BUSINESS CASE FOR A NATIONAL INSTITUTES OF HEALTH BUSINESS SYSTEM

June 6, 2000

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EXECUTIVE SUMMARY

This document presents the business case for replacement of administrative computing systems at the National Institutes of Health (NIH). It summarizes the results of a comprehensive evaluation to assess the feasibility of replacing the Administrative Data Base (ADB) with new technology, either by upgrading the ADB or by replacing the ADB with integrated commercial software. Four basic questions were answered in this evaluation:

- What do we want a new system to do? Goals and requirements were developed through a comprehensive analysis conducted by seven workgroups representing the seven basic business functions served by the ADB. The workgroups were comprised of NIH staff representing all segments of the NIH community and facilitated by expert consultants. A total of 136 business goals and over 3,000 system requirements were identified by the workgroups and reviewed by a committee of scientists to assure that they met the needs of the scientific community.

- What are the alternatives for achieving those goals and requirements? Two alternatives were considered: replacing the ADB with a new proprietary system, the "build" alternative; or purchase of a commercial software package, the "buy" alternative.

- If the "buy" alternative is selected, what are the viable products and which should be our choice? The applicable commercial software vendors were studied and evaluated.

- Is the proposed alternative a sound investment of NIH resources? A net present value analysis was performed in accordance with OMB Circular A-94.

NIH evaluated a proposal by CIT to migrate the ADB to a new system with improved functionality and also evaluated commercial products. The evaluation was based on a set of five evaluation criteria, namely functionality, technology, vendor risk, culture, and cost-benefit, which were approved by the Steering Committee, and weighted by them for relative importance. The evaluation of the commercial vendors was exhaustive, and was characterized by an unusually high degree of community participation by those NIH experts best able to assess the individual criteria. These groups applied objectivity and rigor to the evaluation. The final results of the evaluation were presented to the Steering Committee on March 15, 2000 and there was unanimous agreement to pursue the "buy" alternative, i.e., to purchase commercial software, and to select the vendor with the highest overall total score and the lowest overall cost. The selected vendor offered a fully integrated solution covering the basic requirements in all seven functional areas.

A cost-benefit analysis, following the required OMB guidelines, was undertaken for the selected option to determine the financial soundness of the decision. The analysis described in this document indicates, that, although based only on a limited sample of

quantified benefits, the NBS will generate a positive return of $23 million (Net Present Value - NPV). A cost sensitivity analysis shows that, based on the limited sample of quantified benefits and conservative cost estimates, even a 31% cost overrun over the investment period, which equals an overrun by $27 million (not discounted), would make the NBS a viable investment, further solidifying the soundness of the investment. In order to avoid cost overruns, the project budget includes a 12% contingency fund, amounting to a total of $9.5 million over three years.

Despite the positive results of the investment analysis, this document outlines the substantial risks that the community must consider in pursuing a commercial solution and address if success is to be achieved. The risks are of three types: organizational, project related, and technical. These are summarized as follows:

- Organizational: decentralized decision making resulting in decisions "by committee"; the willingness of the business community to change current practices to conform to "best practices embedded in the commercial product; and competing demands on resources.

- Project: expanding the original project, known as scope creep, and the risks and uncertainty from being one of the first Federal agencies to implement an integrated ERP project.

- Technical: building excessive interfaces to too many secondary systems; high volume of data conversion; and customization of the software beyond a reasonable point.

For each of these risks, this document proposes solutions to mitigate their occurrence and effect.

Based on the evaluation of alternatives, the consideration of the investment analysis, and the identification of risks and potential mitigating strategies, four recommendations are proposed for NIH approval:

Recommendation 1

It is recommended that the NIH purchase commercial ERP software to replace the ADB; it should consider the CIT proposal for migrating to a new proprietary system as a back up plan.

The analysis of the "buy vs. build" options contained in this report indicates that, despite the risks associated with ERP packages, a commercial solution is superior to a proprietary one. The capacity for improved administrative and scientific support, the cost-benefit analysis, and the market trend information all support this conclusion. This recommendation also is consistent with the OMB directive to give first priority to the purchase of commercial software. This recommendation is predicated on the assumption that NIH is willing to commit to the principles detailed in Recommendation 4.

Recommendation 2

It is recommended that NIH purchase its commercial software from the vendor that both scored the highest number of points in the evaluation and proposed the lowest overall price.

As noted earlier, this vendor cannot be named in this document because of procurement rules protecting this information prior to contract award.

The evaluation methodology described in this report was based on a set of criteria, approved by the Steering Committee, and weighted by them for relative importance. This evaluation of the several products judged to be the best fit for the NIH was exhaustive, and was characterized by an unusually high degree of community participation and by specialized reviews undertaken by those NIH experts best able to assess the various criteria. These groups applied objectivity and rigor to the evaluation and there was unanimous agreement by the Steering Committee to endorse their assessment.

Recommendation 3

It is recommended that NIH develop an implementation plan for the selected ERP product within approximately 60 days of the presentation of the Business Case to the Steering Committee.

The implementation plan begins the Phase 2 implementation effort and should include the following components:

- *Organizational Structure*: This component of the implementation plan should include the definition of the project organization structure, detailed definitions of individual roles and responsibilities, and an approach for staffing the project.

- *Governance Plan*: The governance plan should include the charter for the Steering Committee, a definition of the issue resolution and escalation process, and a recommendation for the roles and responsibilities of other decision making bodies.

- *Financial Plan:* The financial plan should be as comprehensive as possible, and include costs, beyond those of the system integrator and the software to be purchased, that may have been budgeted elsewhere within the NIH. It should include the staffing and other associated costs for the project team and provide sufficient resources so that an IC or OD office whose employee is assigned full time on the NBS project can backfill that position if desired.

- *Deployment Plan*: The deployment plan should define the implementation timing and associated functional scope, major tasks, and major deliverables.

- *Change Management Plan*: The change management plan should be based on a stakeholder analysis, identifying stakeholder groupings and how they are impacted by the NBS deployment over time. Based on this analysis, the change management plan should include a communication plan, a training plan, and a high level staff transition approach for each stakeholder grouping.

- *Project Evaluation Plan*: The final component of the implementation plan should define the performance measures that will be used to track and evaluate the progress of the NBS project. The evaluation plan should include periodic and long term performance measures.

The implementation plan should be submitted to the Deputy Director for Management, and approved by the appropriate groups that he designates. Given the complexity of the Phase 2 implementation effort, and the risks and costs involved, there must be a comprehensive plan in place. This will assure that NIH's commitment of resources is based on a thoughtful consideration of actions to be taken in the design, testing, deployment, and maintenance stages.

Recommendation 4

It is recommended that NIH adopt a set of principles as the basis for developing the final Phase 2 implementation plan described in Recommendation 3.

The proposed principles are as follows:

a. *No Customizations***:** The NIH should commit to a policy of endorsing the best practices embedded in the ERP software to the maximum extent, and that any customization of the commercial software should be the exception. Any limited exception should be made only after a complete analysis of its potential cost and impact on the implementation schedule and approval by the Steering Committee.

b. *Limited Number of Interfaces:* The NIH should commit to a policy that during the Phase 2 implementation, interfaces will only be built to connect the NBS with other NIH-wide enterprise systems and that extensions, defined as systems beyond the fundamental transaction-based sub-systems of the NBS, be deferred until after deployment.

c. *Empowered Governance:* The overall governance structure should be representative of the NIH communities that will be supported by the NBS, and possess sufficient authority to resolve all issues emerging during implementation in a timely fashion. This governance structure also should include a process:

- to approve exceptions to the policy limiting customization, and
- to approve any enhancements to the ADB or the development of other administrative systems, to be developed during the period of the NBS implementation, that may replicate or enhance capabilities of the NBS.

d. *Assignment of the Best-and-Brightest to the Project:* The organizational structure and staffing plan should reflect NIH's commitment to the future. NIH employees selected to participate in the NBS should be those best able to lead this effort and most knowledgeable in the pertinent administrative and scientific support functions. Key members of the implementation effort should be assigned to work on this project on a full time basis.

e. *Phased Deployment:* The implementation plan should assume a phased deployment. The plan will consider whether this deployment should be phased by IC (implement all functions in one IC at a time) or by function (sequentially implement functions one at a time across all IC's). This implementation schedule should also balance the desire to quickly provide new services with the reality of the difficulties inherent in changing current ways of doing business.

f. *Rigorous Budget Management:* Budget Management should be a major activity of the implementation effort resulting in timely notification to the IC's of costs and the timing of resource needs and the discipline to control costs and set priorities.

g. *Comprehensive Change Management:* The change management strategy should be comprehensive, recognizing that most problems that emerge in the implementation of ERP products are due to inadequate attention to these issues.

h. *Continuous Project Evaluation:* The evaluation strategy should have a review mechanism that will allow the project to be revised, or terminated, at intermediate points should it be necessary.

These principles are drawn from the experiences amassed over numerous implementations of ERP products and recognize the factors that often cause such projects to either succeed or fail. Commitment to undertaking an ERP project in a timely and cost-effective manner also carries with it a commitment to provide sufficient priority to reduce the changes to the software to a minimum, to make timely decisions, to commit sufficient resources, to schedule aggressively but realistically, and to recognize the difficulties inherent in change.

PART ONE: INTRODUCTION

Purpose of this Document

The National Institutes of Health (NIH) has completed a comprehensive evaluation to assess the feasibility of replacing its Administrative Data Base (ADB) with new technology so as to improve administrative and scientific support. The purpose of this document is to present the results of this evaluation as well as a set of recommendations on the most cost-effective approach for upgrading current service levels. These recommendations are the result of a rigorous analysis, which directly involved a large segment of the NIH community. If approved, these recommendations will form the basis for the development of a comprehensive implementation plan to effect their intent.

This document is divided into four Parts:

- Part One: An introduction that describes the process, organizational structure and methodology for this evaluation.
- Part Two: An analysis of the alternatives considered for replacing the ADB and the results of that analysis.
- Part Three: An analysis of the costs and benefits, and potential risks, of utilizing ERP software for administrative and scientific support at NIH.
- Part Four: Final recommendations resulting from the evaluation.

Project Background

During Fiscal Year 1998, the NIH conducted a preliminary assessment of the ADB and identified significant improvement opportunities. Part of the evaluation included consideration of commercial off-the-shelf software for future system development. The final report on this activity recognized that, while the ADB has supported the scientific enterprise superbly for the past two decades, it has been overtaken by advances in technology. The report proposed that the ADB be replaced as quickly as possible by a new system, since named the NIH Business System (NBS), that can provide new and improved support to the NIH. The report further suggested that there is a rich competitive environment among several software vendors who have products that appear to meet many of the requirements of an NIH Business System. Use of such software would allow for the implementation of best practices, facilitate the replacement process, and simplify future software maintenance. On the other hand, such software would not be tailored specifically to the NIH, as is the ADB, and might require NIH to modify some business practices.

Subsequently, in the fall of 1999, the NIH began the feasibility study, referred to as Phase 1 of the NBS, which is summarized herein. It analyzes various technology options for an

NBS to facilitate the achievement of the NIH's business goals and objectives. The two primary options that were considered were to:

- Upgrade the ADB; or

- Replace the ADB with integrated commercial software frequently referred to as "Enterprise Resource Planning" (ERP) software.

Scope of the NIH Business System Analysis

The overall objective of the NBS is to enable administrative/scientific support that is cost effective, provides more accurate and timely information, and facilitates the scientific mission of the NIH. The scope of the NBS includes seven business or "functional" areas currently included in the ADB:

- Financial Management
- Property Management
- Accounts Payable (Commercial Accounts)
- Acquisition
- Service and Supply Funds Operations
- Supply Management
- Travel Management

A separate Human Resource Management system is currently being implemented under the direction of the Office of the Secretary, Department of Health and Human Services. This project, known as the Enterprise Human Resource Program (EHRP), is utilizing commercial software developed by PeopleSoft, Inc. The EHRP implementation at the NIH will be coordinated with the NBS through the NBS Steering Committee which will be described in more detail below.

Project Organization and Approach

With the overall NBS objective in mind, a project infrastructure was established to conduct the feasibility study (Phase 1). Key elements of the NBS project include:

- Establishment of the NBS Project Management Team headed by the Executive Officer, NIA. This team was charged with the overall responsibility to manage the Phase 1 evaluation process.

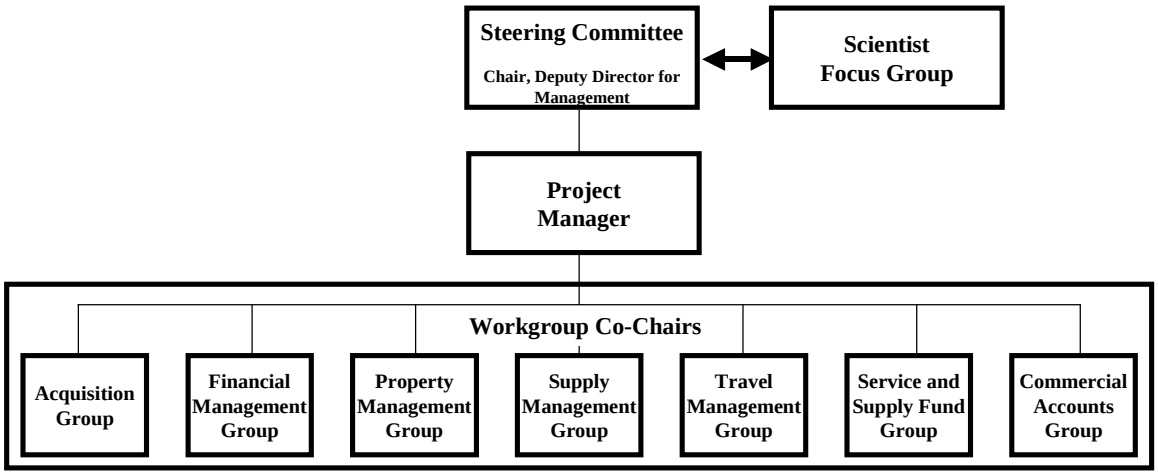
- Oversight by a NBS Steering Committee comprised of senior Office of the Director (OD) and Institute and Center (IC) personnel and chaired by the Deputy Director for Management, NIH. This committee was charged with overseeing the process to assure its integrity and to make a final recommendation to the Deputy Director for Management on whether, and how, to proceed with the Phase 1 recommendations.

