MANAGEMENT INFORMATION: A KEY TO BETTER ACQUISITION AT NIH

Report NI801R1

April 1990

Harry H. Moore
Cynthia W. Shockley
Robert A. Spargo

Prepared pursuant to Department of Defense Contract MDA903-85-C-0139. The views expressed here are those of the Logistics Management Institute at the time of issue but not necessarily those of the Department of Defense or the National Institutes of Health.

LOGISTICS MANAGEMENT INSTITUTE
6400 Goldsboro Road
Bethesda, Maryland 20817-5886

Executive Summary

MANAGEMENT INFORMATION: A KEY TO BETTER ACQUISITION AT NIH

The acquisition process at the National Institutes of Health (NIH) provides a wide variety of supplies and services to the on-campus research and administrative staff. Management of the process must balance responsiveness with frugal procedures that meet all statutory and regulatory requirements.

Achieving the appropriate balance is a challenge, particularly since NIH has no objective, quantifiable, acquisition performance standards. We recommend that it develop such standards and use them to measure how well the acquisition process is meeting its goals. In addition, NIH is not managing its information resources to best support its organizational goals and objectives. We recommend that it do so in a systematic process that we term a management information system (MIS). The MIS should be defined by a MIS team - a partnership of acquisition information specialists and functional managers who work together to define the data and system needed to make good decisions.

We believe that NIH can improve its automated resources to better support the MIS. Data essential for the MIS are now in two isolated databases or, in some cases, are not collected at all. We recommend that as part of its planned redesign of the Administrative Database (ADB), NIH establish criteria for effectively integrating all data sources to better support management information needs. The MIS team should also coordinate acquisition management recommendations for the ongoing ADB redesign.

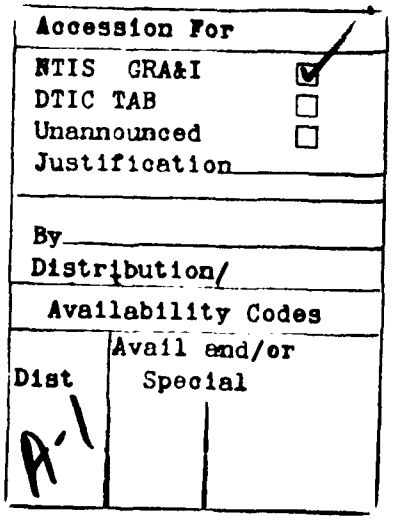
Since a redesigned ADB will not be available until the mid-1990s, NIH managers need an interim solution. As that interim solution, the MIS team should extract the best management information possible from currently available sources. It should also acquire data that are currently not collected by implementing new stopgap stand-alone systems where necessary.

Finally, we recommend that acquisition managers be encouraged to use information as a resource – to insist that management information be relevant and

accurate, and to put it to use more effectively than in the past. With proper direction, those acquisition managers can use the information the MIS will initially provide and progressively tailor the MIS to help the NIH acquisition process meet the goals of responsiveness, economy, and compliance with regulations.

CONTENTS

CONTENTS (Continued)



CHAPTER 1

BACKGROUND

The National Institutes of Health (NIH) is the largest medical research facility in the world. It employs more than 15,000 people in 12 Research Institutes, a large Clinical Center, a Medical Library, 4 support divisions, and the Office of the Director. Its FY90 budget is more than $6.9 billion.

While more than 80 percent of NIH's research is conducted under grants and contracts to outside universities, institutes, and corporations, a substantial intramural research effort is under way at NIH's Bethesda, Md., campus. To support the intramural research and its administrative organization, which is also located at the Bethesda campus, NIH must continually acquire an incredibly diverse range of material and services, from paper clips to multimillion dollar building complexes. Furthermore, in providing that support (called *station support* at NIH), responsiveness to customer needs is critical since a particular line of research may suddenly require unforeseen material or service support on very short notice.

While it meets those responsiveness goals, NIH must also acquire material and services economically and comply with applicable regulations. As a goal, economy is relatively straightforward: NIH needs to get the maximum benefit possible from every purchasing dollar. The goal of regulatory compliance is equally straightforward. As a Government agency, NIH is legally bound to purchase material and services in accordance with Federal statutes, the congressionally mandated Federal Acquisition Regulation (FAR), and agency and departmental regulations.

The Public Health Service (PHS) and the Department of Health and Human Services (DHHS) are charged with acquisition and policy oversight of NIH. In that role, they recently conducted a number of reviews that were critical of NIH's station support acquisition system. Much of that criticism was centered in the small purchases area and focused on NIH's failure to adequately control the system's cost and assure compliance with procurement regulations. In a previous study, the

Logistics Management Institute (LMI) concluded that one reason for the low level of control was the lack of information available to NIH acquisition managers.[1]

REPORT ORGANIZATION

This report describes the acquisition management information requirements at NIH and a method to meet those requirements. Chapter 2 examines the management structure of NIH intramural acquisition and describes the goals, objectives, and standards of the acquisition system. Chapter 3 analyzes the information needed by acquisition managers to support those goals, standards, and objectives. Chapter 4 surveys the information resources available to support the information needs. Finally, Chapter 5 presents our recommendations for a program to build a Management Information System (MIS) for acquisition managers that makes best use of the available resources.

---

[1]LMI Report NI701R1. *Improving Consumable Material Support at the National Institutes of Health*. Handy, John B., et al. April 1988.

CHAPTER 2

NIH ACQUISITION GOALS, OBJECTIVES, AND STANDARDS

A necessary first step to determining NIH's acquisition information requirements is to identify the goals and objectives that the information will support. We found that identification to be surprisingly difficult. Managers throughout the NIH acquisition organization have a clear idea of what the organization as a whole intends to accomplish but are often unsure of exactly what part they are expected to play in that accomplishment.

As an example, when we interviewed managers in the Division of Logistics (DL), we obtained a broad consensus that the mission was to provide "the best service with quality products at the lowest price." Beyond that consensus, they had no formal process to define those goals concretely, to set objectives in accomplishing them, or to measure progress. As a result, each manager we interviewed had a different interpretation of organizational priorities. The other NIH acquisition organizations we examined were similar.

Without a clear concept of the organizational goals and objectives, managers can neither manage nor use management information effectively. They will simply not share a common understanding of what they are expected to do. Thus, before an information system is designed, we believe NIH managers must know those goals and objectives. In addition, if information is to be useful in measuring how well those goals and objectives are met, managers must also have set meaningful performance standards. We describe the goal, objective, and standard setting process below. At the end of the chapter and in Appendix B, we set forth what we believe to be NIH's station support acquisition goals and objectives on the basis of our observations of current operations. Our analysis of information requirements in subsequent chapters is also based on those observations.

CURRENT GOALS, OBJECTIVES, AND STANDARDS

The first step in the process is to establish concrete organizational goals. NIH senior management has established the overall acquisition goals as responsiveness, economy, and regulatory compliance. Senior management has communicated those

goals to all levels of management. Unfortunately, the process has stopped there. If goals are to produce clear direction, they must be defined in terms of objectives. This will make them meaningful and will resolve situations in which two goals are in conflict. The objectives must then be broken down into subobjectives for subordinate activities so that all of NIH strives for the accomplishment of the high-level goals. Subobjectives should not only be assigned to subordinate activities, but they should also be personally assigned to the managers responsible for attaining them.

Performance standards can be used to communicate and measure the objectives. Performance standards are carefully designed criteria that specify the desired performance of an organization in pursuit of its objectives and against which the current performance of the organization can be measured. Those standards also serve as the vehicle to communicate objectives down through the organization. Performance standards also indicate to NIH management how well the organization is meeting those objectives. All organizations have performance standards of some type, formal or informal. At NIH, we found those standards to be only informally chosen, communicated, and used.

Characteristics of Successful Performance Standards

In studies of other organizations, we have seen many effectively used performance standards. Several characteristics are common to the most successful ones. If standards are to be effective as management tools, they must be objective, personal, understandable, empirical, attainable, flexible, and measurable. Most current performance standards at NIH are not.

Objective

We found that most NIH managers we interviewed relied on subjective performance standards and that such reliance impeded the effectiveness of NIH acquisition managers. As an example, several managers had performance standards that read in part, "meets NIH needs at a generally acceptable level of service." Such standards are inadequate without an objective description of what the needs are and what constitutes "acceptable" service levels. The subjective performance standards we saw tended to degrade the communication between supervisors and subordinates by adding personal judgment as a critical factor. They also imposed an added burden on the superior to continually match current performance to the poorly defined

standard and to constantly redefine the standard to the subordinate in terms of recent activity.

Objective performance standards, in the few cases they were used, improved interpersonal communication by leaving much less room for confusion about what was meant. With objective standards carefully formulated, supervisors could concentrate their efforts on assisting persons who do not meet standards. While all performance standards cannot be objectively set, especially those for senior managers, we believe that greater use of objective performance standards would improve the ability of acquisition managers to accomplish their objectives.

Personal

When a performance standard is established, it must also be incorporated into the personal performance appraisal of the organization's leader. Without a direct connection between what the organization and its leader are each expected to accomplish, it is likely that the organization will be led in a different direction than is desired. In our review of NIH individual performance plans (NIH Form 2585), in no case was the performance rating for an individual manager directly related to the measured performance of the organization he or she managed. In both divisions, some managers we interviewed believed that they and their organizations had been doing well in the past year according to the standards they had been given. They were confused and upset when their performance was nonetheless evaluated unfavorably.

Understandable

Like subjective standards, ambiguous standards inhibit communication and reduce the ability of the organization to concentrate its energy on the accomplishment of its objectives. We found that many of the NIH managers' individual performance standards were vague. One example is, "Work products are . . . of an acceptable quality," with no further clarification of what "acceptable" meant. While no standard can be made completely clear, a method of increasing the clarity is to publish the performance standards of higher organizations and explain how the local performance standards should contribute to meeting them.

Empirical

Some NIH performance standards have been derived externally. An example is the "800 actions per year" standard for purchasing agents, which is a modified form of a Department of Defense standard. Other current standards reflect a theoretical view of process, rather than reflecting actual experience. The usefulness of those standards is limited at best. We believe that better, more useful standards can be developed from NIH's own historical experience. By doing that, NIH can establish a realistic baseline of actual system performance from which reliable predictions can be made and upon which realistic improvement strategies can be based. NIH does not now collect the data upon which to base empirical standards; we believe that it should begin to do so.

Attainable

A performance standard should present a challenge but at the same time must be attainable. We saw several acquisition standards at NIH that cannot be met for one reason or another. An example of such a standard is the Division of Logistics' criterion of 100 percent availability of stocked items in the warehouse at all times. When an unattainable standard is established, no one can be reasonably held to it, and the actual standard evolves to some lesser, ill-defined, unspoken level of performance.

Flexible

Because NIH acquisition exists in a dynamic environment, the standards for performance must be constantly re-evaluated in terms of changes that occur. Because performance standards should be increasingly specific at lower levels of the organization, changes in the environment have their greatest impact there. Thus, managers must be willing and able to determine the effect of changes on the entire organization and to modify their standards as necessary. Failure to do this can make performance standards unrealistic and therefore unproductive. An example of an inflexible standard is the requirement for 48-hour processing of Accelerated Purchase Requests; the increase in the contract operating section's workload over time has made the standard increasingly difficult to achieve. As a result, the standard has been met at the cost of degradation to other parts of the procurement operation or it has not been met at all.

Measurable

To be useful, a performance standard must be measurable. Unless a manager actually attempts to measure performance against the standard and provide feedback to the subordinate, the standard is likely to be ignored in the press of other business. We found a prime example of this: NIH had a large backlog of station support contracts that had been completed but had not been closed out as required by the FAR. Since no one checked whether contracts had been closed, the sections instead concentrated on other work, and a considerable backlog of closeouts developed. Thus, the lack of measurements and feedback led to a situation that required substantial management attention to resolve.

Numerical measurement is an effective means for assessing performance. It is a labor-saving device for most NIH acquisition managers, who simply do not have time to monitor the ongoing operation of a complex organization in detail and at the same time perform their other management tasks. For lower-level managers who are intimately familiar with the operation, numerical measurement can indicate when unusual conditions require their attention and can provide a framework for overall evaluation of their operation. Senior managers cannot be close enough to all of their subordinates to maintain a good subjective understanding of day-to-day operations; for them, numerical measurement is the only way they can have a good idea of what is actually going on. Even though not all standards can be measured numerically, numerical measures can be used to assist in making subjective measurements if the limitations of the numerical tools are kept in mind.

Using numerical measurement has a cost, however. Numbers are meaningless by themselves. Before beginning to use them, a manager must invest the time to choose meaningful measures and to understand what they mean, where they come from, and how reliable they are.

NIH ACQUISITION GOALS AND OBJECTIVES

By analyzing the current organization, we identify the major goals and objectives for NIH acquisition. Appendix B also lists objectives at division level and provides the framework for determining the subobjectives for subordinate organizations.

As we pointed out in our previous report,[1] the NIH acquisition process must be responsive, economical, and in compliance with regulations. To identify NIH's acquisition objectives, we must examine the characteristics of the acquisition environment and then determine how that environment affects NIH acquisition managers in their attempts to achieve the goals.

The Acquisition System

NIH operates a complex support system that includes both centralized and decentralized acquisition activities (see Figure 2-1). It divides the acquisition process into two major subprocesses that are relatively isolated from each other. The first – Research and Development (R&D) – consists of the procurement and administration of contracted research programs carried out by non-NIH institutions such as universities, hospitals, or other organizations. In the R&D area, procurement is decentralized and conducted in several separate contracting offices within the individual NIH bureaus, institutes, or divisions (BIDs) that generate the requirements. The Division of Contracts and Grants monitors the BID contracting offices and thus exercises central management control. Its director reports to the Associate Director for Administration. Since R&D procurement is beyond the scope of this report, it is not discussed further.

The other major acquisition subprocess – station support acquisition – involves directly obtaining material and services in support of NIH research and administrative organizations mostly at the Bethesda campus. The Director of Acquisitions Management, who also reports to NIH's Associate Director for Administration, is responsible for managing that process. However, the Director of the Division of Contracts and Grants has been designated the Principal Official Responsible for Acquisition (PORA) for NIH as a whole. As such, he provides policy and procedural support, and also exercises regulatory oversight responsibility for all station support procurement except small purchasing.

The Station Support Acquisition Environment

One goal of station support acquisition at NIH is to perform in accordance with the standard regulations governing Federal procurement and material management.

---

[1] LMI, op. cit.

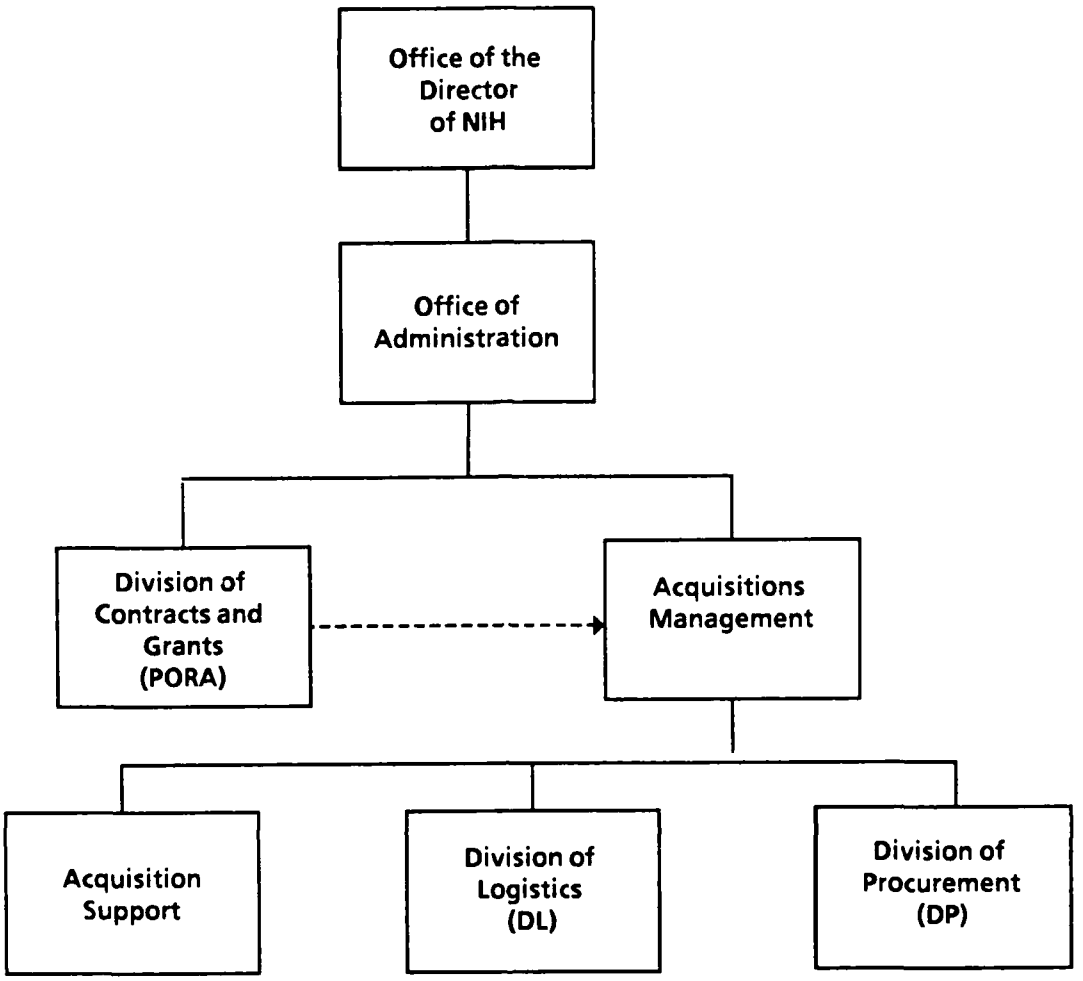


FIG. 2-1. NIH ACQUISITION ORGANIZATION

However, two factors make fulfillment of that goal difficult: the need for maximum responsiveness and the volatility of the NIH acquisition process.

Because NIH is a research organization, much of its acquisition is in direct support of ongoing research programs. Research is an unpredictable process, so its requirements cannot be accurately predicted very far in advance. A research laboratory can rarely predict its needs for material and services more than a few weeks in advance; often, the laboratory must acquire a critical item within hours.

As a result, much of the station support acquisition system has been decentralized so that it is extremely responsive to customers' needs. This

decentralization has produced a real challenge to acquisition managers, who must in all cases adhere to the Federal and agency procurement regulations.

The acquisition environment in which NIH acquisition managers must perform is an extremely volatile one for three principal reasons. First, the requirements for acquisition have changed dramatically in the past few years. Not only has the level of effort increased dramatically – with NIH research expenditures increasing over 51 percent in just 3 years – but new programs such as Acquired Immunodeficiency Syndrome (AIDS) research and the effects of recent scientific advances have tended to change the level, type, and recipients of the acquisition support required. Second, the Office of Management and Budget (OMB) has attempted to control costs throughout the Government by imposing increasingly restrictive personnel ceilings. Thus, in spite of a large increase in the level of research effort at NIH, its personnel levels have not increased correspondingly. Finally, NIH acquisition is the focus of increasing attention from Congress, the PHS, and the DHHS. In the current resource-constrained fiscal environment, those organizations have shown a determined interest in making the acquisition system as inexpensive as possible.

