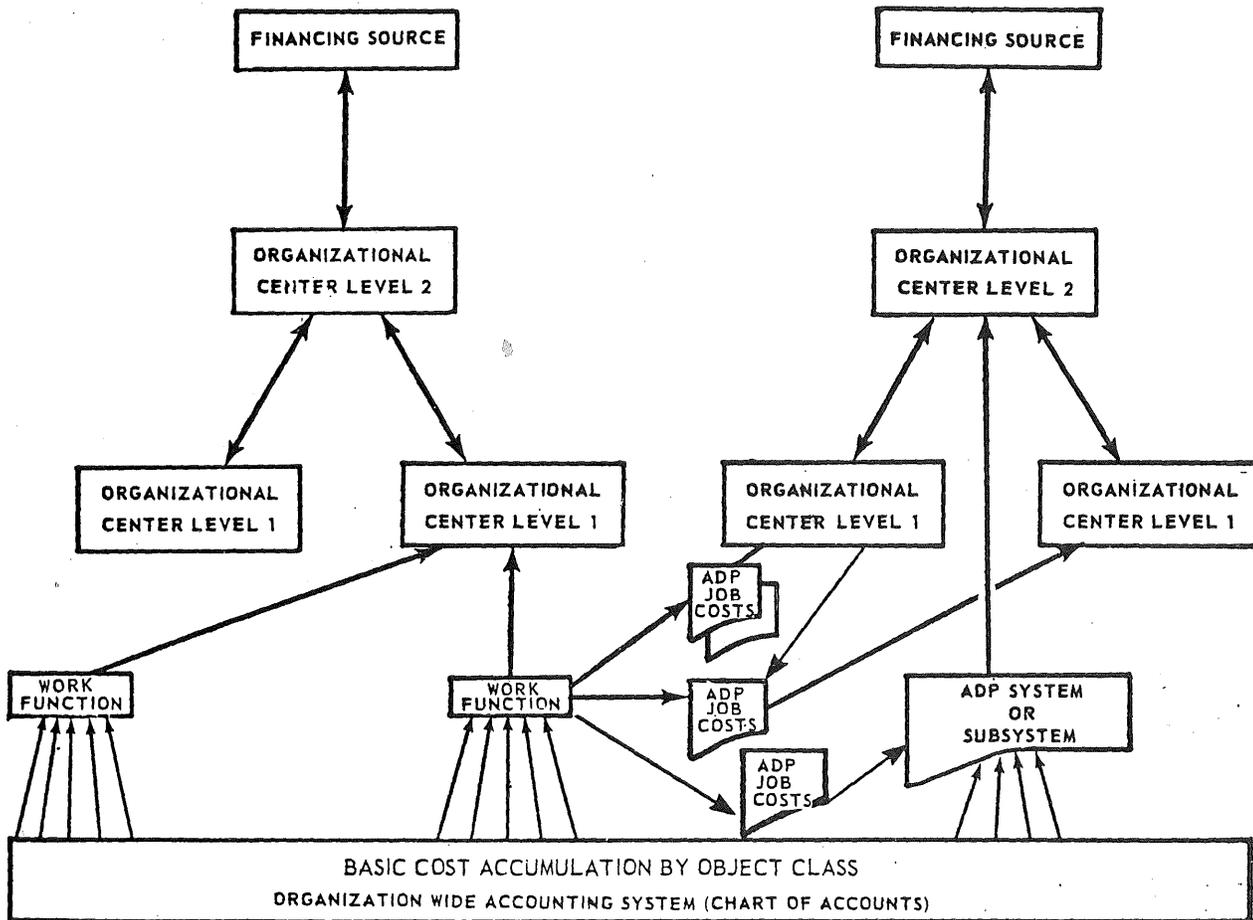
It is not necessary that such costs be transferred to the the ADP system operations or systems design and development activities. Identification, without cost assignment, provides a basis for the aggregation of all costs of ADP activities for the appropriate levels of management. It also provides for proper cost reporting in organizational and government-wide reports and for parties external to the organization. Cost assignment or transfer of such costs from the non-ADP function to the ADP activities may permit a better definition of the management responsibilities. Cost assignment from ADP activities to end user units of an organization is discussed in the next chapter.

Object Classification and Responsibility Centers

The initial classification of costs in the formal accounts is generally by object of expenditure classification (commonly referred as "object class") which is required in the accounting and budgeting for all Government agencies. Although this type of classification is fundamental to all costing procedures, it may be the least useful of the various classifications to operations management. The object classifications should be sufficiently detailed to allow for many types of managerial analysis. Costs, once classified by object class, can then be accumulated in responsibility centers as illustrated in Figure 3 and explained below.

