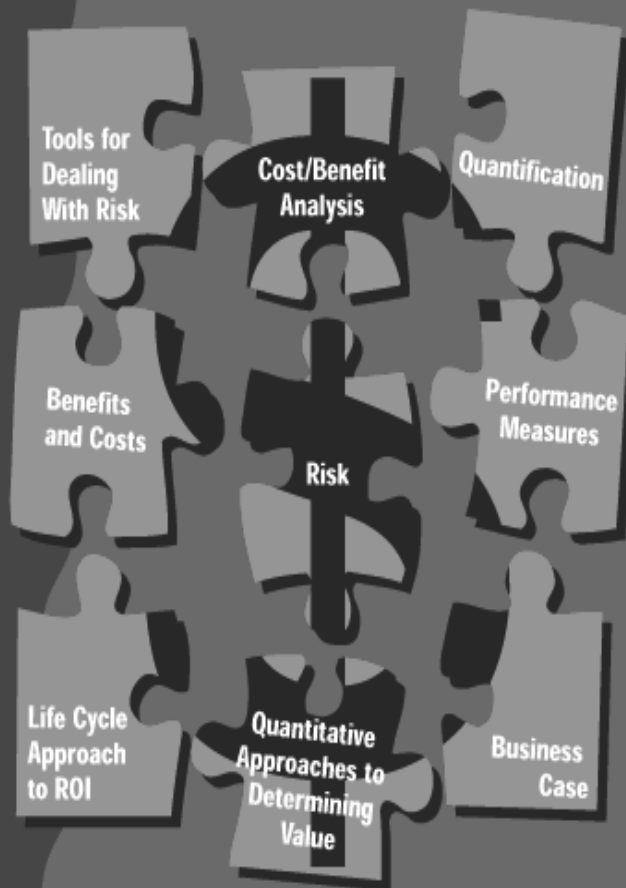


ROI and the Value Puzzle



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EXECUTIVE SUMMARY

To solve a jigsaw puzzle you need all the necessary pieces at your disposal. The same holds true for IT Capital Planning initiatives: you need all the parts carefully laid out to complete the value puzzle!

In October of 1997, Government Computer News along with the Industry Advisory Council and the Federal CIO Council conducted a study to look at government IT investment environment issues such as methodologies for making IT investment decisions, evaluating ROI and ROI barriers, and the overall influence of IT on organization's structure. Twenty-one hundred questionnaires were issued to administrative, operations, CIO's, directors, and managers in both the public and private sectors. The results of this research were reported at the October 1997 IAC Executive Leadership Conference in Richmond, Virginia. The findings of this study serve as a foundation for, and are woven throughout, this document.

An all-encompassing evaluation of ROI (Return On Investment) can accurately size up an investment's total value to an agency. But, this endeavor is not as easy as it seems because there is no one universally accepted prescription for assessing the value of an investment. Not only do agencies differ in their approaches to calculating value, many times divisions within agencies take varying approaches as well. Herein lies the challenge of evaluating ROI: it must be a standard, repeatable process, while containing a significant degree of flexibility. The process of assessing the total value of an investment informs decision-making, but this task can be difficult to perform without a clear agreement of the definition of terms, or paths to follow.

The benefits and costs of an investment alternative provide the crux for any decision-making or analysis and must be identified. Identified benefits must closely align with the agency's mission and should answer the question, "What can this investment provide?" Intangible (soft) benefits, while not always quantifiable, are an important factor in investment decision-making, and should not be overlooked. Identified costs, on the other hand, provide the reality check for the proposed alternative. All costs and benefits should explicitly show the performance and budget changes that will result from the pursuit of a particular investment alternative.

The Clinger-Cohen Act of 1996, OMB guidance and GAO directives speak strongly of building prototypes, using pilots and conducting studies as valuable parts of any Capital Planning and IT Investment project's design and development processes. Prototypes and pilots are motivated by the need to mitigate risk, clarify requirements, enhance system functions and design, or to assess new technologies. OMB strongly encourages the use of pilots and prototypes for Capital Planning and IT Investments and consider them an integral part of any ROI analysis or study addressing ROI and the value of Investments.

Many of the projects highlighted in this document employed pilots or prototyping. Pilots allow an organization to research a new technology or project in a very limited and low risk setting prior to committing the full funding and resources that full life-cycle projects may require. Additionally, prototypes allow the sponsoring organization to immediately begin to capture benefits and the return on the investment. This is very helpful to project managers and executives for demonstrating the business case of a project and its positive impact on the organization while posing a minimal amount of risk.

Risk is inherent in every IT investment and comes in all forms. A proactive risk management process is the best defense against potential cost overruns, schedule variances, and other potential trouble areas for an investment. It is to the agency's

advantage to rigorously cite as many of the potential risk sources as possible. Some tools that can be used to address risk and uncertainty include: sensitivity analysis, expected value analysis, and options analysis.

There are a variety of financial tools available for use in the capital planning and decision-making processes. Net Present Value (NPV) is the most commonly accepted, recognizing the time value of money by discounting all monetary costs and benefits over the life of a project. NPV allows managers to objectively evaluate projects on an equal footing, regardless of their scale differences. Other tools such as the Internal Rate of Return (IRR) and the traditional Return on Investment (ROI) ratio can provide complementary insight to a proposed alternative's financial health.

Because of its recognition of the time value of money, calculation of NPV provides the backbone for a Cost/Benefit Analysis (CBA). The CBA is structured as a systematic and organized collection of facts that *lead* to decision-making. The CBA should yield clear cost, schedule, and performance goals that will be integral components when managing the investment or project.

After all financial and non-financial analyses have been generated for the proposed investment alternatives, the business case presents these findings as a persuasive and comprehensive argument that speaks to the total value of an investment. Benefits, costs, and risks should all be incorporated into the business case to substantiate an investment's viability. All business cases should tie directly to the agency's mission and should be geared toward a targeted audience.

Once an investment has been deployed, it must be continually monitored to ensure success. Performance management is a process that allows the organization to gauge how an investment is faring. The timely assessment and reporting of actual achievement compared to expected achievement will help to ensure that investments are performing. All stakeholders should be actively involved in the design of performance measurements, as they are able to draw easily from their own experiences and business areas.

The evaluation of ROI should never be used as a passive justification mechanism for investment decisions that have already been made. Rather, it should be used as an active managerial tool throughout the life cycle of the proposed investment or project.

It is essential that executives continually align and realign their expectations of results with their agency's mission. In today's fast-moving environment, expectations are in a constant state of movement making what seemed like an appropriate investment decision yesterday a less than optimum investment today.

We hope that the tools presented in these pages will help managers across government make increasingly better investment decisions based on measurement and facts.

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INTRODUCTION

ROI and the Value Puzzle

Webster defines value as:

- 1: a fair return or equivalent in goods, services, or money for something exchanged*
- 2: the monetary worth of something: marketable price*
- 3: relative worth utility or importance: a good value at the price*

Ask a dozen organizations if they measure ROI (return on investment), and they will respond “yes,” “no,” or “sometimes,” but ask them to define ROI, and you will probably get 12 different answers. Descriptions of ROI generally fall into one of three categories: a mathematical equation, some combination of quantitative techniques (NPV, IRR, CBA, etc), or a broader definition referring to an investment’s *total value*.

In its first and narrowest definition, ROI refers to a simple mathematical equation: total monetary benefits from an investment divided by the initial and subsequent costs, with the dividend stated as a percentage. This ratio incorporates the financial factors of profitability into one tight equation intended to help organizations select the most effective use of their capital. While this does yield a number, it does not portray the total picture.

In contemporary practice, the second definition of ROI is more commonly adopted. This approach consists of a combination of quantitative techniques, the most popular being Net Present Value (NPV), Cost/Benefit Analysis, Discounted Payback Period, Return On Investment, and Internal Rate of Return (IRR). Surveys of IT executives in the U.S. revealed that 97 percent of respondents use cost/benefit analysis, 44 percent NPV, and 22 percent weighted scoring methods to evaluate their IT investments. All of these techniques share a common characteristic – they rely on measurement of costs and benefits in strictly financial terms and exclude factors not expressed in dollars.

The Government IT Investment Environment study found that the same things are true in the Federal government. The 1997 study states that at the time of the study, among those agencies and departments who evaluate their IT investment plans, nearly three out of five use traditional return on investment (ROI) measures. Forty-five percent of Federal/CIO Council respondents use Net Present Value (NPV) measures, compared with 36 percent of respondents overall. Nearly 70 percent of Federal/CIO Council respondents consider non-quantitative factors when evaluating their IT investment decisions, compared with nearly 60 percent of respondents overall.

The third all-encompassing definition of ROI includes the assessment of an investment’s *total value* based on all factors, including those measured in units other than dollars and true intangibles defying conventional forms of measure. While the traditional tools are invaluable, business managers have recognized that fostering rational decision-making requires them to expand their evaluation techniques to recognize IT’s extensive impact on the entire organization, its customers, and competitors. Financial measurements alone are seldom sufficient to support decisions with

long-term impact. Managers must consider the financial return of an IT investment in relationship to other factors such as risk, feasibility, and the long term goals of the organization.

Based on the initial findings of the study, and our follow-up research in this document, we found that organizations are moving toward valuation of their IT investments based on measurements of changes in the business' performance. This expansion necessitates a more comprehensive understanding of the old standbys as well as the addition of new tools for evaluation. The wide variety of techniques employed by organizations to determine the value of their IT investments substantiates the common belief that there is no one way for ascertaining value. However, the practice of determining ROI must be embraced as an active managerial tool, versus a passive justification mechanism. This vital approach to ROI is the one that will be highlighted throughout this document.

Late Breaking News in the world of ROI and IT Investment - There are few areas of business today more dynamic and changing than the techniques and tools for measuring the value of Information Technology and Information Technology's impact on business. We have attempted to capture the myriad of processes and decision tools in use in this arena and to highlight those with the most potential for depicting measures and value that are easy to understand and explain. It is impossible to capture all aspects and techniques in use today but we have focused on those that are most important. There continues to be a growing interest in ROI and the Value of Investment as business leaders in both the private and public sector search for new ways to capture, measure and document the value of IT investments and their impact on the overall business of the organization.

A study released by Giga Information Group, November 12, 1998, entitled "Value Based Models for IT Decision Making" is creating a great deal of interest as it provides a Giga developed value based model termed "Total Economic Impact (TEI)". Giga discusses the emerging role of IT as both utility provider and as venture capitalist. It is the area of venture capitalist where many of the aspects of the Capital Planning and IT Investment processes brought about by Clinger-Cohen are discussed in greater detail. Giga offers the idea and tools to use TEI as a driver of IT decisions to help shift the perception of IT as a cost center to that of IT as a value center.

While there is not an in-depth discussion of TEI in this guide, it is definitely an idea with merit. Tools such as this are invaluable to IT organizations as we continue to evaluate projects and investments based upon costs, benefits, and value to the business in order to approve the projects and investments that will return the greatest "bang for the buck".

In an article in *InformationWeek* dated June 22, 1998, Jeffrey Kaplan discusses the advantages of focusing on the total ROI of IT rather than obsessively pursuing reductions in the elusive TCO (Total Cost of Ownership). Mr. Kaplan notes: "The ROI approach makes more sense. Identifying the positive impact of IT initiatives and investments raises the visibility and value of IT. This approach can help CIOs prove their contribution to the organization and ensure that their efforts are aligned with the overall business of their company. Quantifying the added revenue or profits generated by an IT initiative is not always easy. But this is a more fruitful exercise than arguing how much IT costs."



Benefits and Costs

In this chapter...

- Selection and management of IT investments begins with identification of benefits and costs.
- Benefits should describe how the investment enhances the agency's mission and detail added functionality or cost savings.
- Separating an investment's benefits into explicit and measurable units provides standards for comparison of alternatives.
- Neither the desirability nor the total value of an investment can be gauged without consideration of all resources expended.

Successful IT investment decision-making and management begins with the identification of benefits and costs. These two building blocks are crucial steps regardless of the nature of the investment, metrics applied, or approach used to value them. ROI valuations without identification of all costs and benefits are potentially misleading and can deter sound decision-making.

■ Describing the Benefits

Benefits are defined as an advantage, profit, or gain attained. They are commonly thought of as an investment's return and should describe what the investment enables an agency to accomplish and how the mission is enhanced. Focusing on improved business outcomes rather than the technology is the one of the best ways to ensure that the expenditure of any resource furthers the agency's mission.

Investments in the Federal arena are generally undertaken for one, or a combination, of three general purposes:

- 1) Expansion or improvement in service or function of agency.
- 2) Reduction of operating costs/increasing revenues.
- 3) Research and Development.

Benefits should clearly answer the question, “What does this investment provide the customer, public, or organization?” Whether expressed in qualitative or quantitative terms, benefits should relate directly to the fulfillment of specific, expressed needs. Benefits should align with the purpose of the investment, although at times some secondary benefits not directly supportive of an investment’s core purpose accrue in conjunction with IT projects.

Types of Benefits and Their Roles

Most Federal agencies are not involved in revenue producing activities in the same manner as private sector for-profit enterprises. Rather, agencies focus on investments that provide enhanced services to the public, cost savings, and cost avoidance. However, the ability to generate revenues may be increased by many of the benefits presented here, such as improved customer awareness of, and access to, services. For purposes of evaluation, many organizations also aggregate individually identified benefits into broad categories such as strategic alignment, management information value, and operational value.

When gathering data in preparation for evaluation of investments, include all benefits regardless of whether or not they initially appear difficult to support or quantify. Approaches for categorizing benefits in conjunction with investment evaluation vary. The following classification is provided for the purpose of illustrating identification of characteristics of benefits:

Expanded services or products delivered to public and internal or external customers:

- ***Improves ability to deliver*** – Providing receptionists and telephone service representatives with access to information via desktop PC’s allows them to respond to customer inquiries more accurately and quickly.
- ***Improves access to services*** – The investment increases the number of people reached. Customers can communicate with an organization by telephone, e-mail, or Internet in addition to existing mail services. Customers are provided the ability to remit payment by credit card over the Internet or through direct draw on account.
- ***Improves access to information*** – Internal users gain direct access to resources or information enabling them to perform daily tasks more efficiently. The Public can obtain information on tax issues, health services, etc. via the Internet or telephone.
- ***Improves accuracy*** – The investment improves accuracy by reducing the need for manual data entry or reducing number of data entry errors, thus improving integrity of data. This may also improve productivity and reduce operating costs by reducing time spent on error correction.
- ***Improves compatibility*** – One alternative is more compatible with existing facilities and procedures, requiring less training of personnel or less new equipment and software. System meets agency’s IT architecture requirements.
- ***Improves effectiveness and impact of information delivered*** – On-line interactive training tutorials provide employees unlimited opportunities to improve skills, increase participation in training, and improves retention of new information. This may increase productivity, reduce turnover, etc.
- ***Provides options or flexibility for capturing future opportunities*** – Investments that provide the ability to capture additional gains in the future. An investment in a network for the transfer of data between remote locations can support e-mail in the

future. This approach can be particularly helpful in garnering support for investments in infrastructure and pilot projects.