Acquisition managers have a difficult time balancing those requirements. They must comply with acquisition regulations, achieve maximum economy, remain responsive to their NIH customers, and accomplish this ever-changing mission with fewer people.

Station Support Objectives and Organization

Where direct support by the Division of Procurement is impractical, NIH delegates limited procurement authority to its customer organizations. Thirteen organizations have been delegated authority for contracting, small purchasing, or both. Those decentralized acquisition organizations are operated by the customers, subject to functional management oversight, and are outside the scope of this report.

For its other customers, NIH provides a variety of means for acquiring the material and services they need. First, contracts and large or unusual small purchases that require professional procurement expertise to execute are performed by a centralized procurement operation in the Division of Procurement. Next, smaller routine purchases (usually under $1,000), are performed by the BIDs themselves through a mechanism known as delegated procurement (DELPRO). DELPRO is a centrally controlled, locally operated small purchasing system that is

designed to be extremely responsive to the customer. Finally, NIH maintains a small warehouse, operated by the Division of Logistics, to provide routinely needed supplies inexpensively.

A diagram of the organization of the Division of Procurement and the acquisition portion of the Division of Logistics is presented in Figure 2-2. (The Director of Acquisitions management also retains a small Acquisitions Support staff to provide general analysis and technical support.) Station support procurement at NIH is actually conducted as a joint effort of the Division of Computer Research and Technology, the Division of Procurement, and the Division of Financial Management. The Division of Computer Research and Technology maintains a large computer-based system called the Administrative Data Base (ADB). That system makes possible direct on-line requisitioning from customers, direct channeling of procurement actions to the Division of Procurement and to the appropriate action office, and maintenance of historical records of the transactions. The system also transmits the completed action to the Division of Financial Management, which pays the vendors' invoices. The ADB is the procedural backbone of most of the station support procurement at NIH and comes as close as we have seen to a "paperless" procurement system. We address its capabilities in Chapter 4.

Central Procurement

The three contract branches together constitute a central procurement office that executes all contract actions and purchase orders. It also procures all material and services that cannot be procured by DELPRO (except for that procured by the decentralized offices). While these sections are aware of the importance of economy and regulatory compliance, they are in fact, organized to maximize their responsiveness to their customers. Each branch is totally responsible for meeting the needs of an assigned group of BIDs and works for other customers only if requested by another branch and if its responsiveness to its own customers would not be degraded as a result. Occasionally, the BID assignments will change as the Director of Procurement determines that changing customer requirements are creating an unbalanced workload.

The organization of central procurement affects the ability of the branches to meet all of NIH's acquisition goals. Responsiveness is enhanced, and the contracting specialists and purchasing agents develop a close working relationship with their

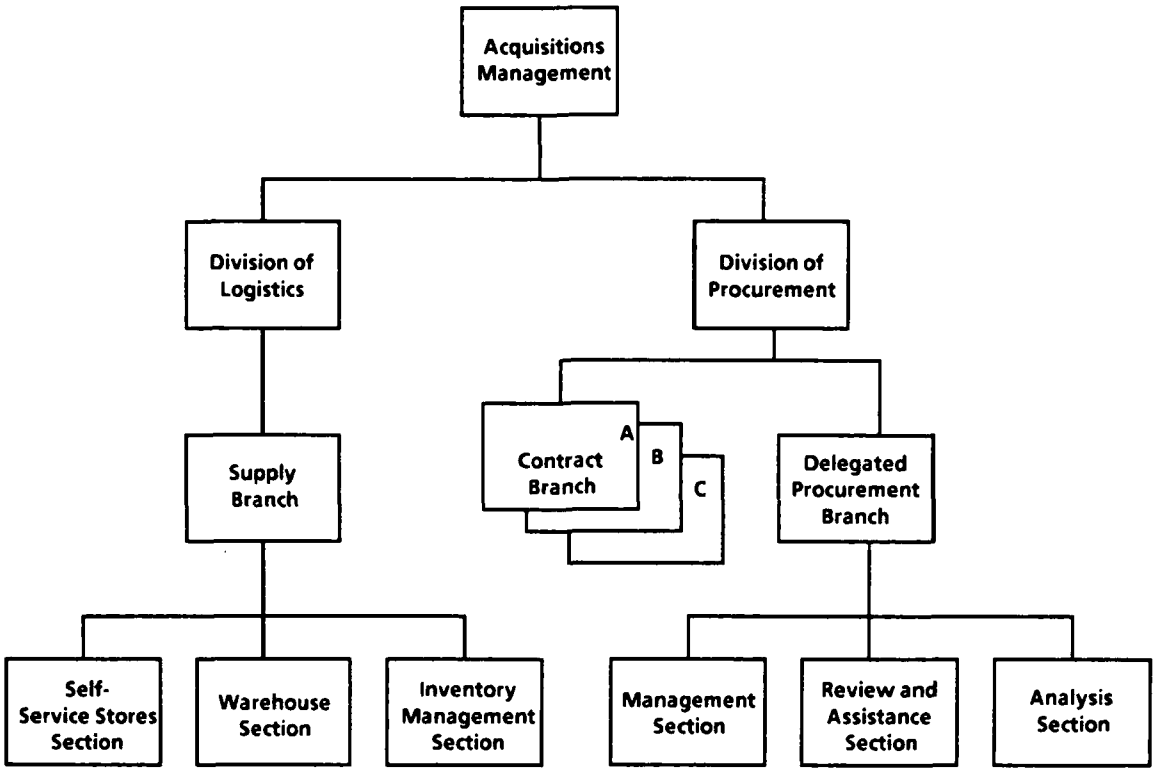


FIG. 2-2. NIH STATION SUPPORT ORGANIZATION

customers. However, this organization sacrifices some of the advantages of the more traditional commodity-based organization found in many Federal procurement offices. Because each branch serves only a relatively small part of the NIH community, it may be unable to detect large patterns of purchasing that would allow NIH to utilize cost-saving procurement vehicles such as indefinite delivery contracts. Recovering this capability has required NIH to establish a separate analysis capability in the DELPRO Branch. Furthermore, because a small group of contract specialists and purchasing agents must perform a wide variety of procurements, a branch may have difficulty developing expertise with particular commodity markets or specific procurement vehicles.

Because two particular BIDs specialize in limited commodity areas, their supporting branches do have special expertise in those areas. Branch C, which supports only the Division of Engineering Services, is expert in construction and architectural and engineering procurement; Branch A, which supports the Division

of Computer Research and Technology, has developed considerable expertise in automatic data processing (ADP) acquisition.

The activity of the branches can best be described as a structured workflow operation. Customers enter requests for procurement action into their terminals in the ADB. After they are approved by the appropriate officials in the BID, they are electronically dispatched to the appropriate contract branch. The action is then processed according to one of a number of discrete procedures. The resulting final contract or purchase order is forwarded to the appropriate parties such as the vendor, the requisitioner, and the finance office for further action. Although some manual procedures exist and are used in the routing system, they tend to supplement the automated system.

As in any structured workflow operation, the contract branches are highly susceptible to sudden surges in workload; in fact, such surges constitute the major management challenge within the branches. Much of the time, the requirements arriving at the branches for action arise as the result of ongoing research and cannot be predicted far in advance. In peak periods, workload from one branch can sometimes be diverted to another branch; however, at the end of the fiscal year, a deluge of transactions causes the extensive use of overtime and may result in the degradation of procurement quality.

For those reasons, the objectives of the contract branches are also similar to those of a production environment in a manufacturing concern: to process incoming transactions as efficiently and rapidly as possible while maintaining established quality standards.

DELPRO

DELPRO is a partially decentralized adjunct of the central procurement system in which hundreds of ordering officials throughout NIH can purchase material and services directly from vendors without passing their requests through a central procurement office. It is designed to maximize responsiveness for small purchases and does so very well at some cost in economy and regulatory compliance.

Authority to make DELPRO purchases is delegated to the BIDs by the PORA through the Director of the Division of Procurement, who uses the Delegated Procurement Branch to control the operation of the system. Because responsiveness

is essentially the responsibility of the user in this decentralized system, the Delegated Procurement Branch concentrates on the management of economy and regulatory compliance.

DELPRO users acquire goods and services through Blanket Purchase Agreements (BPAs), which are not formal contracts binding the Government or the vendor but rather are general agreements on the means by which the Government will purchase from a vendor on a routine basis. DELPRO BPAs are established and maintained centrally by the Delegated Procurement Branch. DELPRO users may not buy from a vendor who does not have an established BPA; may only buy items that are specifically covered by a BPA; and may not buy material in excess of the dollar limit placed on the BPA, usually $2,500. In practice, those restrictions do not impede responsiveness because the Delegated Procurement Branch maintains a large number of BPAs covering an extremely broad range of material and services. In addition, the vast majority of purchases needed on a day-to-day basis are well under the limit. (The average BPA purchase in FY88 was $545.)

Supplies and services can be ordered relatively simply through DELPRO. The customer, usually a lab technician or office secretary, fills out a local form describing the supplies or services and suggests appropriate vendors. That form is delivered to a designated purchasing clerk in the BID, who then opens an acquisition file for the order. The clerk obtains any required NIH clearances for those items and if the item is not available from the supply warehouse, the clerk checks a published list of BPAs to determine which vendors carry them. The clerk then contacts selected vendors bytelephone and negotiates availability, unit cost, and delivery date.[2] The vendor who provides the lowest acceptable quotation is given a purchase order number and instructions for delivery. At this point, the order is entered into the ADB through the clerk's terminal.

Within 24 hours, a BID Administrative Officer must review all orders made by the purchasing clerks. Each order is printed out in hard copy, signed by the Administrative Officer to approve the expenditure of funds, and then placed in the clerk's acquisition file. The vendor delivers the goods or services directly to the original customer, and if the shipment is acceptable, the customer prepares a delivery

[2]If the purchase is less then $1,000, a single vendor may be contacted and awarded the purchase if he provides a "reasonable" price. If the purchase is greater than $1,000, at least three vendors must be contacted to provide price quotations.

ticket and gives it to the purchasing clerk, who enters the shipment data into the ADB terminal. Meanwhile, the vendor mails an invoice to the Accounts Payable Section of the Division of Financial Management where it is matched with the automated record of the original order and with the receiving report and is paid.

DELPRO is highly responsive but at some cost in economy. Since the prices of the covered goods and services are generally not specified in the BPA, they are negotiated directly between the purchasing clerk and the vendor at the time of the purchase. Because users buy individually rather than in concert with the hundreds of other users at NIH, they are unable to take advantage of the potential for significant discounts. In the past, the huge volume of DELPRO orders (almost 250,000 in FY88) discouraged NIH management from attempting to increase the economy of DELPRO buying. However, the large amount of money spent through DELPRO ($82 million was spent on supplies alone in FY88), has led to an attempt to improve the cost-effectiveness of the system. The Delegated Procurement Branch has attempted to reduce the number of BPAs in given commodity areas and has achieved notable success in using NIH's considerable buying power to negotiate specified discounts in the BPAs that remain. In addition, the branch is attempting to identify those items that are purchased frequently by the NIH community and to analyze the commercial market on those items so that more cost-effective alternatives to the BPA, such as Indefinite Delivery Contracts (IDCs), can be used instead. The establishment of new negotiated BPAs and IDCs is a continuing major initiative of the Delegated Procurement Branch.

Enforcing regulatory compliance by DELPRO users is a difficult problem. DELPRO has more than 200 potential users, and monitoring their regulatory compliance has been extremely complex. Users are required to follow applicable regulations just as professional purchasing agents do, and the Delegated Procurement Branch is charged with overseeing that compliance. With its limited resources, the Delegated Procurement Branch can only conduct one on-site audit per customer site per year. In the interim, it reviews a sample of purchases from the ADB records of each active user every week. If it identifies a problem, it contacts the user informally and its reviewers concentrate on improving the performance of users with chronic problems. We believe that such an approach is an excellent use of existing resources because it provides prompt, personalized feedback to a large population of users in a resource-constrained environment.

It is clear that the overriding objective of DELPRO is to provide extremely responsive small-purchasing support, and we believe that DELPRO is well-designed to provide that support. The challenge for the Division of Procurement is to maintain the high levels of responsiveness required while setting and attaining reasonable objectives for economy and regulatory compliance.

Central Supply

Central supply at NIH aims to provide customers with a wide variety of low-cost material without compromising the requirement for superior responsiveness. Unlike other Federal warehouse operations we have seen, cutting procurement leadtime is not a major necessity; the material stocked could be made available to customers on short notice through DELPRO. Thus, the major objective for central supply should satisfy NIH's goal of economy: to produce the maximum net cost avoidance for NIH as a whole, including overhead, without compromising its other goals of responsiveness and FAR compliance.

To accomplish that objective, the Supply Branch of the Division of Logistics operates a central warehouse (with annexes) that acquires material at volume discounts from suppliers and issues that material in the smaller quantities required by NIH customers. The intent is to reduce net costs to NIH by taking advantage of volume discounts.

In the past, the warehouse has attempted to be extremely responsive by attempting never to be out of an item at the warehouse (100 percent availability) and to deliver items to customers on request within 24 hours. We believe given the nature of inventory management as a statistical process and the overall objective of cost savings, those objectives promise customers what the system can't deliver. A more realistically stated responsiveness standard would be "to deliver material to customers within a mean time of x working days, including the day the material is ordered and the day it is delivered and also including the time needed to fill backorders."

The central supply system also operates four self-service "stores" for the convenience of customers. The stores allow customers to acquire small items from a centrally located store, rather than requiring them to order the items individually

through DELPRO or the warehouse. Thus, they effectively cut leadtime to zero while saving the administrative cost of acquiring low-cost items one at a time.

To meet its objectives, central supply must keep the overhead associated with material management at both the warehouse and the self-service stores as low as possible. Thus, a subordinate, but critical objective is to conduct inventory management, warehousing, and administration efficiently.

The Supply Branch must also identify candidate items for stockage in order to add cost-effective new items to stock. To do so, the Supply Branch and the Delegated Procurement Branch must work closely to assure that each item is acquired in the best possible way whether through stockage, on IDC, or both.

FORMING NIH ACQUISITION PERFORMANCE STANDARDS

As an example of how objective performance standards should proceed from organizational objectives, consider the objective of DL: to "fill customer orders as quickly as possible." The related performance standards should tell what is meant by the DL objective and what part they play in its attainment. As an example, they may include the following:

- Delivery of *x* percent of customer orders within *x* days
- Delivery of backorders within *x* days *x* percent of the time
- Having each self-service store item available for purchase at least *x* percent of the time.

Together, the three standards circumscribe the objective and make its attainment measurable. While not all objectives are as easily translated into measurable, objective performance standards as that one, the usefulness of the standards as management tools is obvious.

CHAPTER 3

INFORMATION REQUIREMENTS

To properly manage its acquisition system, NIH managers need a well-defined baseline of functional information that they can use to plan, organize, and control the routine day-to-day operation of the acquisition system. Customers and others need that same information to coordinate the operation of the system with their activities. We believe that a formal reporting system is needed to provide that information. NIH managers also need an information system that can provide large numbers of ad hoc reports. In this chapter, we address each of those sets of requirements.

FUNCTIONAL INFORMATION REQUIREMENTS

In a formal reporting system, management information is used to measure the level of performance against established standards. Since NIH has not yet established those standards, we have implied them in our discussion below. We have concentrated on numerical measurements of performance because subjective measures are more accurate when made by the on-scene manager. However, we have noted areas in which numerical measurement can give insight even in those subjectively evaluated areas.

Our estimate of NIH's acquisition information requirements is summarized in Appendix C. In this chapter, we discuss the information requirements of the NIH acquisition system in three functional areas – central procurement, DELPRO, and supply operations – and then discuss the presentation of information to managers. Finally, we discuss the production and use of management information as a critical resource.

Central Procurement

At NIH, the contract Branches A, B, and C represent a structured workflow operation. While each individual transaction is unique, the performance of the system as a whole can be measured by determining average responsiveness information for the entire population of transactions over a designated time period.

The ability of the contract branches to support NIH acquisition objectives depends on the volume, character, and timing of their workload. As the workload increases beyond normal or expected limits, one or more of the following happens: leadtimes are extended, responsiveness suffers, the degree of FAR compliance declines, and the system becomes less economical. On the other hand, having too many staff members is an expensive luxury. Matching the mission requirements of the branches to available personnel resources is a critical responsibility of the Director of Acquisition Management and other senior managers.

The responsiveness of the contract branches can be measured by the average time it takes to perform each type of procurement action correctly. Because each type of action requires a different set of procedures, the average leadtime differs for each. This is especially true of Branch C, which – because of its specialized construction and architectural and engineering procurement and its heavy workload of contract administration – presents a very different picture from the other contract branches. Each procurement action can be tracked by noting when it passes certain designated points. By compiling the average time that actions take to transit the various steps, a manager can form an accurate picture of the process as a whole, and that picture will be relatively uncomplicated by the unusual characteristics of individual actions.

Tracking actions that way will produce two benefits. First, the progress of individual actions can be tracked against the average times required to identify problem areas and for estimating the time needed to complete important actions. Second, the average times can serve as empirical standards for the process. Those standards are useful for management planning and control by the Director of Procurement and the contract operating sections' customers.

Directly measuring how well the contract branches perform in keeping costs down is difficult. However, indirect measures can indicate whether the branches are operating in such a way as to make economical procurements likely. For example, the increased use of sole-source contracts and purchase orders may show that procurement personnel are choosing less time-consuming but more expensive procedures. Another example is a large number of consolidated procurements, using IDCs or negotiated BPAs, which show that procurement personnel have recognized recurring or redundant demand and have acted to meet it in a less expensive manner. Also, the FAR and other procurement regulations specify formal cost-saving vehicles such as the use of agency excess, NIH competitive BPAs, IDCs, and Federal Supply

Schedules. The Director of Procurement can routinely monitor the rate of use of those options, and the PORA – the Director of the Division of Contracts and Grants – can give them special attention during regular reviews and audits.

Like cost control, the degree of regulatory compliance cannot be measured directly; but also like cost control, indirect measurements can give management some insight into the performance of the organization. Examples of those measurements include the rate of small and disadvantaged business utilization and the number of contracts containing "substantive issues" during PORA reviews. Also, if the average time needed to complete a certain type of procurement is decreasing over time, it may mean that procurement personnel are using undesirable shortcuts to meet their workload.

DELPRO

The Delegated Procurement Branch is responsible for managing and controlling the DELPRO system. Thus, it is responsible for ensuring DELPRO meets all of NIH's acquisition objectives. In practice, the proximity of DELPRO ordering officials to the end user of the material or services ordered ensures responsiveness; only cost control and regulatory compliance need be actively managed.

Regulatory and procedural compliance is monitored and enforced by the Review and Assistance Section of the Delegated Procurement Branch. It does that by conducting reviews of customer purchasing activity. The ADB provides virtually all the information needed to operate this review system. The only requirement not currently met through the ADB is the ability to report to senior management on the progress being achieved in improving the buying practices of the hundreds of ordering officials. Such reporting can be done by merely classifying common mistakes by type and keeping track of their recurrence.

To determine how well the DELPRO system meets the goal of cost control, buying patterns and trends of the large number of users need to be identified through the ADB. Over time, if the branch is successful, the trends should indicate a BPA population with greater aggregate discounts than before and a trend toward customer use of more cost-effective buying vehicles such as Federal Schedules, negotiated BPAs, and IDCs.