- Establishment of workgroups for each of the seven administrative and scientific support functions. Each of these workgroups was staffed with a mix of those providing OD centralized and administrative/scientific support services and those assuring the provision of decentralized services at the IC level. Approximately 250 workgroup members were nominated to assure appropriate representation. Each of the seven workgroups was co-chaired by a senior manager from an IC and a senior manager from OD.

- Establishment of a Scientist Focus Group chaired by the Scientific Director, NEI and advisory to the NBS Steering Committee. This group was responsible for reviewing various products of the workgroups, which are described in more detail below, to assure that the support needs of the scientific community were incorporated into the NBS.

- Award of a contract to KPMG Consulting for the services of an expert team, skilled in assisting the NIH in this evaluation.

The corresponding NBS organization is shown in the figure below. Attachment 1 in the Appendix provides further information for each of the groups involved.



The basic "building blocks" of the NBS are NIH's business goals, the system requirements that must be included within the NBS to achieve these goals, and best practices that NIH wishes to implement. The definition of each of these elements provides the framework for the evaluation of the two alternatives identified in Part Two.

Definition of NIH Business Goals: Business goals express what ultimately needs to be achieved by each administrative and scientific support function. The functional workgroups developed business goals by formulating high-level goals that represent significant and achievable improvement in the respective administrative and scientific support capabilities. An example of a high level goal would be to "Improve the Timeliness for Travel-Related Services". Draft goals were shared among the seven workgroups to assure coordination and comprehensiveness. The final draft was then reviewed with the Scientist Focus Group to assure that they were responsive to the needs

of the scientific community, and approved by the Steering Committee. Overall, the workgroups identified a total of 136 business goals. Ultimately the achievement of the business goals will mark the successful implementation of the NBS.

Establishment of Requirements: Next, the workgroups developed the requirements or characteristics that the NBS must contain to achieve the business goals and to identify any requirements that are unique to the NIH. An example of a requirement for the NBS, related to the goal for improved travel services, would be the "Capability to Electronically Complete Travel Forms". The workgroups identified a total of ~ 3,000 system requirements. The requirements were then reviewed by the Scientist Focus Group to assure that their service needs would be met and by the Steering Committee. This final set of requirements became the program criterion that either a revised ADB or a commercial software product needed to satisfy.

Adoption of Best-Practices: Best-practices are common business practices and enabling technologies that have been adopted by leading organizations to achieve world-class performance. Best-practices are the mechanisms by which business goals are being achieved and, thus, closely relate to the business goals identified by the workgroups. An example of such a best-practice would be the automated reconciliation of Purchase Card transactions.

The commercial software packages were analyzed to identify best practices that are embedded within them to assess their applicability to the NIH. With the exception of a limited number of practices that are pertinent only to the private sector, all identified best practices were endorsed by the workgroups. The NBS Steering Committee concurred with the workgroups' recommendations. The implementation of some of the best practices form the basis for the cost savings used in developing the cost-benefit analysis that is described in the Business Case below.

Having assessed the needs of the community to be addressed by a new system, an evaluation of the alternatives to meet those needs was undertaken and is described below. The goals, associated requirements and best practices, alternatives, and cost-benefit analysis constituted the approach and resulted in the recommendations provided in the last section of this report.

PART TWO: ANALYSIS OF ALTERNATIVES

Alternative 1 - Build: The ADB Migration Strategy

ADB Background

The current ADB system, built and maintained by NIH staff over the last 20 years, is an integrated information technology system that was cutting edge for its time and that services most of the administrative activities of the NIH – financial management, procurement, inventory, travel, property, and service and supply fund activities. The ADB was developed in the 1970's, before the introduction of PCs, to operate through mainframe computers. It utilizes COBOL, an application programming language developed in the 1950's, and Information Management System (IMS), a data base management system developed in the 1970's. A number of characteristics of this system, not unique to the ADB, but characteristic of systems built during this period, have led NIH to conclude that, while the system has served the NIH superbly, a replacement is necessary. These characteristics can be summarized as follows:

- The ADB is extraordinarily complex and difficult to modify. The ADB has evolved and been modified over the years to the point that it now comprises over 800 COBOL programs and 1.5 million lines of code. So many people have altered and patched the code so many times, over such a long period of time, that the internal structure of the system has been compromised. As a result, it is extremely tedious and time consuming to revise the code when it is required to allow the ADB to support new initiatives or new ways of doing business that would improve the service to the scientific and administrative communities.

- The ADB was built before the widespread introduction of PC's with a database structure that, while tremendously useful in its day, is now antiquated. The NIH Data Warehouse translates ADB data into a format that enables formatting and reporting on modern day desktop computers, but a significant effort is required to transform the data each night from the old database.

- The ADB now captures information only from the point at which a decision is made by the NIH Institutes and Centers (ICs) to obligate funds. However, IC's generally need the capability to capture information on the flow of documents through the IC before such a decision on funding is made. Modern systems incorporate this tracking capability and allow users to configure the software to meet current needs.

- The number of personnel skilled in maintaining these outdated technologies is dwindling. As expected, the number of NIH staff maintaining this system has shrunk from 20 to 7 over the past 5 years. Of even greater concern is that by the end of FY 2000, the senior members of

the team who are most knowledgeable about the ADB will have retired, or be eligible to retire.

The end result is that, despite its extraordinary success and the best efforts of a dedicated staff, the current ADB is insufficiently flexible and adaptable in an environment that is both rapidly changing and demanding rapid response to that change. One of the results of this situation is, for example, that the ADB currently is not compliant with Joint Financial Management Improvement Program (JFMIP). The JFMIP is a joint effort of the Treasury Department, the General Accounting Office, the Office of Management and Budget, and the Office of Personnel Management that sets government wide financial management standards. Over the next few years this situation will only worsen and it must be addressed before the ADB is unable to provide acceptable support to the administrative and scientific communities.

Custom Development Considerations

There is little recent literature advocating custom development of a system such as the replacement of the ADB. An interview with GartnerGroup analysts conducted in December 1999 reveals that organizations are only very rarely considering custom development of such a system, primarily due to the large effort associated with the development of software that is also commercially available. Since the commercially available software has become powerful enough and flexible enough to address most organizations' basic business requirements, custom development today often revolves around specific modifications to this software, rather than developing an entirely new system.

A few years ago, when ERP solutions were less mature, however, the decision to build a system such as the ADB was still a more viable option. A GartnerGroup article from 1997 cites four criteria for why organizations choose to build a custom application:[1]

1. **Differentiation**: Building customized software might be advantageous when an organization requires use of unique applications of technology that do not exist in commercial software. For most administrative and support functions, however, the capability exists in today's commercial software and is flexible enough to adapt to the needs of most organizations, whether public or private, precluding the need to customize for that purpose.

2. **Architecture Conformance**: Some organizations may require customized software because of the unique IT architectural requirements of their technical infrastructure. Examples include standard hardware and software platforms such as mainframes and database management systems such as IMS that are waning in popularity. However, in light of the current technological developments related to the Internet, and the need to use these emerging technologies, an architecture that limits these capabilities is in itself undesirable.

[1] GartnerGroup, Build vs. Buy: New Decision Criteria for Applications, 1997

3. **Better Business Practices**: In the early 1990's, commercial software packages were fairly inflexible and static in nature and, according to GartnerGroup[1], did not embed best practices. Hence, if progressive organizations wanted applications that supported best practices they would have had to build them. Today, however, commercial software packages have embedded in them best practices based on the experience of thousands of organizations. In addition, they have also become more flexible, allowing for custom configuration to the needs of individual organizations. This consideration is reinforced for Federal organizations by OMB guidance which indicates that commercial software be given priority over custom solutions. For those unique requirements that cannot be custom-configured, companies usually consider modifications of the commercial software, extensions using such software as a base, or best-of-breed solutions (combining individual pieces of commercial software that will be described further below). These approaches yield the desired results at a fraction of the cost of custom development of an entire system.

4. **Inability to Change**: Although commercial software has become increasingly flexible, its implementation requires a significant amount of user training and will likely require modifications to how an organization performs certain functions. If the cost to the organization of the associated change is high, and propensity of the organization to change is low, custom development of a system that requires only incremental change may be more successful.

ADB Migration Proposal

One of the considerations in Phase 1 was the option of rebuilding the ADB as a customized application. To fairly assess this option against an ERP option, the NIH would have had to invest significantly in an upgrade of the ADB. Rather than embarking on an effort to replace the existing ADB, because of the cost and length of time required, the Center for Information Technology (CIT) proposed a migration strategy that would assure ADB reliability. This strategy proposes a gradual migration of the ADB. In summary, the proposal revolves around the following cornerstones:

- Convert the existing ADB in approximately 3 years to a web-enabled platform and a relational database, primarily maintaining existing capabilities. This would include converting the IMS database management system to DB2, converting software code from COBOL to Java, and developing related documentation and training.

- Add new administrative and scientific support capabilities in year four. This would enable the new system to meet more, but not all, of the NBS's functional requirements, as determined by the workgroups.

- Replace NIH's Central Accounting System (CAS) with commercial software in years 3 and 4.

- Hire approximately 30-35 new personnel to support the migration effort.

- Capitalize on the institutional knowledge of NIH service requirements that have been incorporated in the ADB over the past 20 years.

- Tailor the new system to the unique needs and decentralized nature of the NIH.

- Reduce reliance on outside vendors for the migration effort and ongoing support.

Evaluation Team Assessment

An ADB evaluation team, consisting of representation from each of the seven NBS workgroups, reached a consensus decision that the ADB migration proposal is not a viable option for the NBS. According to the evaluation, the ADB migration would take too long before addressing urgent administrative and scientific support requirements and would not address best practices. It also seemed unclear as to how some of the functional requirements would be met. Furthermore, the recruitment and retention of the required personnel does not seem feasible, particularly considering the tight and expensive IT labor market.

Judgment of the CIO

Following his review of the ADB migration proposal and evaluation, the NIH CIO decided that the ADB migration is not a reasonable alternative to the selection and implementation of an ERP product that meets most of the NBS requirements. The proposal should be considered only if a viable ERP product is not available, or in the event the NIH is unable to implement its chosen ERP product. His conclusion, with which the NBS Steering Committee concurred, is summarized in a subsequent section of this report, "The Alternatives Compared: Buy vs. Build".

Alternative 2 - Buy: The Commercial Software Strategy

Defining ERP and Best-of-Breed

The last few years have seen a remarkable evolution of ready-to-run software that automates the variety of business rules and financial activities used by organizations such as the NIH. Today's commercial software solutions are much more "configurable," or adaptable, so that it is generally no longer necessary, nor desirable, to perform extensive customization to meet the needs of the organization. Customization can lead to time-consuming and costly implementations, resulting in systems that are more difficult to maintain and update. Adhering to standard software packages allows implementations to

be completed as quickly as possible without sacrificing quality, while also leveraging best practices and simplifying future system maintenance and upgrades.

A specific subset of commercial software is often referred to as "Enterprise Resource Planning" (ERP) software. ERP is a term referring to a single integrated commercial software package that dynamically coordinates multiple business functions that are linked. In other words, it is software that supports various administrative and scientific support functions including Financial Management, Accounts Payable, Acquisition, etc. simultaneously in an integrated fashion. The integration is such that a business transaction updates data in all related areas in real time, and data elements reside in a single database. As an example, the purchase of a piece of scientific equipment through the NBS would also simultaneously trigger transactions that create an obligation in the general ledger module, schedule a payment to the vendor, and update the property system.

ERP as a concept aligns itself most closely with the NIH's goals and its desire for an integrated, uniform, and easily maintainable IT system for its administrative functions:

> "ERP software is designed to model and automate many of the basic processes of an [organization]… with the goal of integrating information across the [organization] and eliminating complex, expensive links between computer systems that were never meant to talk to each other. ERP is a software mirror image of the major business processes of an organization, such as [Financial Management and Procurement]. Its success depends upon reach: A circumscribed ERP system is not much better than the legacy system it replaces. In many cases, it is worse because the old code at least was written specifically for the [organization] and the task. ERP's set of generic 'canned' processes shines only when used to connect parts of an organization." [2]

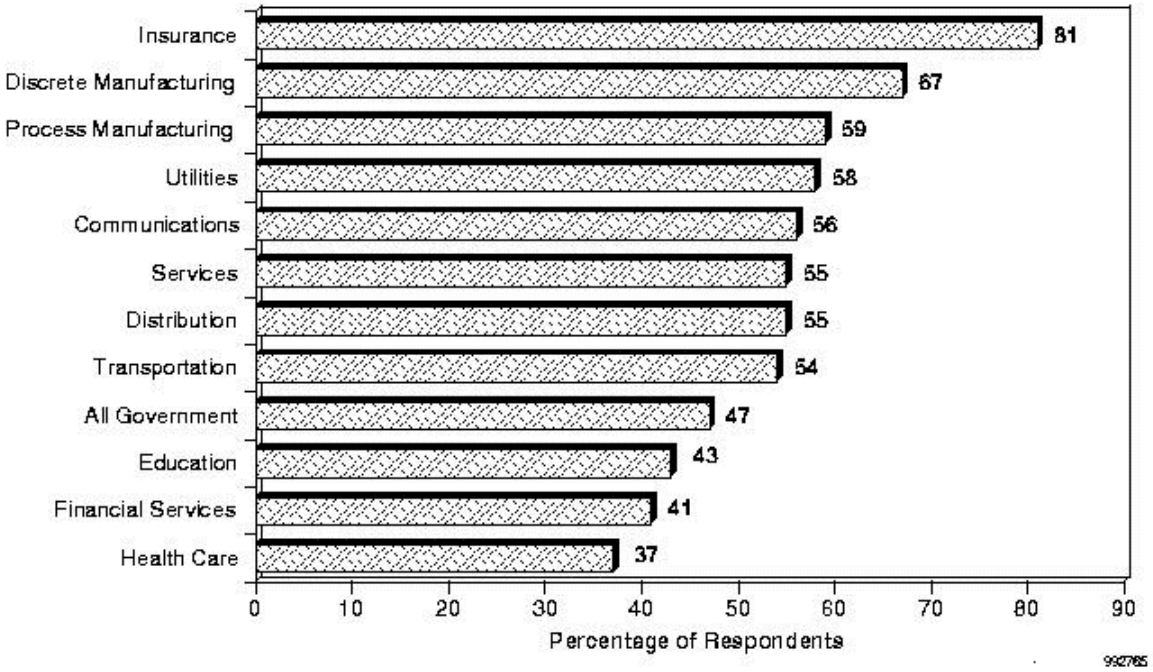
A distinction needs to be made between ERP and "best-of-breed". Best-of-breed implies the use of commercial software from different vendors for each functional area. The best-of-breed approach is often used in environments that have unique requirements in certain functional areas that can best be met by specialized software. Best-of-breed is used when the advantages of the specialized software outweigh the disadvantages of tying together multiple software packages. This approach requires in-house and contractor staff to build and maintain linkages between the separate pieces of specialized software, which eliminates many of the advantages inherent in ERP. Best-of-breed is usually more difficult and expensive to implement, maintain, and upgrade.