Work function center: This is the lowest unit where costs are grouped. As explained earlier, this grouping is around a work function which can be identified as a separate activity or work area and focuses responsibility, attention, review, and control on specific work performed. A computer center might have any number of work function cost centers within it. Some examples might include input-output devices (individual or grouped), central processor unit (CPU), keypunching, production scheduling, applications maintenance work, ADP operating personnel (by work area), and ADP managerial overhead, among others.

FIGURE 3
SOME RELATIONSHIPS BETWEEN THE RESPONSIBILITY CENTERS



Each center is classified by a type of cost. Each center aggregates costs under its classification. Costs are aggregated upwards from the initial accumulation in the lowest element of the figure, as indicated by the arrows. The arrows indicate the cost aggregations and assignments made, usually, on the basis of resource utilization measurements from the RUM subsystem. The RUM and other Cost Accounting Subsystems, as illustrated in Figure 2, provide the relevant input to these cost centers. A project or effort responsibility center, as discussed in chapter II, may be viewed in this illustration as a "temporary" Organizational Center - Level 1. An Organizational Center - Level 2 would ordinarily be a permanent organizational unit, but not necessarily within the ADP activities.

ADP Application and/or Job Cost Centers: The ADP application and/or job cost center requires the assignment of costs from the work function cost centers. Cost allocation from higher levels of cost or organization responsibility centers allows the assignment of the full cost of the services provided within the operations activities or within the systems design and development activity, or other ADP activities. The application system and job costing procedure is basically a production-oriented job order cost system. This is similar to the project-oriented costing procedure in the systems design and development activities.

Within ADP operations activities, associating the cost of work with a major system by some loose or formalized method is prevalent, but not universal. We believe the costing and control of ADP systems, which are significant and material (major) elements in the user's operations, is a useful and necessary objective for investment accountability and for the control of an essential or material resource element in the agency's mission accomplishment. We therefore, give an emphasis to pinpointing the responsibility for the operation of a major, significant, or material ADP system through detailed costing of its individual job components.

Organizational Centers: The organizational centers are the focal points of cost controls since the objective is to assign costs in cost centers to managers who are responsible for incurring these costs. Initially costs incurred by the ADP organization are the responsibility of ADP management. As services are provided these costs should also become the responsibility of the end user. Together the end user and the ADP operations managers should share the cost control responsibility.

Financing centers: The requirements of stewardship of financial resources calls for adequate internal cost accounting for the financing center. In private industry, this would probably be a profit center such as a division or other major organizational or functional unit. In Government, this organizational unit would be the funding source and the responsible agency for carrying out its mission with the aid of an ADP system. In some cases, another agency may have the responsibility for the overall ADP operations activity. In a financing center, consideration must be given to the nature of the funding, such as an appropriation or a revolving fund. Costs are thus planned, budgeted, accumulated, and reported on a source-of-financing responsibility basis.

Guidelines

- I. Budgets, financial plans, related accounts, and reports for ADP operations activities (expressed in monetary terms) should be developed by organization unit with subordinate classifications by work function, process, product, and service.
- II. Planning for ADP operations must be coupled with
 - the agency's/organization's planning,
 - the life cycle context of all ADP systems, and
 - the budgeting and accounting procedures.
- III. Annual and lesser period planning and budgeting of ADP operations requires workload analysis and forecasting to provide for
 - changes in workloads of current systems,
 - new systems and customers, and
 - system modification and development needs.
- IV. Plans and budgets should be developed on the basis of expected costs giving consideration to experienced costs of prior similar accomplishments.
- V. Plans and budgets should contain quantifiable accomplishment data including unit cost data and corresponding requirements information by responsibility center.
- VI. A careful distinction should be made between maintenance and enhancement. Planning and managing significant operations enhancements should be specifically identified and treated by management in essentially the same way as a new application.
- VII. The life cycle view is applicable to hardware and software whether acquired or developed by contract or in-house.