Supply Operations

The main objective of the supply operation in the Division of Logistics is to establish, staff, and operate a supply activity that produces for NIH as a whole the maximum net cost avoidance including overhead, while maintaining high standards of responsiveness and regulatory compliance. Currently, those objectives are not well supported in terms of the information received by supply managers. Because the supply system consists of two distinct operations (the warehouse and the self-service stores), two different sets of information requirements must be considered.

Warehouse Requirements

In order to measure the effectiveness of the warehouse, NIH must be able to measure the discounts achieved by buying in bulk quantities. In addition, it must be able to measure its own costs to assure the gains made through volume discounts are not lost in supply system overhead costs.

The costs of acquiring material for the warehouse are easily captured from present data in the ADB. However, to calculate the dollar savings, the item managers must ascertain the list price of the material if purchased in single units. The net volume discount can be estimated by determining the difference between the list price and the unit cost of the material with the volume discount and then multiplying that difference by the volume purchased. The accuracy of this estimate can be improved over time as (1) the average discount that DELPRO users receive in a particular material category is subtracted from the list price and (2) the overhead costs assigned to a DELPRO purchase are added to the list price.

Once the net volume discounts for the material are identified, the warehouse system overhead costs of storage, transportation, and administration must be subtracted. If the warehouse is successful, the savings achieved through discounts must be greater than the costs incurred through overhead. In order for supply managers to stock material wisely, this information must be calculated separately for each line item stocked. A detailed explanation of this concept is in Appendix A.

In addition to cost avoidance, responsiveness and regulatory compliance must be measured. Responsiveness can be measured by tracking material requests through the system from the point of requisition to the point of delivery, in much the same way that actions should be tracked through the contract branches. Compliance

requirements for the warehouse are twofold: procurement must comply with the terms of the FAR, and material management must comply with the Federal Property Management Regulation (FPMR).

Measurement of compliance with the FAR is simple: since the warehouse replenishes material like a specialized DELPRO node, it can be reviewed in the same way by the DELPRO Branch of the Division of Procurement (DP). It should, however, receive special attention because it usually deals in much larger transactions than do other DELPRO customers. To assist in this, the warehouse's use of small and disadvantaged businesses and its use of General Services Administation (GSA) stock, IDCs, and Federal Supply Schedules (FSSs) should be separately reported.

Generally speaking, measuring compliance with the FPMR can be achieved by measuring the overall efficiency of operation since the applicable sections (41 CFR 1010-25 through -27) merely specify what replenishment sources must be used and require the warehouse to be operated on an economically sound basis. Those requirements have been incorporated into the concepts detailed in Appendix A. Of particular interest, however, is the FPMR requirement to actively manage shelf-life items, excess stock, and items not stored or purchased in accordance with economic guidelines. Status of those items should be reported separately.

Self-Service Store Requirements

Self-service store managers must be able to compare the costs of providing low-value items through those stores with the costs to purchase them through DELPRO or the warehouse. The difference between those costs is the measure of cost-effectiveness of the stores.

Self-service store cost figures are obtained by adding the procurement cost of the material to the overhead costs of operation. This can be done in much the same way that warehouse costs are captured.

The cost that would have been incurred if the customers had purchased the material through DELPRO or the warehouse is more difficult to determine. First, we must determine the list price of the material when purchased in small quantities. We must then add the price to the administrative costs of placing DELPRO or warehouse orders for that volume of material. We can obtain administrative costs for the DP,

the Division of Logistics (DL), and the Accounts Payable Section from current budget control systems and determine BIDs administrative costs through an annual survey such as the one conducted by NIH's Division of Management Policy in April 1988. The costs from that survey amounted to $6.98 per line item sold for the most common type of DELPRO order and $3.00 per line item sold for warehouse orders. As time passes and circumstances change, those costs will change also and must be reestablished by a new survey.

Monitoring Efficiency

In addition to determining the cost information, warehouse and self-service store managers must be able to monitor the efficiency of their operations in order to meet their responsiveness objectives and to control their overhead costs. In Appendix C, we suggest several standard statistics for monitoring that efficiency. In addition to those statistics, supply managers need to know the volume of business in order to relate the performance statistics to the actual workload environment. The following are two of several measures for volume:

- *Stockkeeping Units (SKUs) Sold:* the number of times during the period that warehousemen have to visit different storage locations in the warehouse to withdraw material for customers. Indicates warehouse workload.
- *Pieces Moved:* the number of individual items issued to customers during the period. Indicates transportation workload and volume of business.

AD HOC INFORMATION REQUIREMENTS

Routine reports of functional information allow managers to track the day-to-day operation of the acquisition system, but they cannot by themselves meet the managers' total information needs. While a functional report may point out a problem, it would not ordinarily provide all the supporting detail needed to diagnose it and effect a solution. In addition, the information needed to fully illustrate the problem may involve the integration of data not ordinarily collected for management information purposes. NIH acquisition managers must also be able to respond rapidly to a variety of external requests for information from senior NIH, PHS, and DHHS management and other Government activities. Finally, the requirement to provide information to the public under the authority of the Freedom of Information Act is increasing. Thus, managers need the ability to produce information from the

masses of available source data, on a timely basis, in ways that cannot be predicted in advance.

While the specific nature of the requirements cannot be predicted accurately, we believe that a large majority can be met by manipulating source data that are already being collected by the ADB or by other NIH information systems or that could be collected by the stand-alone systems we recommend in Chapter 5. A vast amount of raw source data – both in volume and scope – are now being collected. Integrating those data into meaningful reports is a serious problem for NIH acquisition managers.

Aside from management requirements for one-time reports, unstructured reports are needed for demand analysis – the analysis that identifies frequently purchased materials. Performing demand analysis well is critical to the success of the DELPRO in identifying more effective procurement vehicles and of supply managers in stocking only the most cost-effective items.

The information needed for demand analysis is particularly difficult to extract from current information resources. To identify recurring demand patterns, analysts must aggregate past DELPRO purchases according to specific classifications of material. While automated records exist for all DELPRO purchases, the extreme diversity of items purchased, the inaccuracy of some input data, and the inconsistent use of NIH's classification system for purchases combine to make it difficult to analyze purchasing trends for particular items or types of items. As a result, the analyst must painstakingly determine trends by examining vendor catalog numbers, item descriptions, and other unedited data in the automated records. To get a reasonable idea of what is being purchased, an analyst must have the expertise to understand the technical characteristics of the materials being analyzed and the ability to sort through masses of data using flexible, heuristic searches.

As DELPRO customers receive better training, they will assist in the production of more reliable data, but the mass data searches will continue for the foreseeable future. In short, the analysts do not need formal reports of statistics as much as they need the training and automated tools to search the data as effectively and efficiently as possible.

MANAGEMENT INFORMATION AS A CRITICAL RESOURCE

We observed that many NIH acquisition managers do not believe that information is a matter of their concern when in fact, as managers, they are in the "information" business. Every manager has a "system" for collecting and processing the information he needs in order to function as a manager. This "MIS" may be formal or informal, and may or may not contain any computer resources. The explosion in computer technology has dramatically increased the availability of information; thus, this detached approach to managing information has become obsolete. We believe that NIH acquisition managers need to actively manage their MIS.

Management Information System

An MIS is a system that produces, maintains, and interprets useful information for managers. It is not necessarily automated; computers should be part of the system only if they are useful in that process.

The information generated from an MIS contributes to the following decision-making or problem-solving activities for management:

- Achieving awareness, understanding, and insight into an issue or identifying a problem
- Defining or collecting relevant information
- Developing alternative options
- Evaluating options and calculating the achievability of various desired outcomes
- Selecting an optimum solution or option
- Implementing the selected option
- Reviewing results or performance as a consequence of the implemented decision and making decisions regarding goal achievement
- Taking reasonable action.

Management information also has an important place in the attainment of organizational goals through the effective use of objectives and performance standards. As shown in Figure 3-1, management information provides the feedback necessary to monitor performance against the standards and to evaluate the

reasonableness and effectiveness of organizational objectives. Without proper management information, performance standards and objectives are useless.

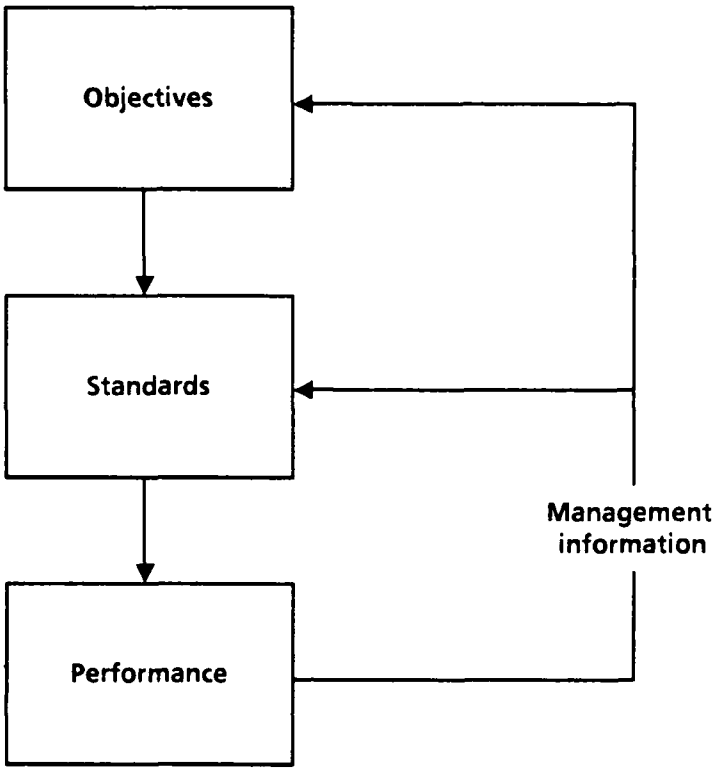


FIG. 3-1. WHERE MANAGEMENT INFORMATION FITS

Determining the Value of Information

In any assessment of information needs, the analyst must consider both the cost and the value of that information. While the cost element is relatively easily defined, the benefit, or "value of information," is more difficult to assess because it inherently involves many intangible considerations. In effect, "Information is valuable only in a world of uncertainty, and information is valued at its ability to reduce that level of uncertainty."[1]

With the information explosion and comprehensive information offering an opportunity for enhanced productivity, NIH is justified in treating information as a

[1]Demski, J. S., "Basic Ideas in the Economic Analysis of Information; First Lecture." In: G. Lobo and M. Maher, Eds., *Information Economics and Accounting Research*. The University of Michigan, pp. 3 – 21, 1980.

resource. In fact, we believe that information is an increasingly vital organizational asset that should be managed with the same concern and attention as other key assets such as people, money, materials, and machinery. A critical part of the environment is the creation of an information infrastructure within the organization to manage the collection, processing, and movement of information.

At NIH, the issue is how to quantify the benefits provided by an acquisition MIS to justify the costs of implementing it. Unfortunately, most of the benefits of better management information are intangible and are extremely hard to separate from the many factors that make up any reasonable measure of overall organizational performance. Thus, any measurement of value must be subjective, and the value of specific information can best be assessed by the managers using it. A manager who is responsible for tne cost of producing information and the productivity improvements resulting from it is in the best position to judge whether the information is worth producing. Therefore, an MIS will work most effectively if acquisition managers are responsible for its product.

The Customer Need for Management Information

The publishing of performance data for customer use is an extremely important purpose of management information that should not be overlooked. Service providers in general and the acquisition community in particular exist to serve the real needs of its customers, and those customers must know how well those needs are being met.

The great majority of NIH customers we interviewed stated that they would be quite tolerant of less-than-perfect performance from the acquisition system if they knew what level of performance to actually expect. We think that this attitude makes sense. If customers know what to expect, they can routinely plan their procurements in an economical and timely manner. If they do not know what to expect from the system, they must often react to unpleasant surprises.

Performance data also provide a basis for dialog between the acquisition community and the customers. Acquisition performance levels are directly related to the financial and personnel resources used to produce them; reporting the results obtained from current resources should point up this relationship and form the basis of a consensus on how much is enough.

The relationship between any service provider and its customers is seldom without friction. However, without honest reporting of service performance levels, the possibilities for misunderstanding and mistrust are magnified. When the levels of service can be meaningfully measured, as in the case of acquisition, they should be reported to customers.

Stratification and Presentation

Management information does not just happen. There is a vast difference between raw data and timely information capable of assisting managers in attaining organizational goals. To take best advantage of the data, information must be constructed from it with a fair degree of skill and a sense of what the information's ultimate purpose will be.

While the efficient collection, storage, and handling of data is mostly of concern to the ADP professional, the construction of useful management information from raw data can best be done as a partnership between the ADP professional and the manager who will use the information. The two main tools used to accomplish that construction are stratification and presentation, which we describe in detail below. Because the value of timely, well-chosen management information is so high, being able to use those tools well should be a vital concern of every acquisition manager.

In Appendix C, we describe information we believe would be useful in measuring the attainment of the goals and objectives in Appendix B. We believe each acquisition manager should use that set of information as a starting point and then use stratification and presentation techniques to make the information clear, timely, and relevant.

Stratification. The information in Appendix C is presented at a level of detail that would be appropriate at the division level. Many NIH managers are either above or below that level, and those managers need information, too. Thus, the information must be sufficiently detailed to allow each manager to identify and solve problems but it must not be so detailed that it overwhelms the manager in minutiae. The process of dividing the data to provide the appropriate level of detail is called

stratification. Data may be subdivided into "strata" in many different ways, depending on how the manager finds it most useful. Among the ways data can be stratified are:

- Time (e.g., current period vs. fiscal year to date)
- Function (e.g., contracts vs. purchase orders)
- Product (e.g., supplies vs. services)
- Organization (e.g., Branch A vs. Branch B)
- Customer [e.g., National Cancer Institute (NCI) vs. National Heart, Lung, and Blood Institute (NHLBI)].

Obviously, the level of summarization and detail depends on how many data are contained in the strata and how many strata are chosen to represent the total body of information.

The stratification necessary for effective management can only be determined by the manager. Since each manager has a different style of managing, each requires different information. Furthermore, as conditions change, the particular stratification needed is likely to change, too. Information system personnel are primarily responsible for assisting individual managers in obtaining the stratification they require.

Presentation. A manager may receive the correct information but be unable to interpret it properly if it is not communicated well. Like the proper stratification, the proper presentation depends on the individual manager. Many media can present information to managers, and each has its strengths and weaknesses. Those media include:

- *Printed Reports.* Printed reports are often the most useful form of presentation because they can present a large amount of stratified information in a relatively small space. In addition, they do not require any particular expertise to use. However, a printed report may not present information in such a manner that draws attention to points of interest, and information contained in a printed report is very hard to manipulate further.
- *Graphics.* Graphics is a powerful medium for presenting information in such a way that its significance is immediately and intuitively apparent. Unfortunately, each graphic display can contain only a small amount of information, and generating graphics is a relatively difficult process.

- *Data Dump.* A data dump consists of giving a body of grossly stratified, formatted data to a manager in a computer-readable form and allowing the manager to personally use a computer to determine the presentation and fine stratification and to alter them at will. It places the burden on the manager to discover the significance of the data and requires that the manager use the many automated manipulation tools available to him.

The appropriate presentation media depends on the stratification chosen by the managers. A manager who merely wishes to monitor a few well-chosen strata will often present those strata with graphics; a manager who, on the other hand, likes to have mountains of fine detail readily available would be well-served by learning to use a data dump. In any case, information personnel should be conversant with the various possible media and should help managers choose well.

CHAPTER 4

MEETING MANAGEMENT INFORMATION SYSTEM REQUIREMENTS

In the previous chapter, we described NIH's acquisition information requirements and introduced the concept of the acquisition MIS to meet them. In this chapter, we discuss the resources needed to implement the acquisition MIS.

THE CURRENT NIH AUTOMATION ENVIRONMENT

Two primary resources are now available to provide raw data to acquisition managers: the ADB and the Public Health Service Contract Information System (CIS). Although those resources contain an impressive quantity of data, those data are very difficult to extract for use in management reports. Because the ADB and the CIS form the bulk of easily available data resources, we analyze both in detail.

The Administrative Database System

The ADB is an agency-wide database system that has undergone continual development and expansion since its inception in 1977. It was developed primarily to replace the manual NIH accounts payable system that had effectively collapsed. Consequently, the ADB was not designed to be an "information system," but rather to be an efficient transaction processing system, and it has retained that orientation. Other applications that have been added have made the ADB increasingly complex and fragile. Today, it consists of 23 interrelated databases supporting more than 300 applications programs. Its current acquisition mission is as follows:

- Provide on-line support to the NIH acquisition system, including the automation of the procurement and supply processes (including DELPRO)
- Provide accounting and other financial management support to the Division of Financial Management
- Provide NIH with an integrated transaction-processing system that controls and manages the flow and processing of acquisition data through the system
- Respond to the internal and external reporting requirements of NIH relative to transaction flow

- Support the NIH user community by providing a means for acquiring goods and services.

However, acquisition is only part of the ADB mission. It also supports other functions, such as travel requests, and performs the budget and accounting chores for them. For that reason, changing the ADB is very difficult since a change in one of the programs or databases involves changes in many other, interrelated parts of the system.

The ADB is supported by the Data Management Branch of the Division of Computer Research and Technology. That division is the central NIH resource for systems design, analysis, and programming. The Data Management Branch provides those services for ADB-related applications, operates under the NIH Service and Supply Fund, and charges NIH customers on a fee-for-service basis. It develops application programs and user-oriented tools for data management and information processing.

Designed and implemented more than 10 years ago, the ADB reflects the technology of that time. For the ADB, the Division of Computer Research and Technology uses the IBM Information Management System (IMS), which supports batch processing and teleprocessing applications operating on IBM System/370 hardware. User application programs are written in COBOL. IMS fields are grouped into segments, segments into records, and records into a database. Segments are related by a hierarchy, or tree structure, different from some of the more modern DBMS, which are relational in structure. Thus, producing information from the mass of ADB data requires the services of a skilled programmer.

The ADB input and edit screens used by acquisition system customers are modeled after the forms used at NIH when the original system was designed and have been modified slightly over the years. The Data Management Branch has been attempting to better standardize the nomenclature used on those screens. At present, the screens cannot accommodate any more fields to handle additional data and no data can be added to the ADB record structure. If new data are required, existing data must be eliminated.

The ADB is a highly effective transaction-processing system. In FY88, it handled almost 350,000 acquisition orders involving more than 860,000 different items. It is capable of producing recurring reports on a routine basis, and a few of

them are used by acquisition managers. However, the gaps in the data in the ADB and the inability to integrate data from other NIH systems have severely limited the usefulness of those reports.

Ad hoc management reports involving ADB transactions are requested through a batch-oriented process that needs programmer support because of the complexity of the systems involved (the programmers are from the ADB maintenance staff). In the past, acquisition managers have had great difficulty getting the reports they need because four steps are necessary for each requirement:

1. *The functional manager must communicate the requirement to the programmer.* Because the functional manager and the programmer do not share a common knowledge base, the requirement is communicated incorrectly more than half the time.

2. *The programmer must program the query.* The requirement must not only be correctly programmed but must also compete with other needs for computer and programmer time.

3. *The query must be run against the database.* Since the database is highly complex, inaccurate queries often result in critical information being left out of the product or reams of unnecessary and unwanted detail being produced.

4. *The resulting printout must be returned to the functional manager.* Printouts can and do become lost, leaving the manager unsure of the fate of his or her request.