[2] CIO Magazine, 1998

ERP Usage

Initially adopted by private sector organizations, close to 70 percent of the U.S.' 1,000 largest corporations use ERP applications today.[3] Enterprise application usage by industry is shown in the figure below. Dataquest defines the enterprise application services (EAS) market as the implementation and management of enterprise application software which includes singular applications, integrated applications, and extended enterprise application software products.

Enterprise Application Projects Worldwide by Industry



Source: Dataquest (September, 1999)

Although the private sector is increasingly saturated with existing ERP technology, the ERP market is expected to grow overall, particularly in the public sector. In the U.S., many major universities, for example, have installed, or are in the process of installing, integrated ERP systems. While the NIH is among the first in the Federal Government to evaluate integrated ERP solutions, similar efforts are being undertaken by other Federal, state and local governments. This trend is reinforced by OMB guidelines stating a preference for the purchase of commercial software by Federal Agencies.[4, 5] According to GartnerGroup, there is also an emerging movement away from singular applications for general ledger, human resources or other functions, and toward integrated systems that incorporate multiple functions. Finally an ERP backbone is vital for organizations seeking to conduct business on the web, e.g., purchasing scientific supplies via the web.

[3] GartnerGroup, The Enterprise Application Services Market Landscape, 1999

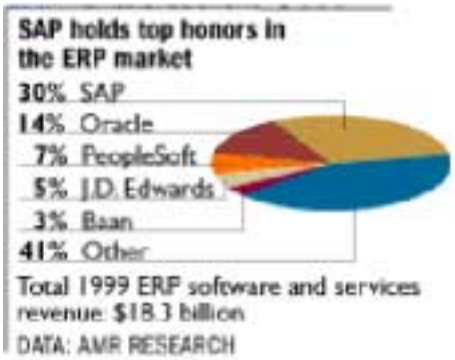
[4] OMB Circular No. A-127, Financial Management Systems, 1994 (revised)

[5] OMB Circular No. A-130, Management of Federal Information Resources, 1996 (revised)

It is predicted that ERP will be redefined as an enabler of e-business within the next two years,[6,7] which is fueling the continued growth of the ERP market.[8]

ERP Vendors

Five vendors account for nearly two-thirds of the total ERP market revenue[9]. They are SAP, Oracle, PeopleSoft, J.D. Edwards and BaaN. The graph depicts individual market shares.



As part of the evaluation process, the NIH requested that KPMG identify potential ERP vendors for consideration. Consistent with the NIH acquisition strategy to utilize the General Services Administration's (GSA) Federal Supply Schedule (FSS) to expedite the procurement process, KPMG considered all vendors that were included on the schedule and whose product had been certified by the Joint Financial Management Improvement Program (JFMIP) as of December 28, 1999. As noted earlier, the JFMIP is a joint effort of the Treasury Department, the General Accounting Office, the Office of Management and Budget and the Office of Personnel Management and choosing a vendor that it certifies assures that the NIH would receive a product that meets Federal financial management standards and requirements. This effort resulted in the identification of six vendors.

[6] TechnologyEvaluation.com, Enterprise Resource Planning (ERP) Market – Dismal 1999, the New Millennium to bring Relief (for Some), 2000

[7] Forrester, The Apps Market: 1998 – 2003, 1999

[8] GartnerGroup, Enterprise Application Solutions in Vertical Markets, Part 2: Industry Snapshots, 1999

[9] TechnologyEvaluation.com, 2000

KPMG then assessed each of these six vendors according to the degree to which the vendors' products provided a proven integrated solution, the vendors' public sector experience, and if the vendors had Tier 1 ERP classification. Tier 1 ERP vendors are those that serve large organizations and have the demonstrated scalability and technical architecture to support the high transaction volumes and diverse processes of large organizations, particularly in the public sector. KPMG's evaluation of each criterion, is shown in the table below:

++ = Best-in-class

	Criterion I	Criterion II	Criterion III	Criterion IV	Criterion V	Recommended for Consideration?
	Federal Supply Schedule	JFMIP Certification	Proven Integrated Solution	Public Sector Expertise	Tier 1	
Vendor 1	+	+	O	++	O	Yes
Vendor 2	+	+	O	O	O	
Vendor 3	+	+	+	+	+	Yes
Vendor 4	+	+	+	+	+	Yes
Vendor 5	Pending	+	O	O	O	
Vendor 6	+	Pending	+	+	++	Yes

+ = Meets NIH requirements
O = Limited fit for NIH requirements

As a result, four vendors were recommended to NIH for full consideration and three responded to the solicitation.

Implementing ERP

ERP implementations are generally perceived to be highly complex and some of the difficulties that have been experienced, particularly when organizations change or customize their software, have been widely publicized. However, a recent GartnerGroup survey of ERP projects yields some surprising insights. The study indicates that ERP deliveries are significantly more successful than custom development projects. Only 10% of ERP implementations were cancelled vs. 28% of custom development projects. More importantly, 85% of the organizations surveyed are neutral to very satisfied with the solution. Only 26% of custom development projects were considered to be a success. [10]

A META group survey of a mix of organizations indicates the average time to implement ERP is 23 months. There is also a strong correlation to the size of the organization with the largest organizations averaging a longer implementation time of 31 months.[11] The same META Group study indicated that, on average, quantifiable benefits were achieved approximately 2.5 years after project initiation and the average breakeven point occurs roughly five years after project initiation. While these studies may provide a sense of implementation times occurring primarily in the private sector, they may be only a rough guide to implementing ERP software in the public sector. The profit incentive and a more

[10] GartnerGroup, Is ERP Delivery So Bad?, 1999

[11] META Group, ERM Solutions and Their Value, 1999

streamlined decision making process may well yield a more timely implementation in the private sector.

ERP implementations differ substantially from traditional IT projects in which IT organizations take the lead due to the high IT content of the project such as programming. "ERP breaks the mold of the traditional systems project, in which IT takes the lead and programming rules the day."[12] It shifts the focus of the project to the business offices, which must develop a new way of doing business maximizing the efficiencies gained by ERP and away from the IT organization, which typically provides infrastructure and technical support. Success depends on deciding how to run the business and then to use ERP to simulate and enforce these decisions. This process is simplified by the fact that ERP systems have embedded best practices as a starting point, which differentiates the implementation process of an ERP from a traditional "blank sheet of paper" Business Process Reengineering project. The process is also facilitated by the use of System Integrators that are deeply familiar with the ERP product and industry best practices to assist with implementation.

The Alternatives Compared: Buy vs. Build

Given the perceived fit of commercial software to NIH requirements, the commercial solution has significant advantages over custom development in terms of functionality, timing, risk, and cost-benefit:

Functionality and Time to Benefit

- As indicated above, one of the primary reasons for updating the current administrative system is the need to improve current administrative and scientific support practices to satisfy budgetary, regulatory and service needs. ERP packages are designed around best practices, most of which have been adopted by the NIH NBS Steering Committee, and makes them available to the NIH more quickly. As will be shown in the Business Case section below, the implementation of best practices will result in significant, and more timely, benefits to the NIH. The adoption of these best practices is a significant factor for selecting an ERP over custom development.

- Because of their significant investment in software development and research, ERP vendors are better positioned to take advantage of the most current technology and implement the latest best practices. Software development is their core competency. Federal organizations, such as the NIH, have a much different mission.

- The ERP solution also allows the NIH to maintain a state-of-the-art technology because vendors upgrade their software on a regular basis.

[12] CIO Magazine, Flipping The Switch, 1996.

Time to Implement

- The time line for implementing commercial ERP solutions is significantly shorter than for building proprietary solutions. Commercial software is already developed and needs only installation and migration. For proprietary solutions, the software must be developed and tested in addition to the installation and migration effort.

Risk

- Selection of the ERP solution is in keeping with the OMB commitment to give first priority to purchasing for Federal applications. Both OMB Circulars No. A-127 and A-130 assert this priority.[13, 14]

- ERP implementations, as previously mentioned, have a significantly higher success rate than traditional application development efforts. Success includes both on-time delivery and post-implementation satisfaction.[15]

- There is a growing set of experiences in implementing ERP solutions in the public sector; lessons learned can be shared with the diverse user and technical community, including NIH.

- ERP technology is proven and has been "tested" by many organizations, benefiting from the suggestions of existing ERP users.

- ERP solutions are, however, not risk free. Many of those risks are noted below, and strategies to mitigate these risks, are detailed.

Cost

- ERP implementations are shorter and less resource intensive than custom development projects. In addition, ERP products include standard documentation, training materials and classes, and simplified software maintenance, significantly reducing the cost of ongoing operations.

- Most importantly, ERP development and maintenance costs, the cost for monitoring the current advances in technology and the costs for adding new functionality are amortized over a large customer base. A proprietary system, on the other hand, usually is financed by a single "customer".

Conclusion – Buy

The four considerations described above were used to reach a "buy vs. build" conclusion. In light of these considerations, the workgroups recommended and the Steering Committee concurred, to opt for the purchase of an ERP solution over building a proprietary and highly customized system.

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[13] OMB Circular No. A-127, Financial Management Systems, 1994 (revised)

[14] OMB Circular No. A-130, Management of Federal Information Resources, 1996 (revised)

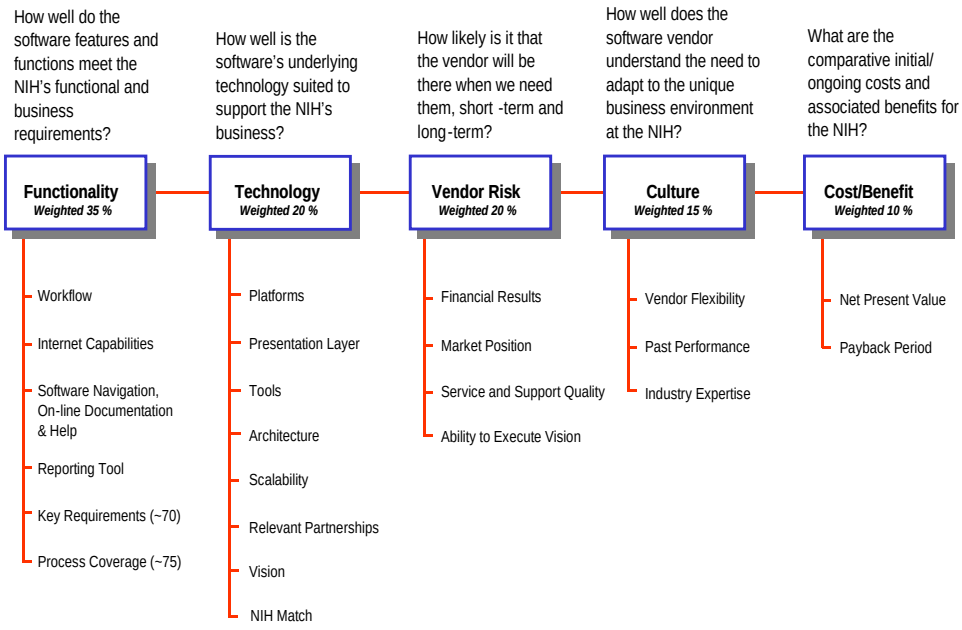
[15] GartnerGroup, Is ERP Delivery So Bad?, 1999

Best-Fit Vendor for "Buy" Solution

Vendor Evaluation Process

Given the decision to "buy", the ERP products that were identified were evaluated as described herein. At the outset, the NIH workgroups evaluated each of the ERP vendors' software to assess whether or not they would satisfy the requirements that had been established by those workgroups. While the individual vendors varied in the ease in which the requirements would be satisfied, all requirements were deemed to be satisfied with the exception of sponsored travel, which will require some customizations, regardless of the vendor selected.

Five criteria, and the weights to be assigned to each of these criteria, were established by the Steering Committee and are illustrated and defined below.



As can be seen, highest weight was assigned to the functionality of the vendor's product to assure that the software will be responsive to the needs of NIH administrative and scientific personnel. Of note is that the Steering Committee considered this factor to be of higher importance than either technology or cost. The evaluation process used to evaluate each of the commercial vendors considered is summarized below for each criterion.

Functionality & Culture criteria: Software functionality and culture were evaluated by the seven functional workgroups because the OD and IC workgroup members are the service delivery experts. Each group identified key requirements from the list of functional requirements developed earlier, and the vendors were given the opportunity to demonstrate that their software could accommodate these requirements during scripted demonstrations. Members attended an all-day overview presentation by each vendor, and then attended individual detailed all-day sessions with each vendor to assess how well

their product accommodated these key requirements for each function. Based on the vendors' performance in those demonstrations and their written responses to functionality and culture questionnaires, the workgroup co-chairs, with advice from their members, rated each vendor independently in each of the evaluation elements of the functionality and culture criteria defined above.

Technology criterion: The underlying technology of each vendor's software was evaluated by a Technology Evaluation team chaired by NIH's Chief Technical Officer. The Technology Evaluation team consisted of technology experts drawn from across the NIH and who were selected on the basis of their technical expertise and their knowledge of NIH's IT strategy and requirements. The team developed a demonstration agenda covering key technology topics of interest such as integration, platform, and Internet capabilities. The Technology Evaluation Team then attended a full day workshop with each vendor based on these topics. Following the vendors' participation in these workshops, and considering written responses to technology questionnaires and analyst reports, the members rated each vendor separately on the elements shown under the Technology criterion defined above.

