



**Department of Defense
Guide for Managing Information Technology (IT)
as an Investment
and Measuring Performance**

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**Prepared for:
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(ASD C3I)**

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How to Use This Guide

This guide provides you with three tools to develop performance measures for your project, program, or acquisition:

1. detailed procedures on how to develop performance measures;
2. examples of methodologies and performance measures; and
3. a case study demonstrating how performance measures are implemented in a hypothetical automated information system (AIS) development project.

These tools, in combination with your technical, managerial, and functional area experience, will help you develop a performance measurement program. The guide is organized into seven sections and a set of appendices.

Section 1 introduces the legislative framework and management rationale for performance measurement.

Section 2 introduces the IT investment process

Section 3 provides an overview of performance measures and identifies the major audiences for IT performance measures.

Sections 4-6 describe procedures for development of performance measures at the enterprise, program, and program/project levels which will be integrated into the Selection, Control and Evaluation of the IT investment process described in Section 2. Even if an effort is well established, it is not too late to begin an active performance measures program. Follow the steps in this section that apply. Use the example measures as a guide to think about benefits, schedule, and cost. Remember, this section is a guide, not a set of mandatory steps.

Section 7 contains a case study providing examples of how each step described in Sections 4-6 has been applied in a hypothetical IM/IT systems project.

Section 8 discusses some proven methodologies for measuring IT performance.

Appendix A is the proposed Investment Baseline/Performance Agreement

The bibliography in Appendix B contains a listing of reference materials. Use this list to select additional readings in areas where you need more guidance.

Most important . . . get going. Start now wherever you are. By using the information contained in this guide, you will be able to make the theory real and put performance measurement into practice.

Table of Contents

EXECUTIVE SUMMARY	ES-i
1. INTRODUCTION	1-1
1.1 Purpose	1-1
1.2 Legislative Background.....	1-1
1.2.1 Information Technology Management Reform Act of 1996.....	1-2
1.2.2 Section 381 of the National Defense Authorization Act For Fiscal Year 1995	1-2
1.2.3 Federal Acquisition Streamlining Act (FASA) of 1994.....	1-3
1.2.4 Government Performance and Results Act (GPRA) of 1993.....	1-3
1.2.5 Paperwork Reduction Act (PRA) of 1995.....	1-3
1.2.6 Chief Financial Officers’ Act (CFOA) of 1990	1-4
1.2.7 OMB Circular A-11, Part 2: Preparation and Submission Of Strategic Plans.....	1-4
1.2.8 OMB Circular A-11, Part 3: Planning, Budgeting, and Acquisition of Fixed Assets.....	1-4
1.2.9 OMB Circular A-130: Management of Federal Information Resources	1-5
1.2.10 Executive Order 13011, Federal Information Technology.....	1-5
2. MANAGING IT AS AN INVESTMENT	2-1
2.1 The IT Investment Management Process	2-1
2.2 Organizational Attributes for Successful IT Investments	2-2
2.2.1 Senior Management Attention	2-2
2.2.2 Overall Mission Focus	2-3
2.2.3 Comprehensive Portfolio Approach to IT Investment	2-3
2.3 Selection Phase:.....	2-4
2.3.1 Screen IT project proposals.....	2-4
2.3.2 Analyze risks, benefits, and costs.....	2-5
2.3.3 Prioritize projects based on risk and return.....	2-5
2.3.4 Determine the right mix of projects	2-6
2.4 Control Phase:	2-7
2.4.1 Monitor actual vs. expected performance	2-8
2.4.2 Taking action to correct deficiencies.....	2-8
2.5 Evaluation Phase:	2-8
2.5.1 Conduct post implementation reviews	2-9
2.5.2 Decide on adjustments	2-9
2.5.3 Identify and implement lessons learned	2-9
2.6 Performance measurement is critical	2-9
3. DoD IT PERFORMANCE MEASUREMENT OVERVIEW	3-1
3.1 Definition	3-1
3.1.1 Parameters of Performance Measurement.....	3-1
3.1.2 Effectiveness and Efficiency.....	3-1
3.1.3 Steps for Measuring DoD IT Performance.....	3-2
3.2 Users Of Performance Measurement Information	3-4
3.2.1 Enterprise Level.	3-4
3.2.2 Functional Level.....	3-5
3.2.3 Program/project level	3-6

4. PERFORMANCE MEASUREMENT AT THE ENTERPRISE LEVEL.....	4-1
4.1 The IT Strategic Plan.....	4-2
4.1.1 Mission Statement.....	4-2
4.1.2 Goals.....	4-2
4.1.3 Objectives.....	4-3
4.2 Identifying Outcome Performance Measures	4-3
4.2.1 Purpose of the measure.	4-3
4.2.2 Who measures and how?.....	4-4
4.2.3 Who uses the data and for what?.....	4-4
4.2.4 What is the cost of measure vs. value to the user?	4-4
4.2.5 What tools and assistance are available to collect and use measurement data?	4-4
4.2.6 What special provisions must be considered?.....	4-4
5. PERFORMANCE MEASUREMENT AT THE FUNCTIONAL LEVEL	5-1
5.1 Identify IT Effort and Its Mission and Objectives.....	5-1
5.1.1 Analyze Guidance	5-1
5.1.2 Analyze Functions and Processes.....	5-1
5.1.3 Identify Requirements for IT Initiatives	5-1
5.2 Identify Links to Enterprise Mission and Strategic Goals.....	5-2
5.3 Define IT Effort Baseline and Develop Performance Measurement Framework	5-2
5.3.1 IT Effort Baseline	5-2
5.4 Validate Feasibility of IT Performance Measures.....	5-5
5.4.1 Identify Data Required to Calculate the Performance Measure	5-6
5.4.2 Identify the Verification and Validation Strategy for the Data Collection.....	5-6
5.4.3 Identify the Collection Cost	5-6
5.4.4 Evaluate Performance Measurement Feasibility.....	5-6
5.5 Finalize IT Effort Baseline and Performance Measurement Framework.....	5-6
5.5.1 Ensure Performance Measures Are Measuring the Right Things	5-6
5.5.2 Ensure Set of Performance Measures Has the Right Measures	5-7
5.5.3 Gain Consensus for the IT Effort Baseline and Measurement Framework.....	5-8
5.5.4 Determine How to Collect, Analyze, Verify, Validate and Track Data	5-8
6. PERFORMANCE MEASUREMENT AT THE PROGRAM/PROJECT LEVEL	6-1
6.1 Identify IT Project and its Mission and Objectives	6-3
6.1.1 Identify the Project	6-5
6.1.2 Identify the Mission.....	6-5
6.1.3 Identify Objectives	6-6
6.1.4 Identify the External Environment	6-6
6.2 Define IT Investment's Internal Performance Baseline	6-7
6.2.1 Identify Performance Measures.....	6-8
6.2.2 Determine Targets and Thresholds For Identified Performance Measure.....	6-14
6.3 Validate Feasibility of Performance Measures.....	6-15
6.3.1 Identify Data Required to Calculate the Performance Measure	6-16
6.3.2 Identify the Verification and Validation Strategy for the Data Collection.....	6-17
6.3.3 Identify the Collection Cost	6-17
6.3.4 Evaluate Performance Measurement Feasibility.....	6-17
6.4 Finalize Investment Baseline/Performance Agreement	6-17

6.4.1 Ensure Set of Performance Measures is Measuring the Right Thing.....	6-19
6.4.2 Ensure Set of Performance Measures Has the Right Measures	6-20
6.4.3 Gain Consensus for the Performance Measurement Baseline.....	6-21
6.4.4 Establish Data Collection Efforts to Obtain Values of the Measures in the Baseline.....	6-21
7. CASE STUDY OF A HYPOTHETICAL IT PROJECT	7-1
7.1 Introduction	7-1
7.2 Development of the Baseline for the HIRMS	7-1
7.2.1 Step 1: Identify IT Effort and its Mission and Objectives, and the External Functional Baseline	7-1
7.2.2 Step 2: Define IT Effort's Internal Baseline with Performance Measures.....	7-10
7.2.3 Activity 3: Determine targets and thresholds for identified performance measures.....	7-15
7.2.4 Benefits.....	7-15
7.2.5 Costs	7-16
7.2.6 Step 3: Validate Feasibility of Performance Measures	7-17
7.2.7 Step 4: Finalize Performance Measurement Baseline.....	7-19
7.3 Investment Baseline/Performance Agreement For The HIRMS	7-25
8. IT PERFORMANCE MEASUREMENT METHODOLOGIES	8-1
8.1 IT Effectiveness Framework	8-1
8.1.1 Uses:	8-1
8.1.2 Measurement Approach:	8-1
8.1.3 Strengths:.....	8-2
8.1.4 Weaknesses:	8-2
8.1.5 Examples:	8-3
8.2 IT Efficiency Framework	8-5
8.2.1 Uses:	8-5
8.2.2 Measurement Approach:	8-5
8.2.3 Strengths:.....	8-5
8.2.4 Weaknesses.	8-5
8.2.5 Sample IT Efficiency Measures	8-6
8.3 Performance Measures for IT.....	8-7
8.3.1 Uses:	8-7
8.3.2 Measurement Approach:	8-7
8.3.3 Strengths:.....	8-7
8.3.4 Weaknesses:	8-7
8.3.5 Sample Performance Measures for IT.....	8-8
8.4 Productivity Measures for IT.....	8-9
8.4.1 Uses:	8-9
8.4.2 Measurement Approach:	8-9
8.4.3 Strengths:.....	8-9
8.4.4 Weaknesses:	8-9
8.4.5 Sample IT Productivity Measures And Sub-Measures	8-10
8.5 Enhanced Cost-Benefit Analysis	8-11
8.5.1 Uses:	8-11
8.5.2 Measurement Approach:	8-11
8.5.3 Strengths.....	8-11

8.5.4 Weaknesses:	8-11
8.5.5 Sample Cost-Benefit Analysis Measurements	8-12
8.6 Information Economics	8-13
8.6.1 Uses:	8-13
8.6.2 Approach:	8-13
8.6.3 Strengths:.....	8-16
8.6.4 Weaknesses:	8-16
8.6.5 Examples	8-16
8.7 Activity-Based Costing	8-18
8.7.1 Uses:	8-18
8.7.2 Measurement Approach:	8-18
8.7.3 Strengths:.....	8-19
8.7.4 Weaknesses:	8-19
8.7.5 Examples	8-20
8.8 Integrated Performance Measurement.....	8-21
8.8.1 Uses:	8-21
8.8.2 Measurement Approach:	8-21
8.8.3 Strengths:.....	8-22
8.8.4 Weaknesses:	8-22
8.8.5 Examples	8-22
8.9 Information System Success Categories	8-24
8.9.1 Uses:	8-24
8.9.2 Measurement Approach:	8-24
8.9.3 Strengths:.....	8-24
8.9.4 Weaknesses:	8-24
8.10 Value Management Framework	8-25
8.10.1 Uses	8-25
8.10.2 Measurement Approach:	8-25
8.10.3 Strengths:.....	8-25
8.10.4 Weaknesses.	8-25
8.10.5 Examples	8-26
8.11 Earned Value	8-27
8.11.1 Description	8-27
8.11.2 Uses	8-27
8.11.3 Measurement Approach:	8-27
8.11.4 Strengths:.....	8-27
8.11.5 Weaknesses.	8-27
8.12 The Balanced Scorecard.....	8-28
8.12.1 Description:	8-28
8.12.2 Uses:	8-28
8.12.3 Measurement Approach:	8-28
8.12.4 Strengths:.....	8-29
8.12.5 Weaknesses:	8-29
Appendix A Investment Baseline/Performance Agreement.....	A-1
Appendix B Bibliography	B-1

List of Exhibits

Exhibit 2-1: IT Investment Management Processes	2-2
Exhibit 3-1: Levels of Performance Measurement.....	3-4
Exhibit 3-2: Reporting Requirements	3-7
Exhibit 6-1: Procedures.....	6-3
Exhibit 6-2: Step 1	6-4
Exhibit 6-3: Worksheet 1 (Project Definition).....	6-4
Exhibit 6-4: Mission Example	6-5
Exhibit 6-5: Objectives Example	6-6
Exhibit 6-6: Worksheet 2 (External Environment)	6-7
Exhibit 6-7: Step 2	6-7
Exhibit 6-8: Worksheet 3	6-8
Exhibit 6-9: Examples of User/Customer Satisfaction Measures	6-10
Exhibit 6-10: Another View - User/Customer Satisfaction Measures	6-11
Exhibit 6-11: Milestone Reviews and Phases	6-12
Exhibit 6-12: Worksheet 4 (Target and Threshold Values)	6-14
Exhibit 6-13: Step 3	6-15
Exhibit 6-14: Worksheet 5 (Validation Worksheet)	6-16
Exhibit 6-15: Step 4	6-17
Exhibit 6-16: Worksheet 6A (Quality Checklist).....	6-18
Exhibit 6-17: Worksheet 6B (Objectives Coverage Worksheet)	6-19
Exhibit 7-1: Step 1	7-1
Exhibit 7-2: Worksheet 1	7-3
Exhibit 7-3: Relationships Between Source Documents and Performance Measures	7-4
Exhibit 7-4: Minimal Acceptable Project Performance Requirements for the HIRMS	7-7
Exhibit 7-5: Completed Worksheet 1.....	7-8
Exhibit 7-6: Completed Worksheet 2.....	7-9
Exhibit 7-7: Step 2	7-10
Exhibit 7-8: Worksheet 3	7-12
Exhibit 7-9: Completed Worksheet 3.....	7-14
Exhibit 7-10: Candidate Benefits for the HIRMS	7-15
Exhibit 7-11: Target and Threshold Funding for Development Phase	7-16
Exhibit 7-12: Schedule Milestones for the HIRMS	7-16
Exhibit 7-13: Step 3	7-17
Exhibit 7-14: Completed Worksheet 5.....	7-19
Exhibit 7-15: Step 4	7-19
Exhibit 7-16: Worksheet 6A	7-20
Exhibit 7-17: Worksheet 6B.....	7-21
Exhibit 7-18: Approved and Required Funding for Development Phase of the HIRMS.....	7-22
Exhibit 7-19: Schedule Milestones	7-23
Exhibit 7-20: Candidate Benefits for the HIRMS	7-24

Executive Summary

This guide summarizes the Department of Defense (DoD) position on Information Technology (IT) performance measurement and presents a framework for managing information technology programs as investments rather than as acquisitions.

DoD's goal is to, within the framework of Government Performance and Results Act (GPRA), the Information Technology Management and Results Act (ITMRA) and other relevant management legislation, establish performance measures as an integral part of the Information Technology (IT) investment process. It is designed to assist DoD in its transition to a performance-based organization.

Managing IT as an investment requires that senior managers be able to systematically maximize the benefits of IT investments throughout the organization by using the three steps of the IT investment process:

- *Selection* - Creating a portfolio of IT project investments that maximizes mission performance, using an approved set of criteria for consistent comparison of projects.
- *Control* - Measuring ongoing IT projects against their projected costs, schedules, and benefits and taking action to continue, modify, or cancel them.
- *Evaluation* - Determining the actual value of an implemented investment against the organization's mission requirements and adapting the IT investment process to reflect lessons learned.

Essential to the successful use of this process is an effective means of measuring the performance of IT investments in objective, outcome-oriented terms. The guide defines IT performance measurement as:

the assessment of effectiveness and efficiency of IT in support of the achievement of an organization's missions, goals, and quantitative objectives through the application of outcome-based, measurable, and quantifiable criteria, compared against an established baseline, to activities, operations, and processes.

Performance Measurement is the means by which an organization measures its effectiveness and efficiency in the pursuit of its missions, goals, and objectives.

The six key steps in effective performance measurement are:

1. Define mission, key result areas, and business functions.
2. Develop mission related goals.
3. Generate performance measures/indicators.
4. Validate and verify performance measures.
5. Implement the performance measures and collect data.
6. Monitor and assess the results and repeat the process as needed.

There is a recognition that different management tiers need different kinds of information to make investment and business decisions.

Enterprise Level: At the Enterprise level , mission results are being focused on, and information is needed to choose policy directions and make mission decisions. Managers make the connection between the IT performance measurement requirements of ITMRA and the overall organizational performance measurement required by GPRA. IT investment decisions are greatly influenced by this level during the Selection phase of the investment process. The timing for information is cyclical.

Relationship:	Policy, mission decision and strategies
Role:	Accountability
Timing:	Cyclical

Functional level: At the Functional level, the focus is on unit results where information is needed to manage and improve operations. These managers are responsible for reporting the performance of major DoD functions across multiple projects, programs, or acquisitions. They combine, synthesize and report program/project-level results for use by enterprise-level managers. The functional level is also where mission related outcome measures are defined and the interests of the IM/IT user community are directly represented, and their requirements are approved, documented, and funded for execution. This level is heavily involved in the Selection and Evaluation phases of the investment process. The program/project level serves as the Functional Level representative during the Control phase of the investment process. The timing for information is periodic.

Relationship:	Management and improvement of operations
Role:	Integration & Planning
Timing:	Periodic

Program/project level: At the Program/project level, activity and task information is critical to make tactical decisions and execute management decisions. Managers are leading programs, projects, or acquisitions that are sponsored by functional-level managers. These managers are involved in the accomplishment of actual IM/IT efforts. This level serves a key role in the Control and Evaluation phases of the investment process. The timing for information is immediate.

Relationship:	Tactical and execution management
Role:	Resource allocation
Timing:	Immediate

For each of these levels, the guide lays out a process for defining IT investments in terms of functional requirements, identifying outcome-based performance measures that accurately assess the achievement of these requirements, and continuously ensuring that the linkage between investments and mission accomplishment is maintained. The functional level in concert with the users, are responsible for conducting post-implementation assessment of IT investments’

operational capabilities, to ensure that the expected functional benefits of an investment are actually realized. This post-deployment assessment is crucial to ensuring that the linkage between IT investments and organizational performance is maintained.

The process culminates in the development of an Investment Baseline/Performance Agreement by all levels of management involved in an IT investment. The Investment Baseline/Performance Agreements' performance parameters represent the minimum number needed to characterize the major drivers of operational effectiveness, suitability, schedule, technical progress and cost. This minimum number include the key outcome measures described in the requirements definition document.

The Investment Baseline Performance Agreement captures the functional performance, cost and schedule baselines for the project, the outcome measures that will be used to evaluate the project's success, and the linkage back to the organization's strategic goals. Jointly validated by the CIO and CFO (or their equivalents), the user representative/functional manager, and the project manager, The Investment Baseline/Performance Agreement firmly ties each IT investment to a set of clearly understood, quantifiable, outcome-based performance measures that directly support mission accomplishment.

The methods and measures described in this guide are widely used for program management purposes. However, they are not meant to imply an exhaustive or required set of measures or methods. The guide does lay out basic principles and processes that users can tailor to their set of circumstances.

1. INTRODUCTION

This document summarizes the Department of Defense (DoD) position on Information Technology (IT) performance measurement and presents a framework for IT program managers to manage their IT programs as investments. Section 1 presents the purpose and legislative background of this document.

1.1 Purpose

As the Department of Defense (DoD) becomes a performance-based organization (PBO), demonstrating results becomes the basis for success, not simply spending allocated budgets. Increased public scrutiny, tighter budgets, and legislative mandates all compel Information Technology (IT) managers to focus their attention on managing IT *investments*, rather than focusing too narrowly on IT *acquisitions*. The emphasis must be on achieving outcomes that contribute to mission effectiveness, rather than simply meeting contractual requirements. To demonstrate success, each program, project, and acquisition must institutionalize outcome-oriented performance measures; performance must be evaluated over time using these measures.

This guide sets out an analytical framework for linking IT investment decisions to strategic objectives, business plans, and organizational mission performance. While this guide supports DoD methods and processes, it does not depend on the adoption of any specific standard. This guide provides a flexible framework for integrating measurements into existing management and development processes. We strongly encourage its use to identify strengths and weaknesses of current IT investment control systems and to develop action plans for improvement.

1.2 Legislative Background

Congress has determined that waste and inefficiency in Federal Information Technology (IT) programs undermine the confidence of the American people and reduces the Federal Government's ability to adequately address vital public needs. Federal IT managers are seriously disadvantaged in their efforts to improve IT program efficiency and effectiveness, because of insufficient articulation of program goals and inadequate information on program performance. Furthermore, Congressional policymaking, spending decisions, and program oversight are seriously handicapped by insufficient attention to program performance and results. Congress recognizes existing planning and management systems have not accomplished their original missions for IT programs. Critical functions such as planning, budgeting, program implementation and program evaluation are disjointed. For many IT programs any linkage between agency-wide goals, budgets, implementation activities, and performance measures is purely coincidental.

To correct the shortcomings associated with current management of IT investments, Congress enacted several pieces of legislation requiring Federal Agencies to implement performance measures in their business processes to ensure the proper oversight and management of IT investments. Performance measures are now required by law to be an integral part of any IT program. This legislation has been followed by Executive Orders and OMB Circulars regarding performance measurement. These documents are summarized below.

1.2.1 Information Technology Management Reform Act of 1996

As part of the National Defense Authorization Act For Fiscal Year 1996, the Information Technology Management Reform Act of 1996 (ITMRA) mandates that the Secretary of Defense implement performance measures for all DoD information technology (IT) programs, projects, and acquisitions. This requirement also applies to National Security Systems.

This act requires the Secretary of Defense to design and implement a process for maximizing the value and assessing and managing the risks of the IT investments of the DoD. The Secretary of Defense is required to provide the means for senior external management personnel to obtain timely information regarding investment progress in an information system. This includes a system of milestones for measuring progress on an independently verifiable basis in terms of cost, timeliness, quality, and system capabilities versus requirements.

The Chief Information Officer (CIO) of DoD must monitor the performance of IT programs of the agency, evaluate the performance of those programs on the basis of the applicable performance measurements, and advise the head of the agency regarding whether to continue, modify, or terminate a program or project.

The Secretary of Defense will report the program performance benefits resulting from IT capital investments to the Director of the Office of Management and Budget (OMB). The Secretary of Defense will also report how these benefits relate to the accomplishment of DoD's goals. OMB will compare DoD's performance to the performance of other executive agencies.

The act requires the DoD to use performance and results-based management. One method that OMB will use to implement this requirement is periodic reviews of selected IM/IT activities as part of the budget process. OMB will enforce accountability through the budgetary process.

With respect to National Security Systems, ITMRA does not require DoD to fully implement OMB direction on IT management. Rather, the Secretary of Defense has the authority to apply this direction to the extent practicable, while accomplishing vital military and intelligence missions. ITMRA expressly provides this authority to be used at the Secretary's discretion.

1.2.2 Section 381 of the National Defense Authorization Act For Fiscal Year 1995

Section 381 of the National Defense Authorization Act for Fiscal Year 1995 requires DoD to establish performance measures and management controls to supervise and manage its IM/IT activities. Specifically:

“(1) The Secretary of Defense shall establish performance measures and management controls for the supervision and management of the activities ... The performance measures and management controls shall be adequate to ensure, to the maximum extent practicable, that the Department of Defense receives the maximum benefit possible from the development, modernization, operation, and maintenance of automated information systems.”

The act also requires the Secretary of Defense to report on the establishment and implementation of the performance measures and management controls in 1995, 1996, and 1997.

1.2.3 Federal Acquisition Streamlining Act (FASA) of 1994

Title V of the FASA contains specific requirements for federal agencies to “define the cost performance and schedule goals for major acquisition programs” and to monitor and report annually on the degree to which these goals are being met. In their annual reports, agencies must assess whether acquisition programs are achieving 90% of their cost, performance, and schedule goals. If not, agencies must determine whether these programs should continue. The FASA also provides for an enhanced system of performance incentives to relate performance to the achievement of these goals.

1.2.4 Government Performance and Results Act (GPRA) of 1993

This legislation requires strategic planning and performance measurement in the executive branch agencies of the federal government. The purposes of the GPRA are to improve federal management and congressional decision making, service delivery, program effectiveness and public accountability, and public confidence in government. The GPRA requires agencies to develop strategic plans by September 30, 1997, for implementation in fiscal year 1999. The OMB has mandated that the plans cover six years and be updated at least every three years. Stakeholders and customers will provide input into the strategic plans.

Beginning in fiscal year 1999, agencies will develop yearly performance plans and set performance goals based on their strategic plans. Starting in March 2000, agencies will write annual performance reports, comparing actual performance to goals established in annual performance plans.

This performance information gives IM/IT managers two advantages: (1) an early warning system to improve program management and (2) information communicating program value to executives, Congress, other stakeholders, and the general public.

1.2.5 Paperwork Reduction Act (PRA) of 1995

This legislation is intended to minimize the paperwork burden resulting from the collection of information by or for the Federal Government; coordinate, integrate, and make uniform Federal information resources management policies and practices; improve the quality and use of Federal information, to minimize the cost to the Federal Government of the creation, collection, maintenance, use, dissemination, and disposition of information, and to ensure that information technology is acquired, used, and managed to improve performance of Federal agency missions.

The Act requires that each agency:

- Develop and maintain a strategic information resources management plan that shall describe how information resources management activities help accomplish agency missions
- Develop and maintain an ongoing process to--

1. ensure that information resources management operations and decisions are integrated with organizational planning, budget, financial management, human resources management, and program decisions;
2. in cooperation with the agency Chief Financial Officer (or comparable official), develop a full and accurate accounting of information technology expenditures, related expenses, and results.
3. establish goals for improving information resources management's contribution to program productivity, efficiency, and effectiveness, methods for measuring progress towards those goals, and clear roles and responsibilities for achieving those goals.
4. Maintain a current and complete inventory of the agency's information resources.
5. Conduct formal training programs to educate agency program and management officials about information resources management.

These provisions of the PRA were reinforced and expanded by the ITMRA in 1996.