Because of that awkward four-step process and the gaps in the data collected by the ADB, NIH acquisition managers have often found it impossible to extract needed information on a timely basis. Thus, they have been unable to fully exploit the ADB's wealth of acquisition data for management information purposes.

The PHS Contract Information System

The objective of the PHS CIS is to provide a single source of PHS procurement award data that will satisfy PHS reporting obligations to the Department Contract Information System (DCIS) and the Federal Procurement Data System (FPDS) and at the same time meet the information needs of PHS management. Each PHS agency is required to report data to CIS in an automated manner, usually with a tape, on a monthly basis. NIH makes two submissions: one contains R&D contracts data from the Director, Division of Contracts and Grants, and a second contains all other NIH procurement action data from the Director, Division of Procurement. Thus, the CIS

is actually two systems: the PHS-level system that processes the agency data and the NIH system that collects the data for PHS. In our discussion of the CIS, we refer to the Director of the Division of Procurement's NIH-level "feeder" system.

The CIS began in 1977 in response to congressional requirements and originally required the collection of 25 data elements for each contract. It has grown dramatically over time, and now, more than 50 data elements are collected. That growth trend is expected to continue.

NIH's CIS database contains data on all contracts that were active at any time or that obligated funds during the fiscal year. Data for each contract in the file include every action made during the life of that contract. (Other data on small purchases, orders from GSA or the FSSs, and orders under a BPA must be separately extracted from the ADB and submitted to PHS.)

Data for each contract action must include every transaction made during the life of that contract that affects the contents of the database. A separate computer record is required for each action being reported.

In the Division of Procurement, CIS code sheets are manually prepared and submitted for each of the following contract actions:

- New definitive contracts
- New indefinite delivery contracts
- New contract resulting from Master Agreement/Basic Ordering Agreement (BOA)
- New letter contract
- Definitive contract superseding letter contract
- Renewal
- Modification
- Continuation
- Termination for cause
- Termination for convenience.

All CIS code sheets require the section manager's approval and are manually key-entered. Some of the same data, collected for other purposes, are also key-entered into the ADB.

Like the ADB, the CIS is managed by the Division of Computer Research and Technology; however, unlike the ADB, it does not have a dedicated support staff. As a result, acquiring management information from the CIS is even more difficult than from the ADB because with the CIS, a functional manager must acquire the services of a programmer from other systems on an "as available" basis.

FUTURE AUTOMATION ASSETS

What NIH needs is a new ADB that incorporates its acquisition management information requirements. An effort is now underway to produce such a system. The Data Management Branch has presented to the Office of the Director, NIH, a plan to redesign the ADB to take full advantage of the latest computer technologies. To begin this long-term effort, the Division of Computer Research and Technology plans to award a contract for the ongoing maintenance of the ADB, thereby releasing in-house personnel to begin redesigning this vital database system. The ADB redesign project is expected to begin in FY92, and culminate with a completely redesigned system by FY97.

The largest single advantage for users of acquisition management information is the possibility that an advanced relational DBMS will be installed. With a relational DBMS, users can access the data without having in-depth knowledge of the data structure inherent in the system. With the addition of "user friendly" fourth-generation languages, the redesigned ADB can provide on-line processing of source data without need for the present programmer-intensive batch system.

In addition to the relational DBMS, other improved hardware and software tools will be available. In the fall of 1989, the Division of Computer Research and Technology awarded IBM a major contract for between $600 million and $800 million in computer equipment and services over a 10-year period. The initial purchase included several IBM 3090 Model 600 mainframe computers. High-speed transaction processing, interactive database management, and batch-processing functions are to be provided by additional smaller IBM 3090 Model 300 computers. That contract also affords NIH the opportunity to replace the old, obsolete software packages such as

TSO (which was first released in 1971) and WYLBUR (which was developed by Stanford University in the late 1960s).

In addition to improving current operations, a successful ADB redesign may provide new capabilities to improve both management information and day-to-day operations. Examples of those potential improvements include the following:

- Maintaining and providing access to historical data on vendor or contractor performance.
- Providing access to on-line, machine-readable catalogs of supplies that are available to NIH users. Catalogs could be maintained in databases, on video disks, or on compact disk (CD) read-only memory (ROM). The new ADB could provide a front-end guidance system to take the user through these resources to help with the selection process and then relate it back to the acquisition.
- Generating machine-readable reports to the requester rather than always providing hard-copy output. Reports could be downloaded from the ADB to a user's local computer and delivered on a floppy diskette or other appropriate medium. Users could further manipulate data and print all or some of the reports.

If the redesign of the ADB is to be successful, the Director of Acquisition Management must take an active role. The best way to do that is to maintain liaison with the Division of Computer Research and Technology redesign team and ensure the personnel who provide that liaison are thoroughly conversant with both the information needs of acquisition managers and the capabilities of the ADP technology.

Since this large-scale redesign, conversion, and implementation project for a "new" ADB will not be completed for 8 years, the Director of Acquisition Management must seek an interim MIS.

The Interim MIS

Between them, the current ADB and CIS contain about 80 percent of the raw source data needed to support NIH acquisition management information needs. Unfortunately, those data are very difficult to extract, process, and present because of the age and fragility of the systems. Because both the ADB and the CIS must retain their present forms to meet external requirements, it is impractical to replace them now; in the same manner, their fragility makes them very difficult to modify. Thus,

NIH acquisition management must find the best way to get information from those systems in spite of the "user-hostile" environment.

We believe that NIH acquisition managers need more help from a team of ADP technical specialists to make the best use of current resources. That team can use available tools to extract the information as needed. However, in order to provide responsive support, the team should also have a firm understanding of acquisition and should be responsible directly to the acquisition staff. We will develop this concept in more detail in the next chapter.

In addition to the difficulty that must be faced when using the ADB or the CIS for management information, gaps exist in procurement document tracking and warehouse material tracking. Those gaps permit critical data to go uncaptured by the ADB or the CIS. Filling those gaps is an important issue that we address below.

Filling the Data Gaps

The ADB and the CIS do not capture the data needed to support NIH acquisition managers in tracking either procurement documents as they pass through the system or the flow of warehouse material. Those are not unique requirements; other current systems can meet them. We believe that those other systems may be useful in filling the data gaps, at least until the redesigned ADB can meet the need. We describe those systems in the following subsections and then suggest some criteria for selecting one or more of them to meet NIH's needs.

NIH Procurement Document Tracking Systems

Preaward Tracking System. Begun in 1983, the Preaward Tracking System (PATS) of the NCI was developed with the assistance of a contractor, General Sciences Corporation. The software was prepared using the Statistical Analysis System and is supported on a computer located in the Division of Computer Research and Technology. WYLBUR is used as the interactive text editing service to introduce data into the division's computer. Only one IBM 3270 terminal is located in the Research Contracts Branch of the NCI for input and querying of the PATS. However, new upgrades permit personal computers (PCs) to access PATS and eliminate the one-terminal limitation.

PATS allows the NCI contract specialist to monitor dates associated with a request for proposals (RFP) or contract as it proceeds to final award. Target dates are

initially developed and entered into PATS when the procurement is first planned by the project officer. Revised dates are entered as the process moves ahead of schedule or falls behind. Actual dates are also captured as each step is completed. At any step, NCI administrative officers can determine the status of any procurement for which they are responsible.

NCI manages and operates its procurement program using PATS. For example, one report informs each contract specialist of actions that are to be accomplished in the upcoming month. Another report informs the specialist of actions that were not accomplished within 9 or more calendar days of the target date. These reports alert procurement managers to situations that require their attention. NCI also has automated various standard contract formats using word processing software. With this capability, it is possible to issue a unique final contract, ready for signature, in a matter of hours.

PATS is a highly capable system for tracking the progress of procurement documents. While the software system is maintained by a contractor and was written specifically for NCI, DP should have little difficulty using the contract operating sections. Installation by a contractor would keep the expenditure of in-house manhours as low as possible. Unfortunately, PATS only tracks actions up to the point of award. To track postaward actions, it would have to be supplemented by a system like the Contract Administration System (CAS).

Contract Administration System. The CAS runs on standard PC hardware and peripherals. It is menu-driven and is designed to facilitate data input. Each contract specialist in NCI's Research Contracts Branch is responsible for typing required data into the CAS PC. Because only one PC is used, the specialists (or purchasing agents) must schedule the PC for 2-hour sessions of data input. All branch staff members have been trained to use the CAS.

The CAS is used to monitor all contract administration in the branch. The reports generated by the system show how well the specialists are monitoring their contracts; each specialist typically has 20 to 25 contracts to monitor. If, for example, a specialist fails to send out a follow-up letter on a delinquent deliverable, the system reports the oversight to the team leader and to the Director of the Division of Contracts and Grants. The specialist must then explain in writing why the required action was not taken.

CAS also tracks activities to be performed by NCI project officers. If required reports are not submitted as scheduled, CAS prepares a report to alert the Chief of Projects and the Administrative Officer that the report is delinquent.

Systems of the National Library of Medicine. The Chief of the Acquisition Branch of the National Library of Medicine (NLM) has developed effective automated systems for tracking both contracts and purchase orders. While PATS and CAS track only R&D procurements, the NLM systems track station support procurements as well.

Once procurement planning is completed, the NLM contract management system records the estimated date that the procurement request is scheduled to arrive in the Contracts Office. It later records the actual arrival date alongside the estimated date and reports any slippage from the project schedule. The request is tracked through all stages including the development of specifications, open-market solicitation, technical review negotiation, and final award. The team leader tracks the progress of each contract and is alerted to any unreasonable delay. After award, each contract deliverable is tracked and the contractors are monitored to determine whether they are meeting the delivery requirements of the contract. Finally, the system ensures the contract is fiscally complete and properly closed out and retired. The Chief of the Acquisition Branch advised us that the PC-based software for the system is available to other contracting officers at NIH.

The NLM's Acquisition Branch, using dBASE III software, has also developed a purchase order tracking system. That system provides requisitioners with ready access to a database that instantaneously gives them the status of any of their small purchase requisitions. In that system, the purchasing agent receives a hard copy of a requisition from the program office and uses the DELPRO system to prepare the purchase order. The agent then enters all the relevant information into the purchase order tracking system: requisition number, purchase order number, vendor, description, delivery date, and award amount. It takes about 30 minutes to enter 15 requisitions into the tracking system. The system also provides management reports that show workload assignments, completions by each agent, total workload, and the aging of each requisition.

Division of Engineering Services Information System. Branch C is unusual in that it conducts only construction and architectural and engineering procurement, and its only customer is the Division of Engineering Services (DES). Because of its close relationship with DES, its need for procurement tracking information closely parallels DES' need for job-order tracking information. Integrating those requirements makes more sense than having a separate stand-alone system for Branch C.

The current DES information system is a workload-tracking system for controlling the architecture, engineering, and facilities maintenance program on the NIH campus. Its management reports provide current status on the hundreds of job orders active at the NIH campus at any one time and summarize workload and financial information for senior DES management. It is a mainframe-based system and runs on the computers at the Division of Computer Research and Technology.

With minor additions, this system can provide the procurement management information needed by Branch C and by senior acquisition management regarding Branch C's workload. Branch C's job is to provide procurement support for DES's mission, and the system provides an accurate picture of that mission. Even though the system does not contain procurement data regarding the job orders it tracks, Branch C managers use the system's reports now to remain current on the branch's workload. If the system added the procurement tracking capability needed to meet acquisition managers' needs, it would also be able to provide DES managers with better information on the overall progress of their projects.

DES managers are aware of the need to incorporate procurement data for their own use into the system and are beginning a redesign effort to do so. With proper coordination, the system can be modified to meet the needs of acquisition management as well.

Other U.S. Government Systems. We examined other Government systems for possible use at NIH. In general, we discovered that those systems were incompatible with NIH's need for small-scale interim tracking systems. While much current effort is spent to automate procurement tracking, especially in the DoD, we found that many of the systems were built to support a specific local database or procurement office and were thus highly specialized and not particularly flexible. In addition, we found a substantial difference between the regulatory environment of the agencies

that designed those systems and the environment under which NIH operates. This incompatibility means that those systems have very little to offer NIH, whose particular needs vary greatly from the needs the other systems were designed to meet.

In spite of the general inapplicability of the systems themselves to NIH's short-term needs, we believe that NIH can gain some valuable insight into the redesign of the ADB by examining what the other systems can do. Most of them do far more than merely track the progress of procurements. Among the many notable DoD systems are the following:

- The Base Contracting Automated System (BCAS) is an Air Force small-purchasing system that provides automated requisitioning, payment, tracking, and status. It is scheduled to be upgraded to provide database query and automation of contracts as well as small purchase information.
- The Navy's Contract Administrative Management Information System (CAMIS) is a postaward contract administration system. It runs on IBM PC hardware and provides postaward tracking, contract closeout, and financial management functions.
- The Standard Army Automated Contracting System (SAACONS) will provide a large, Army-wide system for base-level contracting and small purchasing. It will also provide a comprehensive capability for "cradle-to-grave" contract automation, with many useful features such as on-line FAR search capability.

Evaluating Procurement Tracking Systems

In general, we believe that the NIH systems described in this section meet the need for procurement tracking. Each of the systems has strengths and weaknesses and is capable of contributing a certain part of the solution to the procurement tracking problem. Those strengths and weaknesses are described in general terms in Table 4-1.

Adopting one or more of them would probably meet DP's short-term need for information without being too expensive, and we recommend that NIH take this course of action as the interim systems are implemented.

Given the information requirements detailed in Appendix C, a modified implementation of CAS and PATS appears to be the appropriate choice. However, the process by which NIH managers determine their critical performance standards

TABLE 4-1

STRENGTHS AND WEAKNESSES OF NIH PROCUREMENT TRACKING SYSTEMS

System	Strengths	Weaknesses
PATS	• Contractor-maintained • Automatically generates target dates • Capable of extensive management reporting • Runs on Division of Computer Research and Technology mainframe	• Tracks preaward activities only • Designed for R&D tracking, not station support • Tracks contracts only • No direct connection to CAS
CAS	• Contractor-maintained • Automatically generates target dates • Capable of extensive management reporting • Runs on IBM PC	• Tracks postaward activities only • Designed for R&D tracking, not station support • Tracks contracts only • No direct connection to PATS, ADB
NLM Tracking System	• Tracks both preaward and postaward activities • Tracks contracts and small purchases • Capable of extensive management reporting • Runs on IBM PC	• Entire system on one PC • No direct connection to ADB • In-house maintenance
DES Workload Tracking System	• Comprehensive tracking of all Architect and Engineering (A&E) contracts • Integration of procurement tracking already planned • Runs on Division of Computer Research and Technology mainframe	• Tracks A&E procurement only • System not under DP control

is certainly not complete. The need to measure those standards, once determined, should dictate the specific requirements for information and thus also determine the means for providing it. None of the NIH systems contains all the information that could conceivably be needed. NIH should first determine what information is most

important, and only then decide which interim systems can best provide that information.

Warehouse Tracking

Because of a perceived need to maintain tight control over its material shipments, the Supply Branch is already keeping manual records of picking, shipping, and delivery. Those records currently allow supply managers to track a particular order if they are willing to delve into the paper audit trail. Unfortunately, the system does not lend itself to reporting aggregate performance to senior managers, and the collection of the data is a time-consuming manual effort.

We believe that approach to controlling operations and providing management information falls short of what is required. In order to provide the information needed by managers and to reduce the time needed to collect the data, we believe that a bar code-based material tracking system is needed.

The use of bar coding has been shown in both commercial and Government applications to dramatically increase accuracy while at the same time reduce the time needed to collect source data. It also immediately places the data in machine-readable format so that the data can be processed easily into performance information.

While NIH has not used bar coding in material handling to any great extent, the U.S. Navy has extensive experience in doing so. Most Navy systems use portable readers at strategic points to record the passage of material and load the resulting data into PCs for processing or for transmission to a larger MIS. Bar codes are placed on the material or source documents through several means:

- Printing them directly on the source documents with a laser printer
- Using commercially printed, serially numbered bar code labels and manually identifying to the computer which material is associated with a particular label
- Printing appropriately numbered labels as required and applying them to the material or documents.

While we did not find any Government or commercial systems that can be used as-is by NIH, the basic system is simple and can be constructed by an experienced developer at little cost. NIH may be able to use the Navy's experience in building a

bar code-based material control system by using Navy systems design staff (or one of their experienced contractors) on a short-term, cost-reimbursable basis. One installation that performs this service on a routine basis is the Navy Regional Data Automation Center (NARDAC) in Norfolk, Va.

CHAPTER 5

RECOMMENDATIONS

In this section, we present our six principal recommendations. The first two involve organizational issues while the last four directly concern the acquisition MIS.

RECOMMENDATION 1: DEVELOP AND USE GOALS, OBJECTIVES, AND PERFORMANCE STANDARDS

In the past, because NIH has managed its station-support acquisition effort using vague, subjective performance standards, it has had difficulty in communicating the method by which its acquisition goals were to be achieved and in determining how well the goals had been achieved. *We recommend that NIH concretely define its organizational goals, set organizational objectives to achieve them, and establish performance standards to communicate and measure them.* The goals should express exactly what NIH wants its acquisition organization to achieve; i.e., responsiveness, economy, and regulatory compliance.

Organizational objectives should proceed from the goals and should represent the method for achieving them. Each subordinate organization should have its own well-defined objectives. *We recommend that NIH adopt the stocking criteria specified in Appendix A* since they represent prospective objectives and methods for the warehouse that are in accord with this goal-centered strategy.

Performance standards should communicate the levels of performance to be achieved in pursuit of organizational objectives. *We recommend that where possible, the performance standards be objective, personal, understandable, attainable, flexible, measurable, and empirically derived.*

We recommend that NIH immediately develop a formal procedure for setting goals, objectives, and performance standards and establish them as soon as possible. Once that is done, the formal procedures can serve to modify the goals, objectives, and standards as conditions change and as experience is gained. The objectives and standards should be negotiated between senior and subordinate managers to provide a common basis from which the organization will be managed. We believe that this

recommendation is critical to the long-term effectiveness of NIH's station-support acquisition system and its use of the MIS in pursuit of that end.

RECOMMENDATION 2: MAKE MANAGERS RESPONSIBLE FOR THEIR OWN MANAGEMENT INFORMATION

We have observed a reluctance on the part of NIH acquisition managers to accept responsibility for their own management information, believing it to be solely the responsibility of computer personnel. We believe that such an attitude, which may have made sense when computers were extremely complex and not well understood, is certainly now obsolete. *We recommend that functional managers take an active role in the specification, production, and use of the information they need.*

NIH acquisition managers should be assigned the responsibility for acquiring the information needed to manage their organizations effectively. In practical terms, *we recommend that each manager be held responsible for the following six primary activities:*

- *Applying information to the management process.* To improve the performance of the organization, a manager must apply available information tools to the everyday problems of management.
- *Keeping a mission orientation.* Information is a costly resource that should be used at all times to enhance the main missions of the organization. MIS products that fail to do so should be discontinued.
- *Integrating information into the process of establishing standards.* When setting performance standards, managers should be sure that adequate information is available to measure the actual performance of subordinates against the standard.
- *Combining objective and subjective sources.* No single piece of information is adequate to measure a complex organization. Managers should acquire information from both objective and subjective sources, consider the value of each, and make decisions accordingly.
- *Meeting individual requirements for information.* Since no two managers manage an organization in exactly the same way, their information needs are different. Each manager should work to acquire the information that he or she needs to manage effectively.
- *Staying familiar with the resources available.* We do not believe every functional manager must become a computer expert. We do, however, believe the potential value of automation is such that all managers should

be "computer literate" to the degree that they recognize the opportunities and associated costs of this powerful management tool.