Vendor Risk criterion: Vendor Risk estimates the likelihood that the vendor will be available to provide services when needed, short term and long-term, and is evaluated by assessing the vendor's financial condition, market position, quality of service and support and its ability to execute its vendor vision. The analysis and evaluation, conducted by members of the NBS Project Management Team, was primarily based on the written responses to vendor profile questionnaires and analysts' reports.

Cost-Benefit criterion: The cost-benefit analysis and evaluation was conducted by members of the Project Management Team. The Net Present Value for the NBS was calculated based on the guidance stipulated in the January 2000 release of OMB Circular No. A-94. The Business Case section below lists the assumptions made regarding the cost estimates and the calculation of benefits.

Vendor Selection

The final results of the evaluation were presented to the NBS Steering Committee on March 15, 2000 and the committee concurred with the recommendation to award the software contract to the vendor with the highest overall total score and the lowest overall cost. The selected vendor was unique in offering a fully integrated solution covering the basic requirements in all seven functional areas. It should be noted that neither the recommended vendor nor the pertinent scoring information has been provided in this document, which is being distributed prior to the decision to proceed with an award, consistent with procurement regulations and DHHS' confidentiality of information policies.

PART THREE: THE BUSINESS CASE

Strategic Benefits of the NBS

Implementing the NBS will yield qualitative and quantitative benefits to the NIH because it will enable improved business processes and provide more accurate and timely information to better support the scientific mission of the NIH. The NBS benefits as identified by the workgroups, some of which are quantified in the Net Present Value calculation that follows, include:

- Reduced cost and complexity of doing business
- Increased service levels
- Increased competitiveness of NIH's centralized services
- Better sharing of information between organizational entities at the NIH
- Improved managerial control
- Compliance with mandated legislation and regulations

Reduce the cost and complexity of doing business: Some of NIH's current administrative processes are paper intensive and require multiple approvals. This delays the completion of tasks and results in increased costs due to unnecessary work. One way to reduce the cost and complexity of doing business is to streamline and automate the steps required to complete an administrative process. Excessive routing and processing redundancies can be reduced by the workflow management capabilities of the NBS.

Increase service levels: Like all organizations, NIH would like to be more responsive to its "customers", particularly its scientific staff. The pace of science demands that NIH service and support organizations:

- Improve service delivery timeliness and predictability
- Improve service quality by identifying and quickly resolving errors
- Provide more accurate and timely information regarding status inquiries

Each of these can be accomplished by implementing the NBS.

Remain competitive: Many organizations are opting to outsource their administrative functions to external providers so they can conduct business "better, faster and cheaper". In order for NIH's centralized services to remain competitive with potential external providers, NIH must:

- Eliminate non-value added and manual activities
- Reduce the cost of purchased goods and services
- Optimize resource allocation
- Minimize delays
- Optimize cash/funds management

Implementing the NBS will facilitate each of these.

Facilitate better sharing of information between organizational entities at the NIH: Many of NIH's administrative processes are decentralized and distributed among 26 different ICs. The sharing of information between the ICs is limited partly by the use of separate shadow systems within the ICs. The use of a standard and single data source along with improved reporting will allow NIH to leverage the information that exists across the entire organization.

Improve managerial control: Managerial control refers to accurately tracking and managing all resources in order to refine processes and identify areas for improvement. Informed and timely decisions rely upon the availability of, and access to, reliable information regarding NIH's administrative and scientific support systems.

Comply with legislation and regulations: NIH's administrative systems must be flexible enough to respond quickly to changes in laws and Federal regulations. Particularly pertinent are the requirements of the Chief Financial Officers Act, the Government Management Reform Act and the Federal Managers Financial Improvement Act that dictate standards with which the NIH's accounting system must comply. The NBS vendors' software has been certified by the JFMIP, assuring that it can meet these requirements. In addition, data integrity and strong auditing tools are required to ensure continued compliance with new legislation and regulations.

Implementing the business practices embedded within ERP software can achieve significant savings. Following are case study benchmarks according to Benchmarking Partners, a recognized analyst firm, illustrative of the magnitude of benefits achieved by both commercial and public sector organizations when implementing ERP packages.[16] Although no attempt was made to apply each of these benchmarks to the NIH, these experiences of other organizations demonstrate the magnitude of the potential benefits that can be achieved with the NBS.

Function	Business Process	Metric	Case Study Benchmarks
Procurement and Supplies	Quote / Contract Management	Improved terms and conditions	• Reduced response time to requests for quotes by 80% • Reduction in supplier management costs by 40% • Reduction in the cost of purchasing by 5-10%
	Purchase Order Management	Decreased procurement cost	
	Receiving Management	Reduced handling / storage costs	
	Product Performance Management	Reduced performance variability	
	Financial Interfaces	Improved accounts payable performance	
	Vendor performance Management	Improved vendor contracting	
Logistics and Distribution	Distribution Network Infrastructure	Reduced total distribution costs	• Reduction in inventory levels by 30% • On-time deliveries up from 70-75% to 87% • Reduction in inventory carrying costs by 20% • Reduction in average delivery time by 33%
	Distribution Planning	Improved on-time delivery	
	Inventory management	Improved visibility / reduced inventory levels	
	Warehouse Management	Improved space utilization, reduced pick / pack ship time	
	Transportation Management	Reduced delivery costs	
Finance and Administration	General Ledger	Improved consolidation time / cost	• Reduction in financial close time by 50% • Reduction in administrative staffing by 25% • Increase in payment discounts (due to reduced payment cycle time) by 230%
	Accounts Payable	Minimized cash outflow	
	Accounts Receivable	Reduced credit losses / days outstanding	
	Asset Management	Increased utilization	
	Human Resource Management	Improved personnel productivity	
	Costing	Improved economically-based decision making	

The NBS is a tool that can enable the realization of these benefits. Below are some examples to illustrate *how* specific functionality of the NBS can facilitate some of these benefits:

General Ledger Module provides financial analysis, automated financial and management reporting consistent with legislative requirements, general ledger accounting

[16] Benchmarking Partners, Estimating Strategic and Tangible Return on Investment, 1996

and consolidations that enable the organization to collect and report financial information based on each IC's unique requirements. Features include: unlimited charts of account, unlimited ledger versions, gross and net debit and credit balances, NIH-defined ledgers, flexible calendars, dynamic budgeting, automated journal entry, automated allocations processing and inter-agency journal entries.

e-Procurement / Acquisition Module automates requisitioning, procurement and receiving of goods, services, and property, streamlines acquisition functions through on-line requisitioning, automated sourcing, and application integration. It also enables purchasing agents to manage contractor selection and ongoing contracts more efficiently and cost effectively. Features include: simplified paperless receiving which also supports advanced shipment notifications via electronic data interchange (EDI), payment generation without invoices using pre-established criteria, and automatic receipt requisitions from third party providers.

Accounts Payable Module provides comprehensive accounts payable and cash management functions. Features include: the support of multiple currencies, flexible payment policies, automated three-way matching of receiving, integration with property management module and procurement to track property acquisitions, invoice and procurement action data, recurring vendor contracts, workflow approval for vouchers, and cash requirements analysis and planning.

Accounts Receivable Module manages the receipt of inter-agency payments, and is designed to improve the organization's ability to collect payments in a timely fashion.

Billing Module offers a flexible, modular approach for managing billing and adjustments, generating invoices, and creating account distributions. NIH can create an agency-wide billing information repository, streamline the billing process, and customize billing requirements.

Project Module integrates operational and financial functions, allowing users to perform a variety of tasks, from managing complex capital projects to calculating revenue for billable projects.

Property Module manages the acquisition, maintenance, transfer, depreciation and retirement of fixed assets. Features include asset tracking, maintenance and insurance tracking, flexible depreciation accounting for general ledger, what-if depreciation modeling, and integration with payable and procurement modules.

Inventory Control Module provides the ability to efficiently store and issue stock in response to changing demands, accurately track the movement of stock on a real-time basis, and automatically replenish stock as needed. Features include inventory set-up based on organizational structures, costing and valuation management, warehousing space and stock management, schedule replenishment and distribution, inventory time levels maintenance, material "put away" management, fulfillment of orders, item identification, lot and serial number tracking, local planning and reporting on inventory data.

Budget Module integrates most aspects of the budgeting process, combining spreadsheets, workflow processing and query / reporting tools into an integrated budgeting solution. Features include automatic routing, flexible levels of budget detail, access to data from other modules, access to historical data, flexible time spans, status monitoring and reports tailored to user requirements.

Contract / Acquisition Module creates comprehensive acquisition documents such as solicitations and contracts quickly and easily. Federal Acquisition Regulations (FAR) and clauses are kept in an easy-to-access database.

Travel Module integrates information with the NIH's travel management center. It automates every step -- from trip requests to final confirmations and ticketing. On-line authorization and voucher processing incorporates the latest regulations and per diem rates for full government compliance. Electronic processing automatically audits travel documents for compliance. It creates a seamless stream of documents into the general ledger, eliminating the most time-consuming steps in the travel process. Electronic signature protocol ensures data security and authenticity.

The Net Present Value Calculation for the NBS

According to OMB Circular A-130, an investment of resources for the NBS must be subjected to a Net Present Value (NPV) calculation using the methodology described in OMB Circular No. A-94. This calculation requires the estimate of costs and benefits of the NBS. The difference between the yearly costs and benefits are then expressed in today's dollars, i.e., future dollars are discounted assuming that the cost of capital is 6%. The OMB guidelines indicate that this calculation of net present value be equal to, or greater than zero, i.e., that the discounted benefits be at least as great as the discounted costs, in order to justify a project on economic grounds. The following sections of this chapter discuss the assumptions used in estimating costs and benefits, the calculation of the costs and benefits themselves, and the resulting Net Present Value.

Assumptions

The project's cost-benefit analysis has been developed with the intent to be as realistic as possible. The investment analysis is based on the following underlying assumptions:

- NIH will undertake a phased implementation and deployment by functional area over a 3-year period beginning September, 2000:
    - Financial Management
    - Property Management
    - Travel Management
    - Acquisition, Accounts Payable & Supply Management
    - Service and Supply Funds

  This will minimize risk and afford an orderly transition.

- Initially, NIH will develop interfaces only between the NBS and other major NIH-wide transaction systems. Funds are included within the NBS budget to develop the following interfaces:
    - NIH Administrative Database (ADB)
    - Appropriate NIH Service and Supply Fund modules
    - IMPAC I and II
    - DHHS Payroll System
    - DHHS Payment Management System
    - United States Department of the Treasury Systems
    - NIH Data Warehouse
    - NIH Status of Funds Database

  The NIH CIO is currently conducting a thorough analysis of the e-procurement market and will announce the NIH strategy for accommodating electronic purchasing. When announced, the NBS team will comply with that strategy in its development of an interface to the NIH Intramall.

  Interfaces with other NIH systems may need to be considered on an exception basis by the NBS Steering Committee. If approved, sources of funding for their development and maintenance would need to be identified.

- The software vendor will deliver an ERP package, as proposed, that will be fully integrated across all seven functions as well as with the NIH EHRP.

- NIH will avoid customizing the software, i.e. unless determined otherwise by the NBS Steering Committee, NIH will change its business practices rather than making changes to the software code to replicate existing practices. Customization, in addition to increasing project costs and timelines, defeats the advantages of ERP software and argues for the use of proprietary rather than commercial software and must be held to the minimum level required to achieve program goals.

- NIH will implement the best practices adopted by the Steering Committee in the manner assumed by the software.

- NIH will make maximum use of in-house staff resources in conjunction with systems integrator personnel, to staff implementation teams and to provide management oversight over the implementation process. This recognizes the fundamental principle that the NBS is being undertaken on behalf of the NIH community and should be directed by NIH personnel to assure it meets the needs of NIH.

- All necessary NIH staff will have access to the applications via Web-Browser without the need to make workstation modifications.

- The training approach of train-the-trainer will be primarily utilized.

- The calculations in the cost-benefit analysis are based on a useful life of seven years after an initial investment in year 1, and use a monetary discount rate of 6% per OMB guidance.[17]

Quantified Benefits of the NBS

Cost Savings

The Project Management Team established, and the Steering Committee concurred with, criteria for identifying items that should be counted as having a benefit for purposes of calculating a cost-benefit ratio. These criteria are intended to assure a defensible identification of potential benefits. These criteria establish that items can be included in the cost-benefit calculation if:

- The ERP software selected provides the capability to implement a best practice or achieve a business goal that is not available through the current ADB system, and that the NIH will implement that capability.

- NIH adopts a best practice or a business goal as a result of the analytical process that occurs during the evaluation and implementation of an ERP system, even if the capability to perform that activity currently exists but is not utilized.

It further assumes that an item cannot be considered to have a benefit for purposes of the cost-benefit calculation if the ERP system provides the capability to implement a best practice or achieve a business goal that is unlikely to be adopted by the NIH.

Subsequently, the Project Team selected specific items that meet the criteria, and lend themselves to quantification, from the list of goals and best practices identified earlier by the workgroups and endorsed by the Steering Committee. The benefits have been derived in cooperation with NIH staff using existing data sources. Quantified benefits of the selected items amount to almost $14 million per year. This is judged to be a conservative estimate as it only considers the items that could best be quantified; a larger universe of benefits exists as implied by the benchmarking figures above.

Listed below are the quantitative benefits that NIH can expect to realize with these practices and the NBS. A more detailed discussion of these best practices is included in Attachment 2 in the Appendix. It should be noted that these data are estimates and serve as a general indicator of the feasibility of implementing an NBS.