1.2.6 Chief Financial Officers' Act (CFOA) of 1990

This legislation was enacted to accomplish these objectives:

1. Bring more effective general and financial management practices to the Federal Government through statutory provisions which would establish in the Office of Management and Budget a Deputy Director for Management, establish an Office of Federal Financial Management headed by a Comptroller, and designate a Chief Financial Officer in each executive department and in each major executive agency in the Federal Government.
2. Provide for improvement, in each agency of the Federal Government, of systems of accounting, financial management, and internal controls to assure the issuance of reliable financial information and to deter fraud, waste, and abuse of Government resources.
3. Provide for the production of complete, reliable, timely, and consistent financial information for use by the executive branch of the Government and the Congress in the financing, management, and evaluation of Federal programs.

It requires agencies to include performance measurement data in their annual financial statements.

1.2.7 OMB Circular A-11, Part 2: Preparation and Submission Of Strategic Plans

This circular provides executive guidance for preparing and submitting Agency strategic and performance plans as required by GPRA.

1.2.8 OMB Circular A-11, Part 3: Planning, Budgeting, and Acquisition of Fixed Assets

This circular provides executive guidance on planning, budgeting, and acquisition of fixed assets, specifically IT and NSS-IT, in accordance with GPRA and ITMRA. It requires agencies

to identify baseline goals for cost, schedule, and performance for all proposed and ongoing acquisitions, and provides guidance on reporting compliance with these goals to OMB.

1.2.9 OMB Circular A-130: Management of Federal Information Resources

This circular provides executive guidance on the management of Federal IM/IT resources in compliance with PRA 95. Specific requirements include strategic IM/IT planning tying IT investments to agency mission accomplishment and cost-benefit-analysis of IT systems throughout the system life-cycle.

1.2.10 Executive Order 13011, Federal Information Technology

This order implements the provisions of ITMRA in the executive branch. Besides the specific provisions of ITMRA, the order establishes the Federal CIO Council; creates the Government Information Technology Services Board and the Information Technology Resources Board; and provides additional guidance on the roles of agency CIOs and the use performance measurement in evaluating IT investments.

2. MANAGING IT AS AN INVESTMENT

To help DoD and other Federal Agencies achieve their goals, the General Accounting Office (GAO) studied successful private and public sector organizations to learn the factors behind their success in results-based management of IT investments. GAO and the Office of Management and Budget (OMB) created an IT Investment Guide which DoD fully endorses as a recommended method of managing IT as an investment within the Department. The key provisions of the GAO/OMB Investment Guide are incorporated into this section.

2.1 The IT Investment Management Process

This section describes the critical success elements and key phases that should be a part of a mature IT investment process. The IT investment process created in your organization should match the culture and organizational structure. The overriding objective is that senior managers be able to systematically maximize the benefits of IT investments throughout the organization and establish performance measures as an integral part of the IT investment process. Details are provided below to describe the integration of performance measures, define the process used to link DoD's Planning, Programming and Budgeting System (PPBS) to the Life cycle Management Process and the departments approach to Evaluating the Operational Capability of IT investments once they've been deployed.

The process starts with prioritizing funding requests to maximize the value of scarce resources. This difficult process involves balancing potential benefits against costs and risks and aligning strategic and tactical goals with proposed system investments. Equally critical, the approach ends with clear evidence of positive net benefit to the department for dollars invested.

As described below, the three phases of the investment process occur in a continuous cycle of selection, control and evaluation. Information from each phase flows freely among all of the other phases with the exception of evaluation. The evaluation component of the process has a unidirectional information flow to the selection component. The evaluation component is used to verify or modify the criteria used during selection.

1. *Investment Selection* - Creating a portfolio of IT project investments that maximizes mission performance, using an approved set of criteria for consistent comparison of projects.
2. *Investment Control* - Measuring ongoing IT projects against their projected costs, schedules, and benefits and taking action to continue, modify, or cancel them.
3. *Investment Evaluation* - Determining the actual value of an implemented investment against the organization's mission requirements and adapting the IT investment process to reflect lessons learned.

The control and evaluation phases are conducted throughout the year and their results are fed into the selection phase, which in turn feeds back to the control and evaluation phases.

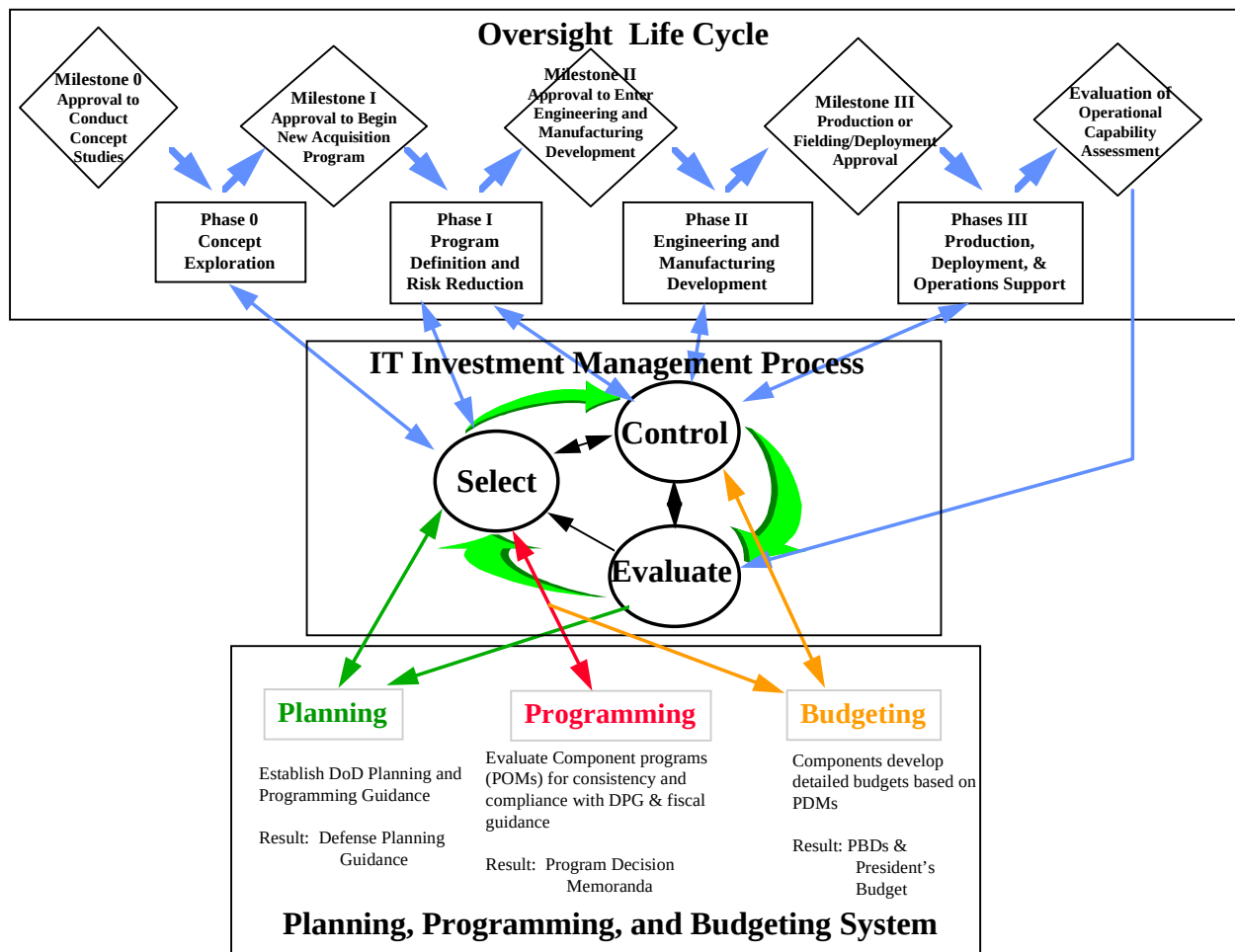


Exhibit 2-1: IT Investment Management Processes

2.2 Organizational Attributes for Successful IT Investments

While each phase of the IT investment management process has unique requirements for successful implementation, there are some overall organizational attributes that are essential for effective investment management. These shared attributes are: senior management attention, overall mission focus, and a comprehensive portfolio approach to IT investment.

2.2.1 Senior Management Attention

Organizations must ensure that senior managers, with the authority to make decisions to continue, modify, or cancel IT investment programs are continuously involved in the IT investment process.

There must be a disciplined decision-making process with the capability to approve, cancel, or delay projects, mitigate risks, and validate expected returns on IT investments.

There must be clearly defined roles, responsibilities, and accountability for the success of IT investments. Formal agreements between CIOs, CFOs, program managers and users of IT

should be established; IT issues and requirements must be integrated into financial and operational strategic planning; and the CFO and CIO offices must be involved in IT operational decisions.

2.2.2 Overall Mission Focus

The strategic plan is the organization's mission, goals, and objectives, and performance measures must be linked to strategic planning as required by ITMRA and GPRA. This requires developing long-term strategic goals, setting annual organizational performance targets in support of those objectives, and annually evaluating performance against those targets.

GPRA and ITMRA require clear organizational hierarchies of goals and performance measures be established. To comply with the spirit and intent of both laws, the goals and measures used at lower organizational levels must be linked to DoD's mission/strategic goals. Mission goals should be translated into objective, results-oriented measures of performance to establish a baseline for measuring the value of IT investments. Research has indicated that without clear hierarchically linked goals and performance measures, managers and staff throughout the organization lack straightforward roadmaps showing how their work contributes to attaining organizational strategic goals.

If an IT investment does not measurably improve agency mission performance (no matter how well the program met its cost and schedule baselines or output and performance indicator measures), that investment should not be made.

Agencies must ensure that functions performed by proposed IT investments are mission-essential and cannot be performed more efficiently by other Government or private activities. The work processes supported by proposed IT investment must be reviewed and, if necessary, reengineered to ensure the full value of the investment is realized.

Mission benefit, not cost and schedule constraints, must be the overriding measure of success for any IT project. It is how IT contributes to mission accomplishment that is the deciding factor for investment purposes.

2.2.3 Comprehensive Portfolio Approach to IT Investment

Organizations must define their portfolio of IT investments in every phase of development (from concept exploration to operational) and of every type (mission-critical, cross-functional, infrastructure, and administrative). Investments which are purely research and development should be considered part of the organization's R&D portfolio, rather than its IT investment portfolio.

For each phase and type of investment, there must be developed appropriate review processes, documentation requirements, and selection criteria.

Dollar thresholds must be established to assign investment decisions to the appropriate level authority, but consistent decision-making processes should be used throughout the organization.

There must be supplemental criteria to identify mission-critical projects that fall below the dollar threshold but still require higher management review.

2.3 Selection Phase:

The selection phase creates a portfolio of IT investments designed to improve overall organizational performance. It requires a standard set of criteria to judge which proposed investments represent the best balance of costs, benefits, and risks. A consistent, objective, methodology for determining these performance measures, ensuring they reflect organizational goals and objectives, and tracking them throughout the investment process is the only means by which sound, rational investment decisions can be made.

Key Enterprise-level management tools and techniques applicable to the selection phase include:

1. An executive management team that makes funding decisions based on objective comparisons and trade-off between competing projects.
2. Documented decision criteria that examine ROI, technical risks, program effectiveness, customer/user impact, project size and scope.
3. Pre-defined thresholds and authority levels that put investment decisions in the right hands.
4. Minimal acceptable ROI values to minimize risk and increase returns.
5. Risk assessments to expose potential technical and managerial weaknesses.

The selection process has four steps:

2.3.1 Screen IT project proposals

A mature investment screening process will prescribe the amount and rigor of supporting documentation for IT project proposals based on their type and phase of implementation. Mission-critical projects will receive more detailed scrutiny than less strategically important ones. Key questions to be answered in the screening process include:

1. Is the project clearly relevant to mission priorities outlined in the organization's strategic plan?
2. Is the project feasible to design and execute, given the agency's proven capabilities?
3. Are commercial off-the-shelf systems available to meet all/most of the project's goals?
4. Have other agencies done this type of project? Have their lessons learned been incorporated into project planning? Have re-use of their product(s) been considered?
5. Does the project conform to the organization's technology and information architecture?

6. Will the project be executed in well-defined stages, with clear decision points for continuing, modifying, or canceling the project?

2.3.2 Analyze risks, benefits, and costs

A detailed evaluation of each proposal is conducted and summarized to support senior management's decision-making process. A technical review team should evaluate the project's benefit-cost and risk analyses, and particularly the projected benefits to mission accomplishment and the proposed performance measures for comparing expected versus actual results. Key questions in this analysis include:

1. Has the relevant office successfully managed other projects of similar risk and complexity?
2. Have project risks been assessed using a well-defined, documented process? Has a sensitivity analysis been done for critical variables?
3. Is there a specific plan for monitoring, managing, and mitigating project risks?
4. What are the operational risks to users/customers if the project does not proceed?
5. Have users and customers validated the proposed mission benefits of the project?
6. Has a systematic, performance-oriented, detailed cost-benefit analysis been prepared?
7. What are the constraints and assumptions that may affect the benefits of alternative solutions?
8. Does the justification for the project depend on projected long-term (>5 years) benefits? If so, what is the level of confidence in those projections?
9. Do the assumptions supporting the analysis accurately reflect market trends in hardware and software? Do projected costs reflect today's prices or those expected in the execution years?
10. Are benefits clearly expressed in terms of improved mission performance?
11. Can project cost be shared with other agencies with similar needs?

2.3.3 Prioritize projects based on risk and return

After analyzing all proposed projects, the organization should use expected risks and benefits to identify candidate investments with the greatest chances of effectively and efficiently supporting key mission objectives within budget constraints. It is essential in making this prioritization that all projects be measured against a consistent set of objective, results-oriented performance measures. Typical risk and return criteria used in this step include:

1. *Investment Risk.* How large is the proposed IT investment cost, particularly in comparison to the overall IT budget?
2. *Project Longevity and Scope.* Is the project using a modular approach? Is it as narrow in scope and duration as possible?
3. *Technical Risk.* How will the proposed technology integrate with existing systems? Does the project take advantage of COTS products? How complex is the system architecture and software design?
4. *Mission Impact.* How will the IT investment support improved performance in specific outcome-oriented terms?
5. *User/Customer Needs.* How well does the investment address identified needs of the IT user or customer communities?
6. *Return on Investment (ROI).* Is the calculated ROI adjusted for risk and analytically sound?
7. *Organizational Impact.* What will be the structural and procedural impacts of the investment on the organization?
8. *Expected Improvement.* Does the investment represent a new capability or the enhancement of existing ones? Is it mandated by law or executive directive? Is it required to maintain mission-critical functions? What is the expected magnitude of the improvement in performance?

The outcome of this step should be a prioritized list of IT investments with supporting documentation and analysis. Typically the list would sort out into three groups:

1. *Likely winners*, with high returns and low risk.
2. *Likely dropouts*, with higher risk and low return.
3. *Projects that warrant further study*, where risks and return are more evenly balanced. The analytical and management focus should be on this group.

2.3.4 Determine the right mix of projects

Once the proposed investments are prioritized, senior management must make the final selection based on technical soundness of projects, their contribution to mission needs, performance improvement priorities, and IT funding levels. Consideration must be given to the factors:

1. *The need for strategic improvements vs. keeping current systems operational.* Managers must strike a balance between continuing to invest in older systems vs. replacing them.

2. *New projects vs. ongoing projects.* Projects approved for funding must be periodically reviewed to ensure they should still be supported. Problems in project execution, or changes in mission or environment may make new investments more consistent with organizational objectives.
3. *High vs. low risk.* Senior management must carefully balance the amount of risk in the IT portfolio against the organization's capabilities and ability to manage risk.
4. *The impact of one project on others.* The integration of systems means that most new initiatives will affect or be affected by other projects or existing systems. Managers must recognize these dependencies and the risks they generate and make decisions accordingly.
5. *The opportunity costs of funding or not funding current proposals.* Too large a commitment to current investments may leave the organization unable to take advantage of future opportunities. Conversely, failure to acquire needed IT infrastructure can severely limit future projects. Managers must carefully judge trends in technology and funding to make the best choices.
6. *External control of funding.* Where funding for all or part of a project is coming from outside the organization, the risks of this lack of control must be weighed in making investment choices.
7. *Budget constraints.* DoD funding is highly dependent on economic and political trends outside the Department's control. Careful analysis of likely funding levels and the possibility of external funding must enter into the investment selection calculation.

The selection of the right mix of IT investment projects with their performance measurement and review plans, risk mitigation strategies, and cost-benefit analyses leads directly into the control phase of the IT investment management process.

2.4 Control Phase:

The control phase represents the classical use of performance measures to track cost, schedule, and performance against a contractual requirement. The critical flaw in many past IT projects has been the failure to effectively ground the performance goals and objectives of a given project in any organizational reality. Managers at every level must ensure that the focus of every IT project is to deliver the capabilities that the end user requires. Performance measures for each required capability must be clearly established up front in the requirements definition process, and user involvement must be maintained all the way to completion to ensure that the mission focus is not diluted as the project progresses.

Key Program/Project Level management tools and techniques applicable to the control phase include:

1. Processes that involve senior management in ongoing project reviews and force decisive steps to resolve problems early in the project.

2. Explicit measures and data to monitor expected vs. actual cost, schedule and performance outcomes. These must be consistently maintained throughout the organization and readily available to decision-makers through automated management information systems.
3. Positive incentives for identifying real and potential problems for management attention and action.

The control phase has two steps:

2.4.1 Monitor actual vs. expected performance

Managers at all levels must monitor the progress of IT investment projects toward their projected mission benefits. Project managers will monitor their projects continuously; senior managers will require periodic reporting and project reviews. The key at all levels is to use a consistent set of objective, outcome-oriented performance measures to ensure that the right things are being measured and that problems are identified as early in the process as possible. Key questions that this step should answer are:

1. How do current cost, schedule, and performance values compare with those budgeted/scheduled? What are the causes of any variances?
2. Would we fund this project as a new start today?
3. Have new requirements “crept” into the project? Have operational needs changed since the project started?
4. Is the project still technically feasible? Is it consistent with our standards and IT architecture?
5. How does this project interact with other projects?

2.4.2 Taking action to correct deficiencies

The decision to continue, modify, or cancel an IT investment project should be a deliberate management decision, documented and justified by the review and analysis in the previous step. IT managers must ensure that operational users are fully integrated into this decision process.

2.5 Evaluation Phase:

The evaluation phase takes place after the IT project is delivered to the user and is operational. It provides the final test of whether the investment provides the promised return in value to the user and the organization. Performance measurement provides the criteria by which success is measured and the process by which these criteria are evaluated. Failure of an investment to achieve the projected benefits may require modification or termination of the project, an overhaul of the performance measurement procedures of the organization, or both.

Key Functional and Program/Project Level management tools and techniques applicable to the evaluation phase include:

1. Post implementation reviews to determine actual project cost, benefits, risk, and returns.
2. Maintaining accountability for project performance and success based on quantifiable measures and positive management incentives.
3. Modification of selection and control processes to reflect lessons learned and ensure continuous improvement.

The evaluation phase has three steps:

2.5.1 Conduct post implementation reviews

Post implementation reviews should determine the actual vs. anticipated results of an IT investment by answering these questions:

1. How effective was the project in meeting the original cost, schedule and performance objectives?
2. What operational benefits did the project deliver? Did they match the projected ones? Why not?
3. Were the operational requirements and assumptions that justified the system valid?
4. What lessons can be learned from this project?

2.5.2 Decide on adjustments

Based on the answers to the review, management must decide whether to continue, modify, or replace the operational system. The review should contain analysis of the possible alternatives with recommendations on which is the best course to provide the required operational capability to the users.

2.5.3 Identify and implement lessons learned

Using the collected results of post implementation reviews across many systems, managers can identify and correct systemic weaknesses in their organization's procedures, processes, and structure. Additional training of IM/IT personnel, improved management control systems, and more rigorous requirements definition procedures are examples of corrective actions that may be needed.

2.6 Performance measurement is critical

As can be seen above, each of these three phases of the IT investment management process depends on the definition, collection, and evaluation of effective performance measures.

The remainder of the guide will provide tools, techniques, and guidance on how to accomplish these critical tasks.

3. DoD IT PERFORMANCE MEASUREMENT OVERVIEW

This section presents the basics of DoD IT performance measurement to ensure a common understanding throughout the Department including a common definition, a common understanding of how to measure performance, and an explanation of the various IT performance measurement levels.

3.1 Definition

DoD defines IT performance measurement as:

the assessment of effectiveness and efficiency of IT in support of the achievement of an organization's missions, goals, and quantitative objectives through the application of outcome-based, measurable, and quantifiable criteria, compared against an established baseline, to activities, operations, and processes.

This definition has several important components. IT investment performance measures must be linked to an organization's missions, goals, and quantitative objectives. More precisely DoD IT investments must be linked to the organization's overall mission through the use of performance measures. Other noteworthy components of the definition are that the performance measures must be quantifiable, measurable, and compared against an established baseline.

3.1.1 Parameters of Performance Measurement

Performance measurement is the process whereby an organization establishes the parameters of performance within which programs, projects, and acquisitions are obtaining the desired results in support of mission goals. These parameters include:

- the "As-Is" or baseline condition, which is the level of performance before the current program, project, or acquisition;
- the current level of performance achieved by the project effort;
- a benchmark, which is the level of performance observed from studies of best practices;
- the target (goal) for the desired level of performance, frequently based on benchmarks; and
- the threshold, which is the level of performance below which the program, project, or acquisition is no longer achieving acceptable results.

3.1.2 Effectiveness and Efficiency

We evaluate performance by two criteria: effectiveness and efficiency. Effectiveness demonstrates that an organization is doing the right things; efficiency demonstrates that an organization is doing things optimally.

3.1.2.1 Effectiveness

Effectiveness is doing the *RIGHT* things.

- Achievement of missions and goals

- Customer satisfaction
- Quality of work

Important effectiveness questions are:

- Has the organization achieved its missions and goals?
- Are end users of its products and services satisfied customers?
- Was the work of high quality?

3.1.2.2 Efficiency

Efficiency is doing things by employing the *BEST* use of available resources.

- Quantity of work
- Cost of work
- Timeliness of delivery (schedule)

Typical efficiency measures relate to inputs, outputs, and processes, and might include the following questions:

- Do obligation rates match the annual budget?
- Was the IM/IT effort completed on time and on budget?
- How much of the product and service was produced?
- How many employees or full-time equivalents (FTEs) were required?

Evaluation of a program's effectiveness and efficiency begins with the establishment of a performance measurement baseline. Performance measures are developed based on expected outcomes, assessed against the baseline, and continually monitored to determine whether they are being achieved. Individual measures are defined and then quantified with targets and thresholds to form the performance measurement baseline.

3.1.3 Steps for Measuring DoD IT Performance

This section briefly highlights the generic steps for measuring the IM/IT performance of an organization, program, or project.

3.1.3.1 Step 1 Define mission, key result areas, and business functions

- Why does the organization exist? (MISSION)
- What major programs are performed by the organization?
- What work effort(s) support major programs?
- What are specific RESULTS produced/delivered by each work effort?
- Who are its customers?
- What are customer and provider expectations?
- What are core competencies?

3.1.3.2 Step 2 Develop mission related goals

- Are there standards/goals associated with the mission ?
- Are historic data available upon which to base goals?
- Are data accurate and reliable?

- Are performance goals realistic?
- Do performance goals represent increased efficiency and effectiveness?
- Will performance goals yield improvement in one or more Key Result Areas?
- How can we identify and adapt the best practices to improve organizational performance (i.e., benchmarking)?
- How does the approach compare to best practices in the industry?

3.1.3.3 Step 3 Generate performance measures

- What is our product/service?
- Is it measurable?
- What unit/scale of measure is appropriate?
- Which measurable criteria have meaning to whom?
- What is the performance measurement (units & equations)?
- What Key Result Area does the performance measure characterize?

3.1.3.4 Step 4 Validate and verify performance measures

- Does the measure provide useful and important information on the program that justifies the difficulties in collecting, analyzing or presenting the data?
- Does the measure address the aspect of concern? Can changes in the value of the measure be clearly interpreted as desirable or undesirable? Is there a sound, logical basis for believing that the program can have an impact on the measure?
- Does the information provided by the measure duplicate or overlap with information provided by another measure?
- Are likely data sources sufficiently reliable or are there biases, exaggerations, omissions, or errors that are likely to make the measure inaccurate or misleading?
- Can data be collected and analyzed in time for the decision?
- Are there concerns for privacy or confidentiality that would prevent analysts from obtaining the required information?
- Can the resource or cost requirements for data collection be met?
- Does the final set of measures cover the major concerns?
- Are we measuring the right things?

3.1.3.5 Step 5 Implement the performance measures and collect data

- Is the data accessible across tiers?
- Are we prepared to manage cultural change within the organization?

3.1.3.6 Step 6 Monitor and assess the results and repeat the process as needed

- Can we measure better because of our analyzed results?
- How can we improve our business processes?
- How should goals be used to improve resource efficiency and customer deliverables?
- Are current Key Results Areas adequate?
- What recommendations should be forwarded to or acted upon by appropriate tiers.

3.2 Users Of Performance Measurement Information

There is a recognition that different management tiers need different kinds of information to make business and investment decisions. Many different audiences are interested in the performance of your program, project, or acquisition. Your set of performance measures must meet the requirements of all of these audiences.

At all levels of review, managers should evaluate what they are doing and how productively they are doing it. Program problems should not be surprises. Managers want to know whether a program is on track or at risk. If a program is not on track, managers want to know that problems have been resolved and that the program will meet desired objectives.

There are three tiers or levels of performance measurement users within DoD, as shown in exhibit 3-1: As you move down, the level of performance detail increases. Measures always align upward, not top down.

