ACHIEVING GREATER ECONOMIES IN DATA PROCESSING IN FEDERAL GOVERNMENT

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As many of you are aware, the Government has become increasingly dependent upon the use of computer technology. It is estimated that the Government will operate more than 18,000 computers this year--the total cost of their installation, operation, and maintenance is estimated to be in excess of $15 billion annually. Because computer systems have become a large investment in the Government, and because they have become inseparable from the Federal programs they support, GAO and the Congress are increasingly interested in evaluating computer systems development and use.

This marriage of Federal programs and computer technology has allowed the Government to perform many operations and applications that in the past were not done at all, or done manually at great expense and time. For example:

--The Social Security Administration estimates that by using an automated system it has significantly reduced the waiting period for people to receive their first benefit checks. This labor saving system is estimated by them to save $25 million over the next four years.

--The Veterans Administration estimates it can get benefits out faster and reduce staff levels by 2,100 staff years over the next 12 years by using automation.

From a Government-wide basis, however, just how have computers cut costs and saved money? Well, try this from a historical basis: The cost of Government services in 1980 increased by about 300 percent over the 1950s. However, the Federal workforce increased only about 15 percent while the number of computers installed increased from a small handfull to over 18,000.

In an effort to improve the Government's management of its ADP resources, we at the GAO have steadily increased the scope and sharpened the focus of our ADP audit activities over the years.

As many of you probably know, GAO has been involved in ADP procurement and utilization for many years. Prior to the Brooks Act, GAO issued about 100 audit reports revealing deficiencies in the acquisition and use of ADP. These reports provided some impetus for the act's passage. This act, which passed in 1965, was a major milestone because the Congress called special attention to ADP. The intent of the law was to make the acquisition and use of data processing goods and services by the Federal Government both orderly and economic.

To accomplish these objectives, the act assigned major responsibilities for Government-wide leadership to three executive branch agencies: the Office of Management and Budget, the General Services Administration, and the Department of Commerce through the National Bureau of Standards. The act also reaffirmed that each individual agency was responsible for determining its own data processing needs.

Our division, the Accounting and Financial Management Division, is responsible for performing audits on the effective implementation of the Brooks Act and for coordinating data processing audits performed by other GAO divisions. We do audits of such areas as ADP system selection, installation, and reliability; we evaluate program agencies as well as central agencies.

After 15 years of the Brooks Act, we have found that problems still persist in all facets of ADP activities. Despite dozens of GAO reports, there is still a lack of clear and concise quidance from the central executive agencies.

Over the past few years, we have issued a number of reports on some rather significant problems. In 1978, we exposed many of the failures in the Federal Information Processing Standards Program. Because of this report the National Bureau of Standards' budget for developing ADP standards has increased significantly. Also, it caused the Bureau to expedite issuing a Federal input/output interface standard. With better standards and compliance with standards, more vendors can compete better for Government ADP requirements.

CONTINUED USE OF COSTLY, OUTMODED COMPUTERS IN FEDERAL AGENCIES CAN BE AVOIDED

And just recently, we issued another milestone report which has been widely publicized in the press. The usual headlines are captioned "GAO Auditors Say Government Loaded With Dinosaurs." Let me assure you that our computer auditors were not counting the bones and fossils at the Smithsonian Institution. The headlines are referring to our December 1980 report on obsolete computers in the Government's inventory.

We undertook this study to determine if the Federal computer inventory is outmoded, and if so, how this situation arose, and how to prevent the situation from recurring. For the purpose of this study, obsolescence was defined as declining in usefulness--useful being the economical, efficient, and effective processing of data.

We used the April 1979 Federal inventory of general purpose computers was used as our universe. It showed 12,645 processors were being used in the Government. From this inventory we concentrated on the 1,366 medium and large-scale computers that had a central processing unit purchase price of more than $250,000 or a leasing price of over $10,000 per month. This represented 76 percent of the inventory based on purchase price.

Our analysis revealed some startling facts and distrubing trends. For example, over half of the medium and large-scale computers were of the 1971 vintage or earlier technology. Almost a third were 15 years old or older. Only 2 percent used 1975 or later technology! As we all know, more than a few technological advancements have occurred in the last 10 to 15 years.

Here's another interesting cut of this data. Included in the 1,366 medium and large-scale computers are nearly 1,000 computers manufactured by four major vendors. Of these:

--60 percent were first available in 1966 or earlier; 15 years ago!

--95 percent were first available in 1974 or earlier; 7 years ago!

Even though our study did not include small computers, we obtained an OMB analysis showing that the average age of small computers was 6.5 years; the average age of the medium and large-scale computers was 7 years. So we may have a similar problem developing in the small computer area also.

Well, we can make many analyses of this data--looking at age and technology changes. But, what is the economic impact? To answer this question, we conducted detailed cost analyses at four agency computer installations. At these installations we found that $1.4 million or 28 percent of their annual operating expenses could be saved by replacing older equipment because the older equipment's operational costs exceeded the costs of leasing and operating newer equipment. When you consider that there are over 1,000 computers of similar vintage in the Federal inventory, the potential savings become extremely significant.