- **Improves security** – System improves security in terms of fraud prevention, protection of confidential information, or enhances data integrity.
- **Reduces risk** – Back-up systems that reduce the risk of data loss or applications that improve timely delivery of critical information.

Cost Savings/Cost Avoidance:

- **Improves the ability to maintain a system** – Investments for which maintenance resources (personnel, experience, components) are more readily available. Ease of maintenance is relevant to both software and hardware.
- **Eliminates duplicate assets** – Investments that replace multiple, non-compatible, stand-alone systems.
- **Improves reliability** – System has better performance record (less down-time) than legacy process or system. Reductions in downtime inversely impact productivity and may also reduce labor costs.
- **Accommodates increases in workload or demand without additional costs** – Systems that will ‘avoid’ hiring additional personnel to handle increased workload or new agency responsibilities in the future.
- **Reduces manual operations** – Systems that automate manual processes thereby freeing staff resources to perform other functions, reducing or eliminating FTE requirements. Systems that allow functions to be performed by lower level staff.
- **Improves efficiency** – Assets that improve access to information or tools that decrease time required to perform daily functions. A system may provide faster or more accurate aggregation and analyses of data.

Enhanced Work Environment:

- **Facilitates ease of use** – Although user friendly systems are generally thought of in terms of increased efficiency or productivity, they can also improve the social and physical environment for employees.
- **Improves physical environment** – Systems that reduce the amount of paper, clutter in the work area, noise, or eye strain.
- **Improves response rates** – Assets that reduce stress by improving employees’ ability to respond to customer inquiries.

Identifying Benefits

Identifying an investment’s requisite attributes should stem naturally from a gap analysis of the organization’s current operations and capabilities, and the strategic and performance plans. Just as OMB counsels that functional requirements should be defined as they relate to the mission, capabilities, objectives, and operating constraints (rather than equipment or software terms), so should benefits. Keep the focus on desired outcomes, or where outcomes are not directly influenced, on the outputs that link the investment to outcome. When describing benefits it is helpful to invert the technology X provides capability Y approach. Rather than stating that a math co-processor enhances computational processing, express the benefit in terms that users and decision-makers can relate to.

Increasingly, both private and public sector organizations expect IT expenditures

to produce a visible return. Federal agencies recognize that identifying benefits is a prerequisite for assessing an investment's value, and many require analyses of costs and benefits for investments below OMB's \$50 million reporting threshold. As the availability of funds declines, investment plans that fail to clearly identify benefits will be passed over in favor of those that do. Identifying and measuring benefits not only allows organizations to estimate an investment's return, but enables decision-makers to evaluate an investment's alignment with critical organizational objectives.

Identification of distinct benefits naturally precedes measurement. Measurement and monitoring ensure that investments attain their full potential and deliver the anticipated gains. Separating an investment's attributes into explicit and measurable units provides standards for comparison of alternatives and provides the foundation for performance measurements. If, for instance, improving the accuracy of data is an important goal, you will need to determine current error rates, describe exactly how the proposed investment will improve accuracy, and agree upon the minimum acceptable level of performance. This might be couched in terms of absolutes, or relative values such as reducing an error rate by 10 percent.

Jacks From All Trades

The best way to identify the benefits of an investment is a multi-pronged approach. Involving internal users and external customers in identifying requirements will help highlight benefits and define them in terms users and beneficiaries can relate to. Use a team composed of representatives from all areas of the organization: IT, finance, procurement, and operational areas likely to be impacted by the investment. If the purpose of an investment is to improve delivery of service to external customers or the public, become knowledgeable about their needs and preferences. Consider conducting surveys or focus groups to solicit input prior to finalizing requirements, or to involve representatives from the target beneficiary population.

■ Winning Tactic...

Fannie Mae's Office of Corporate Information Services notes that investments in infrastructure and R&D type projects are sometimes a hard sell because users can't readily see the role these projects play in facilitating the cost-efficient deployment of the very products they use every day. They created an object factory to create function frameworks that could be used with a variety of applications, some of which do not yet exist. They estimate that they have reaped \$3.7M in cost avoidance savings as a result of the factory. Winning tactic: Describe how a specific past investment in infrastructure has provided current benefits.

Making Sure the Benefits "Work"

One of the lessons learned in both private and public organizations is the critical importance of obtaining buy-in and support of a system by users. Buy-in promotes joint accountability by IT staff and functional users and significantly enhances an

investment's ability to produce the desired results. Program or business area managers are responsible for achieving both performance and financial objectives and have a vested interest in these areas. Management and users must fully understand IT's role in their operations, and the easiest way to gain their confidence in an investment is to relay the benefits in terms of the business process improvement.

Within the IT Department at Fannie Mae, a senior account manager is aligned with a specific business area and is expected to be fully conversant in the workings and needs of his/her area. This approach helps ensure that IT projects are tightly aligned with business areas. Key Success Factor: Investments should be closely aligned with business areas and business partners at all times.

When considering an investment, step back and look at the impact (or potential impact) it has on the organization, your customers, and the public. Also, consider long-range performance plans or increased demands on the enterprise that the investment would cause. A small cost savings at current operating levels may represent an enormous cost avoidance over a five-year time frame in situations of double digit workload increases. This is particularly germane when cost drivers are external and will unquestionably increase. Where there is a direct correlation between increased demand for an agency service and the cost to provide it, project the impact of a cost avoidance over the life of an investment. Comparing projected future demands to capabilities or capacity can bring the full future benefits of utility or infrastructure investments into focus.

Tapping the experience of the IT community may be helpful, particularly in identifying or describing the benefits of investments for research or infrastructure. While another user's experience with a product certainly does not guarantee the same outcome in your organization, it can alert you to highly touted benefits that never materialized, or provide actual results on aspects of performance relevant to your particular goals and requirements.

What are Costs?

Organizations want the benefits derived from their investments to fill the gap between stated performance objectives and actual performance capabilities. But, benefits are only one side of the value equation. The other side is costs. Nowhere may it be more difficult to ascertain real costs than in the realm of IT. Costs that are unidentified or miscalculated in the planning phase frequently account for a large number of IT project cost overruns.

Most organizations know intuitively that the desirability of an investment can not be gauged fully without considering all resources expended. However, organizations can differ markedly in the depth and rigor in which they identify costs and how they use the data once gathered. For some, scarcity of funds forces cost to be the deciding factor; the accurate projection of all costs becomes a matter of survival. Conversely, private sector businesses experiencing sudden windfall profits may well consider cost scrubbing secondary to finding investments that provide a real competitive edge. The situation for Federal agencies generally falls somewhere between these two extremes. Prudent use of public resources must be demonstrated, implying that all costs are identified before an investment is made.

■ Change Your Organization's Paradigm

Although the initial impetus to explore alternative Human Resources systems was triggered by Y2K, the Department of Energy's successful implementation of their Personnel and Human Resources System system validates the benefit of intense involvement of users in all phases of an investment.

In 1995, DOE's CIO and Human Resources Departments championed a study team to refine previously developed system requirements. The partnership forged functional users and information management professionals and this played a major role in the success of the project. In the past, requirements were often wide of the mark, or not completed in advance because technical staff did not understand users' needs and users did not know how to write requirements. After 10 high-level requirements were identified, a team that included users conducted a market survey to find products that would best meet their needs.

The HR community recognized the need for a tool to improve data, accommodate staffing cuts, and improve both the efficiency and quality of operations. HR wanted to be partners with business area managers, not just paper pushers. They realized they needed a system that could make regular reporting chores routine and free-up managers' time for other activities. To accomplish this, they needed to provide tools that would empower managers and eliminate work that did not impart value to the organization.

As a result of past decentralization of HR programs, DOE organizations independently developed solutions for information needs. DOE recognized that maintaining numerous redundant, and in many cases outdated, systems were an inefficient use of limited resources and compromised DOE employees' ability to work together. Implementation of the Personnel and Human Resources System system replaced nearly 80 small systems, the personnel function of their legacy mainframe PAY/PERS system, and six different, non-interfaced training systems.

When the team needed to perform functional research they reached out to the community for assistance, establishing roles at different sites, drawing upon the experience and knowledge of power users across the country. Active involvement of users and IT staff from conception through final implementation, combined with a focus on providing benefits to both HR and business area managers, built support for the system from the entire DOE community. This support was demonstrated by the voluntary pooling of resources from sites across the country to make the plan a reality. *If you sell the users, users will sell the investment.*

The term costs (as used here) refers to both the incurred expenses of an investment and its capitalized costs, and can be categorized as direct or indirect. Direct costs include materials, labor, and other expenses having a direct bearing on the production of a specific good or service. Disposal costs, often overlooked in planning, fall within this category. When calculating labor costs, OMB recommends using prevailing wage rates and salaries. To arrive at fully burdened costs when estimating personnel costs for government employees, you must add overhead costs to salary and fringe benefit costs. OMB *Circular 76* and Chapter II of the *Supplemental Handbook* dated 3/96 provide guidance on fringe benefit factors and percentage rates for overhead computation.

Some examples of indirect costs include rent, utilities, insurance, indirect labor,

and other expenses typically charged to the organization as a whole. Within the Federal government, indirect costs are normally broken into two categories: operational overhead, and general and administrative overhead. Operational overhead is defined as cost not 100 percent attributable to a particular activity and is generally associated with the ongoing management of an activity. General and administrative overhead includes salaries and equipment and relates to functions performed in support of, but outside of, the activity.

For evaluation purposes, costs (both direct and indirect) should only be included if they will change with the introduction of a proposed system. When comparing a proposed system replacement to the continued use of a legacy system, only the ongoing costs of the existing system are included in the analyses. The original acquisition cost of the system and costs of any enhancements are not to be included in this comparison.

Agencies may also find it helpful to develop a generic checklist of cost elements associated with potential IT investments. Such lists serve as helpful starting points for the identification and subsequent organization of the data. A sample broad category list is provided in Table 1 at the end of this chapter.

Studies indicate that organizations frequently undermine a system's success by failing to recognize and budget funds for all support and operational costs associated with an IT investment. While some organizations record downtime, few gather data on how much time end-users spend supporting themselves or the costs of productivity losses as a result of downtime. By default, the burden of unidentified activities is transferred to the end-users who may not be equipped or adequately trained to carry out the necessary functions. As a result, the system rarely runs as intended and users rapidly become disenchanted. Recognizing and addressing all costs, including shadow costs can be a critical success factor when valuing an IT investment.

Maintaining the system *status quo* must also be evaluated as an option. For this reason, organizations must develop an accurate and complete picture of existing systems' costs and capabilities. Selection of the best possible solution to achieving performance goals is impossible without knowing what you have and what it costs.

■ **Misery May Love Company, but...**

Many managers are currently wrestling with building a case and obtaining funds for the replacement of aged and failing equipment. Don't share your misery with future generations. When you prepare cost estimates for new investments, factor replacement costs into life cycle costs. Aging equipment increases maintenance costs and downtime, which in turn reduces user productivity and satisfaction.

The Gartner Group recommends that assessment of current systems be performed in conjunction with the use of an asset management system. Any large organization with significant capital assets can benefit from the use of asset management systems that facilitate continuous updating of costs and provide management with current, accurate information. A recent GAO study of private sector practices found that effective enterprises use these systems to efficiently identify gaps between what they have and what they need in order to achieve objectives and to obtain maximum value from their assets.

Identifying Costs: Some Techniques

There are a number of techniques that can be of great help in identifying most, if not all, costs associated with a system:

- **Use integrated project teams** - OMB's Capital Programming Guide, Section I.2 recommends the use of multi-disciplinary Integrated Project Teams (IPTs). One function of an IPT is to inventory and assess existing assets, as well as those assets active in the procurement phase through lease, purchase, or service contract. IPTs must evaluate assets' full life cycle costs (both direct and indirect) and the affordability of those costs in relation to expected funding levels.
- **Show system limitations** - Including capacity limitations in asset descriptions will assist in the identification of critical points associated with the need for upgrades or enhancements.
- **Identify unit costs** - Identifying costs per user, or costs per business function, is an essential piece in projecting life cycle costs. This is especially important when demands on a system are anticipated to increase.

■ Small Point - Big Savings

A large hotel chain wanted to decrease its paper record storage costs and undertook a study to evaluate the possibility of converting all documents to electronic image files. Funds were tight and preliminary cost estimates for an imaging system, including enhancements to the hotel's existing LAN, were significant. One particular cost savings that senior management was surprised to learn about concerned the impact that labor costs carried for the handling of paper documents. Projected reductions in labor costs alone were sufficient to provide a positive Net Present Value within 18 months.

Resources You Can Use

Involvement of the well-chosen Integrated Project Team (IPT) in the earliest stages of project conception helps to ensure the accuracy of cost projections, as well as the quality of the proposed investment alternatives. Teams consisting of representatives from business or program areas such as IT, finance, administration, and procurement will know what to look for, and how to efficiently gather the necessary data. Additionally, IPT members trained in value management (OMB Capital Programming Guide, Appendix 9) can identify options representing the best value solution for specific functions.

Detailed costs of labor for any specific systems may require extrapolation or estimation. This is especially challenging where one staff supports multiple systems simultaneously, in instances where systems are utilized by multiple business units, or where systems are continuously evolving. In such situations, agencies may benefit from interviewing technical and support staff to establish current labor expenditures or by conducting time studies. Although a time consuming process, asking end-users to provide information on how frequently they perform IT-related support tasks may be the only way to accurately determine the shadow costs.

■ Labor Costs - The Big Bite

A recent Gartner Group study reports: "Analysis of a typical large distributed computing project over a five-year life cycle indicated technology (e.g., client and server hardware, software, upgrades and maintenance) represented only 15 percent of the total, while labor represented 70 percent of total distributed costs."