- VIII. The stages and lengths of time for the life cycle of equipment and system software should be based on the best possible projections of useful life. They should not be based on arbitrary periods.
- IX. The cost accounting system should provide for aggregations of investment in either a new system or an enhancement of an existing system to support life cycle management.
- X. The accounting system should track, accumulate, aggregate, and report the use of ADP resources in meaningful measurement units, e.g., staff-hours or years, machine-hours or computer accounting units, etc. Resource utilization measurement is a basic foundation to adequate cost accounting and a keystone to both supervisory and management control of operations. The use of these resources should be attributed to specific systems, projects and tasks, wherever possible. The system should provide for comparisons of actual to planned utilization.
- XI. The measurement methods should be as stable as possible. They should be reviewed periodically with respect to their uses and validity.
- XII. All direct and indirect costs associated with ADP activities should be identified, accumulated, and aggregated in a manner that will provide for the proper matching of actual costs to planned costs for work functions, responsibility centers, and financing sources.
- XIII. Predetermined rates should be established and applied to measured resource consumption to provide for timely costing of specific projects or tasks. These rates should be adjusted periodically to compensate for variations between predetermined and actual costs incurred.
- XIV. Responsibility reporting by cost control center with appropriate financial plans and control classifications presented consistently to promote the reporting of actual to planned comparisons, identification of variances, and action-oriented indicators to management are of high value in providing management control and accountability information.

- XV. Measurable accomplishment, product and service levels of output, and other output-oriented measures of accomplishment and performance are essential to almost all management reports.
- XVI. Regular periodic review points, milestone review points, and exception reporting are essential to managing ADP operations.
- XVII. Post implementation reviews are essential to the proper evaluation and evolution of an ADP system including a review of the actual benefits and costs shortly after its operations are regularized.

CHAPTER IV

COST ASSIGNMENT TO USER UNITS OF AN ORGANIZATION

Introduction

The economical and effective use of the ADP resources is a user management responsibility. Our approach for meeting this responsibility is for management to require that the cost of ADP services be assigned to the users, that is, transferred from the ADP activities to the end user units.*

Implementing a cost assignment procedure aids management in several ways. First, when the user knows the cost of his service, he is in a position to perform a cost/benefit analysis and can determine whether the value received from a service is worth its cost. As a result, users become more cost conscious and sometimes reduce their demand for services. Second, the ADP manager is aware of the cost of operations of each user, and is in a position to concentrate on those high cost and demand areas warranting attention. And finally, top management can benefit from the cost information in fulfilling its responsibility for making sound ADP investment decisions.**

The principal elements of defining responsibilities through cost assignments are to reflect accurately, to the extent possible:

- The authority of the manager for cost incurrence;
- The accountable responsibility of the manager;

*The report refers to organizational unit(s) receiving the products and services from the ADP activities as the "end user units." Because of the large number of "users" who receive reports and other types of ADP products and services, we believe cost control can be enhanced by the designation of an official within an end user unit as a focal point of responsibility for the cost of ADP products and services. This person is referred to as an "end user."

**A senior management official may be designated as having agency-wide responsibility for reviewing and evaluating the cost-effectiveness of all ADP products and services.

--The degree of cost controllability exercised by the manager; and

--The relationship of the cost to his decisions.

The proper assignment of cost depends on a number of factors, sometimes referred to as the attributes of cost assignment. The attributes considered in this report, although not explicitly mentioned in our guidelines, are a prerequisite to any assignment of costs. Briefly stated, they are that:

--The value of the information provided through cost assignment should be greater than the cost of administering the procedure;

--Cost assignment should result in equitable charges to all users;

--Cost assignment should result in charges which will be consistent for like work;

--The cost information provided be relevant to the decisions, actions, and responsibilities of management; and

--Cost assignment should satisfy legal and other official administrative restrictions and requirements.

Formal Planning and Life Cycle View

Cost assignment and planning have an important relationship. Management decisions concerning future operations are better when based on accurate cost records. Cost assignment contributes cost records to the users facilitating their planning.

There should be consideration of cost assignments with respect to long-term objectives as well as for immediate management needs. Cost assignment relates to long-range planning in two directions, one from the user's viewpoint and the other from the supplier of services' viewpoint. The users need to have information on the future availability of service and the expected costs. From the other viewpoint, the supplier of services needs to know the extent of the users' intentions to use the service. This market should be defined and estimated as part of the long-range and life cycle plans.

The life cycle view concept envisions the aggregation of "birth" to "termination" costs of major ADP systems and their

major components into a cumulative sum of actual costs for comparison with planned life cycle costs for the same periods and accomplishments. The cumulative costs for comparison with the life cycle projections are made available through the cost accounting system as discussed in chapter III, where costs can be aggregated according to management desires for meaningful information.