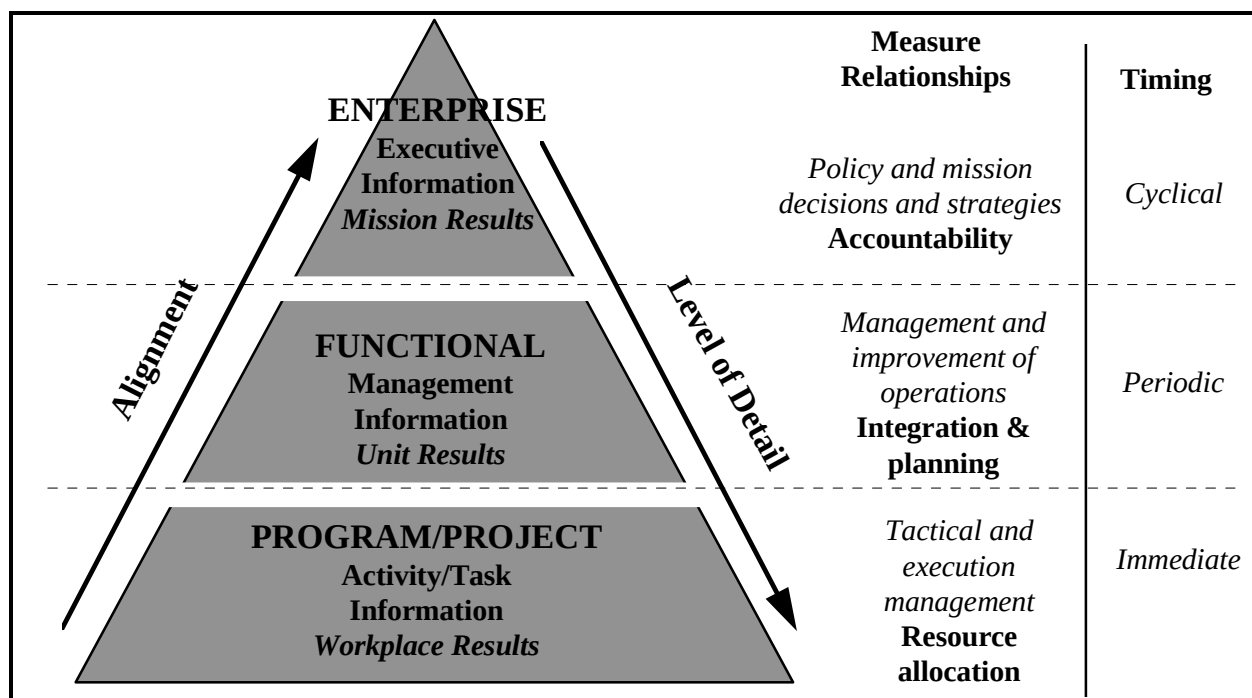


Exhibit 3-1: Levels of Performance Measurement

3.2.1 Enterprise Level.

At the enterprise level, the focus is on mission results, and information is needed to choose policy directions and make mission decisions. Managers make the connection between the IT performance measurement requirements of ITMRA and the overall organizational performance measurement required by GPRA. IT investment decisions are greatly influenced by this level during the Selection phase of the investment process. The timing for information is cyclical.

Relationship: Policy, mission decision and strategies
Role: Accountability

Timing: Cyclical

These managers are responsible for reporting and justifying the use of IM/IT expenditures to Congress, OMB, the General Accounting Office (GAO), and other external entities. Examples of these managers are senior DoD officials, such as the Secretary of Defense, the Deputy Secretary of Defense, Chairman of the Joint Chiefs of Staff, Undersecretaries of Defense, Assistant Secretaries of Defense, the heads of the Military Departments, CIO of the DoD, Principal Staff Assistants (PSAs), and the Combatant Commanders in Chief (CINCs).. At the enterprise level, leaders consider major policy questions:

- Are investments in IT yielding acceptable return on investment (ROI), including quantifiable improvements in mission effectiveness?
- Are dollars invested in IT yielding the expected results?
- Are investment priorities synchronized with overall DoD mission priorities?
- Are approved IT architectures being implemented in a timely and cost-effective manner?
- Is there a proactive oversight system to ensure benefit, cost, and schedule goals are met?
- Is the IT strategic plan explicitly linked to the functional, component, and departmental strategic plans?

3.2.2 Functional Level

At the Functional Level, the focus is on unit results where information is needed to manage and improve operations. These managers are responsible for reporting the performance of major DoD functions across multiple projects, programs, or acquisitions. They combine, synthesize and report program/project-level results for use by enterprise-level managers. This level is heavily involved in the Selection and Evaluation phases of the investment process. The program/project level serves as the Functional Level representative during the Control phase of the investment process. The timing for information is periodic.

Relationship: Management and improvement of operations

Role: Integration & Planning

Timing: Periodic

Functional-level managers include those people who report directly to the PSAs, the CIOs of the Military Departments, and the Service Acquisition Executives. These managers consider such questions as:

- Do efforts under my oversight help achieve DoD strategic objectives?
- Are funded efforts synchronized over time? For example, if Project A feeds into Project B, are they properly resourced and on schedule to achieve proper integration?
- Are best practices and lessons learned being applied across all programs?
- Are related, functional efforts, such as functional process improvements or infrastructure investments, resourced properly and linked to outputs of my IT project?
- Are performance measures being tracked and put into reports that reflect DoD performance required by Congress?

- Do mission support processes, such as business process reengineering (BPR), migration systems, and data standardization, support effective accomplishment of the DoD mission?

The functional level is also where the interests of the IT user community are directly represented. It is at the functional level that requirements of the users of IT systems are approved, documented, funded, and provided to the program/project level for execution. The functional level, in concert with the users, is also responsible for conducting post-implementation assessments of IT investments' operational capabilities, to ensure that the expected functional benefits of an investment are actually realized. This post-deployment assessment is crucial to ensuring that the linkage between IT investments and organizational performance is maintained.

3.2.3 Program/project level

At the program/project level, activity and task information is critical to make tactical decisions and execute management decisions. Managers are leading programs, projects, or acquisitions that are sponsored by functional-level managers. These managers are involved in the accomplishment of actual IM/IT efforts. The program/project level addresses the expected outcomes and results of IT investments. This level involves the collection of information concerning the outcome/result of the IT investment's performance and the comparison of this performance against the established baseline for that investment. Program/project level measures are combined, synthesized and reported to the functional level. This level serves as the representative of the Functional/user level during the Control and Evaluation phases of the investment process. The timing for information is immediate.

Relationship:	Tactical and execution management
Role:	Resource allocation
Timing:	Immediate

These managers consider such questions as:

- How does my effort contribute to my sponsor's strategic and tactical objectives?
- Is my effort within budget?
- Is my effort on schedule?
- Is my effort meeting the specified functional and performance requirements?

It is possible for an individual to act in the capacity of multiple levels. For example, an individual whose primary responsibility is program management of a functional area may, at various times, actually lead a project. In managing a particular IM/IT program, project, or acquisition, the individual is working as a project manager.

Exhibit 3-2 illustrates the reporting relationships among the external oversight agencies and the enterprise, program, and program/project levels. Guidance related to expected results flows down the chain of command to the project managers who are responsible for execution of individual IT initiatives.

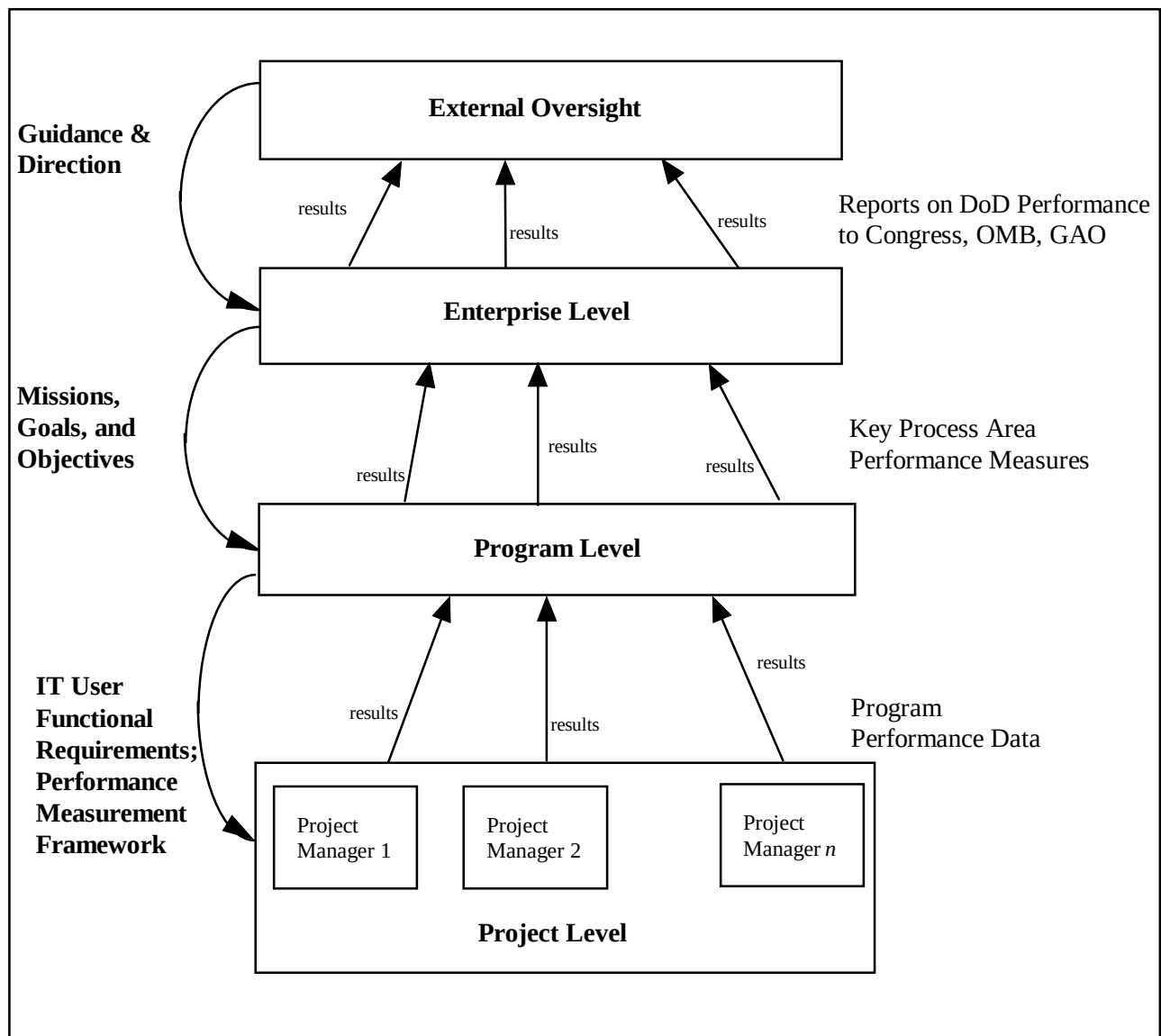


Exhibit 3-2: Reporting Requirements

Most performance data are collected at the program/project level. Program/project-level managers use performance measures to make decisions for their program, project, or acquisition. The program/project-level managers then provide data on their programs to managers at the program level. Functional-level managers collect and, in some cases, summarize the program/project-level results to make managerial decisions across programs, projects, or acquisitions within a functional area. Functional-level managers provide reports and recommendations to the enterprise managers, who use the information to make strategic decisions.

Enterprise managers then report the information to Congress, stakeholders, and other external oversight interests, such as OMB and GAO, as a basis to justify future IM/IT investments.

4. PERFORMANCE MEASUREMENT AT THE ENTERPRISE LEVEL

This section contains guidance for developing and using performance measures at the enterprise level . The approach used within DoD focuses on these five key principles:

Establish Hierarchies of Goals. GPRA and ITMRA requires clear organizational hierarchies of goals and performance measures be established. To comply with the spirit and intent of both laws, the goals and measures used at lower organizational levels should be linked with DoD's mission/strategic goals. Research has indicated that without clear hierarchically linked goals and performance measures, managers and staff throughout the organization lack straightforward roadmaps showing how their work contributes to attaining organizational strategic goals. If an IT investment does not measurably improve agency mission performance (no matter how well the program met its cost and schedule baselines or output and performance indicator measures) that investment should not be made.

Measure Goal achievement. Measures are applied at many levels. A few well-chosen, outcome-oriented measures are better than multiple, potentially conflicting, suboptimal measures.

Empower the field. Empowerment means making the factors for incentives and disincentives of actions and decisions visible. Performance measures allow managers at all levels to measure performance and compare actual results against stakeholder expectations for local use.

Find Trend Indicators. Indicators will be selected to measure progress towards a particular goal. The user should be able to graph value with respect to time for quality, quantity, etc., illustrated below. Each value is represented as a "high-low-most likely" to represent the range of responses. Note that completion of an action is not a trend.

Measure Outcomes. Measures are typically categorized as input, output, and outcome. Input measures are relatively easy to quantify and capture, e.g. resources, requests, students, etc. Output measures can be quantified for organizations with formal product and service descriptions but difficult for those with more abstract mission statements. Outcome measures of the vision or stakeholder satisfaction with products and services are multi-dimensional and hard to identify and quantify. However complex, only outcome measures are considered worth pursuing at the enterprise and functional levels.

Engage Stakeholders. Stakeholders have to be defined at each organizational level and include the following:

- customers and suppliers - current and future
- employees and support contractors - current and future
- higher order management - e.g. headquarters, OSD, OMB, Congress
- subordinate management - e.g. headquarters-field, OMB-OSD, OSD-MILDEPS, etc.

4.1 The IT Strategic Plan

Performance measurement at this level starts with the IM/IT Strategic Plan. This defines the mission, goals, and objectives of the organization and how IM/IT programs and initiatives support the accomplishment of these. Depending on the size and mission of the organization, these goals and objectives can be quite broad, and performance measures must be developed and used very carefully to be truly objective and meaningful.

4.1.1 Mission Statement

The first step in defining IM/IT performance measures at the enterprise level is to define the mission of the IM/IT function within the organization. This is usually derived from these sources:

1. The overall mission statement of the organization.
2. Policy directives and guidance from the organizational leadership.
3. External sources (legislation, OMB directives, etc.)

An example is the DoD IM/IT mission statement:

“Provide the right information, at the right time, to the right destination, in a form that users can understand and reliably use to accomplish their objectives.”

This is an exceptionally broad mission statement, because of the extensive scope of the DoD IM/IT function and the organizational structure of DoD. Smaller organizations with a greater focus on specific IM/IT functions will have more specific and narrow missions.

4.1.2 Goals

From the mission statement the strategic planner defines specific goals that must be achieved in order to accomplish the stated mission. These goals are at the next lower level of detail from the mission statement, and may be organized according to the organizational structure (each goal representing a subordinate element’s IM/IT mission), by functional area (how IM/IT will support specific aspects of the organization’s functions), by specific IM/IT functions (infrastructure, security, communications, etc.), or by a combination of these. The key is to ensure that each goal directly links back to the overall IM/IT mission and to the overall mission of the organization.

At this level, all goals should be outcome, rather than output-based. Only those organizations with very narrowly defined missions as providers of services and products can effectively define performance purely in output terms. For each goal, therefore, a measurable outcome must be defined.

Examples of goals and their outcomes at the DoD level are:

Goal 1: *Improve effectiveness and reduce the cost of meeting military missions and performing supporting business functions.*

Outcome: *All DoD organizations are accountable to stakeholders for cost and performance*

Goal 2: *Establish and manage an integrated global, secure, affordable, and common infrastructure.*

Outcome: *Users and using commands get information technology services to satisfy their requirements, easily and in a timely manner, anywhere in the world. Infrastructure planning ensures that long lead time items, capacity, facilities, and contracts, are available when needed.*

Goal 3: *Ensure the warfighters and those who support them have access to accurate, high quality, timely, and relevant information.*

Outcome: *Users get information they can understand and quick assistance to resolve problems; suppliers can easily make information available,.*

Goal 4: *Assure: (1) the information infrastructures on which DoD's operations depend are protected against exploitation, disruption, and denial of use; and (2) that best practices and procedures are used to protect and defend systems, to include provisions for continuity of operations and the restoration of critical services.*

Outcome: *Users can get authentic, accurate information, and DoD information systems and resources are protected against information warfare, terrorist, and criminal activities. There are risk mitigation provisions for restoring critical services and systems in a priority manner.*

4.1.3 Objectives

Objectives carry the process down to the next level of resolution. They are defined in terms of specific, quantifiable, and measurable outcomes that contribute directly to the achievement of the organizations' IM/IT goals. Objectives may be tied to a specific IM/IT initiative or program, a specified level of compliance with standards, or preferably, a measurable improvement in functional effectiveness or efficiency.

4.2 Identifying Outcome Performance Measures

Having defined mission, goals, and objectives, the next step is to identify the performance measures that will define accomplishment of each. Each performance measure has to answer the following questions:

- What is the purpose of the measure?
- Who measures and how?
- Who uses it and for what?
- What is the cost of measure vs. value to the user?
- What tools and assistance are available to collect and use measurement data?
- What special provisions must be considered?

4.2.1 Purpose of the measure.

The purpose of any performance measure is to assess the accomplishment of the associated objective. For example, an objective stated in the DoD IM/IT Strategic Plan is to:

“Improve IT Acquisition through streamlined contracting, increased use of COTS to shorten acquisition cycle, and more effective reutilization of IT assets.”

Some appropriate performance measures associated with this objective would be:

“Average contract award time for DoD IT acquisitions(in months after RFP release).”

“Percentage of DoD IT acquisitions requiring use of COTS.”

At the enterprise level, it is best to select measures that can provide an indication of long-term or systemic trends within the organization.

4.2.2 Who measures and how?

Which offices and activities will collect, analyze, verify, validate and track data for performance measurement? What is the measurement strategy and methodology? Section 8 lists a number of performance measurement methods that are readily adapted at the enterprise level.

4.2.3 Who uses the data and for what?

Who within the organization will receive the performance measurement data and what will they do with it? What internal reporting mechanisms are in place to handle the data? What are the external reporting requirements?

4.2.4 What is the cost of measure vs. value to the user?

A cost-benefit analysis must be applied against any proposed performance measurement system. If the costs of collecting and analyzing the data exceeds the benefit to the organization, the measure should not be used, unless it is mandated by a higher authority. Similarly, the benefits of the performance measurement effort must be apparent to those performing the data collection and analysis in order to ensure accurate and complete data is reported.

4.2.5 What tools and assistance are available to collect and use measurement data?

What automated tools are available for the performance measurement effort? What, if any, existing data collection and reporting systems are already in place that can be use or adapted to meet performance measurement needs. What specialized training is needed and is it available within the organization?

4.2.6 What special provisions must be considered?

Are there any unusual constraints or requirements on the effort? For example, a National Security System (NSS) IT project may have security constraints that affect how performance measurement data can be collected and disseminated.

5. PERFORMANCE MEASUREMENT AT THE FUNCTIONAL LEVEL

5.1 Identify IT Effort and Its Mission and Objectives

5.1.1 Analyze Guidance

Performance measurement at the functional level begins with analysis of the organization's higher headquarter's mission, functional strategic plan(s), IT strategic plan and other related guidance. From these sources, functional managers and commanders at the functional level determine their organization's mission and objectives and how IM/IT activities and initiatives support them.

5.1.2 Analyze Functions and Processes

Having identified their functional goals and objectives, and the relationship to IM/IT activities, functional-level managers must analyze the functions and processes their organizations perform to determine what adjustments must be made. An effective process for accomplishing this analysis is through business process reengineering (BPR).

Through BPR, the organization clarifies its goals and objectives, analyzes its functional processes in light of their contribution to organizational success, and systematically redesigns and streamlines those processes, and the supporting organizational structures and information systems to achieve the desired goals.

ITMRA specifically requires that BPR or a similar analysis/redesign process be done before any new IT initiative is funded. There are a number of government and private sources providing information and assistance with BPR; the DoD BPR World Wide Web (WWW) Page (<http://137.246.33.239/links.htm>) provides access to several of the most useful.

5.1.3 Identify Requirements for IT Initiatives

As a result of the functional process analysis and reengineering efforts through the organization, requirements to modify, replace, or add information technology systems will be generated. These requirements will flow up from the functional user level, the level which will actually use the required IT, to the appropriate approval authority, depending on the scope and cost of the requirement.

5.1.3.1 Mission Needs

Broad operational needs are first identified in a Mission Needs Statement (MNS) or similar document that describes the functional mission deficiency, discusses the analysis performed to support the deficiency, explains why process redesign or other non-materiel solutions are inadequate or not preferred, identifies possible alternative solutions, and lays out key operational constraints and conditions. The user must begin the performance measurement process here, by identifying a very high level, quantifiable outcome measure for each broad operational

requirement defined in the MNS. Projected cost and schedule requirements are also identified at this stage as a basis for further development.

5.1.3.2 Operational Requirements

As the requirements are further refined and developed, the broad operational needs defined in the MNS are translated into specific performance requirements in the Operational Requirements Document (ORD) or its equivalent. (The ORD is defined in Appendix II, DoD Regulation 5000.2-R.) The ORD breaks down the broad requirements of the MNS into the specific functional capabilities required to obtain the desired end result. It also expands the scope of the requirement to include logistical support and maintenance requirements, human factors engineering, standardization, interoperability, and commonality, etc. For each requirement identified within the ORD, the user must work with the program/project manager to identify an outcome measure and associated target and threshold parameters: the threshold being the minimum acceptable performance required to meet the mission need; the target being the ideal or desired performance. Careful and accurate definition of these terms is crucial to establishing effective measurement of performance.

5.2 Identify Links to Enterprise Mission and Strategic Goals

A key point in ITMRA is the requirement that all IT investments must be explicitly linked to supporting organizational missions and strategic goals. At each level of the process, managers must ensure that their goals and objectives directly support the accomplishment of these higher-level priorities. In many cases, the linkage will be obvious, but as the definition of requirements becomes more detailed the links may become vague or lost altogether. A conscious, focused effort must be made at each stage of the process to identify and document the relationship of each requirement to the accomplishment of a higher-level goal or objective. This is a key step in building the business investment case needed to obtain funding.

The use of the Work Breakdown Structure (WBS) provides a useful tool for managing this process and ensuring that these linkages are maintained and documented. DoD Regulation 5000.2-R mandates the use of the WBS as a tool for managing performance measurement for major acquisition programs; it is easily adapted to an overall organizational approach to defining and linking mission, goals, and objectives at every level of the organization.

5.3 Define IT Effort Baseline and Develop Performance Measurement Framework

5.3.1 IT Effort Baseline

At the functional level, IT managers are concerned with measuring performance across multiple IT projects and initiatives and relating that performance to their functional missions goals, and objectives and to the strategic objectives of the larger organization. Development of the baseline for a functional-level IT effort requires these steps:

1. Identify and document all IT investments and their contribution to the organization's mission goals and objectives

2. Define and document the functional outcome requirements for each investment.
3. Identify/develop performance measures for each requirement.
4. Determine performance measures' targets and thresholds.

5.3.1.1 Identify and Document IT Investments

IT investments are proposed or existing systems, functions, or processes that use information technology to support or accomplish an organization's mission. Examples of IT are the data warehousing systems that support a personnel center, the Combat Information Center on a warship - this would be a National Security System (NSS) IT investment, the IT that supports an air traffic control system, or the office automation suite that support a staff office in the Pentagon. A less obvious examples is an initiative that does not involve buying new technology *per se*, such as a systems migration program.

Functional-level managers must take stock of their current and proposed IT investments and carefully review and document how each links to mission accomplishment or compliance with a higher-directed goal or objective. Where the link is absent or is vague, the investment must be considered for termination or redesign.

5.3.1.2 Define and Document the Functional Outcome Requirements

The functional requirements for IT systems should be completely reflected in their respective mission needs statements and operational requirements documents. For fielded systems, a review and comparison of the original requirements must be made in light of changed missions and differences in operating environments. Requirements that were critical five years ago may now be irrelevant to the organization's current needs. Where requirements have changed, managers must assess the need for modifying or replacing the affected system, or simply revising the measurement criteria.

For non-material processes and functions, requirements are usually more loosely documented and less clearly defined. Managers should apply the same scrutiny to existing investments that they would for new ones. The questions that must be answered are:

- How does (or would) this investment support my mission?
- What are the desired outcomes of this investment?

Functional area objectives may often be found in the functional economic analysis (FEA) or the results of a BPR project. The FEA may also contain find benchmark, target, and current estimates for the objectives.

For example, DoD would like to decrease cost and cycle time for providing goods and services to the warfighters. The functional user should know the current or baseline cycle time for filling a part requisition. They could conduct a benchmarking study of the best practices of the private sector or other government agencies to determine the achievable cycle time. Benchmarks give a perspective on the functional area's alignment with comparable measures in comparable organizations.

Benchmarking is a method of obtaining values that are based upon the best practices of industry or other government agencies. Benchmarking is defined as searching for the best practices leading to superior performance. In *The Benchmarking Workbook: Adopting Best Practices for Performance Improvement* (1991), author Gregory H. Watson describes performance benchmarking as “the analysis of relative business performance among direct or indirect competitors.” *The Benchmarking Workbook* recommends a process that involves planning, searching, observing, analyzing, and adapting to gain improvement in business practices.

The functional area ROI is associated with the benchmark and target values for the functional objectives. ROI can be computed to answer the question of what did I or what will I get for the investment. ROI is the ratio of the present value of the benefits achieved over the life cycle of an IT investment to the present value of the investment cost over the life cycle of an IT investment. Consult the *OSD (PA&E) Automated Information System (AIS) Economic Analysis (EA) Guide*, PA&E, 1 April 1995 for more information concerning ROI.

Many projects are initially approved using an estimation of ROI. Maintaining this ROI depends on program efficiency and effectiveness. If either part of the equation changes, the ROI should be recalculated to ensure that it is still above the minimum target for justifying the investment.