[17] OMB Circular No. A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, Rev. Jan. 2000

Cost Element	Rationale	Benefit
Reduce OFM's Costs Related to Financial Audits	The NBS will produce financial statements automatically, and eliminate much of the manual reconciliation now performed by OFM staff.	$368,000
Reduce Costs of OFM's Central Services Budget and Accounting	The NBS contains integrated cost management and budgeting capabilities that should automate some analysis and rate-setting activities that are now performed manually by OFM's Central Services Budget and Accounting staff.	$850,000
Reduce NIH-wide Transaction Costs of Procurements	OPM estimates that Internet procurement, automated workflows, and the user-friendly screens, all facilitated by the NBS, will significantly reduce the time required for NIH purchasing agents to complete a procurement transaction.	$4,860,000
Reduce Costs of Administrative Supplies.	Contracting with a prime vendor for administrative supplies with door-to-door delivery will enable savings to the NIH's current inventory system.	$705,000
Reduce NIH-wide Cost of Developing and Maintaining Shadow Systems	An integrated, NIH-wide NBS with workflow capability will reduce dependence on "shadow systems".	$3,110,000
Reduce NIH-wide Costs Related to Purchase Card Reconciliation	The NBS should eliminate the manual reconciliation of the listing of credit card purchases with the purchase card statement that is currently required.	$1,730,000
Reduce Costs within the Division of Supply Management.	The NBS will eliminate the manual reconciliation that now must occur between multiple databases used in the DSM.	$173,559
Reduce ORS and OLM Physical Inventory Costs	The NBS will enable DES to periodically sample its inventory of maintenance supplies rather than conducting an annual wall-to-wall inventory. In addition, the contractor conducting NIH's property inventory downloads data from the scanner to their own database; the NBS will provide the database, thereby eliminating that portion of the current contract's cost.	$349,000
Reduce OFM Costs associated with tracking Accounts Receivables	The NBS will automatically track and prompt for collections of Accounts Receivables, reducing the tracking performed manually by OFM staff.	$140,000
Reduce OFM Costs by Expediting the Payment of Invoices.	The NBS will enable the best practice of paying for purchases under $2,500 upon obligation of funds and of authorizing payments over $2,500 when an appropriate official enters receiving information. This will reduce this workload, and costs, for OFM's Commercial Accounts staff.	$640,000
Reduce NIH's Interest and Penalties on Late Payments	The NBS will automatically track payments that must be made and provide system prompts alerting OFM to make timely payments.	$150,000
Reduce Equipment Maintenance Expenditures	The NBS will provide real-time tracking of equipment maintenance schedules and warranty information. This will allow NIH to take full advantage of warranties rather than paying for maintenance. It would also facilitate the scheduling of preventative maintenance and the regular updating of maintenance agreements.	$470,000
Increase Discounts Taken on NIH Purchases	The NBS will store information on vendor discount terms, and provide system prompts, that will allow OFM to make payments to maximize discounts.	$50,000

Cost Element	Rationale	Benefit
Reduce NIH Cost per Travel Transaction Through Electronic Booking	The NBS will provide an on-line booking capability that will allow NIH to take advantage of the lower transaction fee charged by the Travel Management Center when a booking is made on-line.	$52,800
Total Potential Benefits for Selected Items		**$13,648,359**

Cost Avoidance

In addition to the almost $14 million in cost savings described above, a benefit accrues to the NIH by "cost avoidance", i.e., the elimination of costs related to supporting the ADB. This cost avoidance is included in the benefits portion of the investment analysis. As the NBS is phased in, these costs will be eliminated and replaced by the "Post-Implementation Support" cost of the NBS, and are shown in the NBS cost table that follows. The cost avoidance projections are based on extrapolating current personnel and overhead costs over the investment period and average approximately $6 million per year once the ADB is completely phased out.

Calculation of Benefits

In order to calculate the present value of the benefits, over the investment period, an assumption needed to be made regarding the rate at which these benefits (i.e., savings) would accrue to the NIH. Consistent with the conservative approach undertaken throughout this calculation, it was assumed that they would occur in a phased manner and that most of the benefits would not accrue until 2004 when the NBS would be fully implemented. The resulting stream of benefits used in this calculation, assuming a 5% increase per year, is as follows:

FY	2001	2002	2003	2004	2005	2006	2007	2008
Cost Savings	$ 13,648,359	$ 14,330,777	$ 15,047,316	$ 15,799,682	$ 16,589,666	$ 17,419,149	$ 18,290,106	$ 19,204,612
Cost Avoidance	$ 5,646,803	$ 5,859,400	$ 6,028,377	$ 6,216,623	$ 6,424,836	$ 6,653,781	$ 6,904,290	$ 7,180,462
Subtotal, Benefits	*$ 19,295,162*	*$ 20,190,177*	*$ 21,075,693*	*$ 22,016,305*	*$ 23,014,502*	*$ 24,072,930*	*$ 25,194,396*	*$ 26,385,073*
Rate that benefits will be realized	*0%*	*15%*	*30%*	*90%*	*100%*	*100%*	*100%*	*100%*
Projected Benefits	***$ -***	***$ 3,028,527***	***$ 6,322,708***	***$ 19,814,674***	***$ 23,014,502***	***$ 24,072,930***	***$ 25,194,396***	***$ 26,385,073***

Costs of the NBS

The second element that is required to calculate the net present value of an investment in the NBS is the estimate of the costs over the same period. As can be seen from the table below, these costs are estimated to be $93.6 million. The shaded area is explained on p. 38.

FY	2001*	2002	2003	2004	2005	2006	2007	2008	
Program Costs									
Licenses and Software	$ 2,801,570	$ 2,354,822	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,156,392
Hardware	$ 1,000,000	$ 900,000	$ 170,000	$ 200,000	$ 50,000.0	$ 50,000.0	$ 50,000.0	$ 50,000.0	$ 2,470,000
Maintenance	$ 648,414	$ 577,226	$ 1,147,681	$ 1,205,065	$ 1,265,319	$ 1,328,585	$ 1,395,014	$ 1,464,765	$ 9,032,068
System Integrator	$ 8,010,000	$ 7,750,000	$ 7,750,000	$ 1,000,000		$ -	$ 1,000,000	$ -	$ 25,510,000
Training	$ 448,511	$ 750,000	$ 720,000	$ -	$ -	$ -	$ -	$ -	$ 1,918,511
CIT Operations		$ 800,000	$ 1,600,000	$ 1,700,000	$ 1,700,000	$ 1,700,000	$ 1,700,000	$ 1,700,000	$ 10,900,000
Contingency Fund**	$ 3,500,000	$ 3,000,000	$ 3,000,000						$ 9,500,000
Subtotal, Program Costs	*$ 16,408,495*	*$ 16,132,048*	*$ 14,387,681*	*$ 4,105,065*	*$ 3,015,319*	*$ 3,078,585*	*$ 4,145,014*	*$ 3,214,765*	*$ 64,486,971*
Cumulative Program Costs	*$ 16,408,495*	*$ 32,540,543*	*$ 46,928,224*	*$ 51,033,290*	*$ 54,048,608*	*$ 57,127,193*	*$ 61,272,207*	*$ 64,486,971*	
Operating Costs									
Implementation Staffing	$ 4,606,000	$ 4,709,250	$ 4,564,350		$ -	$ -	$ -	$ -	$ 13,879,600
Post-Implementation Staffing	$ -	$ -		$ 2,396,284	$ 2,376,315	$ 2,495,130	$ 2,619,887	$ 2,750,881	$ 12,638,497
Furniture and Equipment	$ 500,000								$ 500,000
Space	$ 450,667	$ 436,800	$ 458,640	$ 132,151	$ 138,758	$ 145,696	$ 152,981	$ 160,630	$ 2,076,322
Subtotal, NIH Staffing Cost	*$ 5,556,667*	*$ 5,146,050*	*$ 5,022,990*	*$ 2,528,434*	*$ 2,515,073*	*$ 2,640,826*	*$ 2,772,868*	*$ 2,911,511*	*$ 29,094,419*
Total Costs	**$ 21,965,162**	**$ 21,278,098**	**$ 19,410,671**	**$ 6,633,500**	**$ 5,530,391**	**$ 5,719,411**	**$ 6,917,882**	**$ 6,126,276**	***$ 93,581,390***

*** This analysis assumes that the implementation will begin September 2000 (FY 2000). Therefore, the costs shown in the FY 2001 column also include the costs for that additional month.**

**** The contingency fund is excluded from the NPV calculation and sensitivity analysis.**

A description of each cost items in the table above is as follows:

Licenses and Software include the costs for: the vendor's core software application, application software from other vendors that will be incorporated with the core software, and database software to support all the seven administrative and scientific support functions within the scope of the NBS. This category also includes funding to develop needed interfaces between the core application and the software of other vendors. These costs are based on the estimates presented to the NIH by the recommended vendor. Based on these assumptions, total licensing fees amount to $5.2 million over the investment period.

Hardware cost estimates include funding to purchase all central computing hardware that is necessary for the NBS. No funds are provided to upgrade local and wide area networks as NIH's current infrastructure is sufficient. Total hardware costs are estimated to amount to $2.5 million over the life of the NBS and include the following cost components:

- Application and Data Base Server costs, which are based on vendor estimates submitted to the NIH as part of the written proposal. This request supports sufficient equipment to operate two systems, one for test and development and one for operations.

- A limited fund of $250,000 to share expenses related to upgrading IC workstations at the IC's if necessary. Predicting the need and sizing this cost category is extremely difficult. This estimate was based on other

organizations' experience with the current state of internet technology of the selected vendor.

- A limited fund of $250,000 for other equipment possibly related to network upgrades and other costs related to the project team's computer equipment needs.

Maintenance costs are based on the recommended vendor's proposal for maintenance costs for software, including the database and hardware. Maintenance fees are phased-in over the implementation of the NBS and then stabilize at $1.2 million per year (with 5% per year for inflation) over the remaining period. The maintenance costs typically include a 24x7 toll free vendor helpline for the implementation teams and CIT, an on-line issue resolution process, software updates and release upgrades, as well as on-site support. The total over the investment period is estimated to be $9 million.

System Integrator cost estimates are based on a detailed task and resource analysis consistent with the implementation assumptions shown above. System integrator costs can be grouped into three categories: application support, technical support and installation, all of which have been considered in the cost estimate and supplement NIH staffing resources. Finally, the cost estimates include system integrator resources to assist in the development of interfaces between the core software and other NIH enterprise systems. No funds are included to link the NBS to systems other than the enterprise systems as indicated and explained above. Also included in the system integrator cost estimates is the cost associated with two software version upgrades, one in 2004 and one in 2007. Total system integrator costs to implement the NBS are estimated to be $25.5 million.

Training costs are estimated based on three training modes:

- *Implementation Team Training provided by the selected vendor* - Implementation team members usually go through three rounds of training, beginning with an overview class at the start of the project and continuing with more specialized classes at different points throughout the implementation. Funding for this training mode is based on training recommendations and cost estimates provided to NIH by the selected vendor: $338,511.

- *Implementation Team Training through knowledge transfer from the system integrator* – The most intense training for the implementation team is working with system integrator to simulate business processes using the software on a day-to-day basis. This training mode is an inherent part of implementing the NBS using pre-existing process scripts, product documentation based on the system integrator's methodology and configuring the software itself. The funding for this training mode is included in the system integrator costs above.

- *End-user training developed by the implementation team and administered by a central mechanism* – End-user training is limited to the needs of end-users to perform day-to-day operations within their functional area. End-

user training is unique to the NIH as it teaches NIH-specific business rules and use of data. Training materials are, therefore, developed by the implementation team and are based on predefined training templates using the system integrator's methodology. The proposed training approach for end-users at the NIH is to embed the software end-user training into the overall functional training courses provided by the Division of Workforce Development (DWD) or some other central mechanism. Training would, initially, be supported by the implementation team and key users in the individual IC's, to train-the-trainers and to maximize initial coverage. While much of the training development costs are embedded in the system integrator budget and the NIH staff resources, additional costs to develop and administer the training are estimated at $1.6 million.

CIT Operations – This cost category refers to CIT charges for the NBS' use of IT infrastructure. CIT operations charges consist of Network usage and support, data center support, etc. and are estimated at $1.7 million per year after full deployment of the NBS and total $10.9 million over the period of the projection.

Contingency - Although every effort has been made to include all costs in the categories above there are certain areas of uncertainty. Cost estimates may emerge with the refining of the implementation plan that will occur prior to commencing the implementation and it would not be responsible not to provide a contingency for such costs that are anticipated but which can't be precisely quantified at this time. A contingency fund of $9.5 million over three years will be used for items such as the following:

- Costs arising during the refinement of the implementation plan and development of a change management strategy.

- Costs that might be required to configure and install client-server software modules in NIH users' workstations in cases where pure web access is impractical.

- Costs possibly required to customize the software to incorporate sponsored travel into the NBS. This was the single major NIH requirement not satisfied by the commercial software products that were evaluated.

- Costs related to implementing NIH's eProcurement strategy. NIH is still in the process of developing an eProcurement strategy and the final plan may incur additional licensing and implementation costs.

This project should be considered to be similar in size and complexity to a major facilities construction project. In such cases, it makes good business sense to plan for the unexpected.

Operating Cost estimates include all additional NIH resources required to implement and support the NBS. Internal resource costs are grouped as follows:

- *Implementation*: Based on the detailed implementation task analysis, it is estimated that over the three-year implementation of the NBS on average

39 NIH employees would be dedicated full time to the NBS project. Most of these individuals are assumed to be existing NIH employees but funds are proposed so that OD and IC offices can backfill these positions if NIH decides to do so as part of the project's costs. This includes a Project Management Team, Functional Team members (i.e. a financial management team, a property team, etc.) comprised of current OD and IC employees, a Technical Team, and CIT infrastructure support personnel. It should be noted that each of the teams will be complemented and supported by a comparable number of system integrator personnel (budgeted in system integrator line above). Total cost for NIH staff required during the three-year implementation of the NBS is estimated at $13.9 million and the FTE's required are displayed by year, in the table below. Actual costs will be determined, however, by the degree to which NIH utilizes the strategy of backfilling positions of those IC/OD personnel who will be serving on these teams.