One of the difficulties in the interrelationships of long-range and life cycle plans with cost assignment is the fact that an accounting period of 1 year is the most common interval for rate setting. Thus, long-range considerations, not present in the rate-setting period, are difficult or impossible to include. Under such conditions, as a minimum, there should be an awareness of the long-range plan on the part of the individuals concerned with cost assignment.

Another relationship between cost assignment and planning involves the general concern that plans, budgets, cost accounting, and cost assignment be in terms that are relatable to each other. It must be possible to compare cost assignment results with budgets and plans. Ideally, accounting should be formatted in the same way and in the same terms as budgeting and planning; or conversely, budgeting and planning should be done in exactly the same terms and format as accounting. While this ideal may not always be achievable, our use of the words "relatable terms" indicates that it must be possible to check results against plans directly or by means of a simple translation process. It is also necessary that cost assignments be in terms useful to management and in compliance with statutory requirements.

One of the topics discussed in this chapter is priorities as a control over the schedule. The use of priorities and premium and discount rates for priorities permits load leveling and sequencing of work. These factors should be considered in the long-range and other plans.

With respect to checking the actual results against the plan, regularly scheduled checkpoints are recommended for review. A quarterly reconciliation is advisable.

Resource Utilization Measurement

The resource utilization measurement concept discussed in previous chapters applies to and aids the cost assignment process. The objectives of cost assignment are better fulfilled when resource utilization measurement is used in the cost assignment process. Normally, staff-hours is the

preferable unit of measure for assigning the cost of resources used in providing services such as, systems analysis, programming, and keypunching. In a single job stream environment, a single element - normally elapsed time - is the unit of measure for assigning the cost of resources such as the central processor unit (CPU) and peripheral equipment. The following table shows the units of measure that are used generally for measuring the computer system resources in a multiprogramming environment.

Units of Measure Commonly Used in Multiprogramming Environment

<u>Resource</u>	<u>Unit of Measure</u>
Central Processor Unit	CPU Hours, Minutes, or Seconds.
Internal/External Memory	Kilobyte hour, Number of word blocks used, Region size in kilobyte units, Elapsed time.
Input/Output	Number of accesses, Number of tape or disk drives used, Sum of unit record transfers (sometimes in a block, e.g., per 1000 cards read), Elapsed time (e.g., disk channel time in seconds).

Summary or general information is often provided when an installation has few users. More complex, specific, and detailed information is generally provided when there are many users. Cost assignments are generally based on the level of input resources used in generating ADP products and services. However, if outputs are relatively standardized, one should consider the possibility of assigning costs on the user units of output (e.g., invoices issued, transactions processed, or accounts updated). The standard cost per unit of output could, of course, be calculated on the expected or average level of input resources used to generate the output.

Cost assignment should be related to the consumption of resources actually used in providing the ADP products and services. However, in some cases, costs should be assigned on the basis of resources that have been committed whether used or not. For example, a user, in a multiprogramming environment might request the allocation of three tape drives for his program. If these tape drives cannot be used by any other program until the user's program is completed, the user could be charged for three tape drives whether he actually used all three or not. Similarly, resources can be committed by a contractual

agreement, such as an agreement to have the computer system available for dedicated use during certain hours of the day. The user could be charged whether it is used or not.

Management Reporting

The cost assignment procedures should bring to management the information needed in the form required for management decisions. The cost assignment procedures may result in a dollar-billing process based on the aggregated information. It is also possible to provide resource utilization measures in terms of equipment usage and personnel time. These may be part of the cost assignment report, separate memo billings, or contained in other management reports.

Guidelines

- I. Cost assignment should generally reflect the full cost of resources used or committed.

Full cost generally includes directly relatable costs such as wages and related personnel costs, supplies, inter-agency and intraagency services, depreciation or amortization of hardware, long-lived software, and facilities assets.

- II. In certain instances it may be desirable to employ rate differentials for those considerations which promote more efficient or economical use of the resources.

Users wanting priority turnaround, for example, should pay a premium to encourage users not to ask for fast turnaround if the added value of such service is less than the priority premium. Similarly, peak periods (e.g., during the day and at month-end) should carry higher rates to help smooth the load. In composing a budget, a balancing of total premiums against total discounts should be planned to achieve full cost assignment.

- III. A priority system may be employed in conjunction with cost assignment if management control over ADP will be improved.

Generally, a priority system should be used to control systems design and development as well as data processing operations. Establishing priorities should generally be the responsibility of a management committee where both ADP and user management are represented.

- IV. Cost should be assigned on the basis of predetermined rates.