The initial ROI value is normally calculated as part of a FEA that reflects the functional area’s strategic planning and BPR activities. After a baseline ROI is established, current ROI estimates are calculated during program execution as costs and benefits become more certain. ROI should be tracked to ensure that the continuation of the effort still makes sense.

5.3.1.3 Identify/Develop Performance Measures for Each Requirement

The accomplishment of functional missions and goals (mission benefit), not completion of individual projects on time and within budget, is the most important measure of success for any IT investment. How a specific investment contributes to mission accomplishment will vary, but will typically fall into the categories of efficiency or effectiveness.

- Efficiency benefits result from improved operations and are the benefits typically identified with the system, such as cost reductions through reduced staffing, lower overhead, etc.
- Effectiveness benefits reflect the value added to the user and to the organization or the organization's clients (e.g., more timely response to inquiries). These benefits are service improvements not provided by the status quo.

Cost and schedule measures are highly interrelated with benefit measures through the required linkage of dollars or time to the achievement of a particular performance result is achieved. Typically, the following cost and schedule data are measured for IT investments:

1. Return on Investment (ROI).
2. Current project funding support.
3. Value of benefits(\$ value).
4. Projected project costs.
5. Rate of budget expenditures compared to projections.
6. Adherence to baseline schedule/time-frame.

The Earned Value Management approach (section 8.11) provides an effective mechanism for linking cost, schedule, and benefits performance for acquisition programs.

5.3.1.4 Determine Targets and Thresholds For Identified Performance Measure

For each identified outcome performance measure the program/project manager and user must define a target and a threshold value. The target is the desired outcome or value for the level of performance; the threshold is the level of performance below which the investment is no longer achieving acceptable results. Targets and thresholds can be developed from these sources:

- Observations or studies of best practices (benchmarking).
- Values mandated in the requirements documents.
- Historical data (if available).
- Standards and requirements imposed by higher authority.

Establishing target and threshold values of performance measures requires analysis of existing data or the initiation of data collection efforts.

Primary sources of target and threshold values are the requirement documents, user strategic and tactical level plans, values from existing system performance (if the investment is for a migration or replacement system, and DoD policy documents, such as the DoD 8000 series, DoD 5000 series, MIL-STD-498.

5.4 Validate Feasibility of IT Performance Measures

Once an IT effort baseline is developed, each performance measure must be evaluated to ensure that its collection, verification, and validation are possible and that collection is cost effective. The best performance measures are outputs from the measured process. Measures that are natural results of work performed are less expensive and more accurate.

Three major issues must be addressed:

1. What data are necessary for calculation of the performance measure, when are the data collected, and who collects the data?
2. How will results be verified and validated?
3. What is the cost of the data collection?

5.4.1 Identify Data Required to Calculate the Performance Measure

Frequently, many pieces of data are necessary to calculate a measure. It is helpful to define data components to clarify the required data. For example, at a minimum, ROI consists of both a return and investment component.

Identify all data necessary to calculate the performance measurement, when the data will be collected, and who will collect the data.

5.4.2 Identify the Verification and Validation Strategy for the Data Collection

Verification and validation of measures are critical. It is important to have confidence in the measures reported. Identify a method to ensure the quality of the information that is reported. For example, developmental and project testing will provide insight into operation after the system is fielded. The testing provides the opportunity to gather and analyze preliminary data.

5.4.3 Identify the Collection Cost

Determine the administrative burden of collecting the measure (in hours or dollars). For example, if the measure is captured in a standard generated report, the costs will be relatively low, perhaps a half hour to obtain the report and extract the necessary information. However, a measure that requires information from several sources and subsequent compilation or only exists in a raw form may have higher costs.

5.4.4 Evaluate Performance Measurement Feasibility

The answers to these three issues determine whether the performance measures can be used effectively. If any measure is not feasible, it must be excluded from the performance measures set. Different measures or a different collection strategy should be sought.

5.5 Finalize IT Effort Baseline and Performance Measurement Framework

The IT Effort baseline should contain a complete set of feasible performance measures that are linked to the IT effort's mission and objectives. The baseline must now be finalized by obtaining stakeholders' approval and by establishing the framework that will provide the needed data for progress or performance evaluation. Managers must ensure that measures gauge the expected outcomes from the stated requirements.

The activities involved in this step include the following:

1. Ensure set of performance measures is measuring the right thing.
2. Ensure set of performance measures has the right measures.
3. Gain consensus for the performance measurement baseline.
4. Establish data collection efforts to obtain periodic values of the measures in the baseline

5.5.1 Ensure Performance Measures Are Measuring the Right Things

- *Does the set of measures address improvement in performance of objectives?*
 1. Are all objectives covered by at least one measure?
 2. Does set of measures indicate how well your effort achieves those objectives?

The second component requires evaluation to determine whether collecting the set of performance measures will indicate continually improving performance.

- *Does the set of measures use a small set of significant performance measures that provide a clear basis for assessing accomplishment, facilitate decision making, and focus on accountability?*
Ensure the performance measures set is as small as possible to gauge the accomplishment of objectives, support any directed data collection, allow management to make informed choices, and focus on accountability. It is better to have few measures that are highly managed than a large set of measures that are not used.
- *Do the measures assess the “value-added” contribution made by the IT investment?*
Ensure that the measures can capture the non-IT benefits of IT investments. Examples of these types of measures include reductions in cost to perform the function, increased satisfaction levels for the functional area’s customers, or decrease in the lag time between requests and delivery of service.
- *Do the measures capture the requirements of internal and external customers?*
- *Does the set of measures address the internal performance of the IT function?*
Ensure that the set of measures captures the effectiveness and efficiency of the IT function itself. Examples of potential measures include adherence to budgets and schedules or technical performance criteria such as response time. IT investments are intended primarily and foremost to return benefits to the functions that utilize IT. Internal IT measures are only meaningful if the IT effort has external benefits.
- *Does the set of measures address the benefits, costs, and schedules?*

5.5.2 Ensure Set of Performance Measures Has the Right Measures

- *Are MNS and ORD measures linked to a clear outcome (results rather than inputs or outputs)?*
Ensure that measures gauge accomplishment of outcomes, results, and benefits rather than inputs and outputs. Input and output should be developed later by the program/project manager and the user to define test and acceptance parameters.
- *Is the set of measures understood at all levels that have to evaluate and use the measures?*
Do the measures support effective management decisions? Do performance measures communicate achievements to internal and external stakeholders?
- *Is the set of measures effective in prompting action?*
It is better to measure areas that are "actionable," which refers to areas where performance has the possibility to change the outcome.

- *Is the set of measures accurate, reliable, valid, verifiable, and cost effective?*
Ensure that measures produce an accurate, reliable, valid and verifiable indication of mission success. Make sure that the set of measures is built on data that are available at reasonable cost, appropriate, and timely for the purpose. Do not create artificial measures as a separate reporting item that are not otherwise monitored internally.
- *Does the set of measures include, along with long-term measures, short-term measures or goals that show interim progress?*
Include short-term measures or goals that allow for demonstration of progress and provide a performance-motivating or performance-sustaining achievement factor.

5.5.3 Gain Consensus for the IT Effort Baseline and Measurement Framework

The baseline document should create a formal agreement among the requiring activity, the IT manager and the next higher level of oversight, including the CIO and CFO or their functional equivalents. As a last step, it is useful to gain consensus from all stakeholders that the baseline targets will satisfy the existing needs. Once established, the baseline should be placed under configuration management to ensure that all stakeholders agree to any changes to the baseline.

For each IT investment, the functional-level manager should initiate the Investment Baseline/Performance Agreement (see Appendix A) by defining the following data elements:

1. The mission goals of the functional area supported by the proposed investment.
2. The current operational capability.
3. A listing of the enhanced functional capability requirements.
4. For each requirement, the associated expected outcome measures.
5. An evaluation of how closely the investment supports the organization's strategic goals.
6. A definition and assessment of the risks and benefits associated with the investment, including those incurred if the project is not done.
7. The approach for conducting a post-deployment assessment of the operational benefits and capabilities of the proposed investment.
8. The projected cost and schedule for the investment.

Once this information is determined at the functional level, and the investment is approved for execution, the remainder of the Investment Baseline/Performance Agreement is negotiated with the responsible program/project-level office and put into its final form. Section 6 describes this process.

5.5.4 Determine How to Collect, Analyze, Verify, Validate and Track Data

A final consideration is to determine whether mechanisms are in place to generate the data that are needed to measure progress towards goals and to determine whether the effort is within threshold values.

6. PERFORMANCE MEASUREMENT AT THE PROGRAM/PROJECT LEVEL

This section describes the steps necessary to develop and manage the Investment Baseline/Performance Agreement for an IT program or project. Baseline development is used to measure progress from the current position of a program, project, or acquisition toward future goals. Measurement against this baseline can also be used to gauge program stability and control.

Section 3 identified the three levels (enterprise, functional, and program/project) interested in IT performance measurement. Now, we need to address the information needed to provide these groups with the basis to develop their baseline, measure performance, and analyze results.

The information necessary to support all three levels of interest has to be generated and captured during the development and implementation of the IT project. The key information will link the project's requirements and results back to the overall goals and objectives of the DoD.

In addition, performance measurement will capture the program/project-level performance information related to how well the project is being executed -- is it on time, within cost, meeting milestones and requirements, and providing the anticipated benefits of the specific project?

What is the key information needed to support the enterprise and functional levels of the organization? In most cases this information is different from what would be needed just to run a project and consider it a success. This information provides the frame of reference to see the results of the project on a larger scale - how does it help improve the department's operations; how do the results compare with industry best practices; how does it support the overall approved technical architecture?

To answer these questions, the project leader, in coordination with the user, has to ascertain that the essential information is available. This information includes:

- the baseline information for the functional area/activity that the project is supposed to "improve" the baseline for the functional area is termed the "external" or functional baseline;
- the best practices benchmark (if appropriate) for the functional area/activity that the project is supposed to improve;
- the approved project targets for the functional area/activity, which are the basis of the project's existence (what it should deliver in terms of functional results);
- the timelines for achieving the functional results; and
- the ROI the project is supposed to deliver in functional improvement (and the timeline for achieving the ROI).

The functional baseline's benchmarks and project targets must be defined in measurable terms. The functional area must be defined in such a way to provide the key cost, time (absolute or cycle time), quality, and results/performance/customer satisfaction measurements. These quantified definitions must be recorded for the baseline (start) position, the benchmark (best practice) position, and the project target position (project requirements driver).

The project manager must work with the sponsoring user to track the results of the project in the same quantifiable functional terms. It is not enough that a project is executed on time, within costs, and meeting prescribed project requirements. The evaluation of the project must also include the assessment of the results of the project on the larger functional environment and how those results support DoD strategic plans.

There are four major steps in developing project performance measures (the internal baseline):

1. Identify the IT project, its mission and objectives, the external, functional baseline, the benchmark (if appropriate), and the project target positions.
2. Define baseline performance measures.
3. Validate feasibility of performance measures.
4. Finalize performance measurement baseline and define a methodology to track "external" project results.

It is impossible to overstate the need to incorporate the functional user in every step of this process to ensure that mission accomplishment remains the focus of the project. DoD Regulation 5000.2-R dictates the use of integrated product teams (IPTs) that include all affected functional areas for major acquisition programs; the approach is an excellent one at every level.

What follows is a roadmap for constructing a tailored performance measurement baseline for an IT project. The procedures involve answering a series of questions and recording the answers on the provided worksheets. Exhibit 6-1 presents an overview of the major steps in this process. The rest of this section provides greater detail on the set of activities within the process.

A performance measurement baseline consists of two major components: the performance measure itself, and the threshold and target values for the performance measures. The measures within a baseline will depend upon whether the baseline is project (internal) or functional (external).

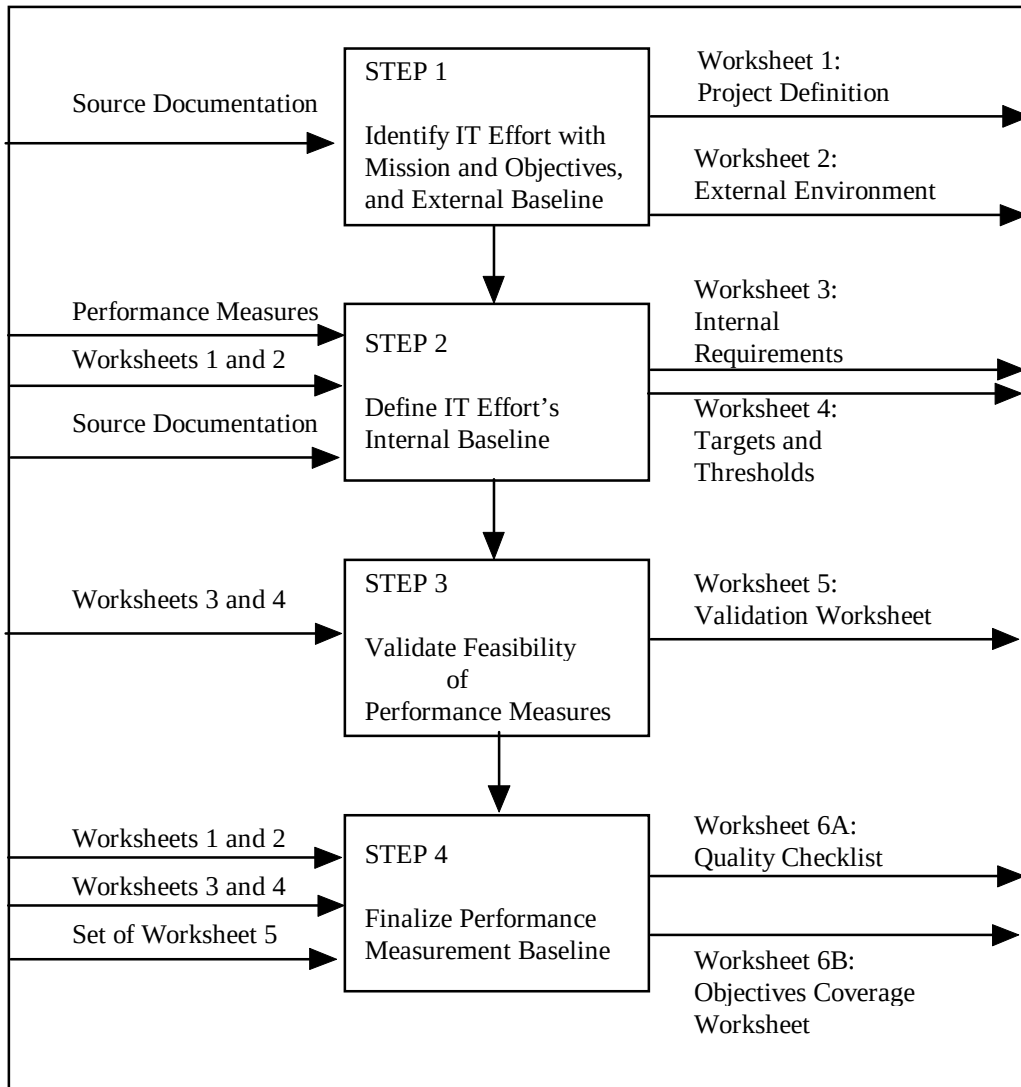


Exhibit 6-1: Procedures

6.1 Identify IT Project and its Mission and Objectives

Identifying the IT effort with its mission and objectives and the external functional baseline is the most critical step in the process of creating an internal performance measurement baseline. This step is critical to measuring performance based on the ability of the effort to successfully complete its mission and reach its objectives. With a clear understanding of why the effort exists (mission) and must accomplish to obtain the desired results (objectives), and the external frame of reference for the functional area, it is possible to assemble a set of performance measures that track the progress of the project and functional area.

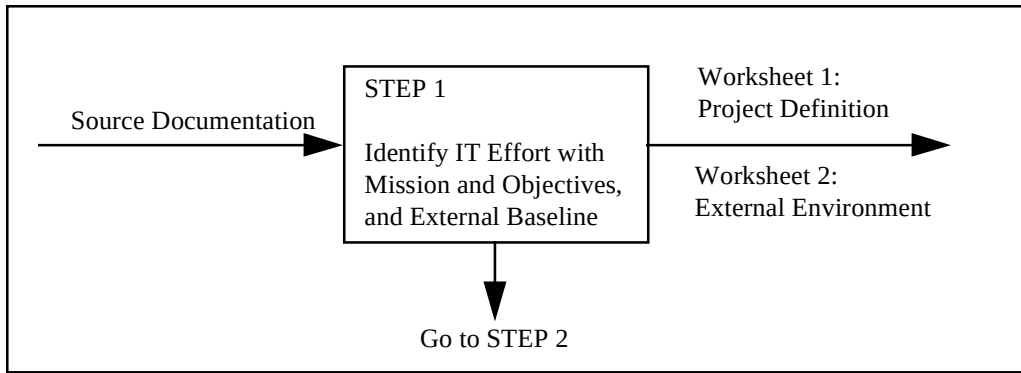


Exhibit 6-2: Step 1

This step requires answering the following questions:

- What is the project? (What is the project name; Who are the users and customers?)
- What is it doing? (What kind of project is it and what are the work efforts?)
- Why is being done? (What are mission and objectives?)
- What is the external environment? (What are the functional objectives?)

Use Worksheet 1 (Project Definition) in Exhibit 6-3 for recording the answers to the first three questions and Worksheet 2 (External Environment) in Exhibit 6-6 for answering the last question.

Worksheet 1: Project Definition	
Project Name:	
Project Leader:	
Customers:	
Project Type:	
Work Efforts:	
Mission:	
Objectives:	Source:
1. 	
2. 	
N. 	

Exhibit 6-3: Worksheet 1 (Project Definition)

6.1.1 Identify the Project

Record the project name and project leader.

Direct project customers are likely to be the offices that fund the effort. They also have expectations for what they will receive in return. Indirect customers may include personnel who are affected by the effort. Examples of indirect customers are users of a new system or implementors of processes and procedures, such as BPR or data standardization. Record both customer types on the worksheet.

When thinking of customers, project managers should determine what their expectations are from the project effort. There should be a direct relationship between their expectations and the objectives identified in later steps.

The project type defines the effort as a system development, a migration project, or other type of IT investment.

The work efforts are the specific tasks to be accomplished by the project.

6.1.2 Identify the Mission

The purpose of any IT effort should translate into a statement of mission describing benefits of the effort. Consider what outcomes are expected from the project. The contribution to the DoD mission should be clear.

Record answers on Worksheet 1 along with the source for the mission. The requiring activity should be the primary source for the mission statement, from the MNS, ORD, and functional area strategic plan.

The following example illustrates the above:

The System X Project is developing an open-standards-based system. System X is in the middle of development. The Mission Need Statement (MNS) for System X provides an introductory paragraph which states that System X “will provide the X managers the ability to reduce costs by Y% while reducing processing time by Z weeks, and to raise customer satisfaction as measured by numbers of repeat customers.” In addition, System X will be based on open standards. It will use standardized data. A Departmental memorandum also states that to succeed, System X must interface with other project AISs to provide timely updates of an executive information database. From this and other documented information, a mission is derived declaring that “the System X Program will deliver an open, standardized system providing timely and concise decision information to Departmental decision makers through the extraction of project data.”

Exhibit 6-4: Mission Example

6.1.3 Identify Objectives

Next, identify the objectives of the effort. Objectives are measurable outcomes that are critical to the accomplishment of the IT effort's mission. The objectives are the primary source of the measures that will be included in the baseline.

The user or requiring activity should provide project requirements, statements of need or effectiveness, or other descriptions of what the effort must achieve to be successful in the initial Investment Baseline/Performance Agreement. Developing objectives is an iterative process that distills a variety of information into a set of measures that can be used to determine status and progress. It is imperative to state objectives in a measurable manner.

After reviewing the worksheet, it should be possible to construct a list of objectives that are critical to accomplishing the project's mission. The identification of customers addressed in the first question and their expectations from the project should translate into specific objectives. Any IT effort probably has multiple customers. It is likely that beyond the obvious results, there are additional performance expectations that are less obvious.

Specific work efforts may involve contracted efforts that have SOWs along with required deliverables. The SOWs and their deliverables should be mapped into the objectives.

Record objectives on the worksheet as they are formulated, along with the sources of information used. These sources will be useful in developing numerical targets and threshold values for the measures that are based on the objectives. Ensure that project objectives on Worksheet 1 align with functional area objectives on Worksheet 2.

The following example illustrates how to identify IT effort objectives:

The results expected of System X are distributed throughout the programmatic and system documentation. The MNS and Functional Description for System X directly state the desired results from the system. A partial list of the desired results from System X includes:

- increase in the population served, 100,000 in fiscal year 1995, by 30% to a population of 130,000 by the end of fiscal year 1998*
- decrease the training costs of system users from \$1,000 per person per user in fiscal year 1995 by 25% to \$750 per user by end of fiscal year 1998*

Exhibit 6-5: Objectives Example

These examples of desired results meet the criteria for quality objectives. Each of these is results-oriented, measurable, and supports the DoD mission with regard to effective and efficient personnel management.

6.1.4 Identify the External Environment

The information required to complete Worksheet 2 (External Environment), illustrated in Exhibit 6-6, should be provided by the sponsoring functional-level organization in their proposed

Investment Baseline/Performance Agreement. Use this input and any supporting documentation to clearly identify the functional objectives that the project supports. Record answers on the worksheet along with the name of the director and title of the sponsoring office or organization.

Worksheet 2: External Environment				
Functional Area: _____				
Project Sponsor: _____				
Functional Objective:	Baseline Value	Benchmark Value	Approved Target	Revised Estimate
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
Return on Investment:				
Functional Economic Analysis:		_____	Date: _____	
Current Estimate:		_____	Date: _____	

Exhibit 6-6: Worksheet 2 (External Environment)

6.2 Define IT Investment's Internal Performance Baseline

Once the project manager has identified the project type and objectives (the critical results that must occur to accomplish your mission), performance measures are selected that track the accomplishment of your objectives. The activities involved in this step are as follows:

- 1) Identify performance measures.
- 2) Determine performance measures targets and thresholds.

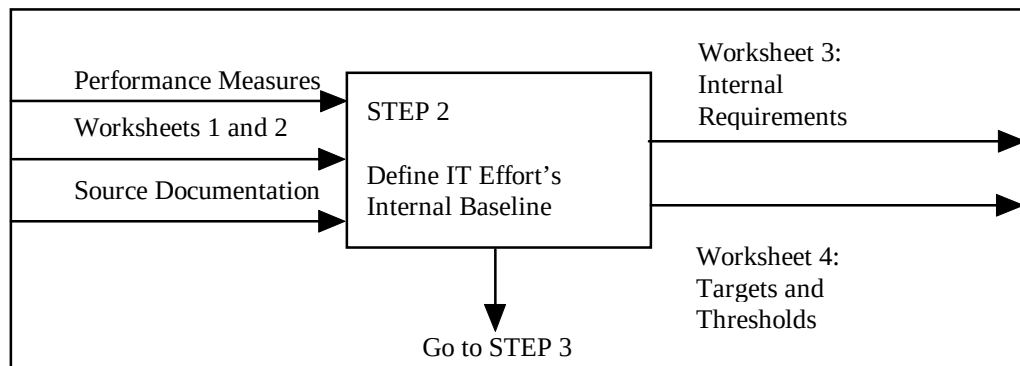


Exhibit 6-7: Step 2

6.2.1 Identify Performance Measures

Performance measures selected for the baseline should be critical to the accomplishment of the effort. Consider the specific nature of the project, the objectives identified in Step 1, and all available source documentation. Add additional performance measures to Worksheet 3 that specifically address objectives in the areas of benefits, cost, and schedule.

Worksheet 3: Internal Requirements	
Project Type:	
Name:	Definition and Source:
1. ROI	ROI of project taken from the economic analysis for the Milestone II review.
2. Funding	Funding in support contained in Exhibit 43.
3. Standards	Degree of compliance with prescribed architecture(s).
4. Standard Data	Number and percentage of data elements in data model that are standardized data elements from the DoD Data Dictionary System (DDDS).
5. Benefits (\$ value)	Value of benefits documented in the economic analysis developed for Milestone II review.
6. Cost	Program costs documented in the economic analysis developed for Milestone II review.
7. Cycle Time	Reduction in administrative lead time as documented in the benefits portion in the economic analysis.
8. Quality	Accuracy, response time, availability, maintainability, and restoration. Separate targets and thresholds will be established based upon the TEMP, and data will be obtained through project and developmental testing.
9. Customer Satisfaction	Ease of system use. Obtained through developmental and project testing.
10. Budget	Measure of budget execution, and rate of expenditures compared to projections in Exhibit 43.
11. Schedule	Measure of schedule/time-frame adherence to baseline established at Milestone II review.
(Custom)	
12.....N	Project-unique measures tailored to particular requirements.

Exhibit 6-8: Worksheet 3

An excellent approach to performance measurement in projects requiring software development is contained in *Practical Software Measurement: A Guide to Objective Program Insight*, by the Joint Logistics Commanders Joint Group on Systems Engineering.

6.2.1.1 Benefit Measures

The accomplishment of functional missions and goals (mission benefit) , not project completion on time and within budget, is the most important measure of success for any IT project. How a specific project contributes to mission accomplishment will vary, but will typically fall into the categories of efficiency or effectiveness.

Efficiency benefits result from improved operations and are the benefits typically identified with the system, such as cost reductions through reduced staffing, lower overhead, etc.

Effectiveness benefits reflect the value added to the user and to the organization or the organization's clients (e.g., more timely response to inquiries). These benefits are service improvements not provided by the status quo.

The manager or analyst can directly measure many benefits in monetary terms. For example, projects for modernization or replacement of existing equipment can generate operating and support savings relative to the status quo. This benefit is quantifiable in direct monetary terms.

Replacing a particular work step, function, or piece of equipment is another common benefit. For example, administrative lead time or delay can be reduced, resulting in fewer resources needed. A remote job entry station can replace the central data entry operation, with a resulting cost reduction. Productivity and accuracy gains through on-line entry may also translate into personnel savings.