- *Post-Implementation*: As certain functions are deployed, and become stable, a sub-set of the implementation team will move into a "competency center" to support, maintain and refine the NBS. The competency center will be responsible for continuing support for reporting, documentation, workflow, and will operate as an NBS helpdesk. The FTE estimates for the competency center are shown in the table below under the heading "Post-Implementation":

FY	2001*	2002	2003	2004	2005	2006	2007	2008
Implementation:								
Project Management Team	10.8	10.0	10.0					
Functional Teams:								
NIH	17.5	18.0	15.0					
Contractor	14.0	14.8	10.2					
Subtotal, Functional Teams	*31.5*	*32.8*	*25.2*					
Technical Teams:								
NIH	9.7	9.0	9.0					
Contractor	5.4	5.0	5.0					
Subtotal, Technical Teams	*15.1*	*14.0*	*14.0*					
CIT Infrastructure Support	2.2	2.0	2.0					
Subtotal, Implementation	*59.6*	*58.8*	*51.2*					
Post Implementation:								
Functional Support				13.0	12.0	12.0	12.0	12.0
Technical Support				3.0	3.0	3.0	3.0	3.0
Infrastructure Support				2.0	2.0	2.0	2.0	2.0
Subtotal, Post-Impl. Sup				*18.0*	*17.0*	*17.0*	*17.0*	*17.0*
Total NBS Support	***59.6***	***58.8***	***51.2***	***18.0***	***17.0***	***17.0***	***17.0***	***17.0***

*** This analysis assumes that the implementation will begin September 2000 (FY 2000). Therefore, the numbers shown in the FY 2001 column also include the FTE's for that additional month.**

Furniture and Equipment – Funds totaling $0.5 million are included to provide for the one-time cost of furniture and equipment for the Project Management, Functional and Technical Teams.

Space - Assuming the staffing requirements for NIH staff and system integrator resources indicated above, the project team will require approximately 13,000 square feet of work-space for the four year duration of the implementation. Assuming a facilities rate of $32 per square foot per year, facilities costs related to the NBS implementation are estimated at $1.3 million over the three years of the implementation and a fraction thereafter to house the competency center.

Intangible costs, such as productivity losses during deployment resulting from the "learning-curve" and cost of re-organization have been excluded in the analysis. These costs are difficult to estimate because they vary widely depending on an organization's propensity to change, which has as much to do with organizational commitment, as with the degree of change the organization will experience. Every effort has been made,

however, to minimize these costs by budgeting for re-training and change-management programs.

The time spent by other NIH staff who may devote small portions of their time to NBS matters in NBS workshops and IC specific activities has also been excluded due to the fragmented and unpredictable nature of such activities. Although small groups may be required to assist the project team in a focused fashion over short periods of time, these costs are small.

Reconciliation of NPV Cost Estimates with Original NIH Estimate

Midway through this evaluation and the development of the detailed cost analysis, NIH requested a 5-year budget estimate (FY 1999 – 2004) for purposes of anticipating the budget needs of the various IT projects that are now being planned across the NIH. In response to that request, the NBS Project Management Team estimated the implementation costs to be $52.4 million over the 5-year period for the costs of the software as well as contactor support to assist in this implementation.

This resulting evaluation has confirmed the accuracy of this initial estimate – the NBS is still estimating that the software and contractor support will cost $52.4 million over this 5-year period. The shaded area on the table on p. 34 displays the $52.4 million less the FY 1999 costs of $1.4 million. The difference between this and the estimate of $93.6 million displayed is the result of 4 factors:

- The estimate follows the OMB guidelines for estimating the Net Present Value of major IT acquisitions. The OMB calculation of costs and benefits is calculated over a different and longer time period – FY 2000-2008 vs. the NIH Budget information of FY 1999-2004.

- The estimate displays costs of the Project Management Team as part of the NBS. Most of these costs are currently budgeted elsewhere within NIH and do not represent additional costs to NIH beyond the original estimate. However, including them within the estimate for the NBS provides a consolidated display more accurately reflecting the total cost of the NBS project to NIH.

- The estimate requests funds for new activities resulting from NBS project staff analyses of selected major Universities who have implemented ERP systems successfully. These proposals are the direct result of the Phase I evaluation, and do represent additional costs beyond the original estimates. They are discretionary but are presented to NIH for consideration as they represent the best professional judgment of both the NBS Project Management Team and the Universities that have undertaken a similar initiative.

    - University contacts strongly recommend that NIH experts from the OD and ICs be devoted full-time on

implementation teams. They further recommend that the NBS project budget funds so that the OD and ICs can backfill these positions on a temporary basis to mitigate some of the understandable reluctance on the part of managers to make their best personnel available to this project.

- University contacts strongly recommend that this project be viewed, not as a technical IT project, but a business project that will involve a considerable amount of change in the way functions are administered. They note that most delays are the result of human resource issues related to such change and recommend acquiring sufficient change management expertise to plan for this change.

- The estimate includes a small amount of resources to cover the costs of space, furniture and administrative requirements related to the administration of this program. These cost were not anticipated in the original estimate.

A crosswalk reconciling these figures is presented below:

FY 1999-2004 estimate of software and contractor support		$52.4 M
Adjustments required by the NPV timeline of FY 2000-2008:		
- FY 1999 costs included in NIH Budget estimate	($ 1.4 M)	
+ FY 2005-2008 costs included in NPV estimate	$24.3 M	
Subtotal		$22.9 M
FY 2000-2004 Costs of the PMT budgeted elsewhere within NIH		$ 3.6 M
FY 2000-2004 proposals emerging from the evaluation of successful implementations at selected major Universities:		
+ Backfill IC/OD personnel assigned to implementation teams	$10.7 M	
+ Change Management initiative	$ 1.5 M	
Subtotal		$12.2 M
FY 2000-2004 miscellaneous administrative expenses		$ 2.5 M
Total, FY 2000-2008 display of NPV costs		$93.6 M

In summary, the $52.4M projected cost of the software and contractor support for the NBS implementation is the same as previously projected. While the difference between the $52.4M and the $93.6M contained in the Net Present Value calculation appears significant, the majority of this difference, in fact, does not represent additional costs to NIH and results from the fact that these numbers are not comparable - the NPV calculates cost and benefit through FY 2008 rather than FY 2004 (+$22.9M); and this estimate consolidates funds currently supporting the NBS but budgeted elsewhere within NIH ($3.6M). Of the remaining costs, most ($10.7M) would be provided to IC/OD offices to allow them to backfill for employees assigned to the implementation teams. The

remainder represents modest increases to address issues related to the management of change within the ICs and the OD (+$1.5M) and to meet space, furniture, and other administrative expenses of the project not previously considered (+$2.5M).

Net Present Value of the NBS

As noted above, the OMB guidelines establish that the standard criterion for deciding whether or not a Government program can be justified on economic grounds is the calculation of its Net Present Value (NPV). NPV is the benefits over the investment period, minus the costs, expressed in today's dollars. This calculation of net present value should be equal to, or greater than zero, i.e., that the discounted benefits be at least as great as the discounted costs.

In the table below, the line entitled "Costs" represents the costs displayed on page 34, excluding Contingency Fund. This fund is excluded because of the uncertainty as to whether or not it will be needed. The Benefits line contains the benefits previously calculated and displayed on page 33, and the "Difference" line contains the difference between the costs and benefits. As can be seen from the table, costs are greater than benefits through FY 2003, primarily because the implementation costs occur during those years but benefits do not begin to accrue substantially until after implementation is complete. Beginning in FY 2004, benefits exceed costs and the net positive difference generally grows each year.

FY	2001	2002	2003	2004	2005	2006	2007	2008	Total
Benefits	$ -	$ 3,028,527	$ 6,322,708	$ 19,814,674	$ 23,014,502	$ 24,072,930	$ 25,194,396	$ 26,385,073	$ 127,832,810
Cost*	$ 18,465,162	$ 18,278,098	$ 16,410,671	$ 6,633,500	$ 5,530,391	$ 5,719,411	$ 6,917,882	$ 6,126,276	$ 84,081,390
Net Benefit (Benefits - Costs)	***$ (18,465,162)***	***$ (15,249,571)***	***$ (10,087,964)***	***$ 13,181,174***	***$ 17,484,110***	***$ 18,353,519***	***$ 18,276,515***	***$ 20,258,798***	***$ 43,751,419***

***Excludes contingency funds.**

The final step in the Net Present Valuation is to sum the difference between costs and benefits for each and apply the 6% discount required to convert these to current dollars. This calculation yields a Net Present Value for the NBS of $23 million.

A cost sensitivity analysis shows that, although the investment analysis is based only on a limited sample of quantified benefits and the cost estimates are considered realistic, even a 31% cost overrun over the investment period, which equals an overrun by $27 million, would make the NBS a viable investment. Any variation in cost or assumptions will not change the decision to buy commercial software as opposed to building a proprietary system because the risk of failure is higher for proprietary systems. In addition, any change in costs or assumptions will not change the relative value between the commercial vendors analyzed and will, therefore, not alter the selection of the ERP vendor. The sensitivity analysis further solidifies the soundness of the investment.

NBS Implementation Risks and Mitigation Strategies

While the cost-benefit analysis indicates that the NBS is a sound investment, implementing ERP has some inherent risks due to the magnitude, organizational impact and complexity associated with this type of project. Risks can loosely be defined as vulnerabilities or threats to a project or the organization at large. Risks can be grouped into three major categories:[18]

> **Organizational Risks** are factors that impede organizational change and resource availability.
>
> **Project Risks** are factors that negatively impact the project schedule and project budget.
>
> **Technical Risks** include factors such as the operability of the hardware and software. The lack of these may put the organization at risk and may cause the project to fail.

Organizational Risks

A lack of efficient decision-making is a risk inherent in NIH's decentralized environment. While "decisions by committee" help to ensure balance and create buy-in, this approach decreases the likelihood of decisions being made in a timely fashion and can negatively impact the implementation success. Implementing the NBS will likely require changes to policies and procedures that may be controversial and require firm decisions on how to proceed. The NBS project can only be successful if the following success-factors are in place to facilitate efficient decision-making:

- *Establish effective sponsorship and leadership* – A sponsor is the senior program official who ultimately assumes responsibility for the project. This program official, who oversees the project and the activities of the Project Manager, must be highly visible and empowered to make difficult decisions that inevitably arise. The sponsor's decision-making authority should be defined, accepted by the community, and communicated throughout the organization prior to implementation.

- *Make the project the number one priority* – The NIH community must understand that the NBS' impact will be far-reaching and that the project must have high priority in order to be successful. The Steering Committee must consistently articulate the project's importance. The program official serving as the project sponsor must be able to effectively champion the importance of the NBS and to maintain momentum in decision-making.

The degree of change that will occur as a result of the NBS implementation is high and will present many obstacles to the project. Although change management is an inherent element of implementation, a few tactical change management efforts must be formulated in order to successfully bridge the gap between NIH's current administrative

[18] United States General Accounting Office, Assessing Risks and Returns: A Guide for Evaluating Federal Agencies' Investment Decision-Making, 1997

and scientific support processes and its adoption of best practices. Unlike commercial entities where the decision to change business practices is a question of business survival, the NIH responds to a different set of incentives. It is therefore important to incorporate the following change management concepts into the implementation plan to avoid failure and to encourage change:

- *Establish critical project success metrics* – Incentives must be developed to reward change and discourage resistance so as to create an atmosphere conducive to change. An example of such an incentive is to establish project success metrics consistent with the organization's goals and objectives and to hold people accountable for their achievement.

- *Establish a communication plan* – This plan should identify target audiences, appropriate messages, activities and resources needed for effective communication over the project life cycle. Communications should focus on the fact that the NBS is not just a new technology system but also a business imperative for the NIH to keep pace with technological advances and to improve support services. The vision that the NBS will enable new capabilities such as the use of e-commerce, electronic workflow and one point of data entry must be articulated and understood by the community. Communication should also be used to set expectations and to explain that certain changes to existing ways of doing business must be made in order to realize other benefits of ERP. An effective communication plan incorporates multiple channels to manage expectations and to disseminate project progress.

- *Establish a training plan* – This plan will ensure that all appropriate personnel understand how processes will change after the NBS is implemented. The plan should define those to be trained, the training levels that are appropriate and the requisite resources. Typically, personnel receive different levels of training depending on their role, and their use of the system.

The following table lists, at a high level, possible communication and training concepts by target audience:

Communication and Training Concepts

Audience	Depth
Executive Level	▪ General ERP Concepts (Integrated system, embedded best practice examples, customization considerations) ▪ Implementation plan and scope of each phase (Including which systems will be replaced by the ERP and why) ▪ Benefits to the organization ▪ Impact on the organization (100%-time resource allocation, commitment required) ▪ Importance of business community buy-in ▪ Design of the Program Management Office
General Users	▪ What is ERP and how does it work? ▪ Implementation plan and timeframe ▪ Why implement an ERP system? (Include expected benefits) ▪ How will business processes change? (Training on how to use ERP reporting features and web-based

Communication and Training Concepts	
Audience	**Depth**
	portal technology to complete everyday tasks such as property, travel and purchase orders)
"Heads-down" or super users (ex, purchasing agents, accounts payable clerks)	▪ What is ERP and how does it work? ▪ Implementation plan and timeframe ▪ Why implement an ERP system? (Include expected benefits) ▪ How will the ERP system affect me? (Provide overview to entire system as well as specific and detailed functional training as appropriate)

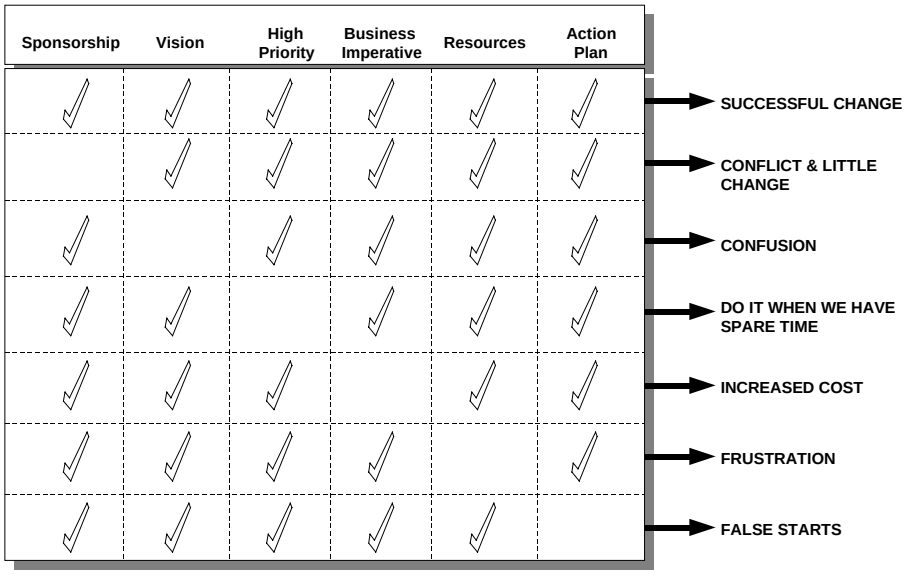
Competing demands for resources are a risk to ERP projects. The following should be considered regarding appropriate resource allocation:

- *Executive sponsorship* – The sponsor(s) should promote the importance of the NBS project to the ICs and ensure availability of all requisite resources through comprehensive financial planning throughout the life of the project. The IC's must be able to plan for costs to facilitate the availability of resources.