Questions frequently arise as to exactly which costs to include during the process of linking costs to specific investments. For example, the acquisition of a new application program may require upgrades to some users' desktop PCs. The upgrades will support future enhancements, so would the upgrade be a cost applicable to the new application, or should it be considered an infrastructure cost? If, in the near future, installation of additional applications in conjunction with another project is planned, should the upgrade costs be pro-rated between the two projects? Agencies and decision-makers will benefit from addressing these issues.

Attaining consensus and formulating guidelines on the separation of specific project costs from infrastructure, overlapping projects, etc. encourages balanced evaluations. A recent GAO study found that one leading organization unbundles proposed projects into their smaller components, allowing costs and benefits to be closely matched. Managers are able to assess the value of individual pieces and re-combine them to find the mix that yields the highest return with the lowest investment.

Identifying costs per user, or costs per business function, is essential in projecting life cycle costs when demands on a system or the program are anticipated to increase. Detailed identification of unitized costs is necessary for consideration of outsourcing as addressed in Raines' Rules. Without accurate and detailed cost data, agencies can neither determine if an external source could provide a function more cost effectively, nor can they formulate realistic performance measures for themselves or for an external provider.

■ Fine-Tooth Comb

The Army Corp of Engineers conducted a pilot at one location to confirm the feasibility of implementing an Optical Disk Imaging system and gather the necessary data to project the costs and savings for multiple sites. Based on the results of the Phase I survey, they identified the number of linear feet of records, file cabinets required, and facility space costs per foot for the cabinets at 63 sites. Projected personnel costs were also factored in based on the number of records managed per FTE and the average salary for the position. The detailed data gathered on the number of records maintained and physical storage requirements, allowed them to project and compare costs (including a conservative rate of records growth), for both the existing manual and proposed ODI systems, over a six-year period. While their Executive Summary included a number of benefits associated with the ODI system, a positive Net Present Value was directly tied to the savings from record storage and handling.

Organizing your cost findings as they relate to the budget and reporting requirements contained in OMB Exhibit 42 and Schedule 300B will ease the final compilation of the data. Breaking out one-time costs from the recurring or steady-state operation and maintenance costs, aids the preparation of subsequent analyses (such as the computation of NPV, ROI, CBA, etc.) and helps ensure that recurring costs are factored into evaluations.

Go Outside For Help

Look beyond the confines of your agency for help in developing cost data. Some external sources might include:

- **Industry publications and trade journals** provide not only information on new products, but often include general prices and frequently publish reviews or comparisons of similar products.
- **Vendors** are generally willing to provide costs as well as new product information that may meet your needs.
- **Web sites** frequently include pricing and are a good source of information. Government-wide agency contracts (GWACS) and the OIRM Web site for IT Acquisitions (<http://www.oirm.nih.gov/itacquis.html>) are potential sources for cost data. The Schedule 70 (ITPS) contract identifies labor categories and rates.
- **Market research** can provide guidance for estimating labor for proposed projects or serve as a reality check when deriving costs from existing systems.

Do not hesitate to call on members of the IT community outside your own agency. Another organization's recent experience with a similar project can provide valuable insight on operating costs. If you identify individuals in another agency with experience with similar systems, you might consider borrowing the expertise to build your analysis and business case. Another resource is the Information Technology Resources Board (ITRB). In addition to providing peer review and sharing "Best Practices," they may be able to assist you in identifying individuals with experience in systems you are researching. For more information, contact Ms. Ginnie Schaeffer of the ITRB, Michele Heffner of the CIO Council, or Pat Smith of the GITSB.

When the major purpose for investing in an IT asset is to reduce costs and detailed operating costs are not available, agencies are faced with the choice of generating estimates with little or no basis, or expending resources to identify functional costs. While it may be expensive to perform workflow studies or examine financial records, a well-chosen sample can provide sufficient information to substantially improve projections. One agency found that additional research costs were worthwhile when it was revealed that what appeared to be a good investment was off-target. By tracking the progress of a selected sample of documents through the work flow process, they discovered that the bulk of the delay they hoped to eliminate by automation resided in an area that would be virtually unaffected by the system they were proposing.

TABLE 1: Cost Checklist**Hardware/Equipment (purchase and lease costs)**

- Client desktop workstations, laptops, and peripherals
- Servers: local workgroup and Enterprise servers
- Communications hardware (hubs, routers, bridges, switches)
- Power protection devices
- Memory upgrades
- Off-line storage devices
- Network cabling
- Network interface cards
- Lab or test equipment (% of use dedicated to specific project)
- Network upgrades
- Auxiliary furnishings (printer stands, etc.)

Software

- Purchased COTS applications
- Periodic COTS license fees
- Desktop/workgroup software
- Network operating systems
- Application development tools
- Network and systems management applications
- Help desk tools for management
- Contractor supplied development and maintenance

Labor (fully burdened)

- Installation costs
- Maintenance
- In-house development and modification
- Requirements development/documentation
- Testing
- System and network administration/management
- Help desk support
- Acquisition/contracting
- Procedures development
- IS staff training and education
- End-user training
- Supplemental staffing
- Shadow costs
- Data maintenance
- Research and planning

Infrastructure

- Upgrades or additions to telecommunications lines
- Upgrades to power lines

■ TABLE 1: Cost Checklist cont'd

Miscellaneous

- Contractor costs
- Data storage costs
- Supplies (diskettes, toner, printer ribbons, paper, etc.)
- Facilities costs (system-related floor space and utilities costs)
- Consultants

There is also help beyond the agency for issues other than just identifying cost data. GAO, OMB and Congress have been providing opportunities for new ways of looking at the same problems and offering ideas such as Sections 5301 through 5305 of the Clinger-Cohen Act that provides that Agencies, in consultation with the Administrator for the OMB Office of Information and Regulatory Affairs, may conduct pilot programs in order to test alternative approaches for acquisition of information technology. There are several requirements and restrictions associated with pilots initiated using this authority. The pilot programs:

- May not exceed five years in duration
- Allow that contracts entered into before the expiration of the pilot shall remain in effect according to the terms of the contract after the expiration of the program
- Shall have measurable criteria for evaluating the effects of the procedures or techniques to be tested under the program
- Shall submit to Congress a detailed test plan for the program, including a detailed description of the procedures and a list of any regulations that are waived
- Shall submit to the Director a report on the results and findings under the program and provide a copy to Congress, no later than 180 days after completion of the pilot

While this section of the Act does waive regulations and guidelines, it in no way should be construed as authorizing appropriation or obligation of funds for the pilots or programs.

Teaming and partnering between industry and government such as Electronic Data Interchange and electronic commerce activities are providing a great opportunity for utilizing pilots, prototypes, and partnering. The National Partnership for Reinventing Government (NPR) has been a strong proponent of pilots since its inception. Guidelines from Clinger-Cohen, OMB and GAO have provided many opportunities for agencies and departments to use reinvention laboratory projects to try reengineered processes and projects to test new ideas and processes. The Capital Planning and IT Investment Process detailed in OMB's Capital Programming Guide utilized several agencies and departments as pilots of this new way of performing Capital Asset Planning and IT Investments. OMB uses the pilot technique for virtually all new guidance and initiatives for the Federal Government. GPRA, Performance Planning, Capital Planning and IT Investment Process, Capital Asset Plans and reports on Information Technology are among the most well known in the IT Community.



Quantification

In this chapter...

- Determining an investment's value entails quantifying costs and benefits in an equitable way.
- Dollars are not the only metric of value.
- Financial figures alone fail to present a complete view of an investment's total worth.
- Organizations should attempt to quantify all significant benefits, including intangibles.
- A common approach for comparing dissimilar investments is the use of a subjective system entailing scoring an investment on a predetermined set of weighted criterion.

Why Quantify?

Gilbs Law: Anything can be measured in a way that is superior to not measuring it at all.

After you have identified and gathered costs and benefits, they must be integrated meaningfully into capital planning decisions. To balance these elements within an investment or to objectively examine alternatives, they must be framed in some comparable way.

Determining an investment's value entails weighing all the necessary elements, and therefore naturally implies quantification. An increase in the bottom line is the most common determination of value in private industry, but the public gauges government's effective use of resources against more complex standards. The number of accidents prevented, deaths avoided in combat, or gallons of water decontaminated may be a better indication of value and be of more interest than an arbitrary dollar assignment to these benefits. While the use of monetary units promotes comparison of alternatives on an easily understood and equal baseline, they are not the only indication of value.

Many executives feel financial measures alone are inadequate tools for strategic decision-making. The best metric will align the investment with its intended objective. For example, if the investment's goal is to reduce the time required to process and rule on applications, the prime measurement is the reduction in the number of processing days. That is not to say that measuring this benefit in dollars serves no purpose.

Indeed, the ability to select the best investment from alternative solutions that reduce processing time may hinge on the identification of differences in labor cost savings.

As many managers note, one of the challenges in calculating the return on IT investments is its natural overlap with nearly all facets of the organization. With some exceptions, it is unrealistic to say definitively that investments in IT alone resulted in increased sales, reduced inventory carrying-costs, or improved customer service. Invariably, other factors such as changes in processes and human activities come into play, which reasonably deserve credit for these improvements. However, that does not mean recognition of IT's contribution must be limited to its direct impact.

One solution for building a credible benefit claim is to identify the cause and effect chain between the capabilities provided by IT and the impact on business in concrete terms. This requires collaboration with functional area managers, not only to gather the data necessary to establish the chain, but to obtain their agreement on IT's contribution to the business improvement.

By quantifying the interplay between people and IT, it may be possible to determine a logical and defensible percentage of the organizational gain attributable to IT. For example, as the result of an IT investment telephone sales representatives are able to respond to customer inquiries and complete sales orders an average of four minutes faster. The IT investment might be credited for a reduction in labor costs (labor rate multiplied by time.) However, the decreased processing time, in tandem with additional training, enabled the company to meet a strategic objective of increasing sales by X percentage or Y dollars. By estimating the costs of achieving those same objectives without IT (perhaps additional staff required), it is possible to arrive at a percentage of these gains attributable to the IT investment.

“Most soft benefits can be quantified but measurements need to be sensible and logical—producing numbers for the sake of having numbers is not necessarily beneficial.” -- General Accounting Office

Intangible Benefits

An intangible benefit is defined as one that is not immediately obvious or measurable. A review of current literature reveals no shortage of experts expounding that “all benefits can be measured,” and that IT investments are always quantifiable. Yet, most organizations, including OMB, acknowledge that intangibles exist and may carry significant importance in project evaluation. Good investment analysis will focus on primary benefits and quantify them meaningfully in relation to the objective the investment is intended to satisfy. If a benefit is truly produced, then it must bring about an observable change. If it improves or decreases something, that change can then be measured.

Difficulty in quantifying soft benefits is frequently a by-product of poor definition. For example, improving employee morale is nearly always classed as an intangible. But if morale is really a problem that needs to be addressed, then unquestionably indicators of bad morale must exist and those same indicators can be used to measure improvement. The appropriate metric might be reduced turn-over rates, reduced absenteeism, or

improved productivity. Further, improvements in these factors can be expressed in dollars. If the organization does not maintain its own figures on the costs of replacing employees, national statistics are readily available to assist in the process.

Enhanced decision-making and employee empowerment are frequently considered intangibles, but these can usually be quantified by defining what they constitute. Does the former mean that better information is more readily available to support decision-making? If so, specifically what information, how often is it fundamental to decisions, and what is the impact of those decisions to the organization? Does employee empowerment mean that employees will have direct access to information enabling them to answer customer inquiries immediately? Will fewer supervisors be required, reducing labor costs? If the answer is yes to any of these questions, the benefit becomes tangible in terms of reduced response time and/or reduced labor costs.

Intangibles such as customer satisfaction might be measured by the incidence of repeat business or a reduction in the number of complaints received. Both of these measures can be monetized. Sales organizations know that it costs less to sell a repeat customer than a new one, and handling complaints entails a definite labor cost. If it is not possible to identify repeat business, surveys of clients' levels of satisfaction may provide a standard against which improvements can be measured. Improvements in accuracy can certainly be measured by incidence, and depending upon the nature of the errors, by the costs (including legal costs) incurred to correct them. For agencies heavily relying on scientific applications, the costs of inaccuracy can be staggering.

While installing a new cable plant for the entire General Services Administration's Headquarters in Washington, DC in 1998, the Office of Chief Information Officer (CIO) not only attained their initial expected benefits, but also identified additional benefits and advantages. An added benefit of the cabling solution was the centralization of all network operations into a single server room. Another was the strategic standardization of all wiring closets, including hubs and concentrators, and the decrease of the overall database server population. The cable plant made the GSA Central Office building VLAN capable and virtually eliminated the need for major cable projects for future changes to the network

Completion of the Recabling efforts gave GSA a modern and robust automation platform to serve their needs into the next century. The elimination of major cabling projects for the foreseeable future will save GSA money and time and provide quality performance for the users. GSA's Recabling effort has leveraged the agency into LAN Consolidation and provided the fundamental and essential groundwork for the first Seat Management Contract in the history of the Federal government, which was awarded in December, 1998.

Technology benefits can be quantified when described with modifiers such as effectiveness, quality, productivity, or efficiency. Improvements in efficiency must equate to an increased output rate for a given amount of effort, productivity by quantity of a particular result in a given amount of effort, and improvements in work pattern mean an increase in time spent on activities contributing directly to business goals. Once units of measure are defined, typically a dollar value can be applied to these benefits.

Scrutinizing intangibles and converting them to measurable benefits can reduce

the chance of selecting an investment that will never deliver real returns. Investments for improved delivery of information for decision-making are notorious for failing to effect real organizational gain. Up-to-the minute stock prices are critical to brokers, but too often executives suffer less from a lack of information than from an overload of information. If this is hailed as a primary benefit of a proposed system, ask what information will be delivered? What decisions will it support and what is the range of impact of those decisions? The answers to these questions provide units of measurement and thus the means for subsequent validation of the purported value. When attainment of intangibles comprise the most compelling motivation for an IT investment, managers need to make a concerted effort to dissect and critically assess the benefits.

During the process of interviewing potential providers of a complex software application, the COO of a large corporation expounded in detail on the specific reports he expected the system to produce, and how the information would aid his ability to run the company. During a coffee break his vice president handed him a report reflecting the exact information he'd just asked for. Assuming it was a sample provided by the vendor, he exclaimed, "Wow, these guys are great!" The VP replied, "You get these every Monday, they're kept in your right hand desk drawer."