RECOMMENDATION 3: FORM A PERMANENT MANAGEMENT INFORMATION SYSTEM TEAM

The source data to support the acquisition MIS, when available, is scattered in several relatively inaccessible database systems. Personnel with expertise in automation and those with functional expertise must work together to extract that information from the data and present it in a useful manner. Because information needs change often, that expertise is needed on a continuing basis. *We recommend that the Director of Acquisitions Management form a permanent MIS team and assign that team to the Director's staff to support his requirements, the requirements of the Director's Office, and those of subordinate managers.*

We have seen a "knowledge gap" at NIH between the functional managers and the computer professionals who know how to use the management information capabilities of the ADB and the CIS. We believe that a full-time MIS team is needed to bridge that gap on a permanent basis. The mission of the team would be to provide the information necessary to manage NIH acquisition in the most effective manner. In order to do that, the team should take the following actions:

- *Interact with functional managers and the Division of Computer Research and Technology.* The team should have expertise in both acquisition and computer technology, and that expertise would provide the effective communication needed to exploit the ADB and the CIS. Furthermore, with their own in-house computer expertise, acquisition managers could use other Division of Computer Research and Technology resources that are available.

- *Manage acquisition information resources.* The team should be able to integrate data from all sources and present those data so that they provide useful management information. Where necessary, the team should manage and operate in-house ADP resources, such as stand-alone tracking systems and database reporting programs. In addition, the team should assume the management of the CIS to dramatically improve its responsiveness to information needs.

- *Coordinate the ADB redesign for acquisition management.* As the team gains experience in the management information requirements of acquisition managers, it is in an ideal position to provide effective liaison with the Division of Computer Research and Technology's ADB redesign

effort. The MIS team should initiate a systems criteria identification process to make the liaison as effective as possible.

- *Stay current with technical developments.* The team should assure new ADP tools are applied to acquisition management information problems where practical.

- *Assist managers in using information resources.* As it develops and uncovers new information resources, the team should help educate acquisition managers in using them to meet their management information needs. It should also be able to give advice and guidance in the most effective use of current resources.

- *Analyze cost/benefit tradeoffs.* The team should assist acquisition managers in determining the most cost-effective means of meeting their information needs.

We believe that the team should support both the Division of Procurement and the Division of Logistics. For this reason, *we recommend that the MIS team be part of the Director of Acquisitions Management's staff.* Because the mission of the team is to provide information from all sources to acquisition managers, the team should not belong to the Division of Computer Research and Technology, which does not represent all sources.

Initially, we believe that two additional professionals with appropriate administrative support and one current professional can effectively constitute the team. This estimate is based on our observations of Acquisition Support's Review and Analysis Section, which currently undertakes part of the MIS team's mission. The non-MIS tasks currently performed by the Reports and Analysis staff, such as contract closeouts and keypunch for the CIS, should remain in the Division of Procurement. The MIS tasks currently performed by the Reports and Analysis Staff should be transferred to the team, along with one professional full-time equivalent (FTE) to perform them. The breakout is detailed in Table 5-1.

The qualifications of the two new professionals should reflect the needs of the team. One should be a management-level functional analyst with both procurement and logistics experience and experience with ADP technology. The other should be a journeyman-level systems analyst with small and large systems experience and some procurement or logistics experience.

Later, as the team manages more systems and the redesign of the ADB accelerates, additional personnel may be required. The requirements for

TABLE 5-1

FTE REQUIREMENT FOR MIS TEAM

(Does not include administrative support)

Function	Current FTEs	Proposed FTEs
Manage information personnel	0.3	0.4
Manage Contract Information System	0.1	0.5
Provide ad hoc reports from ADB/CIS	0.5	1.0
Provide consultative services to managers	0.2	0.5
Assist in redesign of ADB	0.0	0.1
Manage design and maintenance of MIS	0.0	0.5
Coordinate and conduct training	0.0	0.1
Maintain currency with functional disciplines and technology	0.0	0.1
Total FTEs	1.1	3.2

management information will almost certainly increase once managers learn its value and the MIS team must be staffed to satisfy them.

RECOMMENDATION 4: DEVELOP A FORMAL MANAGEMENT REPORTING SYSTEM

Acquisition managers at NIH can meet their objectives more readily if they are able to measure their progress. *We recommend that NIH build a formal information system to support the measurement process.*

While the overall management climate of NIH acquisition is dynamic, many of the day-to-day operations of the system may be effectively monitored with established reports. In Appendix C, we suggest the basic information we believe is required. However, we must emphasize those suggested information elements are

only a starting point; an effective system will change over time in response to changing individuals, missions, and management priorities. In addition, the reporting system should exhibit the following useful characteristics:

- *Top-down design.* The system should be designed to measure how well acquisition is being performed in accordance with NIH objectives. Information for subordinate managers is presented only to show how well the individual subordinate organizations are contributing to those objectives.

- *Built-in flexibility.* The formal reporting system should merely identify conditions that may require a manager's attention. The manager must be able to re-examine and further manipulate the source data to better illustrate the nature of the condition. The formal reporting system should consolidate its extracted source data in a DBMS that allows this flexibility.

- *The ability to relate performance to standards.* Acquisition performance should be reported by the system in such a manner that managers have little doubt that subordinate managers are meeting their performance standards.

- *A common frame of reference.* The system should present performance information in a way that is consistent from the top of the organization to the bottom. This consistency will provide a common basis for understanding performance standards and will keep managers from having to respond to statistics whose origins are unclear.

- *Ability to provide meaningful statistics to senior management.* Senior managers must have valid statistics upon which to base their decisions. The managers must be given only those statistics that best reflect the performance of the system in meeting its objectives.

We estimate that about 80 percent of the data needed to support the formal reporting system are available in the ADB and CIS. To acquire the other 20 percent, it will be necessary to establish the following three small systems to collect and forward data to the reporting system database:

- *Warehouse tracking system.* At the current time no issue, shipment, or delivery data are collected from the NIH warehouses. Without those data, the Division of Logistics is not able to measure how effectively and efficiently material is being issued nor how quickly it is being delivered to the customer once it leaves the warehouse. A stand-alone system must be devised to do this.

- *Procurement tracking system.* To control the procurement process, managers mut have a method of tracking documents through the system. Such tracking will not only aid in following individual actions, but also reveal the

performance of the contract operating sections' processes as a whole, once empirical performance standards are established on the basis of experience.

- *A&E procurement tracking system.* While the need to track the progress of the A&E procurement in Contract Branch C is the same as that for the other contract operating sections, the different processes at work, the heavy load of contract administration, and the close relationship with NIH's Division of Engineering Services make a separate stand-alone system unwieldy. Instead, the MIS team should coordinate an add-on to the Division's current project control system that collects procurement tracking data. The system is currently undergoing redesign and will soon incorporate some A&E procurement-activity tracking capability.

As we pointed out in the previous chapter, several software systems at NIH and in other Federal agencies could serve as models for the new systems. *Because development of custom automated systems is difficult and expensive, we strongly recommend that NIH find the pre-existing systems that come closest to its requirements, modify them appropriately, and install them.* If it does so, we believe it can hold the cost of the new systems to under $50,000 each.

RECOMMENDATION 5: BUILD THE SYSTEM INCREMENTALLY

A successful MIS is one that changes and grows with the organization it serves. The designers of such a system must be intimately familiar with both the organization and the tools it has available. In addition, the functional managers who use the system must work comfortably with the system managers and both must take a proprietary interest in its product. Such is not the case with current NIH acquisition managers. *We recommend that NIH vastly increase the chances that the MIS will be successful by developing it slowly and giving it time to grow naturally.*

In contemplating an approach for the interim system, we recognized that MIS failures can generally be attributed to one or more of the following factors:

- Failing to correctly or completely identify user requirements
- Failing to provide flexibility in development life cycle, which prevents an iterative or experimental cycle from emerging and eliminates any chance to include new or additional requirements in the system
- Making systems too complex
- Giving inadequate attention to human and social factors in the design of the system when technical factors have been allowed to dominate.

NIH can avoid those problems by being patient in building the MIS. System builders and users must work together to construct a successful system, and building the system too fast is a prescription for miscommunication and failure. Management should resist the temptation to move too quickly unless it is willing to accept the associated risks. While we have suggested time frames for the completion of the steps, we caution that a decision to proceed on each step is premature until the objectives of the step outlined below are considered. The steps are described in Figure 5-1. We recommend that NIH follow the five steps listed below in building the MIS.

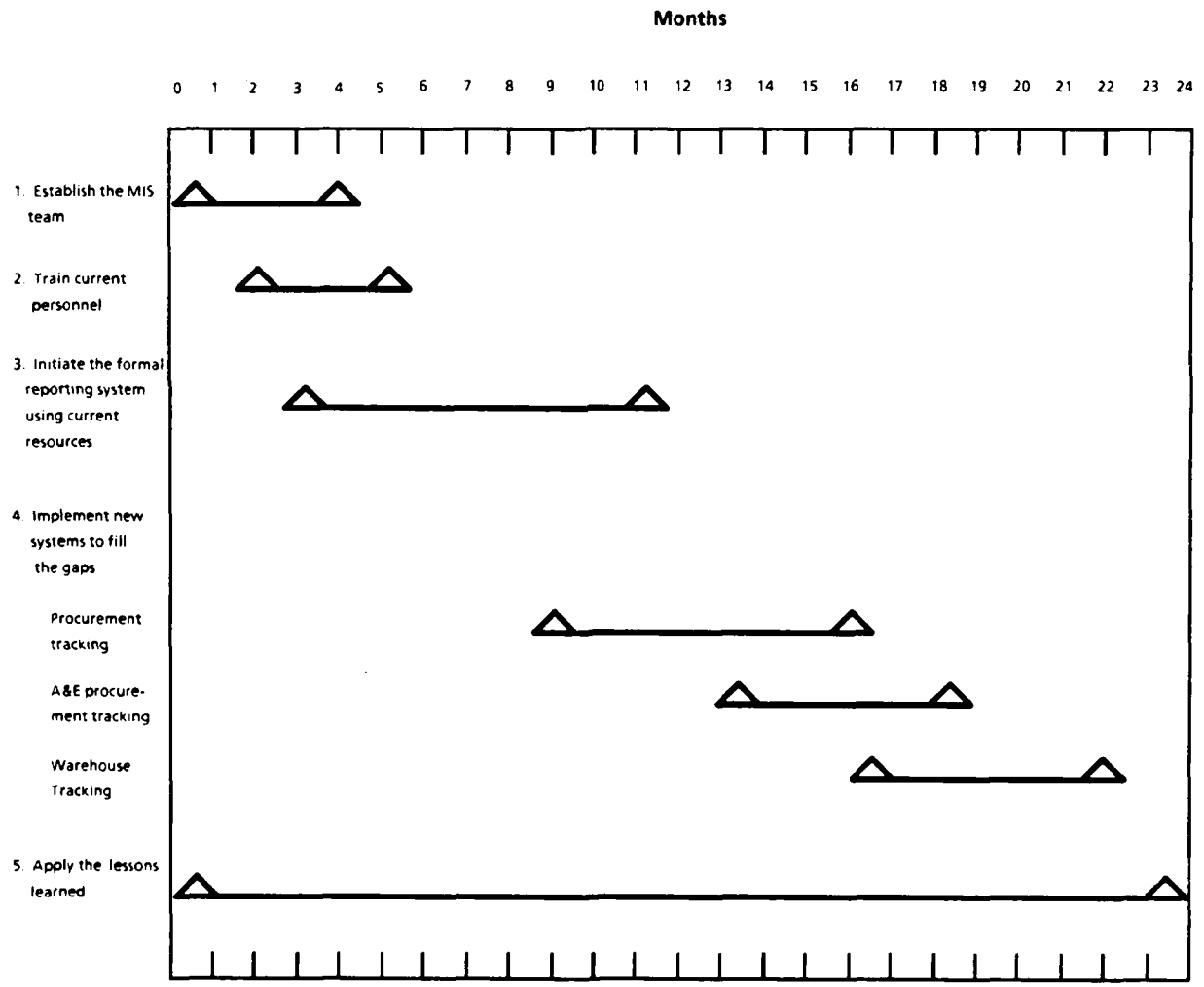


FIG. 5-1. DEVELOPMENT SCHEDULE FOR ACQUISITION MIS

STEP 1: Establish the MIS team. This step is critical. Team members are selected and trained in the appropriate functional areas and in the

NIH ADP environment. Some immediate improvement in management information should occur as the team is able to acquire information from the ADB and the CIS more easily. During this period, the team develops its critical working relationships with line managers and jointly develops the necessary trust and credibility to work together in building the MIS. This step should take at least 4 months.

STEP 2: *Train current personnel.* The team can then begin to provide the training that managers and staff need to use information resources. First, managers should be made "computer literate" in terms of the resources available to them. Then, critical staff can be trained to produce the ad hoc reports they need. Among the staff to be trained are supply item managers and DELPRO analysts.

Supply item managers should make the decision on whether to stock a new item in the warehouse on the basis of whether that item would improve the overall cost effectiveness of the inventory. To do so, they need to be trained to use tools such as WYLBUR to examine the ADB to identify likely candidate items for stockage. They also need to be trained to use automated resources (possibly PC-based) to assist in the process of evaluating the cost-effectiveness of their current items.

DELPRO analysts must carefully monitor the individual buying activities of its users to ensure they buy economically. To do that monitoring, they must determine whether particular commodities that are being purchased with a high degree of frequency are suitable candidates for negotiated discounts with the vendors through devices as BPAs and IDCs. Like the supply item managers, the DELPRO analysts must be able to manipulate the ADB and to use other automated tools to analyze customer behavior and demand patterns effectively and efficiently.

While training is a continuing process, we believe the introductory training we recommend should take about 3 months, depending on the availability of the trainees.

STEP 3: *Initiate the formal reporting system using current resources.* To begin development of the formal reporting system, the MIS team must first establish the "template" database from which it will generate the management reports. Once that is done, the team can begin to fill the database from the source data available in the ADB and the CIS and can then generate prototype reports. Since the ADB and the CIS can provide 80 percent of the total data needed, the prototype reports will have value. If they do not satisfy the information managers' needs, the reports can be changed relatively easily at this stage before NIH pays to collect unneeded data from new systems. This phase should

take at least 8 months in order to "work out the bugs" before they become expensive mistakes.

STEP 4: *Implement new systems to fill the gaps.* The building of new systems is the most difficult, time-consuming, expensive phase of the MIS development process. A knowledgeable, trained MIS team is essential to its success, even though existing software systems or contractor support may be used. This process will take at least 14 months for basic implementation of the three systems, and maintenance of the systems will continue indefinitely. Of all the steps listed here, this one is the most easily compressed. By developing the new systems concurrently, time can be saved if the team has developed the capacity to manage the added load.

STEP 5: *Apply the lessons learned.* The MIS should be a living entity, changing constantly as the acquisition system changes. Keeping up with those changes and modifying the system to do a better job will be a continuing challenge for both managers and the MIS team. The lessons learned in doing that will be invaluable as the ADB is redesigned to accommodate the management information needs of NIH acquisition managers.

RECOMMENDATION 6: DESIGN FOR CHANGE

At NIH, the acquisition process takes place in a dynamic environment and the needs for management information change. While information can sometimes be generated at a lower cost by choosing less flexible techniques and tools, we believe that the long-term maintenance cost of inflexibility negates any short-term cost advantages. *We recommend instead that the following design specifications be chosen for the MIS to specify flexible hardware, software, and procedures.*

- *Relational DBMSs*
- *Structured programming*
- *Industry standard hardware*
- *Industry standard software*
- *"User-friendly" applications generators*
- *Strict documentation standards.*

The cost of providing management information will be high. We estimate that the MIS will require two new FTEs and that the small systems needed to fill the data gaps will cost approximately $150,000. In addition, complete implementation of our

recommendations should take about 24 months. We believe, however, that the added effectiveness the system gives acquisition managers will pay for it many times over.

As a final word, we emphasize that the acquisition MIS is a dynamic system that changes as the management environment changes. Its true measure of success, over time, is the value of its contributions to managers' abilities to further NIH's acquisition goals of responsiveness, economy, and regulatory compliance.

APPENDIX A

STOCKING CRITERIA

STOCKING CRITERIA

We believe that the objective of the warehouse operation as an integral part of the overall National Institutes of Health (NIH) acquisition process should be to provide material at the lowest possible cost within the constraints of quality and responsiveness. The measure of cost reduction should be the incremental difference in the cost to supply the material through the warehouse and the cost to supply it through other procurement means. We term that incremental difference the *net cost avoidance.*

The operation of the warehouse can be described as a three-step process:

- Procure material in large quantities and thus obtain significant volume discounts
- Store that material in a cost-effective manner
- Deliver the material to NIH end users in the smaller quantities that they need.

Each item stored by the warehouse should contribute to the goal of net cost avoidance and should be individually evaluated on that basis. We believe that absorption costing – the inclusion or absorption of all costs associated with an item – is the most valid technique for establishing the value of an item in central supply. Thus, the cost of stocking an item should include the costs of acquiring it, storing it, and issuing it and its pro rata share of the administrative cost of the supply system. That total cost should then be compared with the net cost of procuring the item through other means such as Delegated Procurement (DELPRO); the difference is the net cost avoidance for the item.

The decision on whether to stock a new item should be made on the basis of whether the item would improve the overall cost-effectiveness of the inventory. Thus, the standard of comparison for new items is the cost performance of the items currently in inventory. Before new items are evaluated for stock, the current items must be evaluated in terms of cost-effectiveness. This effort should produce a priority

listing of current stock that not only identifies the most cost-effective items but also suggests items that should be candidates for elimination.

Since a thorough analysis of an individual item is labor-intensive, NIH cannot analyze each one of the thousands of items purchased by the NIH bureaus, institutes, or divisions (BIDs) each year. We believe that a two-step approach would be appropriate for assessing cost-effectiveness.

The first step would be a screening process to identify likely candidate items for stockage. This step would consist of the use of simple algorithms – procedures – to facilitate an automated screening process. Its product would be a priority listing of likely candidate items for further analysis by item managers. Because the screening process would necessarily rely only on rough demand data captured by the Administrative Database (ADB) and would not reflect the crucial conditions of the procurement market for an item, it should not be used as the only criterion for selection.

The second step is the analysis of the cost-effectiveness of items identified by the screening process. In this step, vendor discounts are identified, likely volume projected, and storage and overhead costs estimated. Also, other relevant factors, such as shelf-life constraints, special storage requirements, and availability of warehouse space, are identified. Those items that appear to be most cost-effective are then selected for stock.

Any stocking decision involves an element of risk. Demand patterns can and do change rapidly in a dynamic environment such as that at NIH; inevitably, some items will lose their cost-effectiveness and actually produce a net "loss" to the supply system. Those costs should be included in the overhead costs of the system. By continually tracking actual cost performance of the inventory and by adding and dropping items from stock on a regular basis, those costs can be kept to a minimum.

SCREENING CRITERIA

The criteria used in screening an item are based on the characteristics of currently stocked items. When each criterion is applied to a prospective new item, a certain number of points are awarded; those items with the most points should be analyzed first.