- *Assign the best-and-the-brightest employees to the NBS project* - Identify the best team members to implement the NBS. Successful implementations of this size and complexity require community involvement and a commitment to the future. While there is an understandable reluctance by program managers to having their best employees assigned to a project such as the NBS, it is these individuals who are essential to the success of the project and the future success of the NIH.

- *Use of a Systems Integrator* - Skilled contractor staff should complement the internal implementation team with their knowledge and experience. One strategy is to "pair up" the system integrator staff who are skilled in software implementation, with members of the NIH implementation team who are skilled in NIH policies and procedures. This allows for a steady two-way flow of information as the external and internal resources work side-by-side throughout the duration of the implementation project.

The table below summarizes the organizational success factors discussed above and shows the consequences if not in place. All of these success factors must be in place for the NBS project to succeed.



Project Risks

Scope creep is a serious risk to the success of the NBS project due to the decentralized nature of its 26 Institutes and Centers (IC's), the perceived uniqueness of current operating procedures at many of the IC's and NIH's consensus-based nature of decision making. Scope creep occurs when significant changes are made to the original implementation plan, usually resulting in additional cost and extension of deadlines. Examples include additions to the original scope, customizing the software instead of accepting modification to existing policies and procedures, building interfaces to lower priority systems, and lack of standardized operating procedures. It is fundamentally caused by lack of leadership, enterprise-wide vision, and communication. Skillful program management and top management support is key to mitigating scope creep. The project manager must be able to quickly identify and decide what is "in scope" or "out of scope" of the current project. The program official and the governance structure must then decisively address the issue. The following items are important to avoiding scope creep:

- *Establish effective communication and action plans* - to clearly convey the scope, requirements and tasks at hand to the community throughout the project.

- *Establish approval process* – to secure key decisions and enable key decision makers and the program official to quickly make decisions and to indicate a clear commitment to the project scope, requirements and action plan.

- *Establish a simple and effective issue resolution process* - to decide issues in a timely manner. As issues arise it is important to have a clearly defined issue resolution process that is timely, involves decision makers, and includes appropriate escalation paths.

Being one of the first Federal agencies to implement a fully integrated ERP package in the Federal Government creates uncertainty and risk. The degree to which the software will match to the NIH is less certain because no organization similar to the NIH has actually implemented ERP. Therefore, rather than using pre-defined methods of installing software that have been proven by other organizations, as is the case in the private sector, the NIH must validate the process at every step of installing the software. **In addition, change management challenges such as the acceptance and adoption of best practices in a decentralized organization like the NIH has not been experienced by many organizations**. Thus, the strategies to limit NIH's exposure to the risks associated with being one of the first to implement should include:

- *Use a phased deployment approach and establish a contingency plan* – to implement sequentially, rather than implementing the NBS across all IC's and functions simultaneously. A phased approach avoids exposing the *entire* NIH to the success or failures of the NBS. Phased deployment limits the organizational scope of the deployment, at the same time, minimizing the number of temporary interfaces to the ADB and other systems that will be displaced. Two characteristic deployment styles exist, phased deployment by organizational entity or phased deployment by functional area. The choice depends on the organization and the amount of intra-agency transactions. The business analysis conducted in conjunction with this study indicates that, for the NIH, a functional deployment seems optimal primarily due to the large number of intra-NIH transactions, i.e., all IC's use the same accounting system, property system, etc. In addition to phased deployment, a contingency plan that outlines a fall-back strategy in the event of failure is essential in further minimizing exposure.

- *Limit the scope of the initial implementation* – to only include essential functionality initially. This will significantly decrease risk of failure while providing the promised benefits in a timely fashion. Organizations usually implement the basics first, and then phase-in enhancements and refinements after the operations environment has stabilized.

- *Use milestones as part of the project control process* - to efficiently track the achievement of major deliverables and functionality to be deployed in appropriately spaced intervals.

Technical Risks

The NBS implementation will be technically complex, in part due to seven functions being affected, and the need for the NBS to interact with other enterprise systems. Risks may arise from performing two major technical activities, namely interface development between key transaction systems and converting or transferring data from the ADB to the

NBS. Other technical risks include the potential for the NIH to try to customize the software and reliance on the many shadow systems that, if converted, must be configured to accept data from the NBS for reporting purposes.

Building interfaces, or linkages, for the NBS beyond those that are of the highest priority presents a risk by altering complex software that may produce unintended consequences. The initial deployment of the NBS will focus on establishing transaction interfaces between the NBS and other NIH enterprise systems: NIH Administrative Database (ADB), appropriate NIH Service and Supply Fund modules, IMPAC I and II, DHHS Payroll System, DHHS Payment Management System, United States Department of the Treasury Systems, NIH Data Warehouse, and the NIH Status of Funds database. While the recommended ERP vendor is well known to be an open system, interfaces generally bear inherent risks. In many ways, risks associated with the development of these interfaces parallel the risks of custom development outlined earlier, resulting in the possible loss of data integrity, loss of functionality and reduction of the timeliness of data. To minimize NIH's exposure, the following principles should be followed throughout the implementation:

- *Minimize the number and complexity of the interfaces* – The project should focus on establishing only essential data transfers at first to provide a stable environment. An average of 4 FTEs have been included in the project budget that will be dedicated solely to collaboration with the individual functional workgroups to design, test and implement these interfaces.

- *Clearly define ownership of data and error correction mechanisms* – Many interfaces allow data to co-exist in more than one database. Defining data ownership assures that updates to the data are coordinated and controlled by one source. Similarly, due to data co-existence, errors need to be corrected both at the source of the data and the target. A carefully crafted error correction mechanism, whether manual or automatic, will avoid data getting out of sync.

- *Test extensively* - While implementing ERP revolves much around simulating and validating business rules using software, interfaces need to be tested rigorously for both technical integrity *and* functionality.

Large amounts of data to be converted at the NIH are another special area of risk that needs to be carefully managed. Since data structures, code descriptors, transaction statuses and business rules are different between the ADB/CAS and the NBS, data may not be directly compatible and easily converted, requiring significant amounts of mapping and manipulation, therefore, increasing the risk of compromising data integrity. In addition, because data is updated continuously in varying frequencies, it is constantly changing, making it difficult to convert. Finally, while conversion programs are often used to migrate data from one system to another, they circumvent the standard data entry and data validation process of the ERP, increasing the chances for compromising data integrity. Each of these risks is exacerbated by the fact that the NIH has large amounts of data to be converted. Specific examples include: code descriptor tables (i.e. Object Class, CAN database, vendor database), General Ledger balances, prior year CAS history, open

payables, open receivables, status for prior year allowances, and current and open prior year data for each functional area. The following principles associated with data conversion should be followed:

- *Establish and communicate a detailed conversion plan* – The conversion plan will serve as a control mechanism to monitor the data conversion process.

- *Begin conversion early in the process* – In order to minimize the chances for delaying the project, data conversion should be started early by "scrubbing" the data, e.g. closing out open purchase orders where goods have been completely received.

- *Minimize data to be converted* - Not all data needs to be converted. In many cases historical data may be stored in the data warehouse or a subset of the legacy database for viewing.

- *Perform manual conversions whenever possible* – Writing, testing and using conversion programs is a lengthy and expensive process and needs to be weighed against the cost of hiring temporary help to enter data manually. Manual entry is less risky because it ensures proper data validation and updates and may be facilitated by using data entry templates using default values.

- *Test conversion programs extensively* - Just as with interfaces, conversion programs are one-of–a-kind programs and need to be tested for both operability and functionality.

NIH's organizational tendency toward customization may inhibit implementation success and cause increased maintenance spending in the future. The autonomous nature of NIH's ICs will create the desire for unique NBS customizations. However, extensive customization in the form of changing base code within the system is risky, may result in loss of warranties and system integrity and is, therefore, not recommended for two primary reasons. First, customization efforts often extend the implementation timeframe and may jeopardize the likelihood for overall success. Second, customizations must be maintained manually and re-created each time the system is upgraded. The time, effort and cost of implementing future package releases increase substantially with each customization.

- *Rather than customizing the system to current business practices, NIH should consider changing their business practices to fit the system* – Based on the vendor evaluations performed to-date, customization of the commercial software should be the exception. Any limited exception should be made only after a complete analysis of its potential cost and its impact on the implementation schedule.

- *Use integrated implementation teams* to ensure broad OD, IC and technical coverage when simulating and validating business rules using the software.

- *Establish effective sponsorship and leadership* – In order to resolve policy issues such as resistance to changing current business practices, the steering committee needs to have the authority and decision making capacity to make decisions in a timely fashion.

PART FOUR: RECOMMENDATIONS

Based on the foregoing analysis and considerations, this report concludes with the following four recommendations:

Recommendation 1

It is recommended that the NIH purchase commercial ERP software to replace the ADB; it should consider the CIT proposal for migrating to a new proprietary system as a back up plan.

The analysis of the "buy vs. build" options contained in this report indicates that, despite the risks associated with ERP packages, a commercial solution is superior to a proprietary one. The capacity for improved administrative and scientific support, the cost-benefit analysis, and the market trend information all support this conclusion. This recommendation also is consistent with the OMB directive to give first priority to the purchase of commercial software. This recommendation is predicated on the assumption that NIH is willing to commit to the principles detailed in Recommendation 4.

Recommendation 2

It is recommended that NIH purchase its commercial software from the vendor that both scored the highest number of points in the evaluation and proposed the lowest overall price.

As noted earlier, this vendor cannot be named in this document because of procurement rules protecting this information prior to contract award.

The evaluation methodology described in this report was based on a set of criteria, approved by the Steering Committee, and weighted by them for relative importance. This evaluation of the several products judged to be the best fit for the NIH was exhaustive, and was characterized by an unusually high degree of community participation and by specialized reviews undertaken by those NIH experts best able to assess the various criteria. These groups applied objectivity and rigor to the evaluation and there was unanimous agreement by the Steering Committee to endorse their assessment.

Recommendation 3

It is recommended that NIH develop an implementation plan for the selected ERP product within approximately 60 days of the presentation of the Business Case to the Steering Committee.

The implementation plan begins the Phase 2 implementation effort and should include the following components:

- *Organizational Structure*: This component of the implementation plan should include the definition of the project organization structure, detailed

definitions of individual roles and responsibilities, and an approach for staffing the project.

- *Governance Plan*: The governance plan should include the charter for the Steering Committee, a definition of the issue resolution and escalation process, and a recommendation for the roles and responsibilities of other decision making bodies.

- *Financial Plan:* The financial plan should be as comprehensive as possible, and include costs, beyond those of the system integrator and the software to be purchased, that may have been budgeted elsewhere within the NIH. It should include the staffing and other associated costs for the project team and provide sufficient resources so that an IC or OD office whose employee is assigned full time on the NBS project can backfill that position if desired.

- *Deployment Plan*: The deployment plan should define the implementation timing and associated functional scope, major tasks, and major deliverables.

- *Change Management Plan*: The change management plan should be based on a stakeholder analysis, identifying stakeholder groupings and how they are impacted by the NBS deployment over time. Based on this analysis, the change management plan should include a communication plan, a training plan, and a high level staff transition approach for each stakeholder grouping.

- *Project Evaluation Plan*: The final component of the implementation plan should define the performance measures that will be used to track and evaluate the progress of the NBS project. The evaluation plan should include periodic and long term performance measures.

The implementation plan should be submitted to the Deputy Director for Management, and approved by the appropriate groups that he designates. Given the complexity of the Phase 2 implementation effort, and the risks and costs involved, there must be a comprehensive plan in place. This will assure that NIH's commitment of resources is based on a thoughtful consideration of actions to be taken in the design, testing, deployment, and maintenance stages.

Recommendation 4

It is recommended that NIH adopt a set of principles as the basis for developing the final Phase 2 implementation plan described in Recommendation 3.

The proposed principles are as follows:

a. *No Customizations***:** The NIH should commit to a policy of endorsing the best practices embedded in the ERP software to the maximum extent, and that any customization of the commercial software should be the

exception. Any limited exception should be made only after a complete analysis of its potential cost and impact on the implementation schedule and approval by the Steering Committee.

b. *Limited Number of Interfaces:* The NIH should commit to a policy that during the Phase 2 implementation, interfaces will only be built to connect the NBS with other NIH-wide enterprise systems and that extensions, defined as systems beyond the fundamental transaction-based sub-systems of the NBS, be deferred until after deployment.

c. *Empowered Governance:* The overall governance structure should be representative of the NIH communities that will be supported by the NBS, and possess sufficient authority to resolve all issues emerging during implementation in a timely fashion. This governance structure also should include a process:
   - to approve exceptions to the policy limiting customization, and
   - to approve any enhancements to the ADB or the development of other administrative systems, to be developed during the period of the NBS implementation, that may replicate or enhance capabilities of the NBS.

d. *Assignment of the Best-and-Brightest to the Project:* The organizational structure and staffing plan should reflect NIH's commitment to the future. NIH employees selected to participate in the NBS should be those best able to lead this effort and most knowledgeable in the pertinent administrative and scientific support functions. Key members of the implementation effort should be assigned to work on this project on a full time basis.

e. *Phased Deployment:* The implementation plan should assume a phased deployment. The plan will consider whether this deployment should be phased by IC (implement all functions in one IC at a time) or by function (sequentially implement functions one at a time across all IC's). This implementation schedule should also balance the desire to quickly provide new services with the reality of the difficulties inherent in changing current ways of doing business.

f. *Rigorous Budget Management:* Budget Management should be a major activity of the implementation effort resulting in timely notification to the IC's of costs and the timing of resource needs and the discipline to control costs and set priorities.

g. *Comprehensive Change Management:* The change management strategy should be comprehensive, recognizing that most problems that emerge in the implementation of ERP products are due to inadequate attention to these issues.

h. *Continuous Project Evaluation:* The evaluation strategy should have a review mechanism that will allow the project to be revised, or terminated, at intermediate points should it be necessary.