In a service environment, quantification can be difficult because value-added benefits do not necessarily translate to an increase in revenues. Increased productivity may translate to better customer service or improved performance rather than actual decreases in labor costs as a result of fewer employees.

The Work Value Added Model is sometimes used to help quantify intangible costs and benefits and address the difficulties associated with cost-benefit analysis in service-oriented organizations. Value Added Models focus on estimating quantitative or qualitative changes in workflow. Another approach favored by economists for dealing with intangibles is the value-of-information approach. Net benefits for all quantifiable elements are estimated and non-quantifiable elements are identified. The question is then asked, how large would the non-quantifiable elements have to be to reverse the conclusion of the analysis?

Every time an agency contemplates expending resources to improve a service provided to the public, two questions are implicitly addressed: First, what benefit will accrue to the public; and second, what would the public be willing to pay for this benefit. To a great extent, how well an organization answers the latter determines the fiduciary prudence of their decision. In a free commercial market, the public validates or refutes business' perception of customer satisfaction and willingness-to-pay (WTP) with their wallet. For government services, no free market may exist against which to gauge public WTP, even if an IT investment could be said to independently produce a direct benefit. Agencies may find the discussion of benefit estimation techniques found in Kopp, Krupnick, and Toman's report, "Cost-Benefit Analysis and Regulatory Reform" helpful in considering public WTP.

When attempting to quantify intangibles it is vital to obtain consensus among decision-makers and stakeholders about what constitutes meaningful measurement. All parties need to be comfortable and have confidence in the quantified value estimates. If agreement cannot be reached, you are better off leaving them unquantified. If the users and management do not believe the selected metrics are appropriate, they will not have

confidence in the evaluation and selection process. As a result, real acceptance of the process will wane, as will active participation in refining the methodology.

Dissimilar Characteristics: Comparing Apples and Oranges

Comparing investments with dissimilar characteristics is perhaps the greatest obstacle in the development of a repeatable process for successful IT investments. Despite best efforts to place a value on benefits, true significant intangibles, or primary benefits cannot be expressed in dollars, which excludes their recognition in financial analyses. Investments for research and development typically fall in this category, as do many projects within the Federal government addressing broad public benefit issues such as environmental protection, public health and safety, and energy.

GSA employs a two-tiered investment process. The Administrator leads the Business Technology Council that looks at and establishes the corporate IT vision, and issues other IT investments based on a business case. GSA also uses the Information Technology Council, chaired by the CIO, to review the technical merits of all IT investments.

One common approach employed in both private and public sectors for leveling the evaluation field is to use a weighted scoring method. A number of Federal agencies have implemented a standardized questionnaire to gather information for all IT projects for this purpose. A set of criteria is defined with predetermined weights assigned, reflective of each criterion's importance to the organization. The results of economic analyses are included as just one of the potential factors. All investments are then rated with this tool. Some organizations use this technique to incorporate a Balanced Scorecard approach to evaluating investments. Variations include grouping the criteria into subjects such as risk and strategic alignment and creating a two (or more) dimensional grid. Scores are summed for each category, and the investment plotted on the grid at the intersection of the scores. The positions of the various investments can help evaluators 'see' the differences between various options or the relationship of a project to the entire portfolio.

EPA produced a standard form with questions incorporating evaluation criterion of all projects that involves collection of 80 data points. Their form follows the balanced scorecard sections for each of Raines' Rules and addresses risk from several perspectives. EPA's IRM Planning division numerically scores each question's response for proposed projects during a facilitated session. Specialists within IRM look at the responses to questions within their areas of expertise such as architecture and evaluate both the individual projects and the portfolio on these issues.

When ROI evaluation is applied to the total investment portfolio, it provides structure for looking at the overall picture — by projects, in years, or across organizations. This will enable management to better identify possible trade-offs, opportunities

for consolidation, sharing of resources, and elimination of duplication. As the success rate of projects increases, oversight will decrease, and approval for new ventures will be easier to obtain.

While a weighted scoring approach provides an avenue for recognition of the roles of many factors in investment success, it also introduces subjectivity. This can be potentially dangerous because users can underestimate the impact of subjective judgment on the scoring and fail to challenge rankings they do not understand. Subjective bias can not be eliminated entirely, but it can be reduced through good question design, ample description of the criteria and scoring methods, and training in use of the tool. Employing review boards and independent external review bodies can also help balance the inherent bias in project creation and sponsorship.

There are a number of commercially available tools on the market geared towards IT investment analysis. The “Information Technology Investment Portfolio System” (I-TIPS) is a Web-based application providing decision support and documentation for customized IT capital planning. DHS & Associates’ “Applied Information Economics” tool melds techniques from a variety of scientific and mathematical fields to assist in decision-making.

Quantification Case Study: Assistant Secretary of Defense (Health Affairs) Composite Health Care System II (CHCS II) System

One of the most challenging aspects of determining IT *value* is the development of a model for measuring an investment’s contribution to the organization as a whole and its effect on desired outcomes. Within DoD Health Affairs, the CHCS II program provides an example of approaches to identifying value and offers insight on strategies for meaningful measurement of benefits typically considered difficult to quantify.

Building on the capabilities provided by CHCS I, CHCS II is designed to provide benefits directly linked to the mission of Military Health System (MHS): maintain costs, deliver quality care, and ensure the medical readiness of personnel. This initiative’s goal is to provide cost-effective care without compromising quality. The system provides the ability to create and access complete electronic patient records in a real-time manner. Health care providers will have direct access to patient data from multiple, isolated facilities (approximately 60 source systems), and suggested treatment protocols can be built into the system. Features such as flags that draw attention to lapses in immunizations or a need for periodic screenings, help to promote the administration of preventive care. Studies show that early detection and treatment can preclude escalation of disease to critical and costly stages, thus reducing medical costs in the long run and improving patient outcomes.

The planning process of the program involved users in every step of the conceptualization and development, participation of the Tri-Service Committee, and Tricare Management Activity’s Information Management, Technology, and Re-engineering Directorate. CHCS II is a complex project that attempts to address users’ numerous, and sometimes conflicting, needs. Limited funding resources dictated that the most pressing and critical user needs be addressed in the first phases of the project.

The Program Office conducted intense research both to identify alternatives and to devise methods of measuring benefits. Senior management encourages segmenting major initiatives into usable modules that provide benefits if no further development is funded. Each increment should show a positive up-front ROI, or have such critical import to the mission that the project can be sold to key decision-makers on the merits of benefits that can not be confidently expressed in dollars. Management emphasizes

accurate projection of costs and benefits in quantitative terms and objective analysis by the Program Office staff.

To rigorously analyze and evaluate the project, the Program Office developed a methodology to accurately identify and quantify costs, and benefits. Beyond capture of the direct benefits such as reduced labor costs for maintaining patient records and fulfillment of reporting requirements, MHS wanted to evaluate the systems broader contribution to the delivery of cost-effective health care. This required a flexible and intellectually sound model.

Three methodologies were built into their model:

1) Episode of Care: EOC is a health care concept that looks at treatment for patients over time or over the period of disease. The planning team wanted to identify standard EOCs and focused on Diagnosis Related Groups (DRGs) representing the highest percentage of total care costs. They examined where computer access would impact the episode of care and asked: what benefit would the system provide and can it be measured? Benefits were divided into two categories: financial and non-financial. Issues of feasibility and effort required to collect and measure benefits were addressed. They also wanted to know if the process and benefits could be replicated in the military environments and to the extent projected. A process for verifying the answers to these questions was built into the performance measurement plan.

Identifying financial savings involved examining very specific functions. An example is the time savings to nurses in locating lab results for specific types of EOCs. Fortunately, MHS had extensive and detailed data on DRGs from which to construct a baseline for development and measurement of quantified benefits. Detailed data also existed on the rates of occurrence of different types of DRGs, and for different sites, enabling them to factor in variances in environments in the extrapolation and projection of savings.

The Office will initially focus on short-term benefits they can measure and verify, e.g., episodes of care for selected DRGs. After consulting with experts, they selected two sample DRGs on which they will compile data and monitor. Baseline data will be collected on patients in these groups, and their EOCs will then be reviewed at regular intervals (3 months, 6 months, etc.) Outcomes will be compared against similar patient groups within the same DRG.

2) Linkage of benefits to Military Health System (MHS) IMIT goals and objectives: Alternatives were evaluated on ability to fulfill mission and performance goals, and how each addressed gaps between goals and existing capabilities. Only benefits which were found to support the MHS goals and objectives were included in the CBA benefit algorithms. The CHCS II system facilitates cost-effective health care by enhancing the organization and synthesis of data. From a long-range perspective, the detailed data collected through the system can be analyzed to recognize patterns or protocols that provide the best care (outcomes). Various features promote preventive care, reducing long-term medical costs. These potential benefits were not included in their financial analysis as the Program Office felt they could not yet project the dollar savings with confidence.

3) Balanced Scorecard evaluation: The Program Office wanted to ensure that they were not overlooking an impact of the system to the organization or to their patients. Use of the Balanced Scorecard helped maintain focus on the importance of communication to the field and users. Obtaining maximum benefit from the system will

require some changes in how the organization operates and these changes are addressed in the implementation plan. The need for change within the organization was also recognized as a risk factor.

The pilot phase of CHCS II is currently being implemented. MHS has a philosophy of plan, deploy, and evaluate carefully before proceeding. The results of comparisons of actual benefits achieved to projections will be intently analyzed prior to continued implementation. In addition to reviewing any variances in cost and schedule, evaluation will include surveys of users to validate or refute projections of many factors, including actual time savings, and system performance, etc. Review will also include analysis of Episodes of Care for the sample DRGs to assess changes to patient outcomes. Assuming initial evaluation indicates the project performs as envisioned, CHCS II will be deployed world-wide. MHS intends to measure their investment's value every step of the way.



Quantitative Approaches to Determining Value

In this chapter...

- NPV is the most commonly used tool for investment analysis.
- Other tools (such as IRR, ROI, BIR, SIR, and EUAC) are useful but do not provide as much insight as NPV.
- Financial measurements must be complemented with qualitative factors for a thorough evaluation.
- There is no one way to determine value.

Evaluation of an investment on the basis of its financial impact is the backbone of IT decision-making. Execution of sound financial analysis requires certain basic mathematical computations and an understanding of the various approaches. The following section presents some of the more frequently used financial tools for this analysis.

Discounting and Discount Rates

Discounting underpins sound financial analysis techniques. It is the reverse of compounding, allowing you to answer the question, “How much do I need to deposit in my account today to accumulate a specific amount by a certain date in the future?” Just as you know that the balance in your savings account will grow, discounting recognizes the time value of money: a dollar to be received a year from now is worth less than a dollar received today. The value today of a sum to be received in the future is derived by

At the time you purchase a lottery ticket you will need to decide if you are going to take the winnings as a single lump sum payment, or over a period of twenty years. For one couple, their choice resulted in a one time payment of \$104 million versus \$195 million paid out in equal installments (annuity) over twenty years. Did they make the right choice? The \$104 M represents the present value of an annuity of 20 payments of \$9.75 M. So, $\$104\text{M} \times \text{PVIF of annuity of 20 yrs} = \195M . By solving for the unknown interest factor, we see that if the couple could invest their winnings and earn more than 6.5 percent interest per year, they made the right choice.

multiplying the future value by the discount rate, or present value interest factor (PVIF). Any financial analysis method employing a discount rate, such as Net Present Value, Benefit/Cost Ratio, etc., recognizes the time value of money.

A discount rate is simply an interest rate and is sometimes referred to as the capitalization rate. Within the private sector, identification of the appropriate discount rate is a function of the business' cost of capital. Appendix C of OMB Circular A-94 provides the recommended real and nominal discount rates for Federal agencies, and is updated annually. Section 8 of Circular A-94 discusses the appropriate application of real and nominal interest rates and Appendix B illustrates the effect of discounting. Failure to use the appropriate discount rate may produce very misleading results. Generally speaking, nominal rates should be used in evaluating lease-purchase options, as this higher rate recognizes the interest built into lease purchase agreements. The real discount rate is appropriate for use with constant, or non-inflated costs, while the nominal rate is appropriate where inflation has been built into cost and benefit estimates. For this reason it is suggested that real and nominal costs not be mixed in a financial analysis. If you find that an investment includes both real and nominal elements, separate them and apply the appropriate discount rates to each portion prior to final summations.

Net Present Value (NPV)

NPV is the single most commonly used measurement for financial evaluation of an investment in both public and private sectors. This metric recognizes the time value of money by discounting monetary costs and benefits over a period of time—an asset's life cycle or any selected period of analysis. NPV allows managers to compare, on purely financial factors, investment alternatives with widely disparate cash flows. NPV facilitates objective evaluation of projects regardless of scale differences or the existence of capital rationing, and can be used to compare independent or mutually exclusive projects. OMB requires Federal agencies to compute NPV, which forms the backbone of cost/benefit analysis and cost-effectiveness analysis.

For each year of the analysis period, cash inflows (benefits) and cash outflows (costs) are totaled and then summed to arrive at the net impact on cash. The net cash flow is then multiplied by an appropriate discount factor to arrive at a discounted cash flow for each year. NPV is the total of these discounted cash flows over the period of analysis.

■ OOPS!

One poor soul was much chagrined when a pencil-pushing underling pointed out that the financial analysis for a potential project included what appeared to be an improbably high NPV given the project's costs. After some hours of review, it was discovered that the commercial spreadsheet template used for calculating the NPV failed to compute correctly in scenarios of zero tax liability. Although it allowed input of a zero tax rate, the underlying algorithms divided selected inputs by the tax rate. While most humans recognize that you can not divide by zero, some computers will attempt to please their masters by conjuring-up a number from their memories! If you are using someone else's templates, make certain you understand how they work.

Generating a meaningful NPV requires sound estimates of the costs and benefits of a project, use of the appropriate discount rate, and the identification of the timing of cash receipts and disbursements. NPV focuses on an investment's impact on cash flow rather than net profit, or savings in the case of non-revenue generating entities. Thus, only an investment's effects on cash are considered.