In special circumstances, it may be appropriate to assign actual costs, such as in the transfer of contract service costs or travel expenses (often termed "unique costs").

- V. Rates should be held stable to the extent possible

They should be reviewed at least annually and updated as necessary. Certain conditions, for example, a significant departure from planned usage may warrant rate review and possible adjustment on a more frequent basis.

- VI. Predetermined rates should generally be set using either projected levels of effort and estimated costs and/or last year's actual costs and usage.

Only in certain cases may it be more advantageous to use an historical averaging of costs and usage to derive the rate. To encourage demand in new or experimental installations, predetermined rates could be set using projected levels of effort. The fact that variances may occur must be foreseen and their allocation predetermined. For example, a startup account may be designed to pick up the variance.

- VII. The unit of measure chosen as a basis for assigning costs should be closely related to the resource being measured.

- VIII. Cost should be assigned by applying the predetermined rate to some unit of measure of the resources actually used or committed.

- IX. Variances to predetermined rates should be analyzed by management. If a variance is caused by a user, it should be applied to that user.

A material variance not so attributable may be allocated in one of four ways:

- to general overhead,
- to all users,
- to the ADP organization, or
- as an adjustment to next year's rate.

- X. The frequency with which users are notified of their ADP costs should coincide with an activity's accounting cycle which is usually a monthly cycle.

Individual users may be notified on a more frequent basis by memorandum billings--usually issued upon completion of a specific task or job and including resource usage information.

- XI. To the greatest extent possible, costs should be assigned in a manner that will allow user analysis and control.

Users should be able to understand their ADP bill and interpret its content properly for their decisions, planning, and control. This means that where feasible costs should be stated in terms of the user's operations or transactions, through standard product costing methods.

- XII. Regardless of the formal scheme for allocating costs, every user who makes decisions that materially affect ADP costs should be provided cost information that aids him in the more efficient use of ADP resources.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of Concepts and Guidelines

The planning concept and the underlying guidelines in the preceding chapters call for carefully devised financial plans covering meaningful periods and projects. These plans must be developed from adequate cost accounting and resource utilization records of experience. These records can be used as a coordinated and integrated set of tools with which to plan and, thus, control information systems activities.

The concept of the life cycle view and its supporting guidelines defines a framework and structure for organizing investment accountability for ADP systems. Planning of these systems and their development, operation, and modification requires accurate cost accounting to assist management control through reviews at each stage of the life cycle.

The resource utilization measurement concept and its underlying guidelines call for a systematic and balanced measuring and reporting of all significant elements of resource usage. Such measurements need to reflect both current and past acquisitions, and they must assist management in allocating resources to organizational units in their efforts to accomplish specific results and objectives.

The management reporting concept and guidelines, in this report, call for prompt, action-oriented accounting and reporting of actual costs and results in comparison to planned costs and results. Such reporting should identify specific responsibilities and should be issued periodically during the course of the ADP system life cycle. In particular, reports should be issued at the critical decision points.

The proper assignment of costs to the end user units of an organization is encouraged since it provides a useful and precise definition of accounting control and improves the effectiveness of management reporting.

Conclusions

The essentials of proper planning for ADP systems efforts and of attention to the evaluation of benefits in relation to costs should always apply to the implementation of these guidelines. It is also important to realize that all parties and interests in an organization will benefit from the accumulation, aggregation, and reporting of cost information. Our Task Group statement of objectives and scope states:

"The cost accounting system must meet the needs of the following elements of the organization according to their varied requirements and responsibilities:

- The person in charge of the information systems activities needs better information to measure his cost-effectiveness and efficiency, to plan future workloads, to justify his personnel and property, and where desired, to transfer his costs of his services to the end user units.
- The senior managers and budget officers need information about the nature of the cost of the information systems activities that are easily relatable to the objectives and programs of the entire organization.
- The end user needs information on the nature and cost of the ADP services he is using which he can relate to his activities and that he can understand and control."

In virtually all of the Federal, State, and local government activities and private firms that were included in the GAO survey of current cost accounting and control practices for ADP, there was a confirmation of the need for cost information as an important management tool.

We believe that all levels of management share the responsibility for meeting the purposes and objectives of their organization on an economical basis. To enable management to report on the discharge of its responsibilities for resources and operations, comprehensive accounting information on costs and accomplishments must be available. Clearly, all levels of management share the responsibility for implementing our recommended guidelines.

Nothing in our report is intended to restrict or inhibit innovation or the application of proven management techniques. Flexibility in the management processes is quite valuable and the particular forms of analysis to be applied to a decision can be a direct function of the particular problem.