Benefits that are not specifically monetary, but quantifiable, can often be converted into equivalent monetary values. These benefits include labor savings and error reduction. An efficiency/productivity increase, typically expressed in person-years, is a benefit whose value includes all direct and indirect labor costs. Direct labor costs are salaries or hourly wages, while indirect labor costs include allowances, leave, and fringe benefits to reflect the full cost of providing a person-year of labor. Documented personnel reductions are the best evidence of monetary benefit.

An important category of effectiveness benefits deals with user or customer satisfaction. Exhibit 6-9 contains examples of potential benefit measures in this category. Many effectiveness measures however, will be system- or function-specific and must be determined on a case-by-case basis through the requirements definition process.

A useful method for the identification of additional benefits is the Delphi technique, in which users, managers, and professionals with knowledge of the project being analyzed form a group.

This group can identify possible project benefits. Input from multiple interested parties increases the likelihood that the functional manager will include all important benefits. In addition, group analysis aids in understanding the significance or insignificance of non-quantifiable benefits.

Measure Name	Definition
Adaptability	The ability of a product to become suitable for a specific use or situation that was not originally intended
Administrative Actions	The percent of or cost of administrative actions required (e.g., reduction in the number of administrative appeals)
Communicability	The ability of a product or service to be reliably transmitted over a medium and understood by the receiver
Compliance	The ability to meet legislative or regulatory mandates
Flexibility	The ability of force structure to adapt to surge and changing mission requirements
Morale	The measure of employee attitude to work
Price	End users' satisfaction with what they are paying for the product or services as compared to their other options
Process Time	The elapsed time between the commencement and completion of an activity
Quality	End users' perceived quality of the products and services delivered by the program
Response Time	The elapsed time between the request for a product and when the system or component begins to process the request
Responsiveness	End users' perception that they get what they need when they need it
Re-usability	Ability of the system or parts of the system to be used again
Service Life	Length of time the equipment will be able to support the operation
Set-up Time	The period of time during which a system or component is being prepared for a specific operation
Simplicity	An evaluation of difficulty of performing a particular operation
Speed	The amount of time necessary to respond to project requirements
Staffing Structure	Changes to the structure of the project unit
System Procurement	The time and difficulty of procuring the system
Turnaround Time	The elapsed time between the submission of a request for a product and delivery of completed product
Understandability	The clarity of the system and its functions

Exhibit 6-9: Examples of User/Customer Satisfaction Measures

Another way to look at how the user is satisfied is to set up a perspective view. The diagram below shows performance measures from two perspectives: the **user** which is on the mission side of the axis and the **service provider** which is on the technology side of the axis.

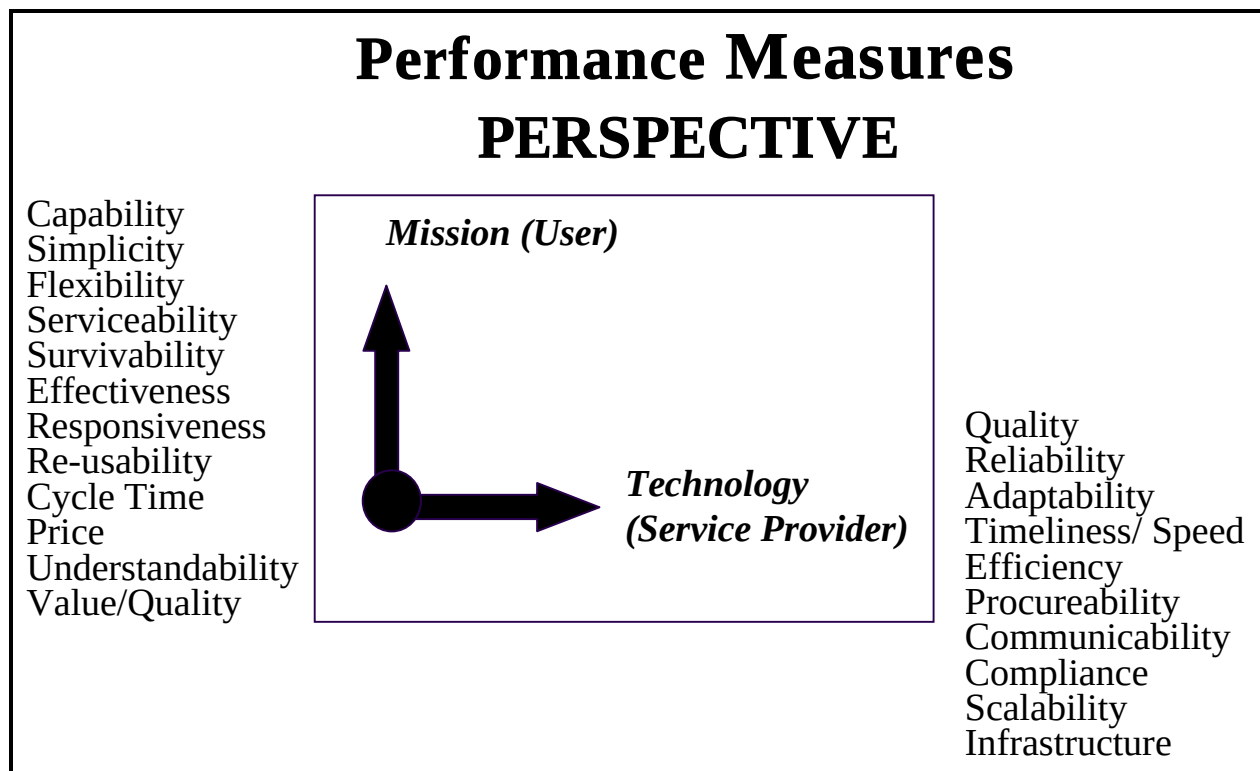


Exhibit 6-10: Another View - User/Customer Satisfaction Measures

Mission accomplishment is, again, the most important measure of success for any IT project. How IT contributes to mission accomplishment tells whether an investment or any additional investment should be made. We are very proficient measuring the Technology side of the equation, but proficiency means little if it does not meet the **user's** perception of capability, understandability, flexibility, price -- in a word, Mission ACCOMPLISHMENT, Mission SUCCESS - now will typically fall into the categories of efficiency or effectiveness.

6.2.1.2 Cost and Schedule Measures

Cost and schedule measures are highly interrelated. Common to both is the required linkage of dollars or time to the achievement of a milestone. A milestone is an event at which time a particular performance result is achieved. For example, within the Major Automated Information Systems Review Council (MAISRC) process, the Concept Studies Decision, Concept Demonstration Decision, the Development Decision, the Production Decision, and Major Modification Decision are all milestones.

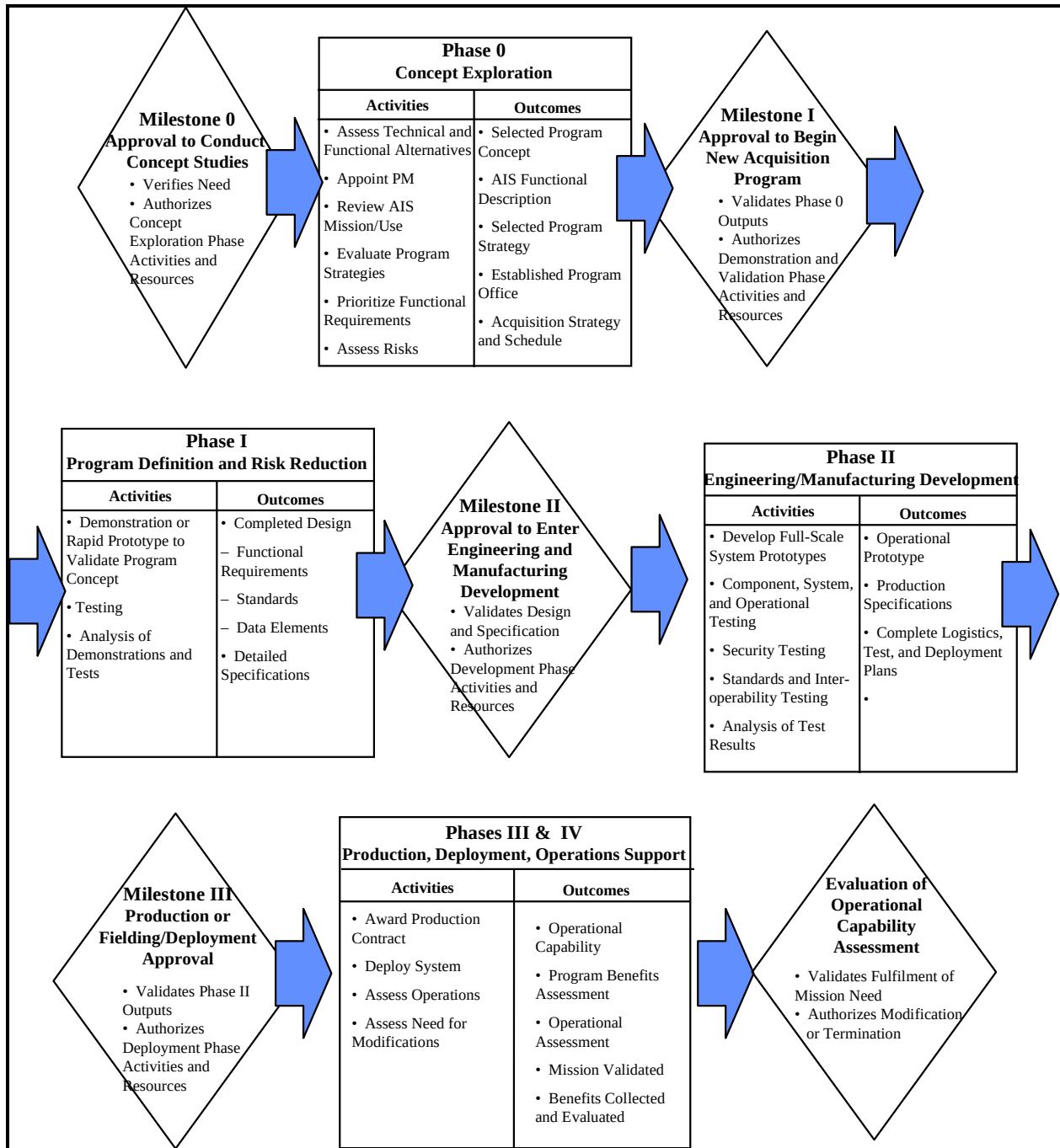


Exhibit 6-11: Milestone Reviews and Phases

For some AIS Development activities, this level of milestones might be at too high a level of granularity. The phases that precede each of the milestones can be broken into smaller performance envelopes, each ending with a milestone. For example, the performance envelopes of Phase 0, Concept Exploration and Definition, are (1) Requirements Definition, (2) Market Survey, and (3) Risk Assessment. Each of these performance envelopes ends with a milestone.

You can break down these performance envelopes further until you obtain milestones at the appropriate granularity.

The IT manager needs to decide the granularity at which to track the progress of the effort. Regardless of the milestone granularity, it is imperative that costs and schedule are linked to the achievement of consistent milestones.

6.2.1.2.1 Cost Measures

Cost measures gauge the number of investment dollars needed to achieve a particular milestone. For example, a performance measure can be the dollars necessary to move an AIS Development effort through Phase 0. Another more granular measure might be the investment required to perform the Requirements Definition portion of Phase 0. The granularity of the performance result is not important; what is important is tying the investment of dollars to the achievement of some result. This task is decidedly different from measuring whether budgeted dollars were spent in a particular fiscal year.

6.2.1.2.2 Schedule Measures

Schedule measures gauge the amount of time necessary to obtain a particular performance result. Using the example stated above, a performance measure can be the amount of time necessary to move an AIS development effort through Phase 0 or the amount of time to perform the Requirements Definition portion of Phase 0. What is important is that your schedule measure is tied to the same performance result as your cost measure.

Baselines should contain major events that have impact on the effort. Achieving these events on time may demonstrate satisfactory progress. For each effort you can establish a target date that is based upon contractual requirements or the need to complete an event before another can start. Thresholds for these events can be set by policy (90 days beyond target) or by absolute need when there is no slack in the schedule. Candidate schedule events include:

- receipt of deliverables required by contracts;
- initiation of testing (developmental, project, follow-on);
- design reviews and sign-offs;
- achievement of initial or full project capability;
- establishment of a specified level of performance;
- development of plans; and
- completion of construction or installation.

At the program and enterprise levels, the number of schedule breaches per year may indicate the impact of oversight and other policies. While a count of breaches in one year is not a meaningful measure, trends established over time can indicate the impact of new policies. Performance measure users at all levels should be interested in determining the financial impact of schedule breaches.

6.2.2 Determine Targets and Thresholds For Identified Performance Measure

Next, for each identified performance measure in the previous two activities, determine its threshold and objective. The target is the desired outcome or value for the level of performance; it is what you want to achieve. The threshold is the level of performance below which the program, project, or acquisition is no longer achieving acceptable results. To develop targets, you should consider these questions:

- What is the level of performance observed from studies of best practices (benchmarking)?
 - Are there standards/goals for this measure?
 - What values are contained in the program's background documents?
 - Are historic data available upon which to base the measure?
 - Are data accurate and reliable?
 - Are performance targets realistic?
 - Do performance targets represent efficiency and effectiveness?
 - Will performance targets demonstrate achievement of the desired result?
 - How can we identify and adopt the best practices to improve performance (i.e., benchmarking)?
 - When does an event need to take place to complement other activities?
- How does performance compare to the best practices in industry?

Establishing target and threshold values of performance measures requires you to analyze existing data or initiate data collection efforts. Because historic data necessary to develop targets may not be available, you may only need to estimate rough, reasonably achievable targets. You may refine candidate values as data accumulates, but changes must be agreed upon by all parties approving the baseline. Enter the initial values for the target and threshold values in the Target and Threshold columns of Worksheet 4, illustrated in Exhibit 6-12.

Worksheet 4: Target and Threshold Values			
Number:	Measure	Target	Threshold
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
...	_____	_____	_____
N.	_____	_____	_____

Exhibit 6-12: Worksheet 4 (Target and Threshold Values)

Primary sources of target and threshold values are the requirements documents, user strategic and tactical level plans, values from existing system performance (for migration and replacement systems), and DoD policy documents, such as the DoD 8000 series, DoD 5000 series, MIL-STD-498. You should also review Worksheet 2, which describes the functional area objectives and

measures. An alternative source of performance data is benchmarking. Remember to repeat this step for each proposed measure until you have completed your set of measures.

6.3 Validate Feasibility of Performance Measures

Once your preliminary internal baseline is developed, Step 3 guides you through evaluating each measure to ensure that its collection, verification, and validation are possible and that collection is cost effective. The best performance measures are outputs from the measured process. Measures that are natural results of work performed are less expensive and more accurate. During this step, when you discover an unfeasible performance measure, you will refine the measure, return to Step 2 to customize a new measure, or delete the unfeasible measure.

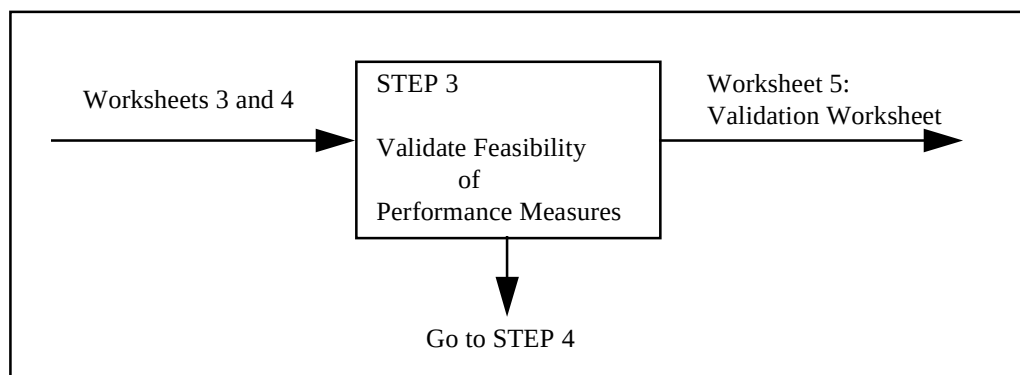


Exhibit 6-13: Step 3

Using Worksheet 3 as an input, you will complete a copy of Worksheet 5 (Validation Worksheet) for each performance measure (Refer to Exhibit 6-14). Worksheet 5 evaluates three major issues:

1. What data are necessary for calculation of the performance measure, when are the data collected, and who collects the data?
2. How to verify and validate the results to ensure that results are accurate?
3. What is the cost of the data collection?

The answers to these questions determine whether each measure is cost effective to collect.

The activities of this step, which are repeated for each identified performance measure, are listed below:

1. Identify data required to calculate the performance measure, and when and by whom the data are collected.
2. Identify the verification and validation strategy for the data collection.
3. Identify the collection cost.
4. Evaluate whether the performance measurement is feasible.

If the collection of this performance measure is not cost effective, either reconsider means of collecting the measure or return to Step 2 and identify a different performance measure that can more effectively gauge this objective.

<u>Worksheet 5: Validation Worksheet</u>		
Measure #: _____ Measure Name: _____		
Data Required	When Collected	Who Collects

**Verification/
Validation Strategy:** _____

Collection Cost: _____

**Cost-Effective
Collection:** **YES / NO**

Exhibit 6-14: Worksheet 5 (Validation Worksheet)

6.3.1 Identify Data Required to Calculate the Performance Measure

Frequently, many pieces of data are necessary to calculate a measure. It is helpful to define data components to clarify the required data. For example, at a minimum, ROI consists of both a

return and investment component. List all data necessary to calculate the performance measurement, when the data will be collected, and who will collect the data.

6.3.2 Identify the Verification and Validation Strategy for the Data Collection

Verification and validation of measures are critical. It is important that you have confidence in the measures that you report. Identify a method by which you can ensure the quality of the information that you report. For example, developmental and project testing will provide insight into operation after the system is fielded. The testing provides the opportunity to gather and analyze preliminary data.

6.3.3 Identify the Collection Cost

Determine the administrative burden of collecting the measure (in hours or dollars). For example, if the measure is captured in a standard generated report, the costs will be relatively low, perhaps a half hour to obtain the report and extract the necessary information. However, a measure that requires information from several sources and subsequent compilation or only exists in a raw form may have higher costs.

6.3.4 Evaluate Performance Measurement Feasibility

Review the information on Worksheet 5 to determine whether you can collect the performance measure cost effectively. If the measure is not feasible, there may be a better performance measure or a different collection strategy that you can use. Measures that are not feasible should be excluded from your performance measures set.

6.4 Finalize Investment Baseline/Performance Agreement

At this point all feasible performance measures that are linked to your IT effort’s mission and objectives have been identified. The previous step determined that you could collect, verify, and validate each of your performance measures. You also determined that the collection, verification, and validation was cost effective. Step 4 finalizes the process by obtaining the stakeholders’ approval and by establishing procedures that will provide the needed data for progress or performance evaluation.

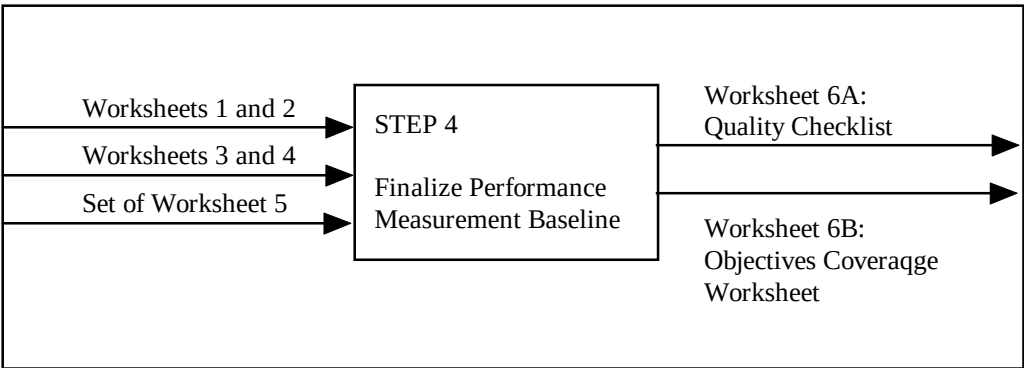


Exhibit 6-15: Step 4

Step 4 examines the set of performance measures as a whole. Using Worksheet 6A (Exhibit 6-16) as a checklist, evaluate the set of performance measures to determine that they are measuring

the right things and that the right measures are being used. Worksheet 6B (Exhibit 6-17) helps ensure that all objectives outlined in Worksheet 1 are measured with at least one performance measure. If performance measures do not meet the criteria discussed in this step, delete ineffective performance measures or return to Step 2. Within Step 2, define additional measures that meet the criteria discussed in this step. In some rare cases, a measure may be unable to meet one of the criteria listed below because of the nature of the function, the cost associated with particular collections, or other reasons. It is important to have these reasons documented.

The activities involved in this step include the following:

- 1) Ensure set of performance measures is measuring the right thing.
- 2) Ensure set of performance measures has the right measures.
- 3) Gain consensus for the performance measurement baseline.
- 4) Establish data collection efforts to obtain periodic values of the measures in the baseline

	YES	NO
1. Are we measuring the right thing?		
• Does the set of measures address improvement in performance of objectives?		
• Does the set of measures use a small set of significant performance measures that provide a clear basis for assessing accomplishment, facilitate decision making, and focus on accountability?		
• Does the set of measures assess the “value-added” contribution made by the IT investment?		
• Does the set of measures capture the requirements of internal and external customers?		
• Does the set of measures address the external performance of the functional area?		
• Does the set of measures address the benefits, costs, and schedules?		
2. Do we have the right measures?		
• Are most measures linked to a clear outcome (results rather than inputs or outputs)?		
• Is the set of measures understood at all levels that have to evaluate and use the measures?		
• Is the set of measures effective in prompting action?		
• Is the set of measures accurate, reliable, valid, verifiable, and cost effective?		
• Does the set of measures include, along with long-term measures, short-term measures or goals that show interim progress?		

Exhibit 6-16: Worksheet 6A (Quality Checklist)

Performance Measure	Objective 1	Objective 2	Objective 3	...	Objective n
Performance Measure 1					
Performance Measure 2					
Performance Measure 3					
•					
•					
•					
Performance Measure m					

Exhibit 6-17: Worksheet 6B (Objectives Coverage Worksheet)

6.4.1 Ensure Set of Performance Measures is Measuring the Right Thing

When any of the below listed criteria are not met, the project manager should consider whether a performance measure should be added or altered. Using Worksheet 6A, evaluate the set of performance measures against the following questions:

- *Are all objectives covered by at least one measure?*
Complete Worksheet 6B to answer. Worksheet 6B is a matrix with objectives in a column and each performance measure in a row. Place an “X” in the intersection of the performance measure and objective when the performance measure gauges the accomplishment of the objective. After this has been done for each performance measure, check to ensure that all objectives are covered by at least one measure.
- *Does the set of measures indicate how well the effort achieves those objectives?*
This requires an evaluation to determine whether collecting the set of performance measures will indicate continually improving performance.
- *Does the set of measures use a small set of significant performance measures that provide a clear basis for assessing accomplishment, facilitate decision making, and focus on accountability?*
Ensure that the set of performance measures is as small as possible to gauge the accomplishment of objectives, provide essential information, allow management to make informed choices, and focus on accountability. It is better to have few measures that are highly managed than a large set of measures that are not used.
- *Does the set of measures assess the “value-added” contribution made by the IT investment?*
Ensure the set of measures captures the non-IT benefits of the investment. Examine the set of measures and make sure they capture the functional benefit that the effort provides.

Examples of these types of measures include reductions in cost to perform the function, increased satisfaction levels for the functional area's customers, or decrease in the lag time between requests and delivery of service.

- *Does the set of measures capture the requirements of internal and external customers?*
Ensure that your set of measures includes measures of customer satisfaction.
- *Does the set of measures address the internal performance of the IT function?*
Ensure the set of measures captures the effectiveness and efficiency of the IT function itself. Examples of potential measures include adherence to budgets and schedules or technical performance criteria such as response time. IT investments are intended primarily and foremost to return benefits to the functions that utilize IT. Internal IT measures are only meaningful if the IT effort has external benefits.
- *Does the set of measures address the benefits, costs, and schedules?*

Assess whether the set of performance measures includes benefit, cost, and schedule measures.

6.4.2 Ensure Set of Performance Measures Has the Right Measures

When any of the below listed criteria are not met, consider whether to alter an existing performance or add a new measure. This activity consists of evaluating the set of performance measures against the following questions:

- *Are most measures linked to a clear outcome (results rather than inputs or outputs)?*
Ensure that measures gauge accomplishment of outcomes, results, and benefits rather than inputs and outputs. Inputs and outputs only have meaning if outputs result in some desirable end.
- *Is the set of measures understood at all levels that have to evaluate and use the measures?*
Ensure the definitions of all performance measures will be understood at all levels of review. Are they the right measures from which to make effective management decisions? Can performance measures communicate project achievements to internal and external stakeholders?
- *Is the set of measures effective in prompting action?*

Ensure the set of performance measures is effective for managing your IT effort. It is better to measure areas that are "actionable," which refers to areas where performance has the possibility to change the outcome. For example, customers served as a performance measure depends on customer arrivals. Better measures of the organization's performance in customer service may be average wait time per customer or case resolution lapse time.