So, we do have an obsolescence problem, but why? Part of the problem is that agency ADP managers have failed to identify all the costs and problems associated with using outmoded equipment. They are overlooking high operating expenditures, extraordinary maintenance expenses, excessive energy consumption, and additional costs of supplemental services. Even though salaries, materials, supplies, and other budgeted items are relatively visible, many hidden costs are also associated with using older equipment.

Let me illustrate by going back to the four installations we visited.

Higher maintenance costs. At one installation, the agency owned its computers and was paying maintenance costs in excess of $2.3 million every year. By updating with computers of comparable power and capacity, the maintenance and lease costs would still have been less: $2.2 million; an annual savings of $100,000.

Higher energy costs. Energy costs were another major factor. If the processors and disk storage capacity at another installation were updated with comparable, newer equipment, we found that the

--processors would use 80 percent less power

--disk memory units would use 90 percent less power

--air conditioning costs would be 78 percent less

The bottom line: over $125,000 in annual savings.

Added floor space. This is another factor which is often "hidden" from management. If one installation updated its disks, its floor space requirements could have been reduced 90 percent. If 7 processors at another installation had been replaced with 2 comparable, updated processors, floor space requirements would have been reduced by 65 percent.

The list in our report goes on and on, including added personnel costs and excessive system non-availability.

In our opinion top agency management has not provided the oversight and direction to assure that total operating costs are identified and assessed in managing Federal ADP resources. However, and probably more importantly, the central agencies have not issued policy and guidance for replacing older equipment when changes in current technology make it economical to do so. This is needed to spur-on the top management in the agencies.

OMB and GSA have acknowledged that there is no central Federal policy regarding computer obsolescence, even though OMB Circular A-71, dated March, 6, 1965, requires such policy

to be developed. According to this circular, OMB is to provide overall leadership and coordination in managing Federal ADP equipment and resources.

GSA is responsible for providing comparative information on the characteristics and performance capabilities of equipment, and developing and publishing guidelines and criteria governing the replacement of equipment to avoid usage beyond the point of economic advantage.

OMB and GSA officials agreed that a specific policy and guidance is needed to resolve the obsolescence problem. These officials, however, could not explain why nothing had been done for 15 years.

To get the Government back on the proper track, we believe two things need to be done. First, we must replace obsolete computers with modern, economical equipment now, where it is economically feasible. Secondly, we must improve the management of Federal ADP resources so that obsolescence does not happen again.

To accomplish this we recommended that GSA issue guidance to agencies outlining the criteria to be used, and the cost comparisons to be made in determining economic obsolescence. Among other things, we suggested that GSA incorporate the following principles into its guidelines:

--existing applications and workloads need not be rejustified;

--replacement systems should have approximately the same relative compute power as the old system;

--the replacement system's memory storage (core and disk) capacity should be restricted to the existing amount;

--replacement systems should be capable of using existing software including, where possible, plug compatible or emulation processors.

The fundamental point is: agencies should be allowed to update their equipment, without upgrading their capacity. We do not want to reward agencies for past bad management.

We also recommended that OMB require Federal agencies to assess their ADP requirements for the 1980's, plan their procurement strategies, and improve management's ADP knowledge and involvement.

Because of the severity of the problem and because the central agencies will need time to implement our recommendations to them, we also recommended that Federal agencies determine immediately if their systems are economically outmoded by using the same criteria and considerations we used in our study. If the systems are outmoded, the agencies should move to replace them expeditiously.

Subsequent to our report, GSA advised us that they have issued policies and procedures which specifically respond to our recommendations. Further, OMB told us they intend ". . . to require agencies to annually identify all obsolete computers and develop explicit plans for their replacement."

I have spent much of my time on the obsolecence report because I believe it is one of our most significant reports in the ADP area. But more importantly, the recommendations in the report, if followed, have the potential to produce large savings and improved operations at a time when everyone is trying to reduce Government costs.

FEDERAL AGENCIES' MAINTENANCE OF COMPUTER PROGRAMS: EXPENSIVE AND UNDERMANAGED

Another recent report I would like to discuss briefly is one we published in February on the need to do a better job of managing and controlling software maintenance. This report has not received as much coverage in the press as the one on obsolescence, but I think it is equally important. I don't know why, but I suppose it is easier to visualize and understand cost savings from buying new "black boxes" than cost savings from better managing and controlling the somewhat vague, yet very costly process of modifying and rewriting computer instructions.

Estimates of Government spending in software range as high as $6 billion a year. The current cumulative investment in software probably exceeds $25 billion. While no exact figures are available, GSA's Software Development Office estimates that software maintenance probably runs at least $1.3 billion a year.

Because the Government's software investment is huge and the cost to maintain it is so high we undertook a study of software maintenance to determine:

--To what extent are resources being spent of software maintenance?

--How efficiently is it being managed?