We believe that our recommended guidelines will provide a consistent and useful basis for improving management control of ADP activities and systems including data communications. We believe that they will prove to be helpful in achieving efficiency, economy, and effectiveness through management control.

The guidelines in the preceding chapters are not intended to cover every specific condition to be encountered in establishing a cost accounting and cost control system for ADP activities and systems. In implementation, organizations must give consideration to:

- Defining the specific work project categories;
- Establishing detailed methods to track and control the progress of projects or tasks;
- Devising, where necessary, meaningful cost centers for their ADP activities;
- Determining the most suitable basis for measuring cost;
- Deciding how to establish predetermined rates and how often to review these rates; and
- Deciding on the methods and frequency of assigning costs.

Recommendations

The Task Group recommends that GAO adopt the structure, concepts, and the guidelines for cost accounting and cost control of ADP activities and systems as presented in the preceding chapters. Because of widespread interest in this subject, the Task Group recommends that the GAO report on this matter should be given wide distribution and should be made available for sale to the general public through the Government Printing Office.

The Task Group further recommends that GAO require, through appropriate directives, the issuance of agency regulations implementing the general guidelines included in this report, supplemented as necessary by specific guidance.

The Task Group recommends that GAO keep abreast of the state-of-the-art as it applies to accounting and cost control over ADP activities and systems with a view towards determining whether some of the problems discussed below, or others that may surface, have reached a stage where it is appropriate to issue additional, or specific, guidelines to the Federal agencies.

Remaining Problems

There are many facets of cost accounting and cost control of ADP systems and activities that have not been explicitly addressed in the foregoing guidelines. These areas may be important to some organizations but not necessarily to others. In many instances, analysis or consideration in terms of specific missions or functions of an ADP system or activity may be required. The identification of some of these areas will require a certain degree of accounting sophistication. Sometimes, the area identifications must be adjusted so that they can be applied to governmental units. The Task Group recommends that organizations be encouraged to develop some of these areas; but, it believes it is too soon to issue definitive guidelines on these matters.

Some of these areas and related problems that were uncovered by our deliberations and surveys are:

ADP systems design and development

- How to capture and relate early life cycle costs to the system objectives and to end user units?
- How does one assign development costs associated with a large information system used jointly by many subunits of an organization?
- When will formal descriptions of the design and development process enable common identification of specific project categories and provide better guidance on cost justification techniques?

ADP systems operations

- When should guidelines be established to identify and control ADP-related costs in end-user organizations (e.g., data preparation and output usage)?

- How should accounting data be developed for ADP operations which are either interdependent or serve multiple functions?
- When is it appropriate to utilize dollar discounting techniques in performing economic analyses?
- Should there be a standard approach to the capitalization of owned hardware, software and lease equity and with respect to depreciation and amortization?
- How does one treat assets whose value to the ADP system increase over time?
- How should job-order accounting be set up?

ADP Cost Assignment

- How should excess hardware capacity be treated?
- What type of a data base is needed to evaluate the relative merits of competing cost assignment methods and for providing guidance on the effectiveness of specific methods in specific sets of circumstances?

General

- How should Federal practices in cost accounting and cost control of ADP activities and systems be correlated with private sector or with State and local government agency practices?
- In an economic sense or as a function of the legislative requirements for an ADP system, is it appropriate to view such systems as a "public good," "utility," "monopoly," or "priceless resource?"
- Should guidelines be extended towards providing specific quantitative goals or objectives for management control over the development and operation of ADP systems?
- In what ways can these ADP-based guidelines be applied to manually operated information systems?

APPENDIX A

GLOSSARY

For the purposes of this report, the following definitions apply:

ADP activities All ADP system planning, analysis, design, programming, testing, documenting, and maintenance; all data preparation, encoding, communications, editing, storage, updating, retrieval, inquiry, extracting, compositing, and printing; all message and report distribution, and producing of written materials or data displays; that are involved with or based on computer system processing, and all ADP resources applied to these functions.

ADP system All ADP resources specifically combined to form a data processing product and service-producing aggregation (system), including the major components of software, personnel, and committed facilities and equipment.

ADP resources All physical, financial, personnel, contract and inter- and intra-agency services and goods applied to ADP activities, including such assets as owned or lease/purchase software, hardware and facilities.

ADP system life cycle The projected or actual period of time encompassing the design (from the point of proceeding with the design stage), development, operation, and evolution (to the point of termination) of an ADP system.