Internal Rate of Return (IRR) and Modified Internal Rate of Return (MIRR)

The internal rate of return is the discount rate that equates the present value of the expected future cash flows to the initial cost of the project. The formula is simply the NPV solved for the discount rate that causes NPV to equal zero. The IRR is frequently calculated in comparison to a hurdle-rate, which represents the minimum rate of return an organization requires to justify the investment, and is based on the firm's cost of capital. The goal of considering IRR is to ensure that the benefits provided by an investment exceed an organization's cost of capital. Within the Federal government, the cost of capital is reported by the Treasury Department and represented by the discount rates provided by OMB.

When cash flows fluctuate between positive and negative after the first year, there will be more than one IRR and the question arises, which IRR should be used to compare with the cost of capital or to rank alternative investments? Unfortunately, there is no absolutely 'correct' answer, and this presents a significant drawback to using IRR as an investment decision-making factor.

Where the IRR is deemed an important metric for evaluation and comparison of IT investments, the Modified Internal Rate of Return provides an IRR when expected negative cash flows occur after the initial period. This method requires computation of the future values of all positive cash flows (also known as compounding), to the last period of the project's life cycle. All negative cash flows are discounted to the first period. The MIRR is the rate at which the present value of the negative cash flows equals the future value of the positive cash flows.

Return on Investment (ROI)

ROI is stated as a percentage and equals the total return for the timeframe of an analysis divided by initial and subsequent investments. ROI may be stated as either a non-discounted or discounted return and OMB recommends the use of discounted methods.

Discounted Payback Period

The discounted payback period is stated in years and represents the length of time required for net revenues to recover the cost of the investment on a discounted basis. The use of payback as the primary factor in selecting capital investments has long been abandoned in favor of other methods fostering broader and longer views. However, payback does provide a measure of project liquidity, and can be of use as an indication of risk. Generally, projects whose return is realized rapidly (with other factors constant) present less risk than longer-term projects.

Savings Investment Ratio (SIR)

Calculating a SIR allows organizations to compare the profit (savings) potential of alternatives and helps to answer the question: Do the recurring savings of the proposed investment, compared to the status quo, justify the costs? The ratio is derived by computing the present value (PV) of the savings produced by the investment relative to the costs of the status quo in each year of the analysis. The discounted savings are totaled and divided by the PV of the investment costs. If costs extend over more than one year, these too should be discounted and summed. The resulting ratio indicates the proportionate savings resulting from an alternative to the status quo to the investment required to implement the alternative. A SIR of 1.0 or greater indicates that the NPV of the savings attained by the new investment are equal or greater than the NPV of the costs incurred to implement the new investment. SIRs can be used to compare multiple investment opportunities, but scale (total costs and savings) must then be considered. When computing SIRs, total annual maintenance and operations costs are not discounted, only the difference between the annual costs of the two alternatives.

Benefit Investment Ratio (BIR)

Comparing the BIRs of investments may be helpful in situations where the financial analysis scores of alternatives rank closely and an additional viewpoint is desired. Dividing the NPV of benefits by the NPV of costs derives the BIR. The NPV and benefit/cost ratio will always indicate the same accept/reject decision for independent projects, but can reflect different rankings of alternatives.

Equivalent Uniform Annual Cost (EUAC)

When the economic lives of alternative investments differ and are shorter than the minimum requirement time period, EUAC allows the alternatives to be compared on a common basis of time. Assuming the alternatives are equal in their ability to fulfill stated objectives, this approach avoids the distortion that would otherwise occur. If factors such as technology are involved, and the alternatives are not equal in their ability to meet requirements, or the requirement will cease prior to the economic life of one of the alternatives, EUAC is not appropriate. However, it can be helpful in evaluating specific alternative components of an IT system.

EUAC converts each option into an equivalent hypothetical alternative with uniform recurring costs. For example, the yearly costs of system A exceed those of system B, but functions without major replacements for five years as opposed to B's three-year economic life. If it can be reasonably assumed that the cash flow patterns of each can be repeated, the costs of both alternatives can be extended to a common denominator point. The NPV of an alternative is calculated and then divided by the sum of the discount factors for its economic life to yield the EUAC. This figure represents the cost of the project if it were budgeted in equal yearly installments. Note that this is not the same as calculating a simple average, which fails to recognize the time value of money. In actual application, chaining replacement costs can be extremely complex and reaching a common denominator year may result in a ridiculously long projection. In such cases the equivalent annual annuity method is a simpler solution. Instruction on this method can be found in most financial texts.

Financial measurements alone may not provide adequate information for decisions with long-term impact. Managers must consider the financial return of an IT investment in relationship to other factors such as risk, feasibility (both organizational and financial), and the long-term goals and mission of the organization. Organizations are employing a wide variety of techniques to determine the value of their IT investments including Economic Value Added, Two Domain Theory, and the Society of Information Management's Value Measurement Model, to name a few. The plethora of products and approaches reflects the common belief that there is no single way, no magic bullet for ascertaining value.

Each of the tools presented in this chapter are subject to certain limitations and organizations frequently use a combination of tools to gain a broader perspective when assessing an investment's value on financial factors. However, organizations recognize that financial measures alone may not present a balanced view of a project's potential worth. The IAC/Cahners Research survey reports that 59 percent of overall respondents consider non-quantitative factors in their IT investment selection.



Risk

In this chapter...

- Sound investment selection requires planning for risk.
- Investments can be subject to many risk factors, both external and internal.
- A repeatable risk management process can help organizations reduce avert catastrophes.
- There are many sources of potential risk areas, some less obvious than others.

In the IT arena, allowing your chickens to hatch *before* they are counted is a dangerous practice. Since most projects lack perfect information, risk must be confronted head-on during a project's life cycle. Successful risk management and risk control are key to this mission.

To get in your car and drive cross country with only one tattered map in your glove compartment is not wise. Somewhere in between Cleveland and La Jolla you realize that Route 70 is closed for repairs. Armed with only enough money to cover the gasoline and tolls you budgeted for, you are in trouble. Now what do you do? This is where risk management plays a crucial role. Because you did not adequately anticipate risks, you are unable to mitigate any that arise. Burying your head in the sand does not equate to IT success!

In order to manage and control risk, an event must first be deemed "risky." Dr. Robert Charette, President of Itabhi, a Management Consulting firm in Fairfax, Virginia, defines risk as, "...the possibility of suffering harm and/or loss." Charette goes on to look at three key Cs (Chance, Consequence, and Choice) that influence whether a particular event carries inherent risk. First, there must be a probability that the event will occur (Chance). Secondly, there must be a significant impact to the objective of the project if the risk does occur (Consequence). Lastly, there must be something that can be done to control the risk (Choice).

Types of Risk

A repeatable documented risk management process is vital to avoid potential cost overruns, schedule shortfalls, and acquisitions that do not perform as expected. One strategy for achieving this level of management is to break down risks into their component parts. There are many different types of risk that must be considered when

evaluating IT initiatives. These risk factors draw from all core business areas within the organization and can include:

- **Technology risk** is considered as the risk that a product or service may not meet its intended objectives or be able to interface with current processes or software correctly.
- **Implementation risk** deals with time constraints. This form of risk includes both the amount of time necessary to complete the task and the compatibility between platforms.
- **Strategic risk** determines how closely a project is linked with its mission and risks. It is important to be comprehensive and include all risk sources regardless of frequency, probability of occurrence, or magnitude of gain or loss.
- **Organizational/ Project management risk** speaks directly to management risk. This human element is difficult to accurately incorporate into a risk assessment, but is a critical factor, nonetheless.
- **Change management risk** attempts to project how easily pilots and prototypes could be incorporated into existing systems. This type of risk also addresses how severely a business would potentially be impacted by a system failure.
- **Human element risk** results from a lack of experience with a given technology (i.e. first data warehouse, first system implementation, etc.).
- **Economic risk** encompasses such events as miscalculating a discount factor or failing to appropriately quantify other risks such as technology risk. Recessions can be an issue here as well. This type of risk poses less of a threat in the public sector.
- **Financing risk**, like economic risk, is not usually a concern in the public sector. Financing risk becomes an issue if budgeted dollars are not available when they are scheduled to be.

Risk Management

Risk management is an organized method for identifying and measuring risk and developing, selecting, and managing options for handling these risks. There are a series of steps that must be followed to complete the process. In order to have the greatest impact on the agency or project at hand, all of the steps must be followed thoroughly and sequentially.

Step One: Show Some ID

The first step in risk management is the identification of all potential risk areas. A risk area is any part of a project where there is uncertainty regarding future events that could have a detrimental effect on meeting the project goal(s). Both internal and external risks should be addressed in risk identification. Internal risks are ones over which the project team can exert some influence or control. External risks, such as market shifts or government action, are ones that cannot be controlled from inside the project team.

Risk identification may be accomplished by citing causes-and-effects (what could happen and what will follow) or effects-and-causes (what outcomes are to be avoided or encouraged, and how each might occur). Potential risks can be identified through project team brainstorming sessions, interviewing project stakeholders, and creating documents such as flowcharts and checklists. When determining a project's potential risks, it is important to be comprehensive and include all risk sources regardless of frequency, probability of occurrence, or magnitude of gain or loss.

■ The Value of Risk Review Boards

The use of an Information Technology Review Board (ITRB) can help facilitate risk management. The Commerce Department uses their own CITRB to assist in risk identification. Their decision and scoring criteria assess risk in four key areas: investment size, project longevity, management risk (organizational experience, modularity, acquisition strategy), and technical risk (architecture, customization).

Step Two : Weights and Measures

Once potential risks are identified, an analysis or quantification of those risks should be performed. This second step in the risk management process is the most detailed and integral step. Here, each risk must be examined individually, then in relation to the others, and ranked according to its level of importance to the performance of the project, either in duration, cost, or meeting the stakeholders' requirements.

A risk analysis should separately measure the risk probability (an estimate of the probability that a given risk event will occur) and the risk consequence (an estimate of the gain or loss that will be incurred if the risk event does occur). However, both of these risk analysis factors can be assessed by breaking down the primary components that will impact them. A risk analysis should include both tangible and intangible risk factors so that a small loss with high probability does not appear to be the same as a large loss with low probability.

Statistical sums, simulations (models), decision trees, and expert judgments are examples of risk analyses. Risk analysis will produce a watch list of potential areas of risk which may identify early warning signs of a potential problem. "As in risk identification, risk analysis continues through the life cycle of the project and the watch list should be updated, when appropriate," counsels OMB.

Step Three: Talking It Over

Once the risk analysis has been completed, the third step in the risk management process is an evaluation. A joint review session with key stakeholders will make certain that all risks have been identified and can be evaluated. The various stakeholders may have input not previously considered, and this will help fill in any gaps in risk identification. Furthermore, some items previously identified as risks no longer fall into that category and should be removed. An important aspect of the evaluation is ensuring buy-in from all the relevant stakeholders and coming to a firm consensus. This vital step will ensure that thorough risk identification and risk analysis has led to thorough risk evaluation.

Step Four: Hot Potato

Risk mitigation is the fourth step in the process and incorporates risk aversion by maximizing opportunities and minimizing threats. Some common proactive and reactive risk mitigation strategies include:

- **Risk reduction** affords you the opportunity to decrease the likelihood a risk will occur.
- **Risk protection** can be referred to as insurance against certain events. Risk protection involves doing something to allow the project to fall back on additional or alternate resources should the scheduled resource(s) fail.
- **Risk contingency** is planning done to define the necessary steps needed if an identified risk event should occur.
- **Risk acceptance** is recognizing a risk and its potential consequences, and accepting that risk. This usually occurs when there is no alternate risk mitigation strategy that is more cost effective or feasible.
- **Risk transfer** is finding another person or organization that can manage the project risk(s) better.

Risks can often be lumped together into groups, and entire groups of risk may be mitigated through the use of one strategy. Conversely, what seems to be a comprehensive mitigation strategy for several project risks may actually have coupling or compounding effects on other risks, thus creating new problems.

Your rationale behind the decision to use one risk mitigation strategy over another should be documented. It is also helpful to create a list of risk mitigation triggers. These triggers can be considered performance measurements and will provide “flags” that can be used to determine if a specific risk mitigation task needs to be performed. This process creates lessons learned for the entire organization and could help identify recurring problems in existing programs.

Step Five - Results, Results, Results

The fifth and last step to the risk management process is the results phase and includes the compilation and synthesis of the previous steps (risk identification, analysis, evaluation, aversion). The results phase requires that regular risk reviews take place. This will identify new risks, as well as eliminate risks that are no longer relevant, in addition to other changes that may occur. The risk review will also allow for a determination as to whether or not overall project risk is decreasing.

Uncertainty is the Only Certainty

Bear in mind, change is inevitable. When changes to the risk management system occur, the basic process of risk management starts all over again with risk identification. Even the most thorough and comprehensive analysis cannot identify all risks and probabilities correctly. The very nature of uncertainty precludes the analysis from ever being “complete.”

Some of the identified risk events will occur, others will not. As anticipated risk events occur (or fail to occur), and as actual risk event effects are evaluated, estimates of probabilities and value, as well as other aspects of the risk management plan, should be updated and archived. The probability of variation between estimated and actual costs, revealed through risk assessment, should be factored in to funding requests.

Manage to Mind Your Own Business

It is pointless to go through the motions of identifying and analyzing risks if you are not going to manage them properly. All of the work generated to bring the risks to

the table will fall on deaf ears if appropriate people are not ready and waiting.

Information Technology managers are a group of people waiting to accept the baton. In order to be an effective IT manager, you must possess strong analytic, people and business skills. But, even the most efficient, tenacious managers must be able to be honest about their staff and operations!

Linking the Agency Business to the Power of Information is a motto of one government CIO. Virtually every Capital Planning conversation this CIO has opens with “we must begin to capture the benefits on day one of the project”. The CIO goes on to say that utilizing pilot projects and breaking the projects into workable pieces facilitates capturing and realizing the benefits almost immediately. This theory also allows the quantification of otherwise difficult to depict benefits because it allows the project to be analyzed in separate phases rather than waiting until completion of the project and trying to recreate the “big picture”. This CIO also requires all of the agency’s projects to make a strong business case for the business areas rather than simply a technology case. This practice invites the business area to take ownership of the process immediately and reinforces its positive impact on the agency’s bottom line.

■ Risk Assessment Model (RAM)

The State of California Department of Information Technology has taken a proactive and unprecedented approach to the management of risk. Before formulating a solid risk management tool in 1995, California used to see an average of 85 percent increase in the total cost of IT projects. After the tool was introduced, this number was dramatically decreased to roughly 15 percent. The Risk Assessment Model made that shift happen. For more information about RAM, visit www.doit.ca.gov.