--What are the causes of excessive costs and problems?

--What could we suggest to reduce software maintenance costs?

To get a good handle on this subject we made detailed analyses of software maintenance at 15 different installations in Government. We received and analyzed responses to a comprehensive questionnaire from 409 sites. We also examined current literature on the subject.

One of the first problems we ran into was the lack of an agreed-upon definition of "what is software maintenance." In some cases, we found inconsistent definitions of software maintenance within the same agency. At the 15 sites we visited,

--some considered modifications to existing software to be development work, not maintenance;

--at others, maintenance work on software developed centrally and run locally, was not considered to be maintenance;

--at still others, only the removal of defects was considered to be maintenance;

--and finally, some had no formal definition at all.

We also found that neither NBS nor ANSI had developed a standard definition of software maintenance. On a Government-side basis, variances in definition make it difficult for central Government agencies to develop statistics and analyze the maintenance function, and to issue across-the-board guidance.

For purposes of our review, we defined software maintenance to include:

1. removing defects;
2. tuning the software to make it run more efficiently and economically;
3. modifying to make it do more end-user tasks than it was originally intended to do;
4. miscellaneous actions such as changing the software so it will work with a new operating system.

The second major problem we ran across was the lack of good cost imformation. We found nobody who had a good handle

on their maintenance costs, even though all managers knew it was significant, particularly for programmers and analysts.

The respondents to our questionnaire estimate that their programmers and analysts spent nearly 53 percent of their time on maintenance; at the 15 sites we reviewed, we found they spent over 66 percent of their time on maintenance.

	Respondents	15 Sites
Operations	Nearly 9%	Almost 12%
Administrative Support	Almost 6%	Just short of 34%
Management	About 10%	Almost 27%
Hardware	About the Same 13-14%	

We also found that data processing managers have little knowledge of the types of maintenance which costs the most in their operations. In some cases, general distinctions could be made between modification maintenance and repair maintenance, but no formal tracking systems exist to provide for meaningful analysis of the maintenance workload.

For the 15 sites we visited, we were able to construct a composite profile of the maintenance activity:

Defect Removal	About 20 percent
Tuning	Over 7 percent
Modification	About 61 percent
Other	About 9 percent

Costs associated with software maintenance should be monitored and recorded. Segregating the costs of different work functions in data processing is essential for effective management. There are several reasons for accumulating such data: For example,

--knowledge of costs is necessary to estimate the feasibility of requests for maintenance work;

--it would enable management to identify all work segments which contribute to maintenance costs;

--it would permit evaluation of the efficiency of specific operations;

--it is necessary in reporting and billing costs to users;

--it could provide a basis on which to evaluate individual performance of personnel involved in software maintenance;

--costs of maintaining individual pieces of software can alert managers to high cost areas in their inventory which warrant attention.

The third major problem we found was that none of the 15 installations had established goals or standards of acceptable levels of software maintenance activity. Such standards would give managers a basis for determining whether their present levels of maintenance are efficient and effective. Essentially, we found that software maintenance is not being managed well--we have no standard definition; no cost accounting, and no goals or targets for reducing software maintenance, which everybody recognizes as a very high cost area.

In our study we found several areas in which software maintenance could be reduced.

Excessive user-requested modifications

Management must do a better job of approving requests for modifications. At one location we found management approval

was based on whether time was available to do the work, and not on the need for the change. At that same location, we found that one application alone had 158 modifications documented in its maintenance history.

Inadequate definition of user requirements in system development phase

Of our 409 questionnaire respondents, 171, or over 40 percent, indicated that better definition of user requirements would be the single most beneficial effort to reduce software maintenance.

Inadequate or missing documentation

We all know and recognize the need for and importance of good documentation, but it still remains as a major problem area.

Inadequate control of contractor software developments

Most managers told us that contractor-developed software requires more maintenance. In an earlier study of contractor-developed software we found two reasons for this. First, agencies generally fail to insure that the contractor has a good quality assurance program; and second, agency personnel who must later maintain it not only learn nothing about it while the contractor is developing it, but they also inherit little or no documentation.

To bring about better management in software maintenance we made a number of recommendations:

We recommended that NBS

(1) develop a standard definition of software maintenance, and

(2) issue guidance directed at techniques for reducing software maintenance costs.

For the heads of Federal agencies, we recommended that they

(1) begin to manage software as a discrete function;

(2) identify and assign costs to resources expended for software maintenance;

(3) develop standards and goals for evaluating maintenance efficiency.

Recognizing that it may be some time before NBS comes out with some guidance, we have included in the report a Provisional Checklist for Software Maintenance Management. I think you will find it very helpful in bringing your software maintenance activity under better managerial control.

* * * *

Well, you now have our views on the economics that can be achieved on the "hard" and the "soft" sides of ADP management. I am certain that our report on obsolescence is going to create alot of procurement activity and savings. I am equally certain that significant savings will also be achieved if serious attention is given to improving the management of software maintenance.

Thank you for your kind attention.