Computer accounting unit A collective, measurable expression used as a basis to track, accumulate, and aggregate data on the ADP resource usage for measuring productivity or assigning costs.

Cost assignment A transfer of cost from one organizational unit, account, or account grouping, to another organizational unit, account, or account grouping regulated by some systematic method and basis.

Memo billing A method by which users of ADP services are advised of the description and cost of such services without any fund or cost transfer.

Predetermined rates Prices (or costs) per unit determined in advance of the accounting period to which they apply and used to ascertain an activity's cost.

User (end user) A user is any person or manager who is directly involved with or responsible for the consumption of ADP services, to include the staff of a consumer involved directly in the consumption of ADP services even though not specifically held accountable for such consumption. An end user is the person, usually a manager, who is held directly responsible and accountable for such consumption. The organizational unit(s) receiving the products and services from the ADP activities is referred to as the end user unit(s) of an organization.

APPENDIX B

BACKGROUND

In the late 1950's, concurrent with the increasing acquisition of computer systems in the Federal establishment and elsewhere, the GAO created an ADP review and evaluation group in its Office of Policy and Special Studies. As the field of ADP and Federal computer applications grew rapidly through several successive stages of development in the 1960's, the GAO's role, capabilities, and responsibilities grew and matured.

In the late 1960's, as a result of the dramatic rise in the Federal expenditures for ADP and the large number of less-than-successful ADP system development projects undertaken by the Federal agencies, the GAO initiated a number of government-wide reviews to uncover the underlying management difficulties. The Brooks Bill (Public Law 89-306) and scores of Congressional inquiries and actions evidenced and underscored the increasing Congressional concern with the management of Federal ADP activities and systems during this period. This concern has increased over the intervening years.

The Executive Orders, Office of Management and Budget (OMB) and General Services Administration (GSA) actions concerning ADP management during this period reflected the increasing concern of the Executive Branch. In 1970, at OMB's suggestion, a task force of the Interagency ADP Committee made a study of the long range plans for ADP in the Federal Government. The task force report, issued in June, 1970 contained a number of critical conclusions and important recommendations for improving ADP management in the Federal establishment.

A GAO-sponsored National Academy of Science Panel studied the feasibility of establishing principles and standards for managing computer-based information systems and the related ADP activities, including data communications operations. The panel's report transmitted by the Computer Science and Engineering Board to the Comptroller General, September, 1972, concluded that

--the development of principles and standards for managing ADP and computer-based information systems was feasible,

--such development was urgently needed, and

--the GAO should assume a leadership role in a cooperative development process with participation by Federal agencies, State and local government activities, professional societies, academia, and other professionals.

In the fall 1972 issue of the GAO Review, an article by O'Connor and Raum of GAO, reported on their study concerning the feasibility of applying the principles and standards of accounting to derive sound cost accounting for ADP activities that would help in the management of ADP in the Federal establishment. They concluded that the general principles and standards of accounting could significantly aid in the management of ADP, if several controversial areas of application were worked out cooperatively. They called upon the accounting and ADP professionals in the Federal establishment to work together in developing specific guidance.

A GAO study, initiated in 1970 at the request of Senator Proxmire, was summarized in a letter to him, dated April 25, 1973 (B-115369). His request had asked, in part, for GAO to develop an independent estimate of the total annual costs associated with Government-owned and -used ADP equipment. The GAO reported to him that:

"The only Government-wide report, published annually by the General Services Administration, which regularly identifies such a cost figure was known to be incomplete. and a more inclusive estimate of "between \$4 and \$6 billion dollars" provided in earlier hearings was viewed as too rough. After an extensive study, we have concluded that a more comprehensive or precise estimate is impossible at this time without an impractical expenditure of effort due to:

- the sizeable ADP operations financed by the Government but not required to be reported to GSA;
- differences among Federal agencies in recording, summarizing, and reporting ADP cost data; and
- most importantly, the lack of clear agreement among professionals and managers concerning the proper accounting treatment of ADP cost data."

The letter report went on to discuss the problems which were found in trying to develop a more comprehensive or precise estimate of total annual costs; conclusions from the study, as above; and several recommendations for improving the accuracy of the expenditure data in GSA's annual report on ADP equipment. Among its conclusions, the report contains the following more detailed statement of the nature of its third conclusion, cited above:

"The lack of agreement by professionals concerning standards for proper accounting has contributed to the problem of inconsistency of data reported under the current reporting systems. We (the GAO) have recently started a project to bring together experts from the academic community, the accounting profession, Government and industry to establish accounting principles and standards specifically for ADP costs and investments. This project will provide much of the additional guidance needed to improve the consistency in reporting Government-wide costs."