The following parameters are to be used for screening currently stocked items:

$\bar{s}$ = the mean monthly sales for currently stocked items in dollars

n = the number of line items currently stocked

$\bar{z}$ = the mean order size for current stock, in units per order

$\bar{s}_x$ = the mean monthly sales for the x^{th} item currently in inventory

d = the standard deviation of sales for currently stocked items

$$d = \sqrt{\frac{\sum_{x=1}^{n} \left(\bar{s}_x - \bar{s}\right)^2}{n-1}}$$

$\bar{v}$ = the mean volume of items sold from current stock per month

$\bar{f}$ = the mean number of BIDs purchasing 5 percent or more each of the total volume of currently stocked items sold.

The following variables are used for screening new items:

M = the number of months that change in demand has been observed for a new item (i.e., the total number of months observed – 1)

$\overline{M}$ = the mean value of the number of months that change in demand has been observed for a new item

$\bar{Z}$ = the mean order size for new item

$\overline{S}$ = the mean monthly sales for new item in dollars

V_x = the number of units sold in month x

$\overline{V}$ = the mean number of units of the new item sold per month

g = the number of BIDs purchasing 5 percent or more of the total sales volume of the new item

C_x = the percentage demand change in units sold from the mean number of units sold, observed for the new item in the x^{th} month of observation

$$C_x = \left(\frac{V_x - \overline{V}}{\overline{V}} \right)$$

$\overline{C}$ = the mean percentage demand change in units sold for the new item across all the months observed

$$\overline{C} = \frac{\sum_{x=1}^{M} C_x}{M}$$

B = the slope of the least-squares regression line relating the monthly observations of percentage change in demand:

$$B = \frac{\left(\sum_{x=1}^{M} x C_x \right) - \left(\overline{M} \sum_{x=1}^{M} C_x \right)}{\left(\sum_{x=1}^{M} x^2 \right) - \left(\overline{M} \sum_{x=1}^{M} x \right)}$$

E = the standard error of the least-squares regression line relating the monthly observations of percentage change in demand:

$$E = \sqrt{\frac{\left[\left(\sum_{x=1}^{M} C_x^2\right) - \left(\overline{C}\sum_{x=1}^{M} C_x\right)\right] - B\left[\left(\sum_{x=1}^{M} xC_x\right) - \left(\overline{M}\sum_{x=1}^{M} C_x\right)\right]}{M-2}}$$

Figure A-1 represents the relationships of those variables.

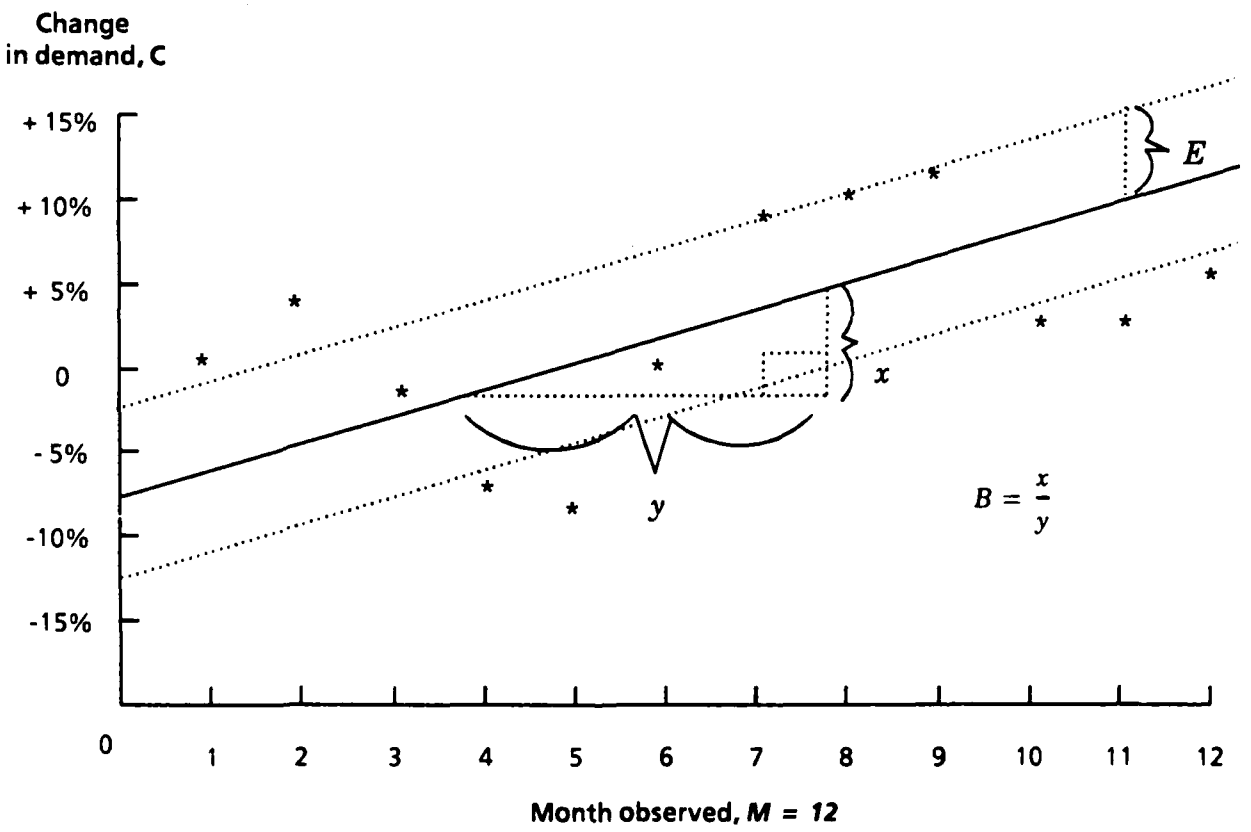


FIG. A-1. EXAMPLE OF DEMAND ANALYSIS OF NEW ITEM

Criterion 1: Eliminate Unsuitable Items

Those items that represent nonrecurring or short-term demands are eliminated by requiring a 7-month demand history and establishing a minimum volume

threshold for consideration. Items with a sharply declining demand are also eliminated.

(1.1) If M is less than 6, eliminate the item from consideration.

(1.2) If $\overline{V}$ is less than 1, eliminate the item from consideration.

(1.3) If B is less than -0.1, eliminate the item from consideration.

Criterion 2: Identify Significant Items

The sales dollar volume of a new item is compared with that experienced with current stock. Items that compare favorably with current stock are then weighted accordingly.

(2.1) If $\overline{S} > \bar{s} + d$, then award 30 points to the item.

(2.2) If $\overline{S} \leq \bar{s} + d$ *and* $\overline{S} > \bar{s}$, then award 20 points to the item.

(2.3) If $\overline{S} \leq \bar{s}$ *and* $\overline{S} > \bar{s} - d$, then award 10 points to the item.

(2.4) If $\overline{S} \leq \bar{s} - d$ *and* $\overline{S} > \bar{s} - 2d$, then award 5 points to the item.

(2.5) If $\overline{S} \leq \bar{s} - 2d$, then award 0 points to the item.

Criterion 3: Weight Secondary Considerations

Give added weight to those items with proven demand histories.

(3.1) Award $(M-6)$ points to the item (10 points maximum).

Award additional points to items that show increasing demand over time.

(3.2) If $B > 0.1$, award 5 points to the item.

(3.3) If $B > 0.2$, award 10 points to the item.

Give added weight to those items with a broad base of demand.

(3.4) Award $P - \bar{p}$ points to the item.

Award 2 points if the item has reflected relatively predictable demand in the past.

(3.5) If $E < 0.1$, then award 2 points to the item.

Discriminate items on the basis of the mean number of units the customer purchases on one order. If the lot size is large, the item is a natural candidate for warehouse stockage; if the lot size is small, the item may be considered for stockage in the self-service store.

(3.6) If $Z > 0.7\,\bar{z}$, then award 0 points to the item.

(3.7) If $Z \leq 0.7\,\bar{z}$, then award 2 points to the item.

DETAILED ANALYSIS

The detailed analysis of items identified by the screening process is necessarily a much less formal process. The desirability of stocking an item depends on many factors that must be examined informally. Among those factors are the nature of volume purchase discounts available from the vendor community, the determination of likely future demand changes, and the ability of current warehouse and personnel resources to accommodate the new item. We believe, however, that NIH's current system of "cradle-to-grave" inventory managers is particularly well-suited to perform this type of analysis.

As a guide, we present here a general equation that reflects the appropriate considerations for inclusion. We recommend that a set of these equations be produced, one for each line item stocked or considered for stockage. The equations would be based on historical information for currently stocked items and on projections for candidate items. The set can be used to evaluate the performance of items in inventory and suggest replacements for those that are not cost-effective.

First, the average price that customers would have paid for the item were it not stocked must be estimated. This price, P, can be estimated as:

$$P = (L \times (1 - D)) + \frac{C_{DEL} - C_{SUP}}{\bar{Q}} + \frac{o - \bar{a}}{\bar{Q}}$$

where

L = the current list price of the item

D = the average DELPRO discount for all supplies

C_{DEL} = the BID administrative cost per line for DELPRO supply orders

C_{SUP} = the BID administrative cost per line for warehouse orders

o = the DELPRO per-order charge less the portion attributable to accounts payable costs

$\bar{a}$ = the average number of lines purchased on a DELPRO supply order

$\bar{Q}$ = the average quantity purchased per line for the item

Some of these variables can be obtained directly from DELPRO historical data, while others must be obtained through surveys of the BIDs. (Such a study was completed in 1988 by NIH's Division of Management Policy, Office of Administration.)

Once P is estimated, the net cost avoidance can be calculated from the following general evaluation equation:

$$(4.1) \quad A = [S \times P] - [(F \times O) + (I \times H) + T]$$

where

A = the net annual cost avoidance achieved by the item. The objective of the supply system is to maximize the total cost avoidance of all items actually stocked.

I = the annual number of items sold.

F = the fixed overhead costs of the supply system that are most accurately allocated on a "per-order" basis. Those costs include administrative, automatic data processing (ADP) and inventory management costs.

O = the annual number of customer orders for the item.

H = the variable costs that are most accurately allocated on a "per-item" basis. Those costs include procurement costs, inventory adjustments, warehouse labor, and transportation expenses.

T = the annual cost of storing the item, based on the average cubic footage occupied by its economic order quantity. Included in this cost is warehouse lease expense, utilities, and any other costs incurred purely as a result of storage.

APPLICATION OF STOCKING CRITERIA

Material provided through the NIH warehouse should cost the customer less than material procured through individual purchase orders or DELPRO. The supply system produces savings through pooled purchasing based on NIH's total consumption. Its inventory should be dynamic, changing over time to meet changing demand.

A new item should replace an old one in stock only if it can save more money for NIH than the old one did. Estimating those savings requires a detailed analysis of the new item; however, the high volume of NIH purchases makes it impossible to carefully evaluate each DELPRO purchase for possible stockage. Thus, only the most likely candidates can be evaluated in detail. To identify those items, NIH should periodically screen DELPRO purchases over the most recent 12 months against a set of criteria. A list of the most promising candidates should then be produced, and as resources permit, items on that list should be evaluated in detail. In this section, we first describe the three screening criteria and then illustrate this process by examining whether to stock six hypothetical new items, A through F.

The key to stocking only the most cost-effective items is to add cost-effective new items to stock, replacing, if possible, less effective current ones. To do that, the cost effectiveness of a new item is directly compared with that of all currently stocked items. In addition, the characteristics of current stock are used as rough criteria to suggest new items for detailed analysis. Thus, before new items are screened, the analysis that we describe below must be performed for the current items in stock. That analysis will provide the benchmarks against which new items can be measured. For purposes of this report, we assume that the analysis of current stock is completed.

Screening Candidate Items

The records of DELPRO purchases for the past months are first analyzed to get a rough estimate of the demand patterns of items purchased. This analysis can be performed as a part of the ongoing effort to identify opportunities for consolidated procurement. (Given the current state of the demand data in the ADB, initial screening will be less accurate than desired; however, even a rough screening by catalog number should yield some likely candidates.)

Once demand patterns are identified, they are evaluated against three main criteria that suggest items suitable for stockage. The first criterion eliminates at the outset those items that are plainly unsuitable. The other two criteria establish a rank-ordered list of likely candidates by awarding points to an item based on its observed performance.

Criterion 1: Eliminate Unsuitable Items

Three tests are applied at this stage to eliminate from consideration those items that are unsuitable for stockage. First, since inventory systems work best when the items stocked are subject to high demand, if the items are ordered less than once a month (on the average), they should not be considered further (equation 1.1). Second, since the system should not stock items that have only a short-term demand, if the items have not been purchased regularly for the past 6 months, they should be eliminated from consideration (equation 1.2). Finally, items whose demands are declining more than 10 percent per month on average should not be stocked (equation 1.3).

Criterion 2: Identify Significant Items

The system should stock only those items that are likely to produce significant savings to NIH. One way to identify those items is to look for a high-dollar sales volume relative to items currently stocked. Three steps are necessary: First, the average annual dollar sales for stocked items must be calculated along with the standard deviation. (The standard deviation reflects the spread of values for the individual items in stock.) Next, the total dollar value of sales for the new item is

calculated and extended over a year. Finally, the value of the new item is compared to the value of stocked items in the following way:

- If the average annual sales for the new item are greater than the average sales of 84 percent of the items currently stocked, award 30 points to the new item (equation 2.1). (The figure of 84 percent was chosen because it represents a value that can be easily computed with standard statistical methods – the average monthly sales plus one standard deviation.)
- If the average annual sales for the new item are less than the average sales of 84 percent of the items currently stocked (average plus one standard deviation) but greater than the average sales of the inventory items, award 20 points to the new item (equation 2.2).
- If the average annual sales for the new item are less than the average sales of the items currently stocked but are greater than the average sales of 16 percent of the items (average sales minus one standard deviation), award 10 points to the new item (equation 2.3).
- If the average annual sales for the new item are less than the average sales of 16 percent of the items currently stocked (average sales minus one standard deviation) but are greater than the average sales of 4 percent of the items (average sales minus two standard deviations), award 5 points to the new item (equation 2.4).
- If the average annual sales for the new item are less than the average sales of 4 percent of the items, award no points to the new item (equation 2.5).

Criterion 3: Weight Secondary Considerations

Once the new items are awarded points on the basis of their relative importance, additional weight can be given to the following items:

- One with a long history of demand that demonstrates consistent use. Award 1 point for every month of demand recorded for the item in excess of 6 (10 points maximum) (equation 3.1).
- One that is subject to increasing demand over time. Award 5 points if the item demand is increasing at between 10 and 20 percent a month (equation 3.2); award 10 points if the demand is increasing faster than 20 percent a month (equation 3.3).
- One that reflects demand from many customers. Add 1 point for each different BID that purchases 5 percent or more of the total amount of the item purchased, minus the average number of BIDs similarly supporting currently stocked items (equation 3.4).

- One with predictable demand over time. Award 2 points if the calculated error of estimate for the new item is less than 10 percent (equation 3.5).
- One customarily ordered in large lots that can be stocked either in case or pallet quantities more easily. If the average units of the new item ordered by a customer at one time are greater than the average for the inventory as a whole, award 2 points (equations 3.6 and 3.7).

Example of Screening

Criterion 1: Eliminate Unsuitable Items

Assume that six items (A through F) are to be screened; the items are first passed through Criterion 1 to eliminate unsuitable items. Relevant information for the items is in Table A-1.

TABLE A-1

PERTINENT CRITERION 1 DATA FOR ITEMS A THROUGH F

Criterion 1 test	Item A	Item B	Item C	Item D	Item E	Item F
Average monthly volume	340	155	40	225	0.5	400
Months of demand history	7	6	12	5	9	10
Average demand change/month	2.0%	15.0%	-3.0%	2.0%	14.0%	-12.0%

While Items A, B, and C pass all of the conditions in Criterion 1, Items D, E, and F all fail and are eliminated: Item D has fewer than 6 months of demand history, Item E has an average monthly volume of less than 1.0, and the demand for Item F is declining in excess of 10 percent per month.

Criterion 2: Identify Significant Items

When Items A, B, and C are passed to Criterion 2, they are awarded points based on their dollar volume of sales compared with the sales of currently stocked items. The sales data for the items and the (hypothetical) average sales data for currently stocked items are shown in Table A-2. The standard deviation for currently

stocked items is also shown. Table A-3 shows how Criterion 2 is applied and points are awarded to each item.

TABLE A-2

PERTINENT CRITERION 2 SALES DATA FOR ITEMS A THROUGH C

Criterion 2 test	Current inventory	Item A	Item B	Item C
Average monthly sales	$21,000	$38,000	$19,000	$16,000
(Standard deviation)	$3,000	–	–	–

TABLE A-3

CRITERION 2 POINTS AWARDED TO ITEMS A THROUGH C

Average monthly sales	Points awarded		
	Item A	Item B	Item C
Greater than ($21,000 + $3,000)	30	0	0
Less than ($21,000 + $3,000) but greater than $21,000	0	0	0
Less than $21,000 but greater than ($21,000 – $3,000)	0	10	0
Less than ($21,000 – $3,000) but greater than ($21,000 – $6,000)	0	0	5
Less than ($21,000 – $6,000)	0	0	0
Total points, Criterion 2	30	10	5

Criterion 3: Weight Secondary Considerations

Once Criterion 2 points are awarded, the items are further evaluated against Criterion 3, and additional points are awarded if earned. The additional information needed to do this is presented in Table A-4. Table A-5 shows how Criterion 3 is applied and points are awarded.

TABLE A-4

PERTINENT SALES CRITERION 3 DATA FOR ITEMS A THROUGH C

Criterion 3 test	Current inventory	Item A	Item B	Item C
Months of demand history	–	7	6	12
Average demand change per month	–	2.0%	15.0%	-3.0%
Number of BIDs buying more than 5% of current sales	4	3	6	4
Standard error of estimate	–	5.0%	21.0%	17.0%
Average order size	3.6	2.4	7.9	4.4

TABLE A-5

CRITERION 3 POINTS AWARDED TO ITEMS A THROUGH C

Average monthly conditions	Points awarded		
	Item A	Item B	Item C
Item has more than 6 months of demand	1	0	6
Item has increasing demand	0	5	0
Many BIDs buying more than 5%	0	2	0
Item has predictable demand	2	0	0
Item is sold in large lots	0	2	2
Total points, Criterion 3	3	9	8

Screening Selection

After Criterion 3 is applied, the points awarded in Criterion 2 and Criterion 3 are added, as in Table A-6. The total points awarded each item indicate the relative likelihood of successful stocking – the more points an item is awarded, the earlier it should be examined in detail to determine whether it is really cost-effective to stock.

Thus, in our example, Item A should be examined first, followed by Item B, and then Item C in that order.

TABLE A-6

TOTAL POINTS AWARDED TO ITEMS A THROUGH C

Average monthly sales	Points awarded		
	Item A	Item B	Item C
Total points, Criterion 2	30	10	5
Total points, Criterion 3	3	9	8
Total points	33	19	13

Detailed Analysis

To decide whether to stock a new item, it is necessary to determine how much money each of the current items in stock saves and compare that savings with the savings that can be realized through alternative procurement means. Once that calculation is completed, the savings for a new item can be estimated and compared to the worst of the current stock. If the cost savings of the new item are estimated to be greater than those of the worst current item, the new item should replace the old item in stock.