If managers are not able to provide candid information during the data collection/ risk identification phase, they are only staving off more severe problems down the road. But, some managers still find it difficult to admit to potential sources of inefficiency, or gaps in their knowledge. They must be convinced that this admission will not force accountability issues on the part of the agencies.

In order to report an honest, accurate assessment of the potential risks of a project, IT managers must understand the key individuals on their team and specifics about the agency or organization itself. This allows the manager to manage risk with a cultural in. One way to foster this understanding is to make sure there is a strong management plan in place to lay the foundation for operating policies and procedures. Included in this management plan should be access to simple software plans that could aid in the assessment of risk.



Tools for Dealing With Risk

In this chapter...

- The choice of approaches for incorporating risk into the valuation of investments will be dictated by the risk.
- Of primary consideration when selecting an approach for evaluating an investment is the organization's ability to effectively interpret the results of the tool chosen.

By its nature, IT capital planning entails various estimates and assumptions about the future which may, or may not, prove to be valid. By reviewing the results of automobile crash tests you hope to mitigate the chances of physical harm by making an informed buying decision on your next car. Likewise, the appropriate use of various tools for quantifying risk (in conjunction with appropriate interpretation of the results) improves the odds of successful IT investments.

The terms risk and uncertainty are used interchangeably, but technically they are not the same. Probabilities can be assigned to true risk because although the value of the variable is not known, the distribution is. Assuming the variable's distribution is normal (recall the familiar bell curve), the probability of a specific outcome can be estimated with a certain confidence level. Rolling a single die is a simple example. You cannot know what number your roll will produce, but you know the range of possible values (one through six.) Assuming an edge has not been shaved and the density of the die is consistent, the probability of rolling a particular number on one roll is strictly 1 in 6, or 16.6 percent.

Unfortunately, what we most frequently deal with is not risk, but uncertainty - the lack of knowledge concerning the distribution of a variable. Unknown value ranges and distributions do not entirely preclude application of probability theory. Generally assumptions can be made concerning potential outcomes, or a range of values can be determined with which to estimate the probability or possible impact of variance. A review of the published maintenance history of a particular hardware component might allow you to reasonably assume that your own experience will not differ dramatically, perhaps no more than +/- 5 percent from that of other owners.

Federal agencies are expected to incorporate risk and uncertainty into their capital planning and decision processes. Measuring risk can be particularly tricky, and in practice a variety of approaches are employed ranging from simply adjusting costs up or benefits down, to the use of statistical modeling and Monte Carlo theory. A few of the more common techniques: sensitivity analysis, subjective scoring, expected value

analysis, and options analysis are presented. For simplicity's sake, unless noted otherwise, risk is not differentiated from uncertainty in the following section.

Sensitivity Analysis

Sensitivity analysis indicates how much an investment's return (or NPV) will change in response to a given change in an independent input variable, with all other factors held constant. This technique can be used on one variable at a time, or on a group of variables (sometimes referred to as scenario analysis). Typically, returns are more sensitive to changes in some variables than to changes in others.

As a general practice, variables with either the greatest uncertainty or variables that represent major components of an IT investment are selected for analysis. Values that are both major cost components and carry a high degree of uncertainty are prime candidates. Examples include custom software development comprising a major cost component, or productivity increases that account for most of the benefits of an investment. Varying discount rates should also be considered, particularly when interest rates are high or when there is a great deal of volatility in rates.

Once the appropriate factors are identified, a range of possible values for each is determined. A common practice is to change a variable by specific percentages both above and below the values initially provided (base case). A new economic analysis, generally a benefit/cost analysis or NPV, should be performed for each investment under consideration using values from the predetermined ranges. Although only one value at a time is changed, any dependent variables must be allowed to change in accordance to their relationship to the value being manipulated.

Where external cost drivers such as increased public demand for a service facilitated by the proposed system have been projected, a sensitivity analysis of these factors should also be performed. For example, over the last five years your organization has experienced an average annual increase of 16 percent in applications received for a specific service. You have no way of knowing for certain whether demand will continue to increase at this rate, level off, or decrease. However, if demand continues to increase at the current rate, additional staff will be required to handle the workload. You are therefore considering an IT system to automate a number of the manual functions currently required to process the applications. As envisioned, the system will dramatically reduce the additional employees that would otherwise be required. There are also a number of dependent savings associated with the need for fewer personnel, (i.e. less office space required, fewer desktop computers, etc.) Assuming continuation of increased demand at 16 percent, the cost/benefit analysis indicates a positive five-year NPV as a result of the cost avoidance the system facilitates. The FTE cost avoidance represents the major benefit of the system, and there is substantial uncertainty in conjunction with the estimates of demand. Running the same analysis at lower, higher, and at no change in demand levels is appropriate to determine at what level of demand the system will fail to provide sufficient savings to warrant the investment.

There are a number of software products available that allow users to perform multiple what if scenarios employing probability distribution functions that will produce confidence levels associated with various outcomes. While such exercises can be helpful, the validity of the information produced is dependent not only on the completeness of the raw data, but on the skill with which ranges of possible values are developed.

The extent to which a project's return is affected by a change in a specific variable indicates the degree of risk associated with the variable and the project. When comparing alternatives, the project exhibiting the greater change in return (more risk) will be less desirable, other factors held constant.

In the real world, factors affecting projects frequently do not operate independently and this reality lends the impetus for evaluating the impact of changes of multiple variables simultaneously. When uncertainty exists in more than one significant variable, some analysts like to construct best and worst case scenarios in which several pertinent variables are simultaneously manipulated to determine the composite change to the investment's return. This entails identifying interdependencies between variables.

The value of performing sensitivity analyses is to alert management to the economic impact on the project of variations in estimated values. Like any other tool, it has both advantages and disadvantages. It is fairly easy to perform and the results present the possible impact of risk factors in comprehensible terms that aids well-founded decision-making. Additionally, the careful examination of factors most likely to influence returns improves the ability to understand the results. Where high-risk investments are deemed worthwhile, the information can be used to develop appropriate contingency plans to mitigate risk. Shortcomings of sensitivity analyses center on the subjectivity in selection of variations to key factors and the lack of a systematic method for determining an appropriate combination of variables to manipulate in scenario analysis.

IT departments may find within their own ranks staff with sufficient backgrounds in mathematics and statistics to make techniques such as Monte Carlo theory a viable option for risk assessment. However the validity of the information produced is dependent on the completeness of the raw data, the skill with which ranges of possible values are developed, and the organization's ability to interpret results.

Expected Value Analysis

Expected Value Analysis (EVA) involves the assignment of probability estimates to alternative outcomes and summing the products of the various outcomes. For example, you might be contemplating options on crude oil. Today the price per barrel is \$10.80 and you think there is a 25 percent probability of the price rising to \$11.50 in the next year, a 25 percent chance it will fall to \$10.50, and a 50 percent chance of a slight increase to \$11.00. The expected value of the future price of one barrel of crude oil would be:

$$EV = (.25)(11.50) + (.25)(10.50) + (.50)(11.00) = \$11.00$$

The math is simple enough, but how are the probabilities determined? For some types of variables, such as population growth, well-developed models exist and in some instances organizations may have sufficient data to build their own models for specific factors. Lacking these, analysts are forced to form subjective estimates of the probabilities. In this scenario, EVA is an incomplete treatment of uncertainty as it does not evaluate the quality of information used to build the probability estimates. EVA also assumes no preference on the part of decision-makers between equal probabilities of a gain as for a loss, and this is seldom the case. A loss of a certain amount may be catastrophic whereas, a gain of the same amount may not have the equivalent opposite impact. For these reasons, sensitivity analysis, or upper and lower probability estimates, are generally better tools to characterize risk associated with IT investments.

Options Analysis

Options analysis is more a framework for critical thinking than a model, requiring analysts to ask if all options for managing uncertainty have been considered. Options analysis may be subdivided into sequential decision analysis and irreversible investment theory.

Sequential Decision Analysis suggests that activities can be broken down into risk in subsequent phases. Subdividing a software development project into phases provides an opportunity to gauge the accuracy of work, cost, and time projections, how well requirements were defined and relayed, and the feasibility of the project as originally envisioned. Knowledge acquired in the initial phase can be used to correct oversights, or modify plans, thus reducing future risk. The precepts of sequential decision analysis are incorporated in OMB's suggestion of breaking large projects into small usable modules.

Most decision tools, such as cost/benefit analysis, help determine if an investment should be made; Irreversible Investment Analysis examines when an investment should be undertaken. Under the pressure of budget deadlines, proposed projects tend to be evaluated within the framework of 'now'. An investment may be rejected as too costly or too risky (in comparison with other alternatives), for funding in the current budget cycle, and disappear never to be seen again. Managers need to be conscious of the fact that time may resolve uncertainty and that the benefit promised by a project may be equally available next year. Further, the portfolio mix may change such that the project's risk is acceptable. It behooves organizations to convey this message and ensure that potentially valuable investments are revisited.

When a proposed investment is not selected for funding, senior management has an opportunity to build support for the investment evaluation process. Providing a thorough explanation to the project's sponsor of how the decision was reached and why demonstrates how value is determined and how an investment portfolio works. Ideally sponsors come away with enhanced skills for evaluating alternatives in the future.

Subjective Scoring

Many organizations take a subjective approach to risk assessment by scoring responses to questions addressing areas that may introduce elements of risk. The resulting 'risk' score may be just one component of an overall subjective investment evaluation. In some organizations, evaluation criteria are individually weighted to reflect their concept of inherent risk. Identified risk factors may be limited to a few points, or even 40, as in the state of California's Risk Assessment Model. The usefulness and validity of this approach depends on a number of factors:

- **Training** – Participants need to understand the role of risk assessment and the tool. Participants must be comfortable providing honest answers and have the ability to respond objectively. Decision-makers must have sufficient training to appropriately interpret the results.
- **Design** – Questions should be clear and specific enough to avoid misinterpretation.

- **Scope** – Questions should address all points where an investment has significant impact.
- **Review** – Regular review of actual investment performance compared to the initial and updated risk assessment allows the organization to identify and correct deficiencies in the tool and the process.

The following table represents a sample of areas considered as potential risk sources that may inhibit a project's success. This list is drawn from various Federal agencies and the State of California Risk Assessment Model.

■ TABLE 2: Potential Risk Sources

Strategic Risk

- Alignment with the agency's overall business strategy
- Clarity of expression of anticipated project outcomes
- Presence of metrics to verify the successful completion of each project phase

Financial Risk

- Size of expenditure required
- Existence of cost/benefit analysis
- Existence of defined payback and time frame of payback
- Reputation and financial status of vendor(s)

Project Management Risk

- Experience of project management team
- Existence of work plan for entire life cycle
- Degree of development of measurable milestones
- Length of time for project implementation
- Existence of system for tracking unresolved issues
- Definition of user and development skill requirements

Technology Risk

- Plan for validating user needs are met
- Existence of load test in accordance with industry standards
- Evaluation of technology options
- Availability of track record for system
- Maintainability and ability to upgrade key technologies
- Vendor's ability to implement technology

Change Management/Operational Risk

- Development of acceptance plan
- Experience and ability of existing staff to support new system
- Organization's familiarity with proposed hardware/software environment
- Development of system operating procedures
- Impact to organization of system failure
- Magnitude of change introduced by system
- Number of business units impacted



Cost/Benefit Analysis and Cost-Effectiveness Analysis

For a variety of reasons, most people would agree that there is frequently a communication gap between the IT and finance departments in an organization. This gap could be directly attributable to reasons such as varying paradigms, or differences in experience. Until quite recently, most decision-making tools were housed quite comfortably on the finance side of this split. But, things have changed. IT managers have come to recognize economic analyses as useful tools to inform and substantiate decision-making.

After you have identified and quantified (where possible) costs, benefits, and risks, you need to assemble them to show the worth or value of the potential investment. There are a variety of approaches that show the relationship between these elements.

In this chapter...

- A comprehensive cost/benefit analysis can serve different purposes:
 1. As a planning device
 2. As a decision-making tool
 3. As a ledger recording the rationale behind a decision
- Effective cost/benefit analyses are systematic collections of facts that consider total business and system costs, and benefits both tangible and intangible.
- There are basic steps to performing a cost/benefit analysis and organizations will benefit from revisiting their own processes over the life cycle of the investment.

Cost/Benefit Analysis

In order to provide a comprehensive analysis of any proposed system or project, a formal metric system must be implemented. The CBA (Cost/Benefit Analysis) method, sometimes termed the benefit/cost analysis method, is a valuable approach. A CBA is used for many purposes: as a planning tool, a decision-making criterion, a means to evaluate investments, etc. While there is not one single way to approach the preparation of a CBA, both driving and opposing factors of the proposal must be set-up in direct opposition to each other for the analysis to be successful.

The selection of the most viable investment alternative, through the use of the CBA, should be made based on a formal economic analysis tool that systematically considers the costs and benefits of the alternative. All of the cost and benefit estimates should explicitly show the performance and budget changes that will result from a particular alternative being pursued.

What to Include in a Good CBA?

The CBA has four major elements that should be factored in for consideration:

- 1) Total business and system costs with the IT investment/ new system
- 2) Total business costs without the IT investment/ new system
- 3) Tangible benefits
- 4) Intangible benefits

The inclusion of time is of the utmost importance in a good CBA. All potential inflows and outflows of the CBA need to be attached to a timeline that accurately portrays the movement of funds throughout the life of the project. Additionally, all costs and benefits both tangible and intangible must be included or acknowledged in the analysis. An attempt should be made to quantify all seemingly intangible (soft) benefits for inclusion in the analysis. If this is not feasible, the intangibles should be represented in the CBA as separate items that show they have been considered for inclusion in the computation.

Advantages of a CBA

There are many advantages to performing a CBA that reach far beyond its ability to facilitate ultimate decision-making processes. A comprehensive CBA will include a documented path that clearly reveals the rationale behind a decision. When a CBA is performed correctly, all assumptions, theories, methods, and procedures are labeled and can be easily extracted from the decision itself. This allows for the modification or clarification of any of the individual elements throughout the life of the project.

The CBA itself is structured as a systematic and organized collection of facts underlying a decision being made about a particular set of alternatives. It is easy to see where gaps in knowledge or resources for a particular project or system emerge when the analysis is derived from a structured template. It is these gaps that provide valuable information to decision-makers. Not only do they highlight areas where additional information may be needed, the gaps can also speak to the degree that the decision makers are able to rely on the information that the analysis provides. No decision is ever made with perfect information, and it is important to acknowledge this up front when undertaking the analysis. Not all gaps can be filled by additional research or input from project teams.