These principles are drawn from the experiences amassed over numerous implementations of ERP products and recognize the factors that often cause such projects to either succeed or fail. Commitment to undertaking an ERP project in a timely and cost-effective manner also carries with it a commitment to provide sufficient priority to reduce the changes to the software to a minimum, to make timely decisions, to commit sufficient resources, to schedule aggressively but realistically, and to recognize the difficulties inherent in change.

APPENDIX

Attachment 1
A. NBS Organization, Phase I

STEERING COMMITTEE MEMBERS	
Tony Itteilag	Deputy Director, Management, NIH (Chair)
Colleen Barros	NBS Project Team Leader and Associate Director for Administration, NIA
Steve Benowitz	Director, Human Resource Management, NIH
Don Christoferson	Associate Director, Administrative Management, NHLBI
Steve Ficca	Associate Director, Research Services, NIH
Ron Geller	Director, Extramural Programs, NIH
Al Graeff	Chief Information Officer, NIH Director, CIT (Ex-Officio)
MaryAnn Guerra	Deputy Director, Management, NCI
Kevin Kirby	Associate Director, Administration, NINDS
Marilyn Kunzweiler	Chief, Extramural Administrative Management Branch, NIAID
Leamon Lee	Associate Director, Administration, NIH
Janis Mullaney	Management Liaison Director, Intramural Research, NIH
Bob Nussenblatt	Scientific Director, Intramural Research, NEI
Martha Pine	Associate Director, Administration & Operations, NIGMS
Lee Pushkin	Assistant Director Budget, Office of Budget, NIH

Attachment 1
B. NBS Organization, Phase I

PROJECT MANAGEMENT TEAM MEMBERS	
Colleen Barros	NBS Project Team Leader and Associate Director for Administration, NIA
Emmett Ward	Senior Advisor to Director, CIT
Rick Nelson	Assistant Director, Finance, NIH
Danielle Kaczensky	Chief, IT Support Services Office
Jack Mahoney	Consultant
Bill Risso	Consultant

Attachment 1
C. NBS Organization, Phase I

SCIENTIST FOCUS GROUP	
Robert Nusenblatt	Scientific Director, NEI (Member, NBS Steering Committee)
Janis Mullaney	Director, Intramural Management Liaison, OIR (Member, NBS Steering Committee)
David Landsman	Senior Investigator, NLM
Kenneth Kirk	Chief, Laboratory of Bioorganic Chemistry, NIDDK
Karyl Barron	Deputy Director, Division of Intramural Research, NIAID
Andy Baxevanis	Associate Director, Intramural Research and Director, Computational Genomics, NHGRI
Richard G. Wyatt	Executive Director, Office of Intramural Research, OIR

Attachment 1
D. NBS Organization, Phase I

WORKGROUP CO-CHAIRS

Acquisition

Jim Marx	Chief, Simplified Acquisition Mechanism Branch, OPM, NIH
Judith Duff	Executive Officer, NEI

Commercial Accounts

Priscilla Irick	Chief, Commercial Accounting Section, OFM, NIH
Linda Adams	Administrative Officer, DIR, NHGRI

Financial Management

Wayne Berry	Deputy Assistant Director, Finance, OFM, NIH
Mary Cushing	Chief, Financial Management, FMB, NCI

Property

Mike Showers	Director, Property Management Division, OLM, NIH
Carroll Hanson	Deputy Administrative Officer, OAM, NHLBI

Supply

Rose Ann Corley	Director, Supply Management Division, OLM, NIH
Charles Leasure	Associate Director, Management, OAM, NHGRI

Service and Supply Fund

Diane Charuhas	Chief, Government Accounting Section, OFM, NIH
William Fitzsimmons	Director, Resource Management, ORM, NIMH

Travel

Rob Weymouth	Director, Division Management Assessment, OMA, NIH
Chris Wisdom	Executive Office, CSR

Attachment 2
Benefits Discussion

Introduction

The following represents a listing of some best practices that, if implemented, will change existing NIH practices. In each case, the change will result in benefits to NIH but other issues that must be addressed may emerge as a consequence. The benefits of some of these items lend themselves to quantification and their implementation has been assumed in the cost-benefit calculations. These items are noted with an asterisk "*".

Accounts Payable

Payment without a three-way match of obligation, receipt, and invoice*

Payment to vendors supplying goods and services to NIH would be authorized by OFM as follows:

- For transactions < $2,500 – Payment would be authorized by the obligation of funds only – neither receiving nor an invoice would be required. Exceptions would be required for certain transactions, e.g., accountable property. For such exceptions, the policy would be the same as that for transactions > $2,500 (see below).

- For transactions > $2,500 – Payment would be authorized when an appropriate official enters receiving. No invoice would be required.

Currently payments are authorized when the obligation, receiving (an acknowledgement by an authorized individual that the goods or services have been received), and the invoice are "matched" by OFM's Commercial Accounts staff. This change from current procedures should eliminate late payments of bills and the associated interest costs, although some payments may be made erroneously; it will also significantly reduce this workload for Commercial Accounts staff that now match all three items before authorizing payment. (Note that receiving would probably still be entered when goods are received – it would however, not be required to authorize payment for transactions under $2,500). Excess staff likely would be required to be retrained for other NIH functions. Adopting these new procedures would also require a significant change in "mindset" so as to acknowledge that making a limited number of erroneous payments can be more efficient than the additional work required to assure that every payment is appropriate and backed by paperwork.

Other best practices applicable to Accounts Payable

Should NIH identify some classes of payments that would still require a three-way match of obligation, receipt, and invoice, it should implement:

- Electronic Data Interchange (EDI) for invoices – This would require that those vendors electronically transmit invoices to NIH rather than sending paper invoices.

- Automated three way match – With the electronic submission of invoices, and integrated ERP software, the invoice, receiving and obligation could be automatically matched.

Again, the major impact of this automation would be to reduce the workload for Commercial Accounts staff and likely force a reallocation of staff to other assignments.

Procurement

Mandatory use of purchase cards for purchases < $2,500

While purchase cards have been available for some time at NIH, there is no overall mandatory policy with regard to their use, and their usage varies dramatically by IC. Mandatory use of the credit card for most purchases under $2,500 (exceptions would have to be made for select items such as radioactive materials.) would reduce the number of payments made by Commercial Accounts staff as individual items would be summarized on a monthly bill and one monthly payment per purchase card would be made. However, while the automatic reconciliation feature of ERP products may reduce some of the current difficulties with the use of the credit card, mandatory use could cause significant discomfort to staff and scientists who likely would prefer to continue to use other procurement mechanisms.

Single sourcing to avoid duplications of contracts where feasible

At the present time, it is likely that NIH has many contracting vehicles that are used to procure essentially the same products, thereby reducing NIH's leverage to obtain best prices. A study by the Logistics Management Institute, as a follow-up to the Arthur Andersen report concluded that duplicative and overlapping contracting vehicles for the purchase of IT provided flexibility but precluded meaningful price leveraging. More pertinent to the NBS, however, the study also found that current NIH information systems do not provide a comprehensive and accurate reporting of IT purchases by contract vehicle. Since it is a centralized database, the NBS should provide a comprehensive listing of the contracting vehicles and the purchases made against these vehicles, allowing a more meaningful analysis.

Supply

Third Party Logistics*

The Division of Supply Management currently operates self-service stores that sell only administrative supplies. A contract with a large vendor such as Staples or Office Depot should allow greater discounts than NIH is currently receiving through bulk purchases

and could feature door-to-door delivery. In addition, the use of such a contract, together with greater utilization of e-commerce and the Intramall, should reduce warehousing costs. Concerns would center on the reassignment of NIH employees that are currently providing these services and that one can get an item immediately from the self-service store rather than waiting for a delivery.

Vendor Managed Inventory

Under the concept of vendor-managed inventory, vendors would essentially manage inventory levels in stores and the warehouse, as opposed to management by NIH employees. Vendors would keep track of the amount of their inventory on hand via the NBS and then restock the shelves when inventories reach a low level. Since vendors are responsible for the inventory, they also would be counting the inventory and making adjustments in the inventory count, when necessary. Finally, when an NIH employee makes a purchase of one of the items in the inventory, NIH would automatically pay vendors for that item via the NBS.

As noted above, a key feature of this practice is that NIH would not purchase an inventory, per se, but essentially only maintains a warehouse and stores for the holding of vendor's goods. Savings would accrue because there would be no costs associated with excess inventory, there would be no costs associated with maintaining the inventory, and no inventory loss to be absorbed by the NIH. Concerns might include the need to reassign employees currently maintaining the NIH inventory as well as the reluctance to give up the control of maintaining this inventory to a large number of private vendors.

Cycle Counting*

Cycle counting is a statistical method to systematically validate the actual inventory to the inventory records. At the current time, NIH conducts a physical inventory by counting each item once a year. Under cycle counting, inventory is counted cyclically throughout the year according to an algorithm that determines the frequency that each item should be counted, e.g., more than once a year for high-value or high-turnover items and maybe once every two years for other items. The intent is to focus effort on those items where the return will be the greatest, and to determine the causes of error and take corrective action.

By focusing efforts on the counting of higher priority items and correcting the cause of errors, the cost performing inventories, and therefore the overall cost of the supply system, should be reduced. In addition, increased accuracy should also reduce the potential for either overstocking an item or unexpectedly being out of an item. The NBS will facilitate the implementation of cycle counting by automatically tracking and classifying inventory, and by determining, through the pre-determined algorithm, the schedule and frequency of counting items in the inventory.

Property

Decentralized Property System

There are a variety of best practices that, taken together, are elements of a quality decentralized property system. These include:

- Real-time access to property records.
- Utilization of standard forms.
- Utilization of computerized asset transfers.
- Integration of the property system with the purchasing and accounts payable systems.

Each of these best practices facilitates a system where the property database is maintained centrally but data is entered and retrieved by decentralized IC property officials. Implementation of the NBS provides the potential of offering the ICs an improved property system that lends itself to operating on a decentralized basis.

Financial Management

Centralized management of shared tables

Fundamental to the NBS is a set of standard financial tables that form the core of the financial accounting system. All IC data must then conform to these tables to allow it to generate consolidated reports. Such a system would require the following:

- Since the OD and the ICs are sharing a common database, rules will have to be established as to the level of detailed financial data that each organizational level can access on a routine basis. The development of such rules will have to balance the oversight responsibilities of the OD with the IC need to maintain certain levels of independence.

- Agreement will have to be reached on the financial data that must be included as part of shared data sets.

- OFM will assume responsibility for maintaining these tables and making changes that CIT is now performing.

Automated Financial Statements*

The Government Management Reform Act requires that a yearly audit be conducted of NIH's financial system and its financial statements. Accounting firms who are under contract with the DHHS Office of the Inspector General conduct these audits. At the current time, substantial OFM staff time is spent constructing these financial statements and reconciling data, often manually, that is contained in different systems e.g., reconciling the value of property in the accounting system with the value of property in the property system. Because the NBS is an integrated system that meets the financial standards set by the Joint Financial Management Improvement Program (a joint effort of the Treasury Department, OMB, GAO, and OPM that set Government-wide accounting standards) it will automatically generate financial statements that will meet auditing standards. It is likely that many of the employees now performing these tasks could be reassigned to other duties.

Centralized processing/decentralized analysis

The NBS, while maintaining a centralized database, has the capability to allow access to the data and then the manipulation of that data in formats established by the user. As a result, many of the functions now performed by the Data Warehouse or other systems established by ICs can be performed at the desktop through the NBS. Difficult decisions will have to be made with regard to which systems should be retained and which should be eliminated. In addition, as noted above, rules would have to be established to determine which organizations, and which individuals within those organizations, have access to what data.

Service and Supply Fund

Real time tracking and reporting of job costs

The NBS provides project tracking and financial capabilities to monitor the progress and cost of centrally provided services. For example, it could monitor the progress and cost of work being performed by ORS shops and make it available to the IC who has ordered the project. With such data, Service and Supply Fund rates could be automatically generated, providing accurate rates that are now developed manually. This may necessitate the reassignment of employees that are currently performing these functions. In addition, NIH must develop rules relating to which organizations and employees within those organizations will have access to which of the data generated, and must also address likely employee concerns regarding the collection of such data that could be used to evaluate their performance.

Travel

Electronic Booking*

A best practice in travel management is to utilize electronic booking for all travel processes including the reservation. NIH's Travel Management Center (TMC) charges different fees depending on which method is used to make the reservation. The lowest fee charged per ticket issued is for reservations made via electronic booking. Currently travel reservations are made via phone, email or fax. By adopting the best practice of electronic booking, NIH should be able to realize savings both in terms of lower administrative costs and by taking advantage of the TMC's lower fee structure.

Cross-cutting

Several issues will likely emerge that cut across many of these functions, some of which have already been alluded to:

- Shadow systems* – Because of the need of the ICs to maintain information, and utilize workflow and other features not easily

accommodated by the ADB, a variety of shadow systems have been developed over time, but whose features will be included within the NBS. Continuing to maintain these systems would be costly and a potential embarrassment, if audited. An inventory of systems taken as part of this study revealed 175 different systems are currently in use at the NIH. At least 78 of the 175 systems were identified providing functionality similar to the NBS. Cost savings were calculated assuming a conservative 50% reduction in operating cost for the 78 shadow systems identified.

- Access to data – NIH will need to establish business rules as to the level of detailed data that each organization, and each individual in that organization, can access. While a few examples emerged above, e.g., financial data and employee performance data, it is likely that there are many, many more areas where this issue will surface during implementation.

- Employee training and change management – The detailed software demonstrations illustrated both the robustness of the capabilities of ERP software, and their complexity. Employees will be forced to learn a new system that is extremely complex, particularly in terms of the many new capabilities that exist, however, the systems are relatively intuitive. While the level of complexity that must be mastered will vary by employee, any degree of change can often be a challenge. Employees will also have to gain a basic understanding of how the system operates, or at a minimum, have ready access to a cadre of specialists who can trouble-shoot problems for the employee.

* Quantified in cost-benefit calculation.