We illustrate this process by comparing the hypothetical items above with the least cost-effective item in current stock, Item Z. For simplicity, assume that the items are to be stored in a warehouse that costs $120,000 a year for rent and utilities and contains 100 storage locations. Thus, each storage location costs $1,200 per year to maintain. Also, the supply system's per-item variable costs such as inventory adjustments, warehouse labor, and transportation are estimated at $6.50 per item sold, while the per-order fixed costs such as inventory management and ADP support are estimated at $2.75 per order (requisition).

Evaluating Items for Stock

In order to establish the savings in a currently or prospectively stocked item, its Economic Order Quantity (EOQ) must be determined. EOQ is the number of items to

be purchased in one lot from a vendor to maximize quantity discounts and minimize storage costs. The number is chosen to minimize the total cost of stocking the item.

As an example, assume Item A is packaged 10 units to a case three cases will fit in one warehouse location, and partial cases take up the space of one full case. Management estimates that this year it can sell 350 total units on 185 requisitions. To maintain established stock availability objectives, the warehouse must maintain a safety level of 5 units. The unit prices of various lot sizes, reflecting quantity discounts available from vendors, are as follows:

- 1 – 9 units purchased: $18.00 each unit
- 10 – 40 units purchased: $15.50 each unit
- 50 or more units purchased: $9.00 each unit.

The EOQ computation for Item A is shown in Table A-7. (The graphic representation for the computation is shown in Figure A-2.) Note that safety stock must be included in the calculation because it will still be in storage when the new lot arrives. We can see from the table and the figure that the lowest total unit cost of Item A results when the warehouse stocks an EOQ of 50.

Once the EOQ has been determined, the savings for the new item can be estimated (equation 4.1). From DELPRO sales records and BID surveys, we know that customers have paid an average of $21.50 for each unit of Item A that they purchased (including DELPRO system costs). Thus, if the item is not stocked, NIH will purchase it through DELPRO at a total cost of $7,525 ($21.50 x 350 units). If it is stocked, NIH will pay the following costs:

• Fixed cost per order ($2.75 x 185 orders)	$ 509
• Variable cost per item sold ($6.50 x 350 units)	2,275
• Procurement cost per item sold ($9.00 x 350 units)	3,150
• Storage cost per year (2 locations x $1,200)	2,400
• Total cost per year to stock Item A	$ 8,334

Thus, it is not cost-effective to stock Item A because NIH would incur a cost of $809 more for stocking.

TABLE A-7

EOQ CALCULATION FOR ITEM A

Lot size	Price per unit purchased (a)	Quantity stocked	Ware-house locations occupied	Price per location	Quantity sold	Storage cost per unit sold (b)	Total cost per unit sold (a + b)
9	$18.00	14	1	$1,200	350	$3.43	$21.43
10	15.50	15	1	1,200	350	3.43	18.93
20	15.50	25	1	1,200	350	3.43	18.93
30	15.50	35	2	1,200	350	6.86	22.36
40	15.50	45	2	1,200	350	6.86	22.36
50	**9.00**	**55**	**2**	**1,200**	**350**	**6.86**	**15.86**
60	9.00	65	3	1,200	350	10.29	19.29
70	9.00	75	3	1,200	350	10.29	19.29
80	9.00	85	3	1,200	350	10.29	19.29
90	9.00	95	4	1,200	350	13.71	22.71

If we conduct the same analysis on Items B and C, we may find that stocking them would produce net annual savings of $2,075 and $175, respectively. When we apply the same analysis to Item Z (which is already presumably stocked at EOQ), we may find that it is also a cost-effective item saving NIH $235 per year.

Since warehouse space is limited in our example, NIH cannot stock all three items. If there are no subjective reasons for not stocking Item B (such as special storage requirements or an anticipated large drop in demand), it should replace Item Z in the inventory. Similarly, since Item Z is more cost-effective than Item C, Item C should not replace it in the inventory.

This process is not as labor-intensive as it first appears. A computer can be used for much of the analysis, with the primary manual effort involved in establishing discounts and applying subjective information and common sense to the detailed analysis.

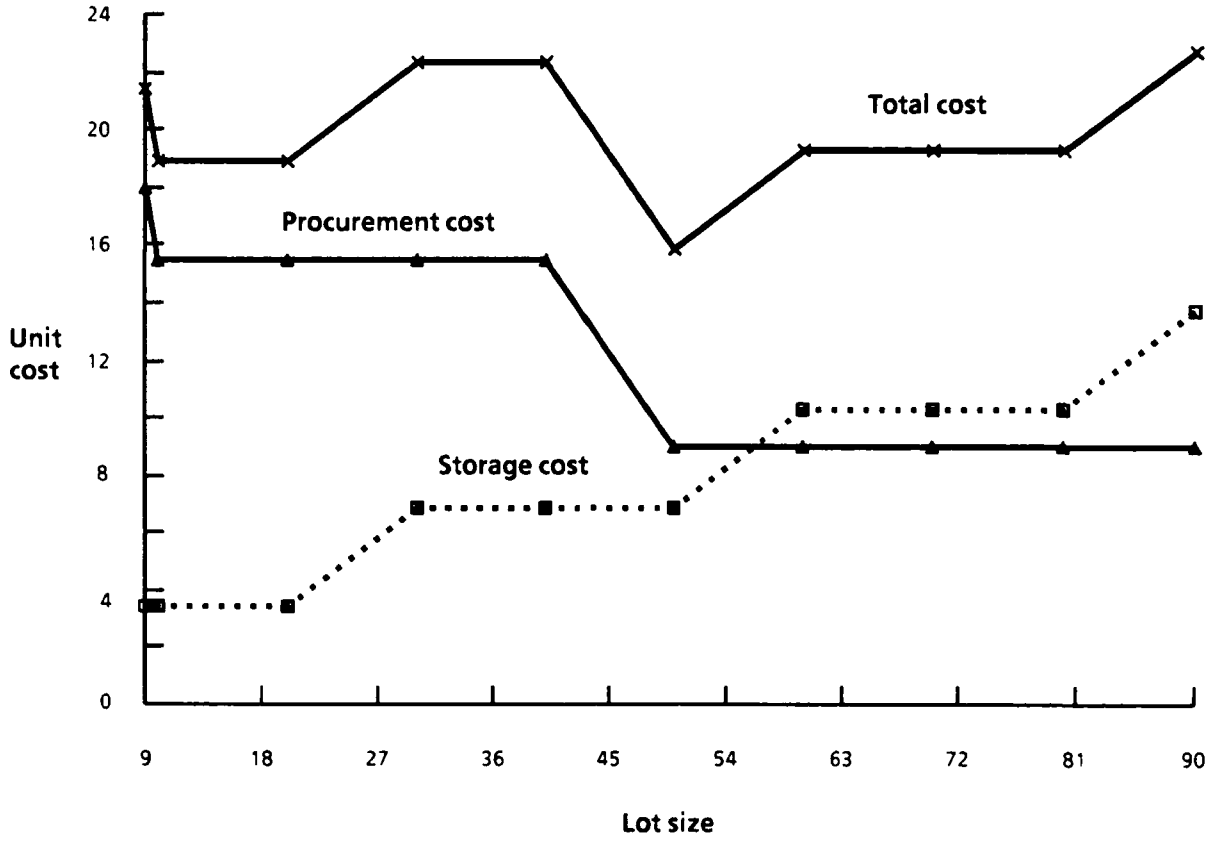


FIG. A-2. EOQ COMPUTATION – ITEM A

APPENDIX B

NIH STATION SUPPORT ACQUISITION GOALS AND OBJECTIVES

NIH STATION SUPPORT ACQUISITION GOALS AND OBJECTIVES

This appendix presents Tables B-1 through B-4, a compilation of the goals and objectives we derived from extensive interviews with the acquisition managers in the Division of Acquisitions Management, the Division of Procurement, and the Division of Logistics. Where the objectives seemed inconsistent, we reconciled the differences in accord with what seemed to be the thrust of NIH's overall goals of responsiveness, economy, and regulatory compliance.

TABLE B-1

NIH ACQUISITION GOALS

Goal number	Description
I	Meet research and administrative acquisition requirements in a responsive manner
II	Acquire materiel and services in a manner that achieves optimum savings
III	Conduct acquisition activities in accordance with applicable laws and regulations

TABLE B-2

ORGANIZATIONAL OBJECTIVES – OFFICE OF ACQUISITIONS MANAGEMENT

Main objectives	Goal supported	Description
		Provide a professionally managed supply system that:
A	I	Meets NIH customer needs for common supplies and provides them to customers in a dependable and timely manner
B	II	Provides supplies at the lowest possible cost, including overhead, that is consistent with necessary quality and service/shelf life
C	III	Conducts supply operations in a manner consistent with the FPMR
D	I	Acquires high-quality supplies that meet NIH's customers needs
		Operate a responsive central procurement office that:
E	I	Procures supplies, equipment, and services to meet required delivery dates
F	II	Procures equipment, supplies, and services at the lowest possible cost, including overhead, consistent with necessary quality, service life, and timeliness requirements
G	III	Conducts procurement in a manner consistent with the FAR, HHSAR, and other applicable regulations
		Both the supply system and the procurement office will:
H	I, II, III	Coordinate the acquisition process with customers to achieve optimum performance.

Note: FAR = Federal Acquisition Regulation; HHSAR = Health and Human Services Acquisition Regulation; FPMR = Federal Property Management Regulation; NIH = National Institutes of Health.

TABLE B-3

SUPPORTING OBJECTIVES – DIVISION OF LOGISTICS

Logistics subobjectives	Main objectives supported	Description
L1	A	The supply system will fill customer orders for stocked material as quickly as possible.
L2	A	Customer warehouse backorders will be delivered as soon as possible.
L3	H	Customers will be given backorder status within *a* reasonable time.
L4	H	Warehouse performance figures will be published for customer planning.
L5	A	Each self-service store item will be available for purchase a high percentage of the time.
L6	B, H	The "fee for service" chargeback system will encourage efficient ordering practices.
L7	B	Purchases of warehouse materiel will achieve a significant discount over list price.
L8	B	The warehouse will be operated to provide significant cost savings.
L9	B	Overhead costs of the warehouse will be kept as low as possible.
L10	B	Self-service stores will stock items with low list price, high sales volume, and a small average order size.
L11	B	Self-service stores will be operated to provide significant cost savings per year, counting savings in customer administrative overhead.
L12	B	Overhead costs of self-service stores will be kept as low as possible.
L13	B	The value of on-hand inventory will be kept as low as possible.
L14	C	Use specified replenishment sources in accordance with the FPMR. (41 CFR 101-26).
L15	C	Manage the inventory in accordance with the FPMR. (41 CFR 101-27).
L16	D, H	Maintain liaison with customers on a continuing basis.

Note: CFR = Code of Federal Regulations

TABLE B-4

SUPPORTING OBJECTIVES – DIVISION OF PROCUREMENT

Procurement subobjectives	Main objective supported	Description
P1	E	Actions received through the ADB will be assigned to a purchasing agent or contract specialist as soon as possible.
P2	E	Sealed bid contracts will be awarded within the shortest time possible, beginning when the action is formally received.
P3	E	Negotiated competitive contracts will be awarded within the shortest time possible, beginning when the action is formally received.
P4	E	Negotiated noncompetitive contracts will be awarded within the shortest time possible, beginning when the action is formally received.
P5	E	Renewal contracts will be awarded within the shortest time possible, beginning when the action is formally received.
P6	E	Routine purchase orders will be awarded within the shortest time possible, beginning when the action is formally received.
P7	E	Accelerated purchase requests will be awarded within the shortest time possible, beginning when the action is formally received.
P8	E	Funded modifications will be completed within the shortest time possible, beginning when the action is formally received.
P9	E	Unfunded modifications will be completed within the shortest time possible, beginning when the action is formally received.
P10	H	Customers will be given status of their procurements as soon as possible, after determination that there is a delay in processing.
P11	H	Procurement performance figures will be published for customer planning.
P12	F	Requirements will be consolidated to achieve volume discounts whenever it can be done without delaying a procurement beyond the required delivery date.

Note: ADB = Administrative Database

TABLE B-4

SUPPORTING OBJECTIVES – DIVISION OF PROCUREMENT (Continued)

Procurement subobjectives	Main objective supported	Description
P13	F, H	The "fee for service" chargeback system will encourage efficient ordering practices through customer feedback.
P14	F	Overhead costs of the procurement system will be minimized to obtain the least overall cost of acquisition.
P15	F, G	Competitive procurement will be used whenever possible.
P16	F, G	New competitive contract awards will receive enough offers to assure lowest cost.
P17	F, G	New competitive small purchases will receive enough quotes to assure low costs.
P18	G	Small and disadvantaged businesses will receive a significant portion of total procurement dollars.
P19	G	Contracting procedures will be followed in accordance with the FAR and other applicable regulations.
P20	H	Liaison with customers will be maintained on a continuing basis.

APPENDIX C

REQUIRED MANAGEMENT INFORMATION

REQUIRED MANAGEMENT INFORMATION

This appendix is a presentation of the information required to determine whether or not the goals and objectives listed in Appendix B have been achieved. Where possible, the information is presented in the form of measurable performance standards. We intentionally did not provide the key parameters that indicate whether the standards have been met. (Those parameters are usually represented by italicized "*x*"s.) We believe that assigning values to the parameters must be done by senior acquisition managers in accordance with the priorities of the objectives that the standards measure.

TABLE C-1

REQUIRED MANAGEMENT INFORMATION (LOGISTICS)

Elements of information	Source	Objective supported	How computed	Notes
Demand satisfaction rate (warehouse only)	ADB	L1	Total customer orders filled, divided by the total number of customer orders	Measures the efficiency of the warehouse in meeting customer demands on currently stocked items
Delivery performance (warehouse only)	ADB, Warehouse Tracking System	L1	Sum of customer delivery time for all delivered orders, including delivered backorders, measured from the time the customer ordered the material to when it is delivered, divided by the total number of delivered orders	Indicates how fast the warehouse is able to deliver material to customers
Percentage of backorders delivered in greater than *x* days, (warehouse only)	ADB, Warehouse Tracking System	L2	Number of backorders delivered in greater than *x* days, measured from the time the customer orders the material to when it is delivered, divided by the total number of backorders	Indicates how fast the warehouse is able to meet demands for out-of-stock items
Percentage of backorders not reported to customer within *x* days (warehouse only)	ADB	L3	Number of status reports to customers divided by the number of backorders	Shows how well customers are kept informed of the status of their orders
Number of warehouse performance reports published (warehouse only)	Manual collection	L4	The number of warehouse performance reports published and distributed to the customer community	Indicates how often performance reports are provided to customers to assist them in planning their purchases
Percentage of item-days in "stock-out" status in the self-service stores (self-service stores only)	ADB	L5	The sum of all items out of stock, times the number of days in the period that each was out of stock, divided by the total number of items stocked, times the number of days in the period	Measures how well the self-service stores are meeting the requirement to have stock on hand as often as possible
Availability of high-volume items in the self-service stores (self-service stores only)	ADB	L5	Percentage of days that the 25 most popular items are out of stock	Indicates whether high-volume items are subject to high stocked-out rates

TABLE C-1

REQUIRED MANAGEMENT INFORMATION (LOGISTICS) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percentage of empty shelves in the self-service stores (self-service stores only)	Manual audit	L5	Number of empty shelves noted divided by total number observed	Shows whether shelves are being kept stocked
Cost performance of fixed overhead vs. amount charged (warehouse and self-service stores)	ADB	L6	Cost of YTD fixed overhead (e.g., administrative, ADP, and inventory management costs), divided by the total sum of YTD (per-order charges to customers)	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower-cost ordering practices
Cost performance of variable overhead vs. amount charged (warehouse and self-service)	ADB	L6	Cost of YTD variable overhead (e.g., inventory losses, transportation, and warehouse costs), divided by the total sum of YTD "per item" charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower-cost ordering practices
Cost performance of procurement costs vs. amount charged (warehouse and self-service)	ADB	L6	Cost of YTD procurement costs divided by the total sum of YTD procurement charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower-cost ordering practices
Gross volume discount for stocked material (warehouse only)	ADB	L7	Total cost of replenishment if purchased at DELPRO price less, the actual cost of replenishment material	Shows the magnitude of gross volume discounts achieved by the warehouse operation
Net savings realized from stocked material (warehouse only)	ADB, Manual Survey	L8	Total cost of replenishment if purchased at DELPRO price, plus estimated administrative costs of DELPRO procurement, less the actual cost of replenishment material, and less total overhead costs	Measures the total cost savings realized by the warehouse operation

TABLE C-1

REQUIRED MANAGEMENT INFORMATION (LOGISTICS) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Overhead cost per dollar of sales (warehouse and self-service reported separately)	ADB	L9	Cost of YTD total overhead, both fixed and variable, divided by the total sales YTD	Measures the cost of overhead adjusted for workload
Fixed costs per customer order (warehouse only)	ADB	L9	Cost of YTD fixed overhead (e.g., administrative, ADP, and inventory management costs) divided by the total orders YTD	Shows the total cost of fixed overhead adjusted for workload
Variable cost per item sold (warehouse only)	ADB	L9	Cost of YTD variable overhead (e g., inventory losses, transportation, and warehouse costs) divided by the total lines sold YTD	Shows the total cost of variable overhead adjusted for workload
Warehouse refusal rate (warehouse only)	ADB	L9, L1	Number of times that material physically present in the warehouse was insufficient to fill an order presented on a WSDD	Measures the effectiveness and accuracy of warehouse processing and its effect on customer service
Gross inventory adjustments (warehouse only)	ADB	L9	The absolute dollar value of all abnormal adjustments to inventory, divided by the total dollar value of the inventory	Measures the effectiveness of inventory management and physical security of inventory
Net inventory adjustments (warehouse and self-service)	ADB	L9	The net dollar value of all abnormal adjustments to inventory, divided by the total dollar value of the inventory	Measures the effectiveness of inventory management and physical security of inventory
Stock turnover rate (warehouse and self-service)	ADB	L9	The total annual sales divided by the dollar value of the inventory	Measures the ability of currently stocked items to justify the fixed overhead costs of stocking them
Inventory accuracy (warehouse and self-service)	ADB, Manual Collection	L9	The number of lines in the warehouse with on-hand balances that exactly match inventory records (measured during 100% inventory)	The best measurement of the effectiveness of inventory management and the physical security of the inventory

TABLE C-1

REQUIRED MANAGEMENT INFORMATION (LOGISTICS) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Procurement cost per sale (self-service stores only)	ADB	L10	Two-month cost of self-service store replenishment divided by number of items sold in last two months	Indicates whether sales reflect the stocking of low-value high-volume material
Average volume sold per line carried (self-service stores only)	ADB	L10	Number of items sold in period divided by the number of lines stocked	Indicates whether high-demand items are stocked
Gross volume discount for stocked material (self-service stores only)	ADB	L11	Total cost of replenishment is purchased at list price, less the actual cost of replenishment material	Shows the magnitude of gross volume discounts achieved by the self-service stores
Net savings realized from self-service stores (self-service stores only)	ADB, Manual Survey	L11	Total cost of replenishment if purchased at list price, plus estimated administrative costs of DELPRO procurement, less the actual cost of replenishment material, and less total overhead costs	Measures the total cost savings realized by the self-service stores
Fixed costs per customer order (self-service stores only)	ADB	L12	Cost of YTD fixed overhead (e.g., administrative, ADP, and inventory management costs) divided by the total orders YTD	Shows the total cost of fixed overhead adjusted for workload
Variable costs per item sold (self-service stores only)	ADB	L12	Cost of YTD variable overhead (e.g., inventory losses, transportation, and labor costs) divided by the total items sold YTD	Shows the total cost of variable overhead adjusted for workload
Value of current inventory (warehouse only)	ADB	L13	Cost of current inventory, valued at current price	Indicates the amount of capital committed for inventory purposes
Percentage of GSA stock replenishment actions (warehouse only)	ADB	L14	Number of GSA stock replenishment divided by the total number of replenishment	ndicates the degree of mandatory source usage
Percentage of GSA stock replenishment dollars (warehouse only)	ADB	L14	Number of dollars spent on GSA stock replenishment, divided by the total dollars spent on replenishment	Indicates the degree of mandatory source usage