By subjecting all possible alternatives to the same CBA process, you are ensuring that there is standardization and objectivity in the decision-making process. Cost/benefit analysis is a particularly accommodating tool when evaluating seemingly non-comparable alternatives or solutions. The CBA template forces all alternatives to be considered on equal footing. This objectivity affirms that the final solution (or decision) was agreed upon in the most equitable and cost-effective fashion.

Disadvantages of a CBA

As with any financial tool, there are a few shortcomings of the CBA that must be acknowledged and managed. Because the CBA hinges on the quantification of all variables, it can be tedious, and at times impossible, to successfully monetize every element to be factored into the analysis. The quantification of intangibles is a concern faced by all decision-makers. Whether the intangibles are directly incorporated into the analysis or not, they must somehow be represented in the process.

It is also challenging to objectively consider the elements to be factored into the analysis without imparting personal judgement over the inputs. It is vital to have a

The Food and Drug Administration devotes a large section of their agency's business case to the preparation and execution of their benefit/cost analysis.

To accommodate this inclusion, the FDA systematically considers four types of quantitative benefits and costs: Legacy System Phaseouts, Business Process Savings, External Benefits, and Other. Qualitative benefits are not overlooked in this analysis either. They are categorized into one of four groups: strategic value, operational value, management information value, and technology value.

documented, repeatable process installed to try and overcome this limitation. Agencies and organizations vastly differ in their approach to the problem of potential bias. Some agencies assign relative weights to their decisions based on objective criteria such as past performance reports, Federal guidance, or even research conducted on effective decision-making. Other agencies capitalize on a different approach using agency-specific information to come up with the best weighting scheme for decision-making.

Additionally, if errors or oversights occurred in any phase of the analysis, these inaccuracies are carried forward and ultimately effect any decision. It is key to ensure that every entered or calculated input is as complete and accurate as possible. This will help stave off future problems that can have grave consequences to the analysis, division, project, and ultimately, the organization.

CBA in Government vs. Private Sector

The CBA plays a somewhat different role in the Federal government and private industry. In the Federal government, CBA can be used to emphasize lowered costs as a driving decision-making factor. Also, social benefits and other qualitative measures are important considerations in the government. Since there is greater external accountability in the public sector, all information (regardless of whether it is positive or negative) must be disclosed in the analysis.

Since private business, on the other hand, operates solely to increase shareholder's wealth, the motivating factors to do a CBA are different. The private sector uses the cost/benefit ratio (yielded from the CBA) to gauge performance across the organization. Also, competitive advantage plays an integral role in private sector decision-making and must be effectively incorporated in to all CBA models.

OMB Guidelines

The Office of Management and Budget Circular No. A-94 outlines CBA as a means to promote efficient resource allocation through well-informed decision-making by the Federal Government. According to the OMB guidance, there are logical steps that must be undertaken to accomplish the CBA appropriately. These outlined steps must be followed sequentially and revisited throughout the life cycle of the proposed system or project. The process includes the following steps:

Step 1: Identify assumptions and constraints:

Assumptions are explicit statements used to describe the present and future environments upon which the CBA is based. Estimated future workloads, estimated useful life of an investment, and the period of time over which it is compared are all considered possible assumptions that need to be identified. A constraint is a factor external to the relevant environment which limit alternatives to problem resolution. Constraints can be physical, time related, financial, or institutional/regulatory.

Step 2: Identify alternatives and their schedules, costs, and benefits:

In order to make any decisions about projects or systems, alternatives must be available. This is true regardless of the size, complexity, or cost of the considered endeavor. When identifying and estimating costs and benefits of a proposed investment, the change in cash flows as a result of undertaking the project must be shown. Maintaining the status quo should always be identified as an alternative and treated as such.

Step 3: Evaluate alternatives:

All investment alternatives should be evaluated using multiple decision attributes that include both financial and non-financial criteria. Some quantitative methods include the use of NPV, BCR, ROI, payback method, IRR, hurdle rate and CEA. Some non-quantitative evaluation considerations include relationship to business strategy, schedule risk, organizational and technical risks, social benefits and legal/regulatory requirements.

Step 4: Perform risk and sensitivity analysis:

Even the most carefully deliberated cost and benefit assessment carries some level of risk and uncertainty. All IT investments and projects should have a formal risk management plan in place regardless of the perceived level of need for it.

Step 5: Develop performance goals and measures analysis for monitoring the project:

The CBA analysis should yield clear cost, schedule, and performance goals that will be instrumental in managing the investment or project.

Cost-Effectiveness Analysis (CEA)

Policy decisions sometimes require Federal agencies to perform a specific service, and in these situations it is generally unnecessary to evaluate an investment on the basis of the dollar value of benefits to be provided. Further, the benefits may not lend themselves to expression in dollars, or the alternatives under consideration will yield the same annual effect. The challenge for the agency is to find the most cost-efficient means

of executing their mandate. In the report “Cost/Benefit Analysis and Regulatory Reform: An Assessment of the Science and the Art,” prepared for the Commission on Risk Assessment and Risk Management, the authors note: “CEA does not imply choosing the policy with the smallest dollar price tag. CEA chooses the policy that achieves the specified goal with the smallest loss in social well-being. The smallest welfare loss might not be associated with the smallest dollar cost.”

A cost-effectiveness analysis is basically a cost/benefit analysis without the benefits. It entails estimating all life cycle costs and discounting the annual costs by the appropriate rate to yield the NPV of each alternative. Like the CBA, it should include the rationale for all assumptions and expected key results that can be monitored.

CEA is also useful for comparing alternatives with identical costs but different benefits, although this situation may also require assignment of weighting factors. An example might be the replacement of legacy system where the alternatives all meet the primary requirements of providing specific functions, but each have different secondary benefits that cannot be separated from the basic product or service. Where all benefits cannot be expressed in dollars, a full listing of such benefits, along with any units of measurement that can be ascertained, should accompany the CEA.



Business Case

In this chapter...

- A well-prepared business case incorporates both financial metrics and non-financial factors into a concise and informative presentation.
- Its purpose is to sell the value of the proposed project and assist decision-makers in the selection of investments that confer the greatest return to the organization.
- The business case should clearly address key issues and facts while revealing the investment's contribution in context to the whole organization and its mission.

Get on the Case!

Even the most obvious criminals can get away with murder if the prosecuting team does not present the facts in a compelling fashion to the jury. The same situation can occur when IT decision-makers try to choose between project or system alternatives. Sometimes the best alternative can be overlooked if it is not presented in the best manner. A sound business case can help combat this problem and provide the necessary information instrumental in formulating an investment decision.

An organization's business case is a tool that incorporates the financial metrics and non-financial factors in one place to present a persuasive and comprehensive analysis of each alternative being considered. The business case specifically addresses benefits, costs, and risks of a project for the purpose of comparing multiple investments in the development of a portfolio of IT investments and to monitor expected results. The business case can also be viewed as an expanded cause and effect analysis that shows the potential relationship between an investment alternative and a set of variables such as time, money, etc.

To Thine Own Business Case Be True

The business case represents the compilation and summation of all the financial and non-financial analyses generated from the project or investment alternatives. A well-written business case can be accurately represented in 5-15 pages of text. Thus, each of the sections in the business case must be meaningful and persuasive enough to convince the reader of its validity.

Alignment is at the heart of all business cases and should provide the underlying foundation for the endeavor. An agency's strategic plan, annual performance plan, and/or capital plan must provide the core that the business case should be written to. If these agency-specific criteria are not taken into consideration when the business plan is conceived, the document will fail to meet its objectives.

The preparation of any business case requires that some level of subjectivity or judgement be imparted on the inputs. While this is unavoidable (and at times even desirable), it is important to acknowledge that everybody approaches the business case preparation and interpretation with different paradigms, values, and experiences. These differing frames of reference will greatly impact how the case is interpreted.

There are a variety of things to consider when selecting which financial metrics to use in a business case. A prudent and thorough manager will opt to include as many of the metrics as possible to conduct the overall analysis. For obvious reasons, this level of detail will translate to a more informed decision being made. But, at times this is not practical. One metric must be chosen to carry the greatest weight in the decision-making process. The cost/benefit analysis (CBA) is usually the preferred tool used in the Federal government to accommodate this mission.

There are a couple of pitfalls to avoid when preparing a business case that should, at the very least, be acknowledged. First, there must be buy-in from all key stakeholders in the project and decision-making teams. You can prepare the best business case in the world, but it will fall on deaf ears if the proper people aren't prepared to receive it, or aren't convinced of its value. David Allardyce, of the United States Department of Agriculture, outlines six important hints to help ensure buy-in:

- 1) Visionary leadership
- 2) Create substantiated arguments
- 3) Truly understand your proposal and your recommendation
- 4) Use the business case as a precursor to dialogue
- 5) Try and keep a consolidated position
- 6) Consider everybody's comfort level and how they will accept the proposals

Another potential pitfall of a business case is the structure of the document itself. Business cases have a high degree of flexibility naturally factored into them. Because of this freedom, analysts often feel that they have free reign to present the material as they see fit. The crux of the document, the quantitative analysis, is often used only to substantiate the case the author is building. The business case developer must be comfortable and skilled at balancing the story and the facts in order to present a compelling, valid, and interesting case for others to understand and buy-in to.

Both form and function play critical roles in the preparation and treatment of the business case. Managers must be convinced that both the methodology and the economic analysis performed are relevant to the task at hand, as well as executed in a correct, careful manner. This will help ensure that buy-in is achieved from all relevant stakeholders in the decision-making process, and will aid the overall process.

One way to capitalize on both successful and non-successful business cases is to formally document and archive them for the organization's future endeavors. After a business case is prepared and considered, it is foolish to merely discard it. Rather, you should hold on to these valuable documents, whereby facilitating somebody else's similar project or investment decision down the road.

In order to prepare the business case in a systematic and productive fashion, you first must have all the requisite components with which to start building it. The comprehensive identification and treatment of all risks, costs, and benefits is vital to the

business case's success in this building phase. These elements must be introduced with particular emphasis on describing added-value and impact to the organization (prioritize key issues and facts.)

One of the benefits of a successful business case is that it can, and should be, revisited throughout the life cycle of the project. The business case is not about a one-time report, but should be considered the basis of a continuing relationship with the organization or agency. The business case should be a living document.

Not only should the business case be used to choose the most reasonable alternative, it should be capitalized on as a way to measure the performance of the chosen alternative. As the project gets underway and resources are expended, these values should be inserted into the business case to see how the actual expenditure of resources compares to the estimated expenditures.

■ Helpful Hints to Prepare the Business Case

- Prioritize the issues and key facts that are to be included in the business case. The longer a business case is, the greater chance that you will lose the interest or buy-in from key decision-makers or readers.
- The key is to sell the business case. Use strong, persuasive, and accurate language in the case's preparation.
- Make certain that the business case is intimately linked to the user or project group. The case should be geared to an audience and speak directly to a targeted group of readers.
- An executive summary and introduction to the business case should be written last. Ideally, the executive summary and introduction should naturally emerge from the content of the document and should be presented as a mini-outline of the overall business case.
- Detailed facts that merely substantiate the points raised in the body of the business case should be incorporated into appendices so as not to interrupt the persuasive flow of the document.



Performance Measures

In this chapter...

- Performance management is a tool for ensuring investments meet their potential and achieve their objectives.
- Determining an IT investment's true value requires performance measures that focus not just on outputs, but on outcomes.
- Performance measures should draw from multiple time frames and across all areas of the organization impacted by the investment.
- To capture the anticipated value of an IT investment, both technical and human considerations must be addressed based on feedback. At the core of this feedback are performance measures that are both meaningful and applicable to the mission of the organization.

In this document we have advanced the idea that determining an IT project's ROI involves identifying where the organization's operations and customers are impacted, what the effect is, and how the investment will enhance performance of the mission. Addressing these questions initially requires quantifying projections of costs, benefits, and risks in the selection and planning phases. *Answering* them, however, requires performance management, and performance measurement is an integral component of this management process.

Truly informed analysis of investment options, maintaining a focus on attainment of strategic goals, and selecting the right IT solutions, are half the key to success. The other half is the timely assessment and reporting of actual compared to expected achievement. Performance measures are crucial to the capture and validation of an IT investment's value.

As governments are admonished to do more with less and at the same time are expected to present evidence of their accomplishments, performance measurement has become an essential tool for demonstrating improvements in efficiency, effectiveness, and accountability. Ideally, performance measurement allows government to determine if it is providing a quality product at a reasonable cost. To assess an IT investment's total return, performance measurement should occur throughout the process.

Performance management utilizing well-chosen metrics can provide a number of benefits, including:

- ***Informed decision-making*** – Provides senior management with the factual data necessary to objectively determine if an investment is living up to its promise.

- **Accountability** – Fosters responsibility by clearly laying out what is expected, when it is expected, and what will be done by whom if planned achievements do not occur.
- **Improved rate of success** – Regularly scheduled updates on actual versus projected achievement levels enables management to take timely corrective action that may turn a faltering project into a successful one.
- **Improved capital planning process** – By measuring actual achievement, organizations are provided the feedback necessary to evaluate the effectiveness of their capital planning process.
- **Validates IT's role in the organization** – Data gathered through the execution of performance measurements substantiates IT's contribution to mission performance.

Performance management is not an exact science and one size does not fit all. Common mistakes include overemphasis on output, failing to anticipate the costs of data collection, measuring only short-term results, and skewing the measurement effort to minimize unfavorable results. To garner the benefits and avoid pitfalls, organizations must demonstrate their commitment to the process by developing and funding an on-going program for performance management.

A review of various performance management plans reveals that each reflects the viewpoint of the organizations for which they were created, but they also share some common themes. Recurring points include an emphasis on measuring IT's contribution to the mission, selection of meaningful factors to measure, and the importance of establishing a cost-effective plan for monitoring, reporting, and reviewing results. The following represents a broad overview of IT performance management as it relates to the steps covered in this document for determining real IT value:

Review the Mission and Strategic Plan

This is where the effort expended to develop a comprehensive business case yields extra dividends. You can use the business case to retrace the process from the beginning. Strategic objectives describe the critical success factors for the mission and the gap analysis of objectives versus capabilities indicate the critical benefits a potential investment must provide. Ensure that the strategic plan reflects current concerns and goals, and that the business plan reflects any changes in the project's scope.