- *Is the set of measures accurate, reliable, valid, verifiable, and cost effective?*
Ensure the set of measures will produce an accurate, reliable, valid and verifiable indication of mission accomplishment. Reexamine measures from Worksheet 3 to ensure that they are effective and efficient. Make sure that the set of measures is built on data that are available at reasonable cost, appropriate, and timely for the purpose. The best measures are tightly integrated into the business process. Do not create artificial measures as a separate reporting item that are not otherwise monitored internally. Measures that are the natural result of functional processes are most likely to be successfully collected.
- *Does the set of measures include, along with long-term measures, short-term measures or goals that show interim progress?*
Ensure your set of measures includes short-term measures. Measures that demonstrate benefit during a given period of performance are preferable to longer-term measures. Include, along with any long-term measures, short-term measures or goals that allow for demonstration of progress and provide a performance-motivating or performance-sustaining achievement factor.

6.4.3 Gain Consensus for the Performance Measurement Baseline

The baseline document should create a formal agreement between the IT manager and the next higher level of oversight, including the CIO and CFO or their functional equivalents. As a last step, it is useful to seek comment and to gain consensus from all stakeholders that meeting the targets within the baseline will satisfy the existing needs. Based on the results, it might be necessary to revisit some of the previous steps to refine the set of performance measures. Once established, the baseline should be controlled using the techniques of configuration management to ensure that all stakeholders agree to any changes to the baseline.

Appendix A contains the format for an Investment Baseline/Performance Agreement designed to serve as the formal baseline agreement between the project manager, the user representative, and the financial activity providing funding for the effort.

6.4.4 Establish Data Collection Efforts to Obtain Values of the Measures in the Baseline

A final consideration is to determine whether mechanisms are in place to generate the data that are needed to measure progress towards goals and to determine whether the effort is within threshold values.

7. CASE STUDY OF A HYPOTHETICAL IT PROJECT

7.1 Introduction

This case study illustrates the use of performance measures in describing the status of an ongoing program, the Hypothetical Information Resource Management System (HIRMS). The case study follows the procedures in Sections 4-6 for creating an internal program baseline. The performance measures in the baseline are drawn in part from the minimum essential set of measures contained in Section 6.

This case study is fictional and has been developed only to illustrate the procedures that have been discussed in this guide.

7.2 Development of the Baseline for the HIRMS

The following steps are defined in Section 6 of this guide, and their application will be illustrated in the subsections that follow.

1. Identify the IM/IT effort and its mission and objectives, and the quantified external functional baseline, benchmark, if appropriate, and project target positions.
2. Define minimum essential performance measures and additional (custom) performance measures for the internal project performance baseline.
3. Validate feasibility of performance measures.
4. Finalize performance measurement baseline and define methodology to track external project results.

7.2.1 Step 1: Identify IT Effort and its Mission and Objectives, and the External Functional Baseline

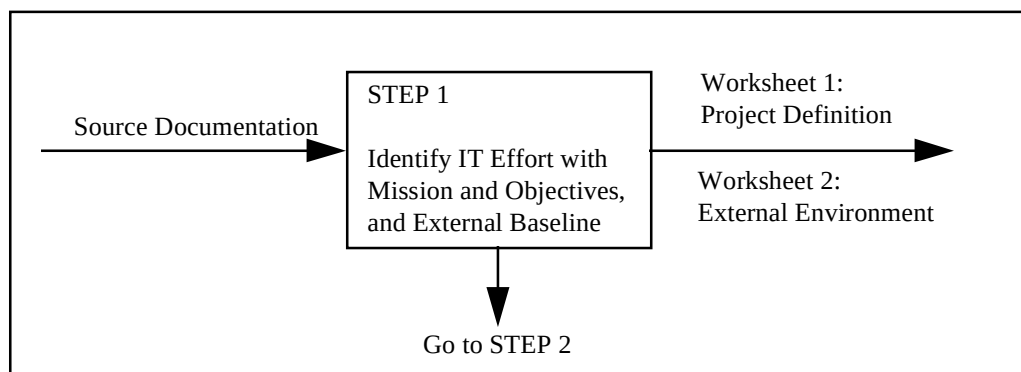


Exhibit 7-1: Step 1

The first step is to identify the IM/IT effort and its mission and objectives. The mission is the reason that the effort exists. Objectives are measurable results, critical to the accomplishment of the mission. Together, the mission and objectives define the contribution that the project will make to the achievement of the functional area objectives contained in the external baseline. The activities included in this step involve answering the following questions:

- What is the project? (Determine project name, leader, and customers.)
- What is it doing? (Determine the project type and work efforts)
- Why is it being done? (Determine mission and objectives.)
- What is the external environment? (Determine functional objectives.)

Use Worksheet 1 (Project Definition), illustrated in Exhibit 7-2, for recording the answers to the first three questions. Worksheet 2 (External Environment) will be used to record the answer to the last question.

Activity 1: Identify the project.

The initial activity involves determining the name of the project and the name of the project leader. The determination of the customers is based upon identifying the office providing the funding for the program and the ultimate users of the system. This information will aid in identifying objectives.

A review of the source documentation for the HIRMS program identifies the office that must obtain the funding for the program by examining the program's Exhibit 43. For this case study this is the Assistant Secretary of Defense for Information Resource Management (ASD(IRM)). This is the primary customer. Additional customers are the users of the system throughout the Department.

Activity 2: Identify what it is doing.

The second question involves identifying the project type and the work efforts that make up the program.

For the purpose of this case study, the government is developing and implementing an HIRMS for obtaining and managing IT equipment and services. The program involves the development of software for an open systems environment and shared databases that will employ standard data elements. The project type is therefore an automated information system (AIS) development. The requirements have been generated following several BPR studies that have identified ways to incorporate IT to reduce the costs of current operations while improving the timeliness and accuracy of information provided to managers. The system will be deployed to numerous sites across the United States.

The entries for work efforts are from the highest level of the program's work breakdown structure (WBS). More specific detail is contained in the lower levels of the WBS and would be more useful in identifying specific program objectives. The primary work efforts include:

- 1) development of an automated information system,
- 2) deployment of the system to sites across the country and abroad, and
- 3) training of users and maintainers of the system.

At this point we will make initial entries into the first worksheet, shown in Exhibit 7-2.

Worksheet 1: Project Definition	
Project Name: Hypothetical Information Resource Management System	
Project Leader: I. M. Incharge	
Customers: ASD(Information Resource Management), system users, and maintainers.	
Project Type: Automated Information System Development	
Work Efforts:	
1. Develop an automated information system. 2. Deploy the system to sites across the country and abroad. 3. Train users and maintainers of the system.	
Mission:	(Include sources) _____ _____ _____
Objectives:	Source:
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____

Exhibit 7-2: Worksheet 1

Activity 3: Identify why it is being done.

Why is this project needed? The answer lies within the mission and objectives for the program. A review of the requirements documentation will provide the answers. The source documents may use terminology other than mission and objectives. The project manager must review the source documents and distill their contents into consistent statements of mission and objectives.

This iterative process attempts to remove inconsistencies and focus on stating the mission and objectives in such a manner that quantitative measures can subsequently be developed

Exhibit 7-3 illustrates the relationships between some of the source documents that provide data to aid in defining the program's mission and objectives and the program's list of candidate performance measures. The Program Manager's Charter (PMC), Mission Need Statement (MNS), functional requirements, and the Test and Evaluation Master Plan (TEMP) provide insight into program mission and objectives, and the expected benefits that will accrue. The TEMP specifically identifies levels of performance that the system must demonstrate to be acceptable, thus allowing product and deployment. The TEMP is a primary source of performance measurement requirements.

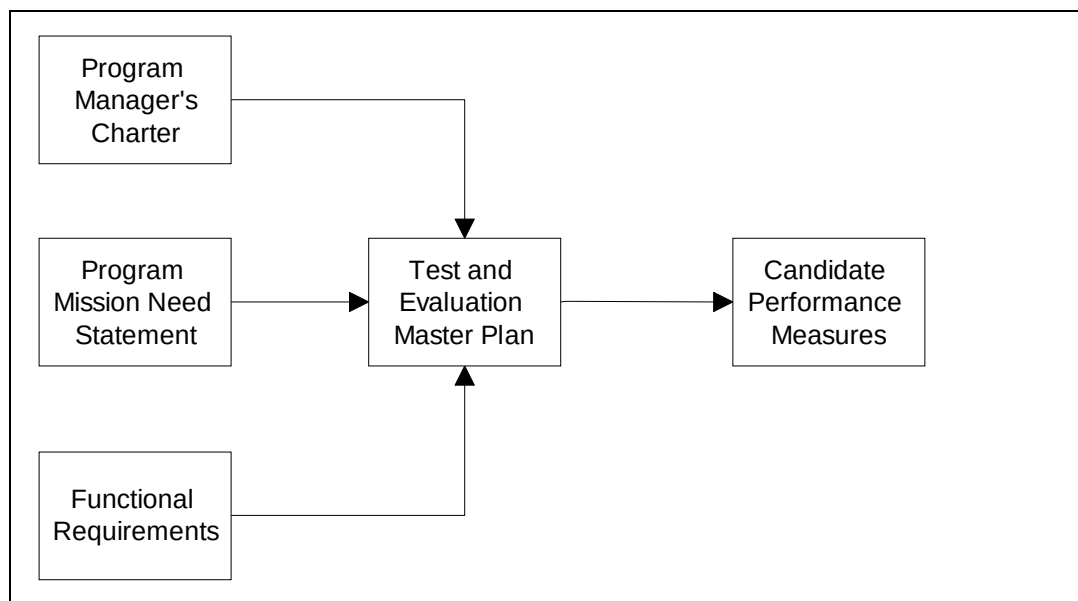


Exhibit 7-3: Relationships Between Source Documents and Performance Measures

Review of these documents should provide answers to the questions of why DoD requires the HIRMS. The answers provide the mission and objectives and the starting point for identifying relevant performance measures for the program.

7.2.1.1 Program Manager's Charter (PMC)

If a PMC is developed, it serves as a written contract between the program manager (PM) and the chartering authority. The PMC:

- provides the authority for ensuring that AIS development and project transition are conducted within a clearly established management framework;
- establishes the objectives, scope, organization, responsibilities, methods of operation, and required resources for the AIS; and

- identifies the lines of authority and accountability, such as relationships among the OSD PSA, heads of the DoD Components, participating and supporting organizations, and the AIS PM.

According to the PMC, the purpose of HIRMS is to establish a fully functional AIS, which will standardize data elements and support uniform business practices throughout the Department.

The scope of HIRMS includes all contracting, receipt, storage, and distribution activities for goods and services required by the Department. HIRMS will use open systems and relational database technology to provide timely and accurate information to improve the management of supplies and services.

The functional objectives of the HIRMS are listed below.

- Support the use of standard department management policies, processes, and shareable data.
- Improve timeliness, accuracy, and effectiveness of management information.
- Optimize, streamline, and integrate disparate IRM automated systems, subsystems, and databases.
- Facilitate the department-wide integration of a standard, robust, management environment through the implementation of standard processes, and standard shared data.
- Provide for improved data management and data integrity by electronic input of selected data to a logically shared data repository. Standard data and data transmissions must be employed. The capability to exchange data within the department, other government agencies, and with industry must be provided.
- Provide information exchange capabilities among department components and related functional areas.
- Provide for use of department-wide electronic commerce/electronic data interchange (EC/EDI).
- Streamline manual management processes, including the automation of manual management activities and the ability to input data only once at the source.
- Provide an on-line means for capturing and evaluating customer feedback information.
- Provide the status of materials that are on order or on hand in a near-real-time environment to enable department managers to more closely monitor the assets of the department.

7.2.1.2 Program Mission Need Statement (MNS)

The MNS defines and documents a mission need, and justifies resource expenditures for the identification and exploration of solutions to satisfy the need. The MNS provides the basis to ensure that the system developed satisfies the requirements as stated in the MNS.

The primary mission for HIRMS is enhanced customer service through process improvements, elimination of paperwork, and improved automated tools for system users. The HIRMS will incorporate improved and standardized business practices and electronic commerce techniques.

These actions will improve customer service by reducing costly, time-consuming paperwork; facilitating responsiveness to customer inquiries; and facilitating prompt and accurate responses to requests for information.

The business process improvements that will be introduced by the HIRMS will facilitate successful performance of management functions under anticipated budgetary and personnel constraints.

The HIRMS will provide improved ability to support departmental needs by more efficiently and effectively providing timely response to managerial requirements, improved visibility of assets, and more accurate information through shared data. Expected benefits include:

- decreased administrative lead time (the time required for management actions should be benchmarked against civilian practices);
- elimination of labor intensive processes, duplicate data entry, and paper-handling tasks, enabling managers to focus on functional tasks requiring judgment and experience;
- increased accuracy on pending action status requests;
- improved security for IRM data;
- increased customer satisfaction;
- decreased training requirements and costs due to the standard user interface and commonality of the AIS among all users;
- increased readiness from improved availability of supplies; and
- enhanced capture of up-to-date accurate information resulting in more efficient management of contracts, which leads to decreased penalties and interest for late government payment.

7.2.1.3 Operational Requirements Document (ORD)

The functional requirements developed during the initial phase of a program serve as the basis for the subsequent Operational Requirements Document (ORD). Both of these documents must contain sufficiently precise definitions of the requirements so that potential system developers can estimate the level of effort required for development and deployment.

The following are excerpts from the ORD for the HIRMS.

- **System Response Time:** The response time between the user initiating any command and the response time arriving at the user's workstation shall be three seconds maximum with a desired interval of two seconds, regardless of the number of concurrent users.
- **System Availability:** The local site's system shall be available 98% of the time. This will not include hardware outages for scheduled system backup and maintenance time.

7.2.1.4 Test and Evaluation Master Plan (TEMP)

A major component of a TEMP is the list of the Minimal Acceptable Project Performance Requirements (MAOPRs) for the program. This list must be individualized for each program and relate the objectives for that program to measures that can be obtained through testing to aid in system evaluation.

The MAOPRs represent the minimum acceptable project effectiveness and project suitability characteristics and performance thresholds against which the system will be evaluated. Exhibit 7-4 contains the MAOPRs that are derived from the HIRMS MNS and functional requirements.

#	MAOPR	Value	Linkage
1	Decreased administrative lead time.	95% of management actions completed within 96 hours.	Mission Need Statement
2	Decreased cost of management due to streamlining of processes.	75% decrease in person-hours required to process a request.	Mission Need Statement
3	Provision of accurate information on requests for status of pending actions.	99% accuracy.	Mission Need Statement
4	Protection of information from unauthorized access.	Rejects unauthorized access and intrusion 100% of the time.	Mission Need Statement
5	User-friendly design.	At least 75% of HIRMS users express satisfaction.	Mission Need Statement
6	Effective training program for personnel who operate/maintain HIRMS.	At least 90% of trained users achieve certification.	Mission Need Statement
7	Sustainability under the current personnel.	No increase in the number of personnel or the entrance abilities of user personnel.	Mission Need Statement
8	Acceptable response time to user commands.	Response time after initiating a command shall be 3 seconds maximum with a desired interval of 2 seconds.	Functional Requirements
9	Maximum availability to sustain operations.	Available 98% of time for software and interfaces. Minimum allowable is 95%.	Functional Requirements
10	Short mean time to restore function.	99% of system faults shall be corrected within 48 hours.	Functional Requirements
11	Provision of the capability to rebuild and restore databases.	100% of data from last backup is recovered	Functional Requirements

Exhibit 7-4: Minimal Acceptable Project Performance Requirements for the HIRMS

Once the mission of the IRM effort has been identified and entered into the worksheet, identify the program's objectives. Objectives are measurable outcomes that are critical to the accomplishment of the IRM effort's mission.

The statement of mission entered into the worksheet is taken from the MNS. The objectives listed are based upon the project performance requirements from the TEMP. For this example, the TEMP, which is the best source of information on quantifiable objectives, is the synthesis of material from other source documents. The completed Worksheet 1 is displayed in Exhibit 7-5.

Worksheet 1: Project Definition

Project Name: Hypothetical Information Resource Management System

Project Leader: I. M. Incharge

Customers: ASD(IRM), system users and maintainers.

Project Type: Automated Information System Development

Work Efforts:

1. Develop an automated information system.
2. Deploy the system to sites across the country and abroad.
3. Train users and maintainers of the system.

Mission: Enhanced customer service through process improvements, elimination of paperwork, and improved automated tools for system users. The HIRMS will incorporate improved and standardized business practices and electronic commerce techniques. These actions will improve customer service by reducing costly, time-consuming paperwork; facilitating responsiveness to customer inquiries; and facilitating prompt and accurate responses to requests for information

Objectives:

1. Decreased administrative lead time.
2. Decreased labor cost by elimination of processes.
3. Provision of accurate status reports on pending actions.
4. Protection of information from unauthorized access.
5. User-friendly design.
6. Effective training program for personnel who operate and/or maintain HIRMS.
7. Sustainability under the current personnel.
8. Acceptable response time to user commands.
9. Maximum availability to sustain operations.
10. Short mean time to restore function.
11. Capability to rebuild and restore databases.

Source:

Mission Need Statement

Mission Need Statement

Mission Need Statement

Mission Need Statement

Mission Need Statement

Mission Need Statement

Mission Need Statement

Mission Need Statement

Functional Requirements

Functional Requirements

Functional Requirements

Exhibit 7-5: Completed Worksheet 1

Activity 4: Identify the external environment.

First, determine the functional area to which the effort belongs. DoD Instruction 8000.1 defines a functional area (e.g., personnel) as comprised of one or more functional activities (e.g., recruiting), each of which consists of one or more functional processes (e.g., interviews). This information will be used in determining the functional objectives that the effort supports. Record answers on the worksheet, along with the name of the director and title of the sponsoring office.

Next, identify the objectives for the functional area that the project supports, along with benchmark, target, and current estimate for each objective. In this example, the Department is interested in decreasing cost and cycle time for providing goods and services to the warfighters. The ASD(IRM) should be aware of the baseline value for cycle time to fill a requisition for a part.

For the purposes of this case study, assume that the current cycle time to fill a request for parts is 96 hours, and it costs \$250 to administer each request. Benchmarking studies of the best practices within industry have determined that leading industrial firms can process requests within 48 hours with an associated cost of \$100.

Intermediate values of \$150 and 60 hours have been established as approved targets based upon unique factors within the government procurement regulations. Without changes in the law, it will be impossible to obtain the benchmarks from the best practices of industry.

The last column records the functional area's revised estimate of the cycle time as progress is made in its reduction. At the start of the HIRMS project, this value will be equal to the baseline value. As progress is made in developing and deploying HIRMS, the revised estimate will show progress towards the approved target. Worksheet 2, illustrated in Exhibit 7-6, has been filled in to reflect the baseline and benchmark values mentioned above.

Worksheet 2: External Environment				
Functional Area: Information Resource Management				
Project Sponsor: Assistant Secretary of Defense for Information Resource Management				
Functional Objective	Baseline Value	Benchmark Value	Approved Target	Revised Estimate
1. Cycle Time	96 hours	48 hours	60 hours	96 hours
2. Cost per Request	\$250	\$100	\$150	\$250
3. Accuracy Rate	95%	99%	98%	95%
Return on Investment:				
Baseline:		4.5:1	Date: Yesterday	
Current Estimate:		5:1	Date: Today	

Exhibit 7-6: Completed Worksheet 2

Associated with the benchmark and target values for the functional objectives is the ROI for the functional area. ROI for the IRM functional area was calculated as part of a FEA that reflected the functional area's strategic planning and BPR activities. The baseline value of 4.5:1 was established after considering the HIRMS and other projects within the functional area. The baseline value of the ROI is recorded on the worksheet along with updates that occur in conjunction with revised economic analyses conducted for the projects within the functional area.

7.2.2 Step 2: Define IT Effort's Internal Baseline with Performance Measures

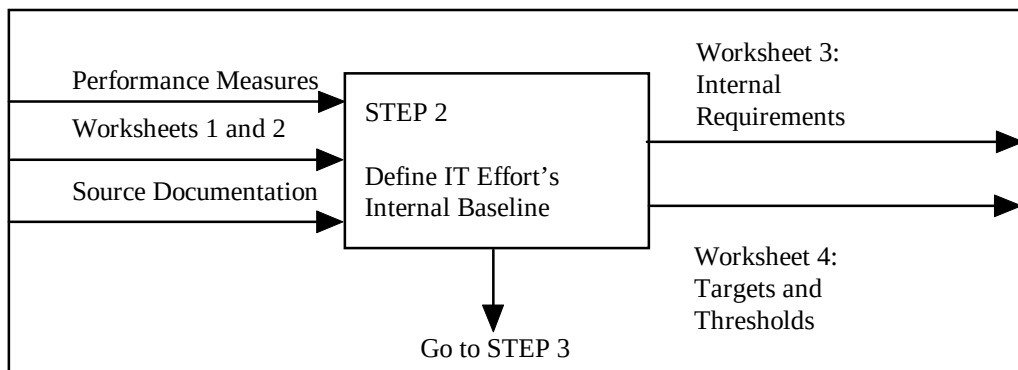


Exhibit 7-7: Step 2

Once objectives are identified, select a set of performance measures that gauge the accomplishments of your objectives. This provides a framework to determine whether the effort is heading towards delivering its benefit to the DoD community. For certain specific areas of IRM, a minimum set of essential measures exists that provides a starting point from which to create a full set of performance measures. The activities involved in this step are listed below:

- 1) Identify relevant minimum essential performance measures.
- 2) Identify effort-specific performance measures.
- 3) Determine targets and thresholds for identified performance measures.

Activity 1: Identify relevant minimum essential performance measures.

The office of the ASD(C3I) has defined nine IRM areas of special interest as discussed in Section 6. The initial activity in this step is to identify which of the nine IRM areas the HIRMS supports. By identifying the IRM areas, we obtain a minimum set of essential measures that were presented in Section 3. The HIRMS is associated with the AIS Development IRM area, and this is listed in the worksheet under project type. The identification of the IRM area also indicates which staff members within ASD(C3I) will be interested in the performance of the program.

Benefits and quality measures should relate to specific targets, such as organizational goals, objectives, missions, and functions, which are directly related to the system implementation and

the costs incurred. Initially, the list may also include items that cannot be quantified. Qualitative benefits should not be dismissed because they may relate to important outcomes of the program.

Worksheet 3: Internal Requirements

Project Type: AIS Development

Number:	Name:	Definition and Source:
1.	ROI	ROI of project taken from the economic analysis for the Milestone II review. The ratio uses the standard measures of cost and benefits (Measures 5 and 6.)
2.	Funding	Funding in support of ASD(IRM)'s strategic plan contained in Exhibit 43.
3.	Standards	Degree of compliance with the TAFIM contained in the HIRMS architecture.
4.	Standard Data	Number and percentage of data elements in HIRMS's data model that are standardized data elements from the DoD Data Dictionary System (DDDS).
5.	Benefits (\$ value)	Value of benefits documented in the economic analysis developed for HIRMS's Milestone II review.
6.	Cost	Program costs documented in the economic analysis developed for HIRMS's Milestone II review.
7.	Cycle Time	Reduction in administrative lead time as documented in the benefits portion in the economic analysis.
8.	Quality (5 measures)	Accuracy, response time, availability, maintainability, and restoration. Separate targets and thresholds will be established based upon the TEMP, and data will be obtained through project and developmental testing.
9.	Customer Satisfaction	Ease of system use. Preliminary results can be obtained through developmental and project testing observations.
10.	Budget	Measure of budget execution, and rate of expenditures compared to projections in Exhibit 43.
11.	Schedule	Measure of schedule/time-frame adherence to baseline established at Milestone II review.
12...N		

Exhibit 7-8: Worksheet 3

Activity 2: Identify effort-specific (custom) performance measures.

The second activity for this step is to determine additional (custom) performance measures that are above the minimum essential set and describe the unique characteristics of the IRM effort. The individual measures that are relevant to the HIRMS are entered into the Worksheet 3 under the “Custom” heading, as illustrated in Exhibit 7-9.

The custom benefit performance measures listed for HIRMS are derived from the objectives listed in Worksheet 1. There are no custom cost or schedule performance measures. The baseline for the program will contain more detail of the events scheduled and the appropriations used for program funding.

Worksheet 3: Internal Requirements		
Project Type: AIS Development		
Number:	Name:	Definition and Source:
1.	ROI	ROI of project taken from the economic analysis for the Milestone II review. The ratio uses the standard measures of cost and benefits (Measures 5 and 6.)
2.	Funding	Funding in support of ASD(IRM)’s strategic plan contained in Exhibit 43.
3.	Standards	Degree of compliance with the TAFIM contained in the HIRMS architecture.
4	Standard Data	Number and percentage of data elements in HIRMS’s data model that are standardized data elements from the DoD Data Dictionary System (DDDS).
5.	Benefits (\$ value)	Value of benefits documented in the economic analysis developed for HIRMS’s Milestone II review.
6.	Cost	Program costs documented in the economic analysis developed for HIRMS’s Milestone II review.
7.	Cycle Time	Reduction in administrative lead time as documented in the benefits portion in the economic analysis.
8.	Quality (5 measures)	Accuracy, response time, availability, maintainability, and restoration. Separate targets and thresholds will be established based upon the TEMP, and data will be obtained through project and developmental testing.
-- Continued --		

9.	Customer Satisfaction	Ease of system use. Preliminary results can be obtained through developmental and project testing observations.
10.	Budget	Measure of budget execution, and rate of expenditures compared to projections in Exhibit 43.
11.	Schedule	Measure of schedule/time-frame adherence to baseline established at Milestone II review.
12.	Labor	Decrease in labor efforts associated with processing actions. Target established in FEA.
13.	Security	Protection from authorized access. Requirements come from the HIRMS Security Plan.
14.	Readiness	Increased readiness from improved availability of supplies.
15.	Training	Percentage of personnel able to achieve certification.

Exhibit 7-9: Completed Worksheet 3

The appropriations required by the program to complete the development phase are:

- Construction
- Research and Development
- Procurement
- Operations and Maintenance.

The milestones listed below represent the major events between Milestone II (Development Decision) and Milestone III (Production Decision) for HIRMS. For purposes of this case study, assume that the HIRMS program is currently undergoing project test and evaluation.