TABLE C-1

REQUIRED MANAGEMENT INFORMATION (LOGISTICS) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percentage of FSS replenishment actions (warehouse only)	ADB	L14	Number of FSS replenishment, divided by the total number of replenishments	Indicates the degree of mandatory source usage
Percentage of FSS replenishment dollars (warehouse only)	ADB	L14	Number of dollars spent on FSS stock replenishment, divided by the total dollars spent on replenishment	Indicates the degree of mandatory source usage
Percentage of non-EOQ replenishment (warehouse only)	ADB	L15	Number of replenishments not made in EOQ quantities, divided by the total number of replenishments	Shows number of replenishments made outside of lowest cost criteria
Value of shelf-life material lost (warehouse only)	ADB	L15	Value of shelf-life material removed from stock but not sold	Indicates proper management of shelf-life items
Number of items in inventory that have negative cost savings (warehouse only)	ADB	L15	Items on inventory that have a net cost avoidance of less than $0, per the criteria set forth in Appendix A	Shows the number of ineffective items in inventory
Number of items stocked for other than economic reasons	ADB	L15	Number of items deliberately stocked in spite of their not being the most cost-effective items available	Indicates those items that require continuing evaluation for elimination
Number of meetings of the formal customer liaison group	Manual Collection	L16	Number of meets during the period	Maintenance of formal liaison process to obtain customer feedback regarding problems, performance levels, and proposed changes

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT)

Elements of information	Source	Objective supported	How computed	Notes
Average time to PA/CS assignment (operating sections only)	ADB/CIS, tracking system	P1	Total time between customer input of all actions and assignment to PA or CS, divided by the total number of actions	Measures the efficiency of the assignment process
Average time to award sealed bid contracts (operating sections only)	ADB/CIS, tracking system	P2	Total time between customer input and award of all sealed-bid contracts, divided by the total number of sealed-bid contracts	Measures the speed with which sealed-bid contracts are processed
Average time to award negotiated competitive contracts (operating sections only)	ADB/CIS, tracking system	P3	Total time between customer input and award of all negotiated competitive contracts, divided by the total number of those contracts	Measures the speed with which negotiated competitive contracts are processed
Average time to award negotiated noncompetitive contracts (operating sections only)	ADB/CIS, tracking system	P4	Total time between customer input and award of all negotiated noncompetitive contracts, divided by the total number of those contracts	Measures the speed with which negotiated noncompetitive contracts are processed
Average time to award renewal contracts (operating sections only)	ADB/CIS, tracking system	P5	Total time between customer input and award of all renewal contracts, divided by the total number of those contracts	Measures the speed with which renewal contracts are processed
Average time to award routine purchase orders (operating sections only)	ADB/CIS, tracking system	P6	Total time between customer input and award of all routine purchase orders, divided by the total number of routine purchase orders	Measures the speed with which routine purchase orders are processed
Average time to award APRs (operating sections only)	ADB/CIS, tracking system	P7	Total time between customer input and award of all APRs, divided by the total number of APRs	Measures the speed with which APRs are processed
Average time to complete funded modifications (operating sections only)	ADB/CIS, tracking system	P8	Total time between customer input and completion of all funded modifications, divided by the total number of funded modifications	Measures the speed with which funded modifications are processed

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Average time to award APRs (operating sections only)	ADB/CIS, tracking system	P7	Total time between customer input and award of all APRs, divided by the total number of APRs	Measures the speed with which APRs are processed
Average time to complete funded modifications (operating sections only)	ADB/CIS, tracking system	P8	Total time between customer input and completion of all funded modifications, divided by the total number of funded modifications	Measures the speed with which funded modifications are processed
Average time to complete unfunded modifications (operating sections only)	ADB/CIS, tracking system	P9	Total time between customer input and completion of all unfunded modifications, divided by the total number of unfunded modifications	Measures the speed with which funded modifications are processed
Percentage of actions over *xx* days old without posted status (operating sections only)	ADB/CIS, tracking system	P10	Number of sampled actions without posted status, divided by the total number of sampled actions	Measures whether status is provided to customers on a timely basis
Number of procurement performance reports published (operating sections only)	Manual collection	P11	Number of procurement performance reports published and distributed to the customer community	Indicates how often performance reports are provided to customers to assist them in planning their purchases
Percentage of consolidated procurements (operating sections only)	ADB/CIS	P12	Number of actions awarded that meet requirements contained in two or more requisitions, divided by the total number of actions awarded	Shows how often requirements are consolidated to save money and overhead expenses
Percentage of small purchases made using FSSs (operating sections only)	ADB	P12	Total number of small purchases made using FSSs, divided by the total number of small purchases	Indicates whether DELPRO transactions are being effectively consolidated in the aggregate
Percentage of small purchase dollars expended using FSSs (operating sections only)	ADB	P12	Number of small purchase dollars expended using FSSs, divided by the total number of small purchase dollars expended	Indicates whether small purchases are being effectively consolidated in the aggregate

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percentage of small purchases made using IDCs (operating sections only)	ADB	P12	Total number of small purchases made using IDCs, divided by the total number of small purchases	Indicates whether small purchases are being effectively consolidated in the aggregate
Percentage of small purchase dollars expended using IDCs (operating sections only)	ADB	P12	Number of small purchase dollars expended using IDCs, divided by the total number of small purchase dollars expended	Indicates whether small purchases are being effectively consolidated in the aggregate
Percentage of small purchases made using DELPRO negotiated BPAs (operating sections only)	ADB	P12	Total number of small purchases made using DELPRO negotiated BPAs, divided by the total number of small purchases	Indicates whether small purchases are being effectively consolidated in the aggregate
Percentage of small purchase dollars expended using DELPRO negotiated BPAs (operating sections only)	ADB	P12	Total number of small purchase dollars expended using DELPRO negotiated BPAs, divided by the total number of small purchase dollars expended	Indicates whether small purchases are being effectively consolidated in the aggregate
Dollar value of consolidated procurements (operating sections only)	ADB/CIS	P12	Total dollar value of actions awarded that meet requirements contained in two or more requisitions	Shows the magnitude of the effort to consolidate procurements to save money and overhead expenses
Cost performance of sealed-bid contracts vs. amount charged (operating sections only)	ADB/CIS	P13	Cost of sealed bid contract processing, divided by the total sum of charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower cost ordering practices
Cost performance of negotiated competitive contracts vs. amount charged (operating sections only)	ADB/CIS	P13	Cost of negotiated noncompetitive contract processing, divided by the total sum of charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower cost ordering practices

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Cost performance of routine purchase orders vs. amount charged (operating sections only)	ADB/CIS	P13	Cost to process routine purchase orders, divided by the total sum of charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower cost ordering practices
Cost performance of APRs vs. amount charged (operating sections only)	ADB/CIS	P13	Cost to process accelerated purchase requests, divided by the total sum of charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower cost ordering practices
Cost performance of funded modifications vs. amount charged (operating sections only)	ADB/CIS	P13	Cost to process funded modifications, divided by the total sum of charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower cost ordering practices
Cost performance of unfunded modifications vs. amount charged (operating sections only)	ADB/CIS	P13	Cost to process unfunded modifications, divided by the total sum of charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower cost ordering practices
Number of actions per contract specialist (operating sections only)	ADB/CIS, tracking system	P14	Total number of actions open, divided by the number of staff contract specialists	Measures how the procurement workforce is being utilized
Number of actions per purchasing agent (operating sections only)	ADB/CIS, tracking system	P14	Total number of actions open, divided by the number of staff purchasing agents	Measures how the procurement workforce is being utilized
Percent of overtime hours used to meet workload (operating sections only)	Manual collection	P14	Total overtime hours used, divided by total hours used to meet workload	Shows whether the current workload is being met through ordinary or extraordinary efforts by the staff

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percent of contracts awarded competitively (operating sections only)	ADB/CIS	P15	Number of contracts awarded competitively, divided by the total number of contracts awarded	Establishes the level of competition used in procurement operations
Percent of contract dollars awarded competitively (operating sections only)	ADB/CIS	P15	Number of contracts awarded competitively, divided by the total number of contracts awarded	Establishes the level of competition used in procurement operations
Percent of competitive contracts awarded with more than one responsive bid (operating sections only)	ADB/CIS	P16	Number of competitive contracts awarded with more than one responsive bid, divided by the total number of competitive contracts awarded	Indicates whether contract specifications are being written that effect genuine competition
Percent of competitive contract dollars awarded on competitive contracts with more than one responsive bid (operating sections only)	ADB/CIS	P16	Number of competitive contract dollars awarded on contracts with more than one responsive bid, divided by the total number of competitive contract dollars awarded	Indicates whether contract specifications are being written that effect genuine competition
Percentage of open- market-small purchases over $1,000 with at least 3 quotes (operating sections only)	Manual audit (sample)	P17	Number of open-market small purchases over $1,000 with at least 3 quotes, divided by the total number of open market small purchases over $1,000	Measures the degree to which small purchases are made following the FAR guidance on competition
Percentage of open-market-small purchase dollars awarded after at least 3 quotes (operating sections only)	Manual audit (sample)	P17	Number of open-market small purchase dollars awarded with at least 3 quotes, divided by the total number of dollars awarded in open-market small purchases over $1,000	Measures the degree to which small purchases are made following the FAR guidance on competition

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percentage of contracts awarded to disadvantaged businesses (operating sections only)	ADB/CIS	P18	Number of contracts awarded to disadvantaged businesses, divided by the total number of contracts awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of contract dollars awarded to disadvantaged businesses (operating sections only)	ADB/CIS	P18	Total contract dollars awarded to disadvantaged businesses, divided by the total number of contract dollars awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of contracts awarded to small businesses (operating sections only)	ADB/CIS	P18	Number of contracts awarded to small businesses, divided by the total number of contracts awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of contract dollars awarded to small businesses (operating sections only)	ADB/CIS	P18	Total contract dollars awarded to small businesses, divided by the total number of contract dollars awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of small purchases awarded to disadvantaged businesses (operating sections only)	ADB	P18	Number of small purchases awarded to disadvantaged businesses, divided by the total number of small purchases awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of small purchase dollars awarded to disadvantaged businesses (operating sections only)	ADB	P18	Total small purchase dollars awarded to disadvantaged businesses, divided by the total number of small purchase dollars awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of small purchases awarded to small businesses (operating sections only)	ADB	P18	Number of small purchases awarded to small businesses, divided by the total number of small purchases awarded	Measures compliance with socioeconomic provisions of the FAR

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percentage of small purchase dollars awarded to small businesses (operating sections only)	ADB	P18	Total small purchase dollars awarded to small businesses, divided by the total number of small purchase dollars awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of contracts with major faults noted during PORA presolicitation review (operating sections only)	Manual Report	P19	Number of contracts having major faults detected during presolicitation review, divided by the total number of contracts reviewed	Indicates trends in the quality of contract processing
Percentage of contracts with major faults noted during PORA preaward review (operating sections only)	Manual Report	P19	Number of contracts having major faults detected during preaward review, divided by the total number of contracts reviewed	Indicates trends in the quality of contract in process
Percentage of actions protested (gross protest rate, operating sections only)	ADB/CIS, tracking system	P19	Number of actions that have been protested, divided by the total number of actions	Indicates trends in the quality of solicited and/or awarded contracts
Percentage of protest denied (operating sections only)	ADB/CIS, tracking system	P19	Percentage of protests that have been denied, divided by the total number of resolved protests	Shows whether trends indicated in the gross protest rate reflect substantive issues
Number of quarters with over 30 percent of annual actions (operating sections and DELPRO reported separately)	ADB/CIS	P19	Number of quarters in past fiscal year in which more than 30 percent of total annual actions originated (measured annually)	Indicates whether BIDs are properly forecasting and planning their annual acquisitions
Gross DELPRO discount rate achieved (DELPRO only)	ADB	P12	The sum of all DELPRO transaction list prices, minus the sum of all DELPRO actual prices, divided by the sum of all DELPRO list prices	Provides an indicator of the level of discounts achieved by DELPRO buyers

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percentage of DELPRO purchases made using FSSs (DELPRO only)	ADB	P12	Total number of DELPRO purchases made using FSSs, divided by the total number of DELPRO purchases	Indicates whether DELPRO transactions are being effectively consolidated in the aggregate
Percentage of DELPRO dollars expended using FSSs (DELPRO only)	ADB	P12	Total number of DELPRO dollars expended using FSSs, divided by the total number of DELPRO dollars expended	Indicates whether DELPRO transactions are being effectively consolidated in the aggregate (at GSA level)
Percentage of DELPRO purchases made using IDCs (DELPRO only)	ADB	P12	Total number of DELPRO purchases made using IDCs, divided by the total number of DELPRO purchases	Indicates whether DELPRO transactions are being effectively consolidated in the aggregate (at GSA level)
Percentage of DELPRO dollars expended using IDCs (DELPRO only)	ADB	P12	Total number of DELPRO dollars expended using IDCs, divided by the total number of DELPRO dollars expended	Indicates whether DELPRO transactions are being effectively consolidated in the aggregate (at NIH level)
Percentage of DELPRO purchases made using negotiated BPAs (DELPRO only)	ADB	P12, P15	Total number of DELPRO purchases made using negotiated BPAs, divided by the total number of DELPRO purchases	Indicates whether DELPRO transactions are being effectively consolidated in the aggregate (at NIH level)
Percentage of DELPRO dollars expended using negotiated BPAs (DELPRO only)	ADB	P12, P15	Total number of DELPRO dollars expended using negotiated BPAs, divided by the total number of DELPRO dollars expended	Indicates whether DELPRO transactions are being effectively consolidated in the aggregate (at NIH level)
Cost performance of DELPRO operations vs. amount charged (DELPRO only)	ADB	P13	Overhead costs of DELPRO operations and support, divided by the total sum of DELPRO service charges to customers	Indicates whether customer charges actually reflect what costs are incurred, thus encouraging customers to use lower cost ordering practices
Discounts achieved per DELPRO manhour (DELPRO only)	ADB, manual collection	P13	Total of list price, minus actual price for all DELPRO purchases, divided by the total hours worked by DELPRO staff	Provides a very rough indicator of DELPRO section productivity

TABLE C-2

REQUIRED MANAGEMENT INFORMATION (PROCUREMENT) (Continued)

Elements of information	Source	Objective supported	How computed	Notes
Percentage of DELPRO purchases awarded to disadvantaged businesses (DELPRO only)	ADB	P18	Number of small purchases awarded to disadvantaged businesses, divided by the total number of small purchases awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of DELPRO purchase dollars awarded to disadvantaged businesses (DELPRO only)	ADB	P18	Total small purchase dollars awarded to disadvantaged businesses, divided by the total number of small purchase dollars awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of DELPRO purchase awarded to small businesses (DELPRO only)	ADB	P18	Number of small purchases awarded to small businesses, divided by the total number of small purchases awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of DELPRO purchase dollars awarded to small businesses (DELPRO only)	ADB	P18	Total small purchase dollars awarded to small businesses, divided by the total number of small purchase dollars awarded	Measures compliance with socioeconomic provisions of the FAR
Percentage of DELPRO purchases with major faults noted during DELPRO section reviews (DELPRO only)	Manual report	P19	Number of purchases having major faults detected during DELPRO assistance reviews, divided by the total number of purchases reviewed	Indicates trends in the quality of BID DELPRO purchasing
Number of meetings of the formal customer liaison group	Manual report	P20	Number of meetings during the period	Maintenance of formal liaison process to obtain customer feedback regarding problems, performance levels, and proposed changes

GLOSSARY

ADB	=	Administrative Database
APR	=	Accelerated Purchase Request
BIDs	=	NIH Bureaus, Institutes, or Divisions
BPA	=	Basic Purchasing Agreement
CS	=	Contract Specialist
CIS	=	Contract Information System
DELPRO	=	Delegated Procurement
EOQ	=	Economic Order Quantity
FSS	=	Federal Supply Schedule
GSA	=	General Services Administration
IDC	=	Indefinite Delivery Contract
PA	=	Purchasing Agent
PORA	=	Principal Official Responsible for Acquisition
WSDD	=	Warehouse Selection and Delivery Document
YTD	=	Year to Date

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT "A" Approved for public release; distribution unlimited.
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) LMI-NI801R1	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Logistics Management Institute 6b. OFFICE SYMBOL *(If applicable)*	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS *(City, State, and ZIP Code)* 6400 Goldsboro Road Bethesda, Maryland 20817-5886	7b. ADDRESS *(City, State, and ZIP Code)*
8a. NAME OF FUNDING / SPONSORING ORGANIZATION National Institutes of Health 8b. OFFICE SYMBOL *(if applicable)*	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER MDA903-85-C-0139
8c. ADDRESS *(City, State, and ZIP Code)* Bethesda, MD 20892	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE *(Include Security Classification)*
Management Information: A Key to Better Acquisition at NIH

12. PERSONAL AUTHOR(S)
Harry Moore, Cynthia Shockley, Robert Spargo

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT *(Year, Month, Day)*	15. PAGE COUNT
Final	FROM _____ TO _____	April 1990	100

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
FIELD	GROUP	SUB-GROUP	

19. ABSTRACT *(Continue on reverse if necessary and identify by block number)*

The acquisition process at the National Institutes of Health (NIH) provides a wide variety of supplies and services to the on-campus research and administrative staff. Management of the process must balance responsiveness with frugal procedures that meet all statutory and regulatory requirements.

Achieving the appropriate balance is a challenge, particularly since NIH has no objective, quantifiable, acquisition performance standards. We recommend that it develop such standards and use them to measure how well the acquisition process is meeting its goals. In addition, NIH is not managing its information resources to best support its organizational goals and objectives. We recommend that it do so in a systematic process that we term a management information system (MIS). The MIS should be defined by a MIS team - a partnership of acquisition information specialists and functional managers who work together to define the data and system needed to make good decisions.

We believe that NIH can improve its automated resources to better support the MIS. Data essential for the MIS are now in two isolated databases or, in some cases, are not collected at all. We recommend that as part of its planned redesign of the Administrative Database (ADB), NIH establish criteria for effectively integrating all data sources to better support management information needs. The MIS team should also coordinate acquisition management recommendations for the ongoing ADB redesign.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE *(Include Area Code)* / 22c. OFFICE SYMBOL

Since a redesigned ADB will not be available until the mid-1990s, NIH managers need an interim solution. As that interim solution, the MIS team should extract the best management information possible from currently available sources. It should also acquire data that are currently not collected by implementing new stopgap stand-alone systems where necessary.

Finally, we recommend that acquisition managers be encouraged to use information as a resource – to insist that management information be relevant and accurate, and to put it to use more effectively than in the past. With proper direction, those acquisition managers can use the information the MIS will initially provide and progressively tailor the MIS to help the NIH acquisition process meet the goals of responsiveness, economy, and compliance with regulations.