Establish Sound Measurement Criteria

While assembling investment options, detailed cost data is gathered and benefits identified. Quantifying those benefits for the cost/benefit analysis further define expectations in measurable units. Expected benefits provide the foundation for requirements, and well articulated requirements serve as a baseline against which actual delivery is measured. The final project selection marries the cost and risk components of the value equation to the benefits, (i.e., the investment must provide capability x, enabling function y, producing benefits a, b, c, at cost z).

By combining criteria from the requirements document, the benefits contained in the business case, and the desired outcomes framed in the strategic plan, a menu of performance measurements can be assembled from which to gauge the actual delivery of value from an IT investment. These sources will produce performance measurements with different characteristics: while some measures might be in dollars, others may be in units of production, or customers served. If benefits expressed in dollars alone do not fully portray a project's value, then dollars should not be the only metric used to judge

actual performance. Some measures will focus on output, but others should look at outcome. Diverse performance metrics can complement each other, providing a total measure of value exceeding the sum of the parts.

Performance criteria are as varied as the environments in which they are applied. Because they are a function of established goals, they reflect the same variance and disparity. But good performance measurements share some common traits regardless of the environment in which they are used:

- **They are valid**, i.e. based upon reliable and accurate data, sources, and methods.
- **They are objective**, measurable, and repeatable.
- **They are accepted** and valued by all organizational components as providing meaningful data on progress and results.
- **They are comprehensive** and sufficiently inclusive of important performance aspects.
- **They are consistent**, compatible with existing business systems and processes.
- **They are cost effective** in terms of gathering and processing information.
- **They are understandable**, and can be mapped to baseline criteria

Within IT, performance measurements are frequently used in two separate but related capacities: technical and business. The former may be used during project implementation in conjunction with an Earned Value Management System, or similar project management tool, to gauge value attained compared to time and resources expended. The latter is more complex and will continue throughout the investment's life. Assessing the value-added to an organization's ability to achieve its mission involves measuring outcomes, or indicators of outcome. In the private sector this might involve mapping IT's contribution to increased net worth. Within government, the business might be improved health care, measured both in terms of patient outcome and gains in cost-effective delivery of services.

Experience shows it is best to start small, selecting only a few measures that focus on the primary benefits for an investment. If time and resource constraints make it difficult to initially define long-term measures of outcome, focus first on benchmarks for use during implementation and measures of performance at full deployment. More measures can always be added later. Focus on processes rather than people. This helps reduce fear and promotes personnel buy-in on the validity and usefulness of performance measures as tools for organizational growth.

The dual role of IT performance measures frequently requires establishment of differing time frames for measurement: short-term, intermediate-term, and strategic. Short-term measures may be employed during implementation. Intermediate-term measures might focus on the system's delivery at full capacity (i.e., does it handle demands as anticipated and fulfill key objectives?) Strategic measures are usually concerned with general or broad-based outcomes, most often relating to organizational vision.

The process of developing and selecting the right performance measurements should involve not only the parties that will review the reported results, but users, customers, and the individuals who will actually monitor progress. There must be agreement that the attributes measured are the right ones, and that the methods of measure are meaningful and appropriate. For example, if users do not view reliability as an important benefit, it's unlikely that the system's error logs will be adequately structured or utilized for reporting purposes. If reviewers do not believe the system-generated reports are accurate, or a valid indicator of reliability, they are unlikely to give the results much credence or to act upon them.

Establish a Process for Monitoring, Reporting, and Reviewing Results

Reporting the results of performance measurement should be done at regularly scheduled intervals, as well as when predetermined alerts are triggered. Potential triggers might be the occurrence of a cost overrun in excess during implementation, or a significant increase in downtime in a mature system. Employees charged with monitoring performance need to know that their reports are reviewed and have the potential of effecting change. This implies receiving feedback from reviewing staff and the opportunity to suggest improvements to the program. The latter can be especially beneficial in conjunction with mature systems that frequently evolve in small stages over time, perhaps rendering pre-existing measurements of little value.

General Factors

There are some general factors that contribute to the successful implementation of performance measures. Management support and involvement at all levels is of paramount importance, and serves to underscore the importance of continued organizational improvement. Additionally, depending on the complexity of the system and measurements employed, organizations need to insure that individuals monitoring and reviewing results receive adequate training to perform the measurements and interpret the findings.

As organizations evolve, IT investments change to meet emerging user needs. The use of performance measures is critical to ensuring that IT investments deliver not only the benefits originally envisioned, but that they continue to provide value to the organization.

Performance management is an essential tool for ensuring that both organizations and investments fulfill their potential and achieve their objectives. But obtaining the benefits of this tool depends on the commitment of senior management and the incorporation of well-designed performance measurements. Determining an IT investment's true value requires performance measures that focus not just on outputs, but on outcomes. This requires measures across multiple time frames, and across all areas of the organization impacted by the investment. A well-documented and comprehensive business case, augmented by input from users, can provide a template for developing measures inclusive of all significant performance aspects. Buy-in for the criteria selected must be obtained from users and beneficiaries of the system, as well as by the individuals charged with monitoring progress, reporting, and reviewing the results. Organizations should select a few significant attributes that can be cost-effectively monitored and measured, and build the process into the normal on-going operations. To capture the anticipated value of an IT investment, both technical and human considerations must be addressed based on feedback. At the core of this feedback mechanism are performance measures that are both meaningful and further the mission of the organization.

EVM: Remember Your Roots

In order to win a track race, you must start with your feet in the blocks and be the first person to break the tape at the finishing line. Earned Value Management (EVM) hinges on the same principle: In order to go somewhere, you first need to know where you came from. EVM incorporates three vital aspects of effective program management: scoping, costing, and scheduling. EVM is a technique aimed at comparing

resource planning to schedules and to technical, cost, and schedule requirements.

The EVM technique serves two distinct purposes: It encourages the effective use of internal cost and schedule management systems and it affords the government the ability to rely on timely data produced by those systems for determining product-oriented contract status. In order to perform an Earned Value Management analysis, you first need to start with a solid baseline schedule that accurately reflects how much work is planned for each time period. After this baseline is determined and captured, work becomes earned in some quantitative form as it is performed. This earned work is then compared to the initial resource allocation estimates in order to determine if the project or investment has utilized its resources meaningfully and cost-efficiently.



Life Cycle Approach to ROI Returning to the Return...

In this chapter...

- ROI must be used in all phases of a project's life cycle in order to be an effective tool.
- Measuring ROI for potential and existing IT investments should ensure the efficient expenditure of resources.
- Do not Select and walk away. The Control and Evaluate phases of the life cycle provide meaningful insight.
- Revisit the assumptions you made while compiling data and making ROI calculations.
- Archive all project-related information you have collected, regardless of the relevancy you think it has.
- Numbers and reports don't make decisions - people do.

It is said that you reap what you sow. But, with IT investments, you have to continue to sow throughout the entire project's life cycle in order to reap any long-term benefits.

The importance of capturing all life cycle costs is frequently tossed around when preparing analyses for decision-making. Life cycle costs are the costs of an asset that include all direct and indirect costs, planning and other costs or procurement. They also include all periodic or continuing costs of operation and maintenance, and costs of decommissioning and disposal. The costs associated with fixed assets are only one facet of the of the Life Cycle Management approach.

Life Cycle Management aims to organize and use data and systems to maximize the ROI of an investment or project. While most IT professionals would not dispute the necessity for considering life cycle costs for a project or investment, there is some hesitancy to incorporate other reporting mechanisms or financial metrics into all phases of the life cycle in the same stringent manner. Return On Investment (ROI) and other metrics commonly used to determine an investment's value serve a crucial role in the initial decision-making and selection phases. But, their contribution does not, and should not, stop here. Formal economic analysis tools need to be constantly updated and integrated into the entire investment process.

A project's ROI must be acknowledged and revisited throughout OMB's Select, Control, Evaluate model. According to David L. McClure, of the General Accounting Office, ROI is a management tool that must be used throughout the life cycle of a project. Too often agencies are comfortable using ROI and other metrics as means to

retroactively justify decisions that were based on non-financial criteria. ROI is often used to back-up decisions that were made on gut-feel. Beyond the obvious benefit of obtaining funding approval for major IT investments, a number of benefits accrue to organizations that perform regular and rigorous evaluations of their IT investments' returns. Critical review provides the feedback necessary for self-education and continual improvement of capital investment decision-making processes. Assuming appropriate measurements of success are used, review keeps the focus on accomplishment of the mission (outcomes).

While some agencies do a good job capitalizing on a detailed and thorough Selection process, management often breaks down in the control and evaluate phases of the project or investment's life. "All too often, agencies select and then walk away," counsels Mr. McClure. "Projections are fraught with imprecision and uncertainty. The front-end process (Selection) can only accomplish so much by itself. The Control phase really needs to pick up and continue to provide meaningful insight to managers."

Mr. McClure goes on to relay that agencies need to revisit their assumptions on a regular basis, update their data and re-evaluate their ROI calculations. A solid and thorough ROI analysis comfortably nestles in the life cycle approach to IT investment and management. A well-performed analysis will build a comprehensive and reliable history of costs and decision-making processes that are updated throughout the life of the project. Agencies are able to build an accessible record of this archived information that facilitates better, and easier evaluation of future projects.

The exercise of measuring ROI on potential and existing IT investments should be performed not as a justification for mechanism for decisions already made, but as a means to ensure that resources are most efficiently used. Rote performance of an evaluation of ROI, regardless of the methods employed, robs an organization of the opportunity to learn how to enhance its ability to fulfill the mission. Numbers and reports do not make decisions - people do. No tool will ever replace critical thinking. But, prudent use of evaluative tools helps to frame information, to provide a way to learn from past mistakes, and to validate good decision-making processes. This will help ensure the life cycle approach to ROI.

APPENDIX A

Government IT Investment Environment

October 1997

About the study:

In October of 1997, the Industry Advisory Council, in conjunction with the Federal CIO Council and Government Computer News, conducted a study to learn government employees' opinions about the information technology investment environment. Areas under study were:

- Method for making IT investment decisions
- Consideration of non-quantitative factors for IT investment decisions
- Importance of IT investment benefits
- Results of last major IT investment
- Difference between decision process for IT and other investments
- IT investment and ROI barriers
- Approximate annual IT investment expenditures
- Influence of IT on organization structure in the past five years
- Frequency of end-user involvement in IT project design
- Method of measuring IT project performance metrics
- Frequency of IT project benefits
- Frequency of barriers to IT projects
- Average expected payback for typical IT investments

Key Findings:

- Overall, two-thirds of agencies and departments have a documented information technology plan.
- Among those agencies and departments who evaluate their IT investment plans, nearly three out of five use traditional return on investment (ROI) measures. Forty-five percent of Federal/CIO Council respondents use Net Present Value (NPV) measures, compared with 36 percent of respondents overall. Nearly 70 percent of Federal/CIO Council respondents consider non-quantitative factors when evaluating their IT investment decisions, compared with nearly 60 percent of respondents overall.
- When evaluating the payoff of an IT investment, four out of five respondents rank 'increases in productivity' as the most important benefit. More than half of respondents rank 'improved time to implementation' as an important benefit. More than 60 percent consider the accessibility for disabled users. Nearly one-third of respondents report high returns on their last major IT investment.
- Nearly one-quarter of respondents report that they perceive senior management's perception of overall IT payoff to be high. A slightly higher percentage report they perceive senior management's perception that IT investments offer marginal returns.

- Respondents report that the top two barriers for measuring ROI for IT investments are 'inability to account for the intangibles' and 'difficulty of measuring IT's economic benefits.' The most common pre-project evaluation types respondents routinely make for IT investments are 'cost reducing' and 'desktop IT.' The most common post-project evaluations are 'cost reducing' and 'mandated systems.'
- Respondents report that the use of IT has increased the influence of the organizational structure with respect to 'span of control.' The majority of respondents report there has been no change in the influence on the organizational structure with respect to 'levels of hierarchy,' 'centralization,' and 'decentralization.'
- Two-thirds of respondents report that end-users and external customers are involved in the requirements phase of IT projects, compared with just over one-quarter citing that vendors are involved in this stage of design. Vendors seem to be more involved in the systems design phase of design. One-third of respondents report that end-users and vendors are interactive throughout the design process.

APPENDIX B

Acronyms and Abbreviations

BIR	Benefit Investment Ratio
CBA	Cost/Benefit Analysis
CEA	Cost-Effectiveness Analysis
CHCS	Computerized Health Care Services
CIO	Chief Information Officer
COO	Chief Operating Officer
COTS	Commercial Off-The-Shelf
DCF	Discounted Cash Flow
DOE	Department Of Energy
DRG	Diagnosis Related Group
EOC	Episode Of Care
EPA	Environmental Protection Agency
EUAC	Equivalent Uniform Annual Cost
EVA	Expected Value Analysis
EVM	Earned Value Management
FDA	Food & Drug Administration
GAO	General Accounting Office
GITSB	Government Information Technology Service Board
GSA	General Services Administration
GWAC	Government-Wide Agency Contracts
IAC	Industry Advisory Council
IPT	Integrated Project Team
IRR	Internal Rate of Return
IT	Information Technology
I-TIPS	Information Technology Investment Portfolio System
ITRB	Information Technology Review Board
MHS	Military Health System
MIRR	Modified Internal Rate of Return
NPV	Net Present Value
ODI	Optical Disk Imaging
OMB	Office of Management & Budget
PV	Present Value
PVIF	Present Value Interest Factor
RAM	Risk Assessment Model
ROI	Return On Investment
SIR	Savings Investment Ratio
TCO	Total Cost of Ownership
WTP	Willingness-To-Pay

APPENDIX C

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APPENDIX D

Interview Participants

AGENCY	PARTICIPANTS
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Department of Energy (DOE)	Chuck Guyker , Director of Planning, Office of the Chief Information Officer Nancy Tomford , Program Manager, Corporate Human Resources Information Systems
Environmental Protection Agency (EPA)	John Adams , Office of Administration and Resources Management
Federal National Mortgage Agency (Fannie Mae)	Cathy Mattax , Director, Business Office, Corporate Information Services
Food and Drug Administration (FDA)	Roderick K. Bond , Director, Planning, Resources and Information Systems Management
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