Milestones:

- Milestone II Decision Meeting
- Award Contract
- Begin Validation and Acceptance Testing
- Complete Validation and Acceptance Testing
- Begin Project Test and Evaluation
- Complete Project Test and Evaluation
- Milestone III Decision Meeting

The performance measures listed in Worksheet 3 provide the input to Worksheet 4, in which target and threshold values are added to the performance measures.

7.2.3 Activity 3: Determine targets and thresholds for identified performance measures.

During this step, the target and threshold columns of the Performance Measures Worksheet will be completed for all measures identified in Worksheet 3. The values for the target and threshold are based upon the MAOPRs contained in the TEMP and policy established for program deviations in DoD Regulation 5000-2R.

7.2.4 Benefits

Exhibit 7-10 contains candidate benefit measures for the HIRMS, along with target and threshold values. Threshold values for benefits are set by agreement between the PM and program sponsor. The threshold represents the level of performance that is the upper limit of acceptable performance.

Measure	Target	Threshold
ROI	6:1	3:1
Decreased administrative lead time	95% of actions transmitted within 72 hours	95% of actions transmitted within 96 hours
Use of standard data	50% of data elements	25% of data elements
Use of standards	Fully compliant with TAFIM	75% compliant
Decreased labor efforts associated with processing actions	75% decrease in labor efforts	50% decrease in labor efforts
Correct response to requests for status of pending actions	99%	97%
Response time	3 sec. maximum	4 sec. maximum
Ease of use	75% satisfaction	65% satisfaction
Protection from unauthorized access	100%	98%
Decreased training requirements	90% achieve certification	75% achieve certification
Availability	98%	95%
Mean time to restore function	99% within 24 hours	99% within 48 hours
Restoration of databases	100%	99%
Increased readiness from improved availability of supplies	95% demands met within 24 hours	85% demands met within 24 hours

Exhibit 7-10: Candidate Benefits for the HIRMS

7.2.5 Costs

Exhibit 7-11 lists the total funding by appropriation required by the program to complete the development phase. The “Approved” column represents the dollars shown in the budget and are the program’s targets. The threshold is set at 115% of the target or approved funding level. The numbers in the exhibit are in then-year dollars.

Appropriation	Approved (Target)	Threshold
Construction	\$ 1.0M	\$1.15M
Research and Development	\$ 9.0M	\$10.35
Procurement	\$ 2.0M	\$2.3M
Operations and Maintenance	\$ 3.0M	\$3.45M
Total	\$15.0M	\$17.25M

Exhibit 7-11: Target and Threshold Funding for Development Phase

7.2.5.1 Schedule

Exhibit 7-12 contains the target and threshold date for the major events for HIRMS during its current phase of its life cycle. The threshold values are computed by adding 90 days to the target value.

Milestone	Target	Threshold
Milestone II Decision Meeting	15 July 1996	15 October 1996
Award Contract	15 March 1997	15 June 1997
Begin Validation and Acceptance Testing	15 September 1997	15 December 1997
Complete Validation and Acceptance Testing	15 March 1998	15 June 1998
Begin Project Test and Evaluation	15 April 1998	15 July 1998
Complete Project Test and Evaluation	15 July 1998	15 October 1998
Milestone III Decision Meeting	15 September 1998	15 December 1998

Exhibit 7-12: Schedule Milestones for the HIRMS

The combination of Exhibits 7-10, 7-11, and 7-12 are equivalent to a completed Worksheet 4.

7.2.6 Step 3: Validate Feasibility of Performance Measures

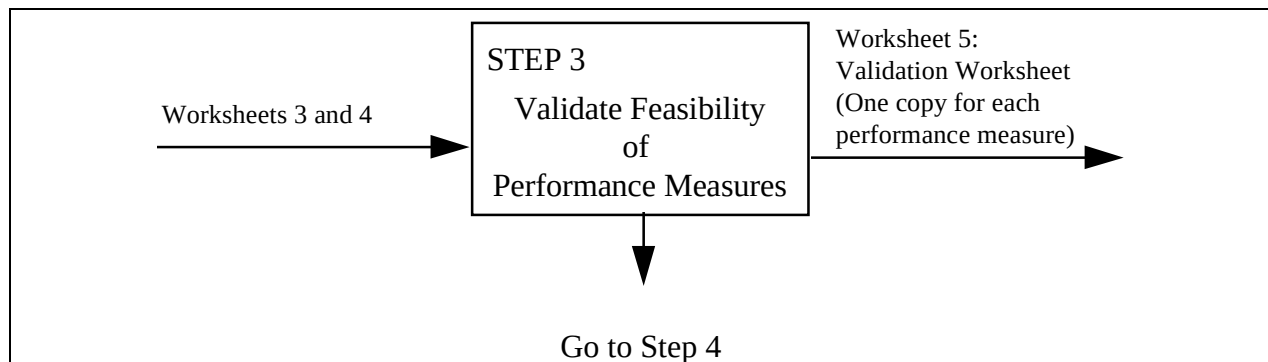


Exhibit 7-13: Step 3

Once the preliminary list of performance measures is identified, you evaluate each measure to ensure that its collection, verification, and validation is possible and that the collection is cost effective. The best performance measures are output from the process measured. During this step, when an unfeasible performance measurement is found, refine the measure or return to STEP 2 to select a new performance measure to gauge that objective.

The baseline must be evaluated from two perspectives: management effectiveness and the costs of collecting the data. This section illustrates evaluating the management effectiveness criteria and the feasibility of collecting the data for the measures in the benefits portion of the baseline. Worksheet 5, illustrated in Exhibit 7-14, is completed for each performance measure during this step using Worksheets 3 and 4 as inputs. Worksheet 5 evaluates three major issues:

1. What data are necessary for calculation of the performance measure, when are the data collected, and who collects the data?
2. How will results be verified and validated to ensure results are accurate?
3. What is the cost of the data collection?

The answers to these three questions will determine whether this measure is cost effective to collect. If, from answering these questions, it is found that the measure is not cost effective, either reconsider the means of collecting the measure or return to Step 2 and identify a different performance measure that can more effectively gauge this objective.

The activities of this step are repeated for each identified performance measure. The activities involved in this step are as follows:

1. Identify data required to calculate the performance measure and when and by whom the data are collected.

2. Identify the verification and validation strategy for the data collection.
3. Identify the collection cost.
4. Evaluate whether the performance measurement is feasible. If not, refine or delete the performance measure. (Do not delete minimum essential performance measures.)

Activity 1: Identify data required to calculate the performance measure and when and by whom the data are collected.

The following questions are criteria for determining feasibility:

1. Are we measuring the right things? (All measurements are linked to an objective and all objectives are measured.)
2. Do we have the right measures? (Management decisions can be made based on the measurements, and effectiveness and efficiency are represented.)
3. Who is responsible for collecting the data? (Identify an individual who is responsible for collecting the data)
4. What is the cost of collection? (Determine whether the value of the data collected is worth the cost of collection.)

Activity 2: Identify the verification and validation strategy for the data collection.

Verification and validation of measures are critical. It is important that you have confidence in the measures reported. Identify a method to can increase the quality of the information.

Activity 3: Identify the collection cost.

Determine the administrative burden of collecting the measurement (hours or dollars). For example, if the measure is captured in a standard generated report, the costs will be relatively low.

For HIRMS, we will validate Measure 4 (response time). The data collected will be based upon the response times observed during the developmental and project testing. This information is entered into Worksheet 5.

Activity 4: Evaluate whether the performance measurement is feasible. If not, refine or delete the performance measure. (Do not delete minimum essential performance measures.)

Based on all of the information on Worksheet 5 and the benefits and costs of collecting the performance measure, determine whether the performance measure is feasible.

<u>Worksheet 5: Validation Worksheet</u>	
Measure #: 4	Measure Name: Response Time. Time required to receive a response after entering a command.
Data Required: Response time for each command that can be entered into the system.	
How Collected: Recorded during developmental and project testing.	
Verification/Validation Strategy: The procedures for collecting and evaluating the data are contained in the Test and Evaluation Master Plan along with the test scripts and data sets.	
Collection Cost: The cost is a small component of the costs of conducting the required developmental and project costing.	
Cost Effective Collection: Yes	

Exhibit 7-14: Completed Worksheet 5

The performance measure, response time, is judged to be cost effective to collect. The measure will therefore be added to the program's baseline.

7.2.7 Step 4: Finalize Performance Measurement Baseline

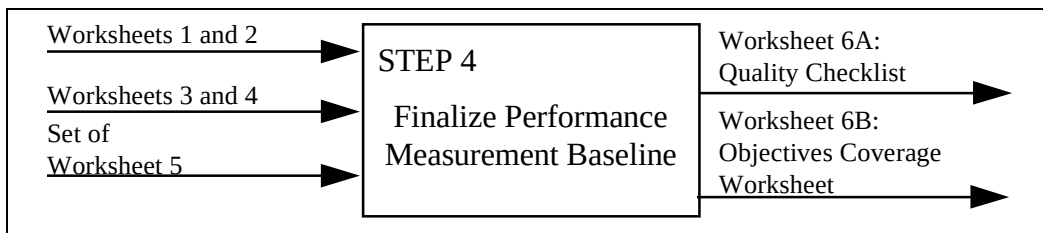


Exhibit 7-15: Step 4

You now have a list of performance measures that are linked to your mission and objective and are cost effective to collect. The next step is to evaluate the performance measures as a set to determine that you and your supervisors can use them to determine progress and track accomplishment of your IRM effort's mission and objectives. During this step, you may need to delete performance measures or return to STEP 2 to define new measures.

This step collects the results of the previous steps in a single document that is submitted to the oversight authority for approval. This step establishes a performance agreement between the PM for HIRMS and his chain of command.

Finalizing the program's baseline involves four activities:

1. Ensure that the set of performance measures is measuring the right thing. Refine set of measures, if necessary.
2. Ensure that the set of performance measures has the right measures. Refine the set of measures, if necessary.
3. Gain consensus from chain of command for the performance measurement baseline.
4. Establish data collection efforts to obtain periodic values of the measures in the baseline.

Activity 1: Ensure that your set of performance measures is measuring the right thing. Refine set of measures, if necessary.

This activity is accomplished by reviewing the questions in Worksheet 6A, as illustrated in Exhibit 7-16, and making adjustments to the set of performance measures until the answer to each question is "yes".

Worksheet 6A: Quality Checklist

	YES	NO
1. Are we measuring the right thing?		
Does the set of measures address improvement in performance of objectives?	X	
Does the set of measures use a small set of significant performance measures that provide a clear basis for assessing accomplishment, facilitate decision-making, and focus on accountability?	X	
Does the set of measures assess the "value-added" contribution made by the IRM investment?	X	
Does the set of measures capture the requirements of internal and external customers?	X	
Does the set of measures address the external performance of the functional area?	X	
Does the set of measures address the benefits, costs, and schedules?	X	
2. Do we have the right measures?		
Are most measures linked to a clear outcome (results rather than inputs or outputs)?	X	
Is the set of measures understood at all levels that have to evaluate and use the measures?	X	
Is the set of measures effective in prompting action?	X	
Is the set of measures accurate, reliable, valid, verifiable, and cost-effective?	X	
Does the set of measures include, along with long-term measures, short-term measures or goals that show interim progress?	X	

Exhibit 7-16: Worksheet 6A

Activity 2: Ensure that the set of performance measures has the right measures. Refine the set of measures, if necessary.

A final worksheet, as illustrated in Exhibit 7-17, maps objectives to measures and is completed during this activity to ensure coverage of all objectives.

Worksheet 6B: Objectives Coverage Worksheet

Performance Measure	Decreased Lead Time	Decreased Cost	Accuracy, Response Time, Availability, Maintainability, Restoration	Security	User-Friendly Training, Sustainable with Current Personnel
ROI		X			
Funding		X			
Standards					
Standard Data					
Benefits			X		
Costs		X			
Cycle Time	X				
Quality			X		
Customer Satisfaction					X
Budget		X			
Schedule					
Labor					X
Security				X	
Readiness	X				
Training					X

Exhibit 7-17: Worksheet 6B

Activity 3: Gain consensus within chain of command for the performance measurement baseline.

The baseline document is a formal agreement between the program functional proponent and the DoD Executive Agent. The PM is responsible for preparing the baseline for approval within the functional organization responsible for the program and the Services' or Agencies' Executive Agent. We will assume that the PM for the HIRMS has updated his baseline prior to gaining the

Milestone II approval. This baseline now forms the contract against which the PM manages the program. (See Appendix A for proposed baseline agreement format.)

Activity 4. Establish data collection efforts to obtain periodic values of the measures in the baseline.

The PM is now responsible for gathering sufficiently accurate and timely data to be able to judge whether his program is executing within the approved parameters for cost, schedule, and performance. Testing events, such as developmental and project testing, will provide leading indicators of how the system will ultimately perform. Data must be collected and processed to compute “current estimates” of the values for the measures in the baseline.

For the purposes of this case study, we will illustrate breach conditions for the HIRMS in the areas of cost, schedule, and benefit. The current estimates, based upon data collected, indicate that there are variances between the program’s targets and the current estimates.

A baseline breach occurs when the program deviates from the approved baseline. A breach of the baseline occurs when the cost shown in the baseline agreement is estimated to increase by more than 15% during the project development phase; there is a projected schedule slippage of more than three months; or there are modifications to approved program funding that result in a nonexecutable baseline.

The HIRMS program is in the developmental phase between Milestones II and III and is currently going through project testing. Several technical parameters of the benefits are not at desired levels. The program is currently facing a slip in schedule due to software redesign, and the costs of completing the current phase are also expected to rise.

Exhibit 7-18 lists the total funding by appropriation required by the program to complete the development phase. The “Approved” column represents the dollars shown in the budget. The “Required” column represents what the PM currently estimates is needed for meeting the approved baseline. The numbers in the exhibit are in then-year dollars.

Appropriation	Approved	Required
Construction	\$ 1.0M	\$ 1.0M
Research and Development	\$ 9.0M	\$ 12.0M
Procurement	\$ 2.0M	\$ 2.0M
Operations and Maintenance	\$ 3.0M	\$ 4.0M
Total	\$15.0M	\$19.0M

Exhibit 7-18: Approved and Required Funding for Development Phase of the HIRMS

The PM currently requests \$4.0 million more than is budgeted for the development phase of the life cycle. This represents a potential cost growth of 26.6%. Since the allowable tolerance for cost growth is 15%, the program has breached its cost baseline, and corrective actions are required to bring the program back under the budgeted costs. If the cost growth is significant

enough, the program's expected ROI must be recalculated to ensure that the program is still a good investment according to the agency's investment portfolio.

Exhibit 7-19 contains the schedule milestones for the HIRMS. The "Completed" column represents the dates on which the events were actually completed. The "Modified Schedule" column represents the current estimate of when the event will occur.

Milestone	Approved Schedule	Completed	Modified Schedule
Milestone II	15 July 1996	15 July 1996	
Award Contract	15 March 1997	15 March 1997	
Begin Validation and Acceptance Testing	15 September 1997	15 September 1997	
Complete Validation and Acceptance Testing	15 March 1998	15 March 1998	
Begin Project Test and Evaluation	15 April 1998	15 April 1998	
Complete Project Test and Evaluation	15 July 1998		15 October 1998
Milestone III	15 September 1998		15 December 1998

Exhibit 7-19: Schedule Milestones

The program is currently estimating that the Milestone III review will slip by over 90 days due to the project testing taking longer than anticipated. This correlates with the estimated increases in program costs due to required redesign and additional testing. The program has breached its schedule baseline, and management review is warranted.

Exhibit 7-20 below contains results from the HIRMS project test and evaluation. The number of breaches (in bold) indicates that additional work is required during the current phase of the program to obtain the desired level of performance in the benefits area.

One method of demonstrating that a program is on track at a particular point in time is to compare the current estimates of the components (cost, schedule, and benefit) within the baseline against the target and threshold values. The trend of a particular performance measure is extremely important for evaluating anticipated results and the direction of movement. Current estimates that exceed the threshold value indicate a breach condition where corrective action is warranted. Current estimates between the target and threshold indicate a warning condition that performance is not at the desired level, and steps should be taken to ensure that the values do not extend below the threshold.

Measure	Target	Threshold	Observed Value
Decreased administrative lead time	95% of actions transmitted within 72 hours	95% of actions transmitted within 96 hours	95% of actions transmitted within 96 hours
Decreased labor efforts associated with processing management actions	75% decrease in labor efforts	50% decrease in labor efforts	N/A
Correct response to requests for information	99%	97%	98%
Response time	3 sec. maximum	4 sec. maximum	5 sec.
Ease of use	75% satisfaction	65% satisfaction	N/A
Protection from unauthorized access	100%	98%	99%
Decreased training requirements	90% achieve certification	75% achieve certification	N/A
Availability	98%	95%	85%
Mean time to restore function	99% within 24 hours	99% within 48 hours	95% within 48 hours
Restoration of databases	100%	99%	99%
Increased readiness from improved availability of information	95% demands met within 24 hours	85% demands met within 24 hours	N/A
Number of shared data elements	400	300	350
Reduction in system development cost due to use of standard data elements	\$30K reduction	\$25K reduction	\$26K reduction
ROI	3.5	3.0	3.2
Savings due to reduction in paperwork and increased accuracy in information provided to management	\$200K reduction over three years	\$90K reduction over three years	\$250K reduction over three years
Savings due to reengineering of business practices	\$500K reduction over three years	\$450K reduction over three years	\$453K reduction over three years
Increased timeliness and accuracy of responses due to BPR initiated changes	Less than 1% reject rate per year	Less than 2% reject rate per year	1.9% reject rate

Exhibit 7-20: Candidate Benefits for the HIRMS

7.3 Investment Baseline/Performance Agreement For The HIRMS

The information collected on the worksheets through the process described in sections 7.1 and 7.2 was used to complete the following Investment Baseline/Performance Agreement for the HIRMS.

OPERATIONAL CAPABILITY

Program Name: Hypothetical Information Resources Management System (HIRMS)

Mission Goal(s): Information Resources Management (IRM) Functional Area

Enhance customer service through process improvements, elimination of paperwork, and improved automated tools for system users. Incorporation of improved and standardized business practices and electronic commerce techniques. Improve customer satisfaction by reducing costly, time-consuming paperwork; increasing responsiveness to customer inquiries; and facilitating prompt and accurate responses to requests for information.

Program Objectives:

1. Support the use of standard department management policies, processes, and shareable data.
2. Improve timeliness, accuracy, and effectiveness of management information.
3. Optimize, streamline, and integrate disparate IRM automated systems, subsystems, and databases.
4. Facilitate the department-wide integration of a standard, robust, management environment through the implementation of standard processes, and standard shared data.
5. Provide for improved data management and data integrity by electronic input of selected data to a logically shared data repository. Standard data and data transmissions must be employed. The capability to exchange data within the department, other government agencies, and with industry must be provided.
6. Provide information exchange capabilities among department components and related functional areas.
7. Provide for use of department-wide electronic commerce/electronic data interchange (EC/EDI).
8. Streamline manual management processes, including the automation of manual management activities and the ability to input data only once at the source.
9. Provide an on-line means for capturing and evaluating customer feedback information.
10. Provide the status of materials that are on order or on hand in a near-real-time environment to enable department managers to more closely monitor the assets of the department.

Current Operational Capability:

Currently the DoD IRM Community is not using a single standardized system to perform the information resource management function. Each component is using one or more “stovepipe” systems to perform their mission. These “legacy systems” are not usually integrated among the components and in only a few cases is EC/EDI possible. There is also a significant percentage of activities who have no automated IRM support systems.

Enhanced Operational Capability Requirements	Enhanced Operational Capability Performance Measures:
Decreased administrative lead time.	95% of management actions completed within 96 hours.
Decreased cost of management due to streamlining of processes.	75% decrease in person-hours required to process a request.
Provision of accurate information on requests for status of pending actions.	99% accuracy.
Protection of information from unauthorized access.	Rejects unauthorized access and intrusion 100% of the time.
User-friendly design.	At least 75% of HIRMS users express satisfaction.
Effective training program for personnel who operate/maintain HIRMS.	At least 90% of trained users achieve certification.
Sustainability under the current personnel.	No increase in the number of personnel or the entrance abilities of user personnel.
Acceptable response time to user commands.	Response time after initiating a command shall be 3 seconds maximum with a desired interval of 2 seconds.
Maximum availability to sustain operations.	Available 98% of time for software and interfaces. Minimum allowable is 95%.
Short mean time to restore function.	99% of system faults shall be corrected within 48 hours.
Provision of the capability to rebuild and restore databases.	100% of data from last backup is recovered

Benefits Assessed:

Return on Investment: 3:1

Quality:

- Accuracy
- Response Time
- Availability
- Maintainability
- Restoration

Compatibility: Compliance with TAFIM.

Interoperability: Use of DoD standard elements.

Annual Maintenance:

Annual Operations & Support Costs

Risks & Deficiencies:

Failed Performance Goals/Measures

Strategic Match:

The HIRMS is a critical component in the IRM Functional Area Strategic Plan to have a common information resources management throughout DoD. The common system will support the functional areas goals for reductions in response times, errors, and costs.

Conduct Operational Benefits Assessment / Post-Deployment

A post-deployment operational benefits assessment will be conducted beginning 180 days after IOC (May 2000.)

PROGRAM COST & SCHEDULE**Program Costs:**

Then Year	\$19,000,000
Base Year	\$16,500,000
Approved Budget Amount	\$15,000,000
Average Unit Procurement Cost	N/A (single system)
Life Cycle Cost	\$60,000,000
Sunk Cost	\$5,000,000
Cost to Complete	\$55,000,000

Program Schedule:

Program Initiation	March 1994
Major Milestone Decision Points	
Milestone 0	March 1994
Milestone I	April 1995
Milestone II	July 1996
Critical System Events	
Award Contract	15 March 1997
Begin Validation and Acceptance Testing	15 September 1997
Complete Validation and Acceptance Testing	15 March 1998
Begin Project Test and Evaluation	15 April 1998
Complete Project Test and Evaluation	15 July 1998
Milestone III	September 1998
Initial Operating Capability	October 1999

Risks & Benefits:**Risks Assessed:**

- **Strategic Uncertainty:** The HIRMS will support streamlining of existing processes. There is minimal risk of failure in this area.

- **Technological Uncertainty:** HIRMS uses technology and techniques well-tried and proven in Government and commercial use. Minimal risk in this area.
- **IT Infrastructure Risks:** There is a moderate risk in this area because of HIRMS dependence on the existing data communications system. If data traffic from other sources significantly exceeds the planning assumptions; HIRMS could fall below required levels for response times.
- **Organizational Risks:** There is a minimal risk in this area. HIRMS requires significant re-training of DoD personnel to effectively use the full system capabilities; however, analysis of the proposed training program reveals no likely problem areas.

Strategic Impacts :

- **Management Information Assessment:** Fielding of the HIRMS directly supports the following mission goals of the OASD (IRM):
 1. Enhance customer service through process improvements, elimination of paperwork, and improved automated tools for system users.
 2. Incorporation of improved and standardized business practices and electronic commerce techniques.
 3. Improve customer satisfaction by reducing costly, time-consuming paperwork; increasing responsiveness to customer inquiries; and facilitating prompt and accurate responses to requests for information.
- **Competitive Response:** Failure to field the HIRMS (or the same capabilities) will seriously degrade DoD's ability to effectively manage IT resources. Inefficient management procedures, lack of accountability, and ineffective user support will worsen without the automated management capabilities HIRMS is designed to provide. Inordinate amounts of the IT budget will have to be committed to maintaining the current system instead of capitalizing on mission-critical enhancements.
- **Strategic Information Systems Architecture:** HIRMS is fully compliant with TAFIM, the DoD data standards, and the DoD IM/IT Strategic Plan.

Variance From Program Baseline Goals

Variance in total program cost - HIRMS is currently projected to be \$4.0 million (26.6%) above baseline costs at the end of this FY. The cost variance is caused by unanticipated problems in software development.

Variance in total program schedule - HIRMS is currently 3 months behind the baseline schedule, again because of software development problems.

Variance in operational capability performance indicators - HIRMS is currently failing to meet performance baselines in three areas:

1. Response time (5 seconds vs. 4 seconds)
2. Availability (85% vs. 95%)
3. Mean time to restore function (95% within 48 hours vs. 99% within 48 hours)

Corrective Actions:

1. Additional software development resources were committed to resolve the immediate problem causing the cost and schedule delays. Two additional software engineers were added to the project team and a more rigorous design review process was instituted to preclude further slippage.
2. The response time problem has proved resistant to all alternatives explored. It is the consensus of the project technical team that the current value represents the best performance available with current technology. Recommend relaxing the performance requirement.
3. The availability and mean time to restore function failures have required minor redesigns of two modules. Preliminary testing indicates these problems can be eliminated without cost or schedule impact. Expect confirmation of test results in next 30 days.

Proposed Revisions to Baseline Goals:

The required response time of 4 seconds has proven to be technically infeasible given current technology and the infrastructure constraints of the system. 5 seconds has consistently been the best the system can deliver, and this has not responded to any alternative solutions. User representatives on the Integrated Project Team have indicated that 5 seconds is operationally adequate if it can be consistently delivered. Recommend relaxing this requirement to 5 seconds.