Establishment of the Task Group

The project referred to had as a principal element the establishment of this GAO Task Group on Principles, Standards, and Guidelines for Management Control of ADP Activities and Systems. Letters inviting participation were sent to selected academicians, Federal agencies, professional societies, and professionals from industry and State governments. The response was nearly unanimous in favor of the objective and in willingness to directly participate. This task group was composed of representatives from GAO, GSA, the National Bureau of Standards, the Energy Research and Development Administration, the National Security Agency, the American Institute of Certified Public Accountants, EDUCOM, Inc, the National Association for State Information Systems, the State of California, the Lawrence Livermore Laboratory of the University of California, faculty members of Michigan State University, New Jersey Institute of Technology, Tulane University, and representatives from the International Business Machines Corporation, Control Data Corporation, Arthur D. Little, Inc, and observers from the Cost Accounting Standards Board, Bell Laboratories, Inc., J.C. Penney Company, and Price Waterhouse & Co.

The initial charge to the task group was to (1) examine for itself the feasibility of establishing principles, standards, and guidelines, and if feasible; (2) develop a plan and a program for such development; and (3) develop in the

near-term, standards and guidelines for the first subject of such a program. From the previous background, GAO suggested cost accounting and cost control as the first topic for the task group.

Objectives of the Task Group

At the first meeting of the Task Group, held on September 18, 1973, an agreement was reached on the areas for which cost accounting and cost control guidelines should be developed. At the fourth meeting, on February 24-25, 1974, the Task Group set out its tentative set of objectives and plans. These were subsequently revised and adopted at the First Symposium on Cost Accounting and Cost Control for ADP Activities and Systems, New Orleans, May 20-30, 1974. The basic objective set out was:

"The Task Group's objective is to develop and refine to the extent possible at this time, principles, standards and guidelines for the management control of ADP activities and systems, with initial emphasis on cost accounting and cost control.

The primary expected benefit to general managers, ADP managers, users, and evaluators is to improve management control by:

- providing from current practices guidance for planning and controlling ADP activities and systems;
- promoting practices which improve the efficiency and effectiveness in the use of ADP resources;
- providing guidance to the managers who must make investment and operating decisions regarding ADP systems; and
- providing criteria for management audits, reviews, and evaluations, including post-implementation evaluations, of ADP activities and systems."

A decision at the fourth meeting was made to restrict initial effort to cost accounting and cost control for ADP activities and systems, a critical central element of management control. Following the initial line of division of the subject, the topics to be addressed were:

- Cost accounting and cost control for the design, development, and evolution of an ADP system and ADP systems design and development activities, including the aspects which must support management decisions on ADP systems and facilities, cost-benefit considerations, and investment accountability.
- Cost accounting and cost control for ADP operations, including data communications and data handling.
- The aspects of cost accounting and cost control concerning the assignment of ADP costs to end user activities and functions of the organization, including criteria for assignments and billing under various conditions.

Current Literature Survey

Along with the establishment of the task group, GAO established an assignment and commissioned a search of the current literature on management control and cost accounting for ADP activities and systems, including:

- Federal research reports, policy statements, and other documents;
- Prior GAO studies, reviews, and reports;
- Professional journals and texts;
- Other studies and documents available and pertinent.

It also supported and commissioned several consulting academicians, task group members, and others to develop working papers on various aspects of the subject, to summarize current thought, and to fill in various holes which were evident from the initial search of the literature. The results of these efforts are to be published in the near future as a special supplemental report on the subject.

Current Practices Survey

In addition, the GAO established an assignment for the development and conduct of a survey of current practices in cost accounting and cost control for ADP activities and systems in the Federal agencies, State and local government

activities, and private industry. The preliminary results of this survey and the literature survey have been invaluable to the efforts of the Task Group in establishing a sense of the state of current practice both within and outside of the Federal establishment and a sense of the current body of thought about what practices could and should apply to management control and cost accounting for ADP activities and systems.

The Task Group has also benefited from the results of concurrent studies by the IBM-SHARE Ad Hoc Data Processing Cost Accounting Action Group, the work of the EDP Audit Research staff of the AICPA, the Cost Accounting Standards Board staff study of Cost Accounting Practices for Service Centers, and the National Association of Accountants' Research Study by Professor Harold Sollenberger on Management Control of Information Systems Development (1971).