ACQUISITION/CONTRACT BASELINE

Earned Value Management Framework

Budgeted Cost of Work Performed:	\$7,500,000
Budgeted Cost of Work Scheduled:	\$15,000,000
Actual Cost of Work Performed:	\$10,000,000
Actual Cost of Work Scheduled:	\$19,000,000

Cost Variance:	\$2,500,000
Schedule Variance:	3 months

Budget at Completion:	\$60,000,000
Estimate at Completion:	\$65,000,000

Acquisition Baseline Cost & Schedule Goals {show the dollar amount of the project that will be completed each year. Identify and discuss how many months it will take to complete the acquisition, important components, and important milestones within that time}

FY 19PY Accomplishments

FY 19CY Planned Program

FY 19BY1 Planned Program

FY 19BY2 Planned Program

Cost Performance Index (CPI)

Schedule Performance Index (SPI)

Acquisition Baseline Performance Goals

Measure	Target	Threshold	Observed Value
Decreased administrative lead time	95% of actions transmitted within 72 hours	95% of actions transmitted within 96 hours	95% of actions transmitted within 96 hours
Decreased labor efforts associated with processing management actions	75% decrease in labor efforts	50% decrease in labor efforts	N/A
Correct response to requests for information	99%	97%	98%
Response time	3 sec. maximum	4 sec. maximum	5 sec.
Ease of use	75% satisfaction	65% satisfaction	N/A
Protection from unauthorized access	100%	98%	99%
Decreased training requirements	90% achieve certification	75% achieve certification	N/A
Availability	98%	95%	85%
Mean time to restore function	99% within 24 hours	99% within 48 hours	95% within 48 hours
Restoration of databases	100%	99%	99%
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Savings due to reduction in paperwork and increased accuracy in information provided to management	\$200K reduction over three years	\$90K reduction over three years	\$250K reduction over three years
Savings due to reengineering of business practices	\$500K reduction over three years	\$450K reduction over three years	\$453K reduction over three years
Increased timeliness and accuracy of responses due to BPR initiated changes	Less than 1% reject rate per year	Less than 2% reject rate per year	1.9% reject rate

Variance from Acquisition Baseline Goals

1. Variance in Acquisition Cost: HIRMS is currently projected to be \$4.0 million (26.6%) above baseline costs at the end of this FY. The cost variance is caused by unanticipated problems in software development.
2. Variance in Acquisition Schedule: HIRMS is currently 3 months behind the baseline schedule, again because of software development problems.
3. Variance in Acquisition Performance goals: HIRMS is currently failing to meet performance baselines in three areas:
 - Response time (5 seconds vs. 4 seconds)
 - Availability (85% vs. 95%)
 - Mean time to restore function (95% within 48 hours vs. 99% within 48 hours)

Proposed Revisions To Acquisition Baseline Goals

The required response time of 4 seconds has proven to be technically infeasible given current technology and the infrastructure constraints of the system. 5 seconds has consistently been the best the system can deliver, and this has not responded to any alternative solutions. User representatives on the Integrated Project Team have indicated that 5 seconds is operationally adequate if it can be consistently delivered. Recommend relaxing this requirement to 5 seconds.

Effectiveness and Suitability Performance Indicators:

Technical Evaluation Criteria

HIRMS conforms with the Technical Architecture Framework for Information Management (TAFIM), consistent with the acquisition of commercial software. HIRMS will use open systems architecture, the Defense Information Infrastructure (DII), relational database technology, standardized data, and Electronic Commerce/Electronic Data Interchange (EC/EDI). HIRMS will interface with other functional areas, including logistics and finance. The system will meet C2 level security requirements.

Operational Evaluation Criteria

- I. The Critical Operational Issues (COIs) and measurement criteria are specified in the Test and Evaluation Master Plan (TEMP). COIs specified include:
 - A. **Performance.** Does the HIRMS enable users to complete required actions at and between sites in accordance with applicable regulations?
 - B. **Usability.** Does HIRMS support ease of use, effectiveness and efficiency, and user satisfaction?

- C. **Security.** Does HIRMS protect its information, provide adequate system protection, and possess the ability to survive unwanted intrusion?
 - D. **Training.** Does the contractor provided training program sufficiently support HIRMS operations?
 - E. **Reliability, Availability, Maintainability (RAM).** Is HIRMS reliable, maintainable, and available for operation?
- II. Minimum Acceptable Operational Performance Requirements (MAOPRs) are provided in the TEMP dated 8 September 1995. MAOPRs represent the minimum acceptable operational effectiveness and suitability characteristics, along with performance thresholds against which each characteristic will be evaluated to ensure that stated deficiencies/needs will be corrected/satisfied.

8. IT PERFORMANCE MEASUREMENT METHODOLOGIES

Successful performance measurements produce measures that are significant, linked to outcomes, correspond to a baseline, and are based on credible information. This section looks at Information Technology (IT) performance from a broad perspective, identifying a number of measures and measurement methodologies that can be used to develop the measures in the baseline. The approaches and the measures detailed in this section are in no way a complete set of measures and are included to help the user start generating performance measures.

The list of methods that follows below is designed to assist users of this guide to select the most appropriate measurement approach for their needs. Each of the sections listed contains a brief description of the approach, an example of the generated performance measures, a discussion of the strengths and weaknesses of the approach, how the approach might be used, and where to find more information about the approach. It may be necessary to use several of the approaches for a single IT performance measurement baseline.

8.1 IT Effectiveness Framework

The IT Effectiveness Framework assesses IT effectiveness at three levels: information and support provided; impact on user processes and performance; and, organizational performance.

8.1.1 Uses:

The framework is useful for assessing the effectiveness of IT in an organization or unit. It can also be used for assessing the effectiveness of an individual system.

8.1.2 Measurement Approach:

The IT Effectiveness Framework suggests that effectiveness should be measured at three levels:

1. **Information and Support Provided.** This addresses the lowest level of impact, since it assesses how effectively IT meets the information needs of the users of systems.
2. **Impact on Processes and Performance.** This level assesses how well IT contributes to improving organizational processes and their performance.
3. **Organizational Performance.** At the highest level, IT should have an impact on some aspects of the organization's overall performance.

To implement the framework, managers must first establish the ways IT contributes to the accomplishment of the organization objectives in the business unit (e.g., improving sales, improving customer satisfaction). Since achieving these goals will be the result of lower level impacts, objectives for each of these must be established as well (e.g., improved decision-making, better information quality).

Once the expected impacts of IT have been identified, performance measures can be developed to determine how effectively IT is doing its job. For example, measures of improved information

quality might include measures of. data accuracy, its scope, and the availability of different levels of data aggregation.

Performance evaluations provided by individuals are good ways to assess IT effectiveness, provided a variety of points of view are incorporated and integrated into the overall evaluation. Such evaluations should include contributions from users, IT, management and internal audit as a minimum.

8.1.3 Strengths:

The effectiveness of IT has typically been difficult to evaluate. The dynamic nature of systems can mitigate against the development of useful measures of effectiveness. This framework attempts to avoid these common problems by broadening the range of performance involved.

8.1.4 Weaknesses:

The development and management of effectiveness objectives can be difficult and time-consuming.

8.1.5 Examples:

Example 1. Sample Effectiveness-Oriented Objectives And Performance Measures

Levels	Objectives	Sample Performance Measures
Information and Support Provided	Improve time of presentation	• Data currency • Delivery schedule • Response time
	Improve information quality	Data accuracy, scope, aggregation
	Improve information quantity	• Access to new data • System interface, flexibility, simplicity, ease of use
	Improve presentation form	Format: graphical, color, etc.
	Improve user support	• Amount of user training • Quality of user guides • Quality of MIS - user relationship
Impact on Processes and Performance	Extent of common information	Change in attitudes toward MIS
	Improved decision making process	• Explicitness of goals/objectives • Consideration of alternatives • Comprehensiveness of analysis • Quantification of action consequences • Length of time to make decisions
	Improved user organizational performance via:	Automate manual data handling/correction
	Reduced information processing costs	Cost displacement(people, equipment)
	Improve asset utilization	• Reduced inventory levels/turnaround • Reduced number of backorders

Example 2. Sample Innovation and Improvement Measures

Innovation	• New Product Developments • Product Performance Characteristics • Time to Develop Next Generation of Products • Product Launch Times: Schedule Adherence
Improvement	Rate of Improvement of Performance

Example 3: Sample Financial Measures

Survival	• Operating Profit • Net Income • Cash Flow
Growth	• Market Share • Sales Growth • Return on Capital Employed
Future Outlook	Forecast and Discounted Future Cash Flows

8.2 IT Efficiency Framework

The IT Efficiency Framework assesses IT efficiency at four levels: (1) the individual information system; (2) the resources required; (3) the production capability of IT; (4) and the level of investment in IT resources.

8.2.1 Uses:

This framework can be used to assess the efficiency with which IT development and operations use resources. It can be used to assess the efficiency of an individual system or of IT itself.

8.2.2 Measurement Approach:

The IT Efficiency Framework suggests that IT efficiency can be measured at four levels:

1. The Individual Information System. This level addresses how closely the individual system complies with development and operations standards (e.g., the adequacy and completeness of controls).
2. Resource Consumption. This level looks at how closely the actual system or systems meet resource plans (e.g., schedules and budgets).
3. Production Capability. Here the number of resources available is assessed (e.g., available person-hours).
4. Resource Investment. At the highest level, the organization's investment in resources is evaluated (e.g., the capital investment in hardware).

To implement the framework, managers must first identify objectives for the individual levels of efficiency. For example, adherence to budget might be one objective for level 2. When this has been accomplished, performance measures can be designed and monitored, e.g., variance from budget or percentage of projects that varied from budget.

8.2.3 Strengths:

Linking efficiency objectives and performance measures ensures that IT monitors efficiency appropriately.

8.2.4 Weaknesses.

This is only one type of framework that can be used to assess IT efficiency. Many alternative approaches can be used effectively also. The collection of data about efficiency and the development of appropriate objectives and measures can be a time-consuming process.

8.2.5 Sample IT Efficiency Measures

	<i>MIS Development Process</i>		<i>MIS Operations Process</i>	
Levels	Objectives	Sample Performance Measures	Objectives	Sample Performance Measures
Information Systems	Technical quality	Compliance to systems development standards for program and database design	Technical quality	Compliance to design specification
	Controls quality	Compliance to applications control standards	Controls quality	Compliance test for adequacy and completeness
	Documentation quality	Compliance to documentation standards	Documentation quality	Compliance to standards
Resource Consumption	Development budget	Budget variance	Operations budget	Budget variance
	Scheduled completion	Schedule compliance	Scheduled run times	• Actual run times • Percent reruns
	User Participation	Amount and type of involvement	Estimated computer resource units required	Actual resource units utilized
Production Capability	Available person- hours	• Chargeable person-hours • Productivity rate • Percent overtime	Available computer capacity (throughput)	• % uptime • Response time • Backlog • % utilization • Actual throughput
			Job description	• Job satisfaction • Job performance
Resource Investment	MIS personnel training	Training expenditures	Capital investment	Capital expenditures (hardware)

8.3 Performance Measures for IT

The Performance Measures approach outlines ten dimensions of IT performance. It emphasizes that appropriate performance measures can change over time.

8.3.1 Uses:

The categories used in the Performance Measures approach will help IT managers to select measures of interest to Senior Leaderships.

8.3.2 Measurement Approach:

The ten most important aspects of IT performance:

1. IT impact on strategic direction
2. Integration of IT planning with corporate planning
3. Quality of information outputs
4. IT contribution to organizational financial performance
5. IT project efficiency
6. User/management attitudes about IT
7. IT staff competence
8. Integration with related technologies across other organizational units
9. Adequacy of system development practices
10. Ability of IT to identify and assimilate new technologies.

A variety of measures can be selected to evaluate IT performance in each of the above areas.

An effective program of IT performance measurement encompasses all of these areas of senior management interest. However, as the IT organization develops, the emphasis on measurement should change from a more structured focus on project efficiency and user satisfaction to more unstructured measures such as impact on strategic direction. IT managers therefore need to balance the various dimensions of performance measurement according to the organization's needs at a particular time.

8.3.3 Strengths:

The dimensions of IT performance measurement in this approach are clearly linked with what senior management wants to know about IT. This approach incorporates analysis of both the tangible and intangible impacts of IT

8.3.4 Weaknesses:

This framework does not incorporate many dimensions of IT performance that could be of interest, for example, quality of user training. Collection, interpretation, and presentation of such a widely-varying amount of performance data can be a time-consuming task.

8.3.5 Sample Performance Measures for IT

Performance Measure	Measurement Description
IT impact on strategic direction	• Productivity increases attributable to IT function • Cost reductions attributable to IT function • Organization would be out of business without IT
Integration of IT planning with enterprise planning	• IT documented plan is designed to support the enterprise strategic plan • Forecasts of IT capabilities exist • Enterprise and IT plans jointly developed
Quality of Information Outputs	• End-user surveys (in-house) • Customer/client surveys (outside organization) • Log of errors encountered by users maintained
IT contribution to organizational financial performance	• ROI • ROA • Cost allocation (method of accounting for systems operations and development) • Value added by IT (ROM) • Comparison of IT budgets as a percentage of revenue . • Budget performance (ability to meet IT budget) • Cost of maintaining systems
IT operational efficiency	• Log of system availability • Users' perceptions surveys • User turnaround time (batch) • Log of computer and communication up/down time • System response time (on line)
User/Management attitudes	• Management and user perceptions of IT performance • User surveys of user participation in systems development • User surveys of IT responsiveness to <i>user</i> needs • Time for IT function to respond to user complaints • Complaint logs
IT staff competence	• Number of managerial and technical education programs for IT staff • Career ladder(s) for IT staff exist • Formal performance appraisal system used • Level of education of IT staff
Integration with related technologies across other organizational units	User/IT development of user/IT budget

8.4 Productivity Measures for IT

These Productivity Measures for IT include assessments of both the efficiency and the effectiveness of IT. This measurement approach suggests ways of selecting appropriate measures of each and a means of integrating them to present to senior management.

8.4.1 Uses:

This approach helps managers select a variety of meaningful performance measures for their IT organization.

8.4.2 Measurement Approach:

There are a large number of performance measures available to IT managers. No single measure will provide senior management with what they need to know about IT productivity. Instead, multiple measures are needed in the following categories:

- Personnel Performance
- Managerial Performance
- Development Performance
- Goal Setting
- Financial Performance

Within each category, several sub-measures should be monitored, including quantitative and qualitative measures. By using similar scales to assess each sub-measure (e.g., 0 - 100), performance can be aggregated and easily compared.

The keys to effective performance measurement include:

1. Collecting data in a consistent manner over time to ensure that it is accurate and reliable.
2. Selecting performance measures that are of critical importance to key users. Involving users in selecting measures is therefore paramount.

Once collected, information should be presented to senior management in terms that can be readily understood. Not all sub-measures should be presented, but only the most important ones (i.e., those representing performance in critical areas). Graphics are a powerful way to integrate these measures clearly.

8.4.3 Strengths:

This approach integrates both the effectiveness and efficiency dimensions of IT performance. The emphasis on multiple measures of IT performance gives a more complete assessment of the value of the IT group than single measurement approaches.

8.4.4 Weaknesses:

There are a huge number of productivity measures available from which IT managers can choose, within each category. This approach does not assist managers in which ones to use.

8.4.5 Sample IT Productivity Measures And Sub-Measures

Performance Measure	Measurement Description
Personnel Performance	• Technical capabilities • Business knowledge • Training • Replacement projections • Job satisfaction
Managerial Performance	• Attitude of senior management • Attitudes of users • Performance audits • Perceptions of IT problems • Perceptions of IT capabilities
Developmental Performance: Quantitative	• Time and cost • Size of system request backlog • System maintenance costs • System cost standards • SLOC/ELOC • Charge out performance
Developmental Performance: Qualitative	• Application portfolio • Formal methodology quality – Structured design – Project control – Productivity aides – Documentation quality • Team size • User interaction
Goal Setting	• Senior management role in IT planning • IT representation in planning • Quality of planning • Forecasts of future technology and future IT capabilities
Operational Performance: Qualitative	• Back up performance • Security and privacy • User interaction • Complete and accurate data • Relevant, timely and understandable output • User friendly operations
Adequacy of system development practices	• Percentage of projects completed on time and/or within budget • Standard methodology for system analysis and design exists • Evaluation of user and IT function documentation is performed • Estimates of number of person-years in backlog of system development requests
IT personnel	• Formal reward system for innovative thinking and development using IT • Number of technical breakthroughs
Operational Performance: Quantitative	• System availability and utilization • Job rerun percentages • Maintenance performance ratios
Financial Performance	• Budget performance • Cost recovery • Distribution of costs • Market-based industry standard costs • Expense categorization

8.5 Enhanced Cost-Benefit Analysis

Enhanced Cost-Benefit Analysis (CBA) is a method of cost-benefit and cost-effectiveness analysis that provides a basis for a systematic and rational planning process for IT investments. It is broader than the traditional financial techniques that have previously been used to assess IT investments because it includes several techniques of measuring intangibles.

8.5.1 Uses:

Enhanced CBA can help senior management make rational IT investment decisions.

8.5.2 Measurement Approach:

CBA consists of five stages:

1. Enumerate of all changes that will result from an IT investment, both tangible and intangible. Changes in resource use, information output, and performance in the sponsoring business unit, other units in the business, and among suppliers/distributors should be documented.
2. Measure the changes identified in Stage 1. Problems can occur with predicting what will happen without the IT investment and in estimating the exact costs of a jointly used resource (e.g., a piece of hardware used by several systems). The most important aspect of this stage is to count the incremental or marginal changes to be brought about by the investment.
3. Attempt an explicit valuation of these changes. Where changes can not be quantified, e.g., improved quality of decision making, the relevant stakeholders should be asked for a valuation.
4. Adjust explicit values according to the timing and uncertainty of their occurrence.
5. Consider the valued and unvalued impacts together to arrive at a final assessment of an IT alternative.

8.5.3 Strengths.

Enhanced CBA incorporates many important principles of logical IT investment decision-making. It identifies and measures the costs and benefits for each stakeholder involved in the IT investment.

8.5.4 Weaknesses:

Cost-benefit analysis has been criticized as: focusing too much on efficiency rather than effectiveness; having a bias towards investments with short-term payoffs; and, ignoring the exploratory nature of strategic IT and important non-economic issues.

8.5.5 Sample Cost-Benefit Analysis Measurements

Stage 1. Enumeration

Look for: Changes in hardware, software, and personnel
 Changes in information output, e.g., quality, speed, timing
 Changes in enterprise performance, e.g., cost, strategic impact, ability to exploit technical development

Look in: The sponsoring unit
 Other organizational departments or divisions
 Suppliers and distributors

Stage 2. Measurement

If change is measurable, count the incremental changes, e.g., number of increased transactions. If not measurable, describe the change clearly and completely, e.g., describe the quality of the information output.

Stage 3. Valuation

Change valuation can be:

- Explicit - e.g., the cost of a transaction will decrease by \$5.00
- Quantitative - e.g., response time will be 15 minutes.
- Imputed - e.g., users state this change will be worth \$500,000 to their operations

Stage 4. Adjustments

Adjust Explicit Values for:

- Timing of the occurrence of the change
- Uncertainty of the change
- Assumptions, i.e., many measurements and values are based on certain assumptions.
- Sensitivity of the change to things like discount rates or risk premiums?

Stage 5. Combine Impacts

- Consider the explicitly valued and other impacts together.
- Make a decision, or reappraise the scope of the project e.g., to include another stakeholder's perspective or redesign the IT investment
- Avoid "management by numbers". Rational decisions do not always need to be numerically based.

8.6 Information Economics

Information Economics (IE) is a two-step process. The first part is a bottom-up approach that assesses both the tangible and intangible return on specific IT investments. The second part is a top-down approach that plans the environment of the overall information systems function within the context of the present and future business organization. (Only the first part is addressed below.)

8.6.1 Uses:

IE can help managers to justify and evaluate information systems and their strategic and economic impacts. IE can also be used to identify the most effective mix of projects for a given IT budget.

8.6.2 Approach:

IE expands the concept of the benefits of IT beyond the rational view of economic benefits. In addition to an enhanced view of return on investment (ROI), internal rate of return (IRR), and net present value (NPV), IE also incorporates the following into its evaluations:

- Strategic Match
- Competitive Advantage
- Management Information Assessment
- Competitive Response
- Strategic IT Architecture

As well as looking at the benefits of IT investments, IE also assesses their costs. The approach expands the concept of simple costs to incorporate the following into its evaluations:

- Strategic Uncertainty
- Organizational Risk
- Infrastructure Risk
- Definitional Uncertainty
- Technology Uncertainty

To assess IT investment projects, managers first systematically evaluate each project in terms of its identifiable tangible and intangible benefits, and its risks and uncertainty.

Second, each IT investment project must be measured against the ideal of maximum tangible and intangible benefits and minimum risks and uncertainties. Generally, a worksheet detailing the criteria for each class of benefit or risk is completed for each project.

Through this process, a project score is developed that will enable unlike investments to be compared in a way that optimizes a company's ability to maximize its strategic investments. Projects can then be compared on the basis of their scores and to determine the optimal value for an organization's IT budget.

8.6.2.1 Benefit Definitions

Enhanced ROI, IRR, or NPV

The commonly used ROI, IRR, or NPV calculations may require special consideration when applied to IS application development projects because they typically have a longer useful life than non-IS projects. They can also provide benefits that can be leveraged into other strategic investments for competitive advantage, and can improve operating efficiency and functional effectiveness beyond the boundaries of a single firm (e.g., EDI).

Strategic Match

Strategic matching assesses the degree to which the proposed project corresponds to established corporate and business unit strategies and goals, emphasizing the close relationship between IS planning and corporate planning. Projects that form an integral part of the corporate strategy will be assigned a higher strategic matching score, regardless of the economic impact calculation.

Competitive Advantage

This evaluates the degree to which the proposed project provides an advantage in the marketplace, for example, inter-organizational collaboration through EDI. The competitive advantage dimension requires that a value be placed on a project's contribution to achieving one or more of the following goals: altering the industry structure, improving the organization's position in its existing businesses, or creating new business opportunities.

Management Information Assessment

Management information assessment examines a project's contribution to management's need for information on core activities, e.g., activities directly involved in the realization of the firm's mission, as distinguished from support and accounting activities.

Competitive Response

Competitive response evaluates the degree of business risk associated with not undertaking the project, which includes the risk of losing market share.

Strategic IM/IT Architecture

This assesses the degree to which the proposed project fits into the overall IM/IT direction and assumes the existence of a long-term IM/IT plan, i.e. an architecture or blueprint that provides the top-down structure into which future data and systems must fit.

8.6.2.2 Benefit Measures

Benefit measures gauge the accomplishment of a result. You may want to consider benefits in two major groups: cost reduction and value enhancements. Cost reduction benefits result from improved operations and are the benefits typically identified with the system. Value enhancements are benefits that result from an increase in services to the organization or the organization's clients (e.g., timely response to inquiries). These benefits are service improvements not provided by the status quo.

The manager or analyst can directly measure many benefits in monetary terms. For example, projects for modernization or replacement of existing equipment can generate operating and support savings relative to the status quo. This benefit is quantifiable in direct monetary terms.

Replacing a particular work step, function, or piece of equipment is another common benefit. For example, administrative lead time or delay can be reduced, resulting in fewer resources needed. A remote job entry station can replace the central data entry operation, with a resulting cost reduction. Productivity and accuracy gains through on-line entry may also translate into personnel savings (value enhancement).

Benefits that are not specifically monetary, but quantifiable, can often be converted into equivalent monetary values. These benefits include labor savings and error reduction. An efficiency/productivity increase, typically expressed in person-years, is a benefit whose value includes all direct and indirect labor costs. Direct labor costs are salaries or hourly wages, while indirect labor costs include allowances, leave, and fringe benefits to reflect the full cost of providing a person-year of labor. Documented personnel reductions are the best evidence of monetary benefit.

8.6.2.3 Risk And Uncertainty Definitions

Strategic Uncertainty

Strategic uncertainty is an assessment of the degree to which the business strategy is likely to succeed.

Organizational Risk

Organizational risk is an assessment of the degree to which an IT project depends on new or untested non-IT corporate or business unit skills, management capabilities, or experience.

IM/IT Infrastructure Risk

The assessment of IM/IT infrastructure risk is essentially an environmental assessment, involving factors such as data administration, communications, and distributed systems. It assesses the degree to which the entire IM/IT organization is both required and prepared to support the project.

Definition Uncertainty

Generally, this assesses the specificity of the business/user objectives that are communicated to the IT project personnel.

Technology Uncertainty

Technology uncertainty assesses a project's dependence on new or untried technologies which may involve a single technology or a combination of new technical skillsets, hardware, or software tools. A project may be inherently risky if it requires the introduction of an untried technology.

8.6.3 Strengths:

IE includes non-monetary aspects of benefit which are usually ignored by traditional methods of evaluating IT projects. By defining value and risk more completely, IE helps to create a formal decision-making process around IT investments. IE assesses both business feasibility and technical viability.

8.6.4 Weaknesses:

A single IE evaluation can involve many complex assessments (e.g. calculating ROI). Combining multiple assessments (e.g., business strategy and technical strategy) can be even more challenging. It is not always clear how to determine the relative weights for the various approaches.

8.6.5 Examples

Example 1. Project Evaluation Using Information Economics

1. Determine the relative weight of each benefit and risk category.
2. Score each projects benefits according to the criteria established in each benefit and risk category. (A worksheet is needed for each category.)
3. Compute the weighted project score for each project.

Benefit Category:	Weight	Score	Weighted Score
Economic Impact	10	4.5	45
Strategic Match	2	5	10
Competitive Advantage	2	2	4
Management Information	2	3	6
Competitive Response	1	4	4
Strategic IM/IT Architecture	3	4	12
Cost Category:			
Definition uncertainty	-2	3	-6
Technological uncertainty	-2	1	-2
IT infrastructure risk	-2	0	0
Final Project Score			73

Example 2. Ranking Information System Projects Using Information Economics

Projects are compared by weighted scores and cost. The maximum score for the budget available is then computed. In this example, even though Project I has a higher total score, Projects 2 and 3 together have a higher weighted score and so are ranked higher given a budget limitation of \$20M.

Project Number	Weighted Score	Project Cost	Project Ranking
1	87	\$20,000,000	3
2	58	\$10,000,000	1

3	55	\$5,000,000	2
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8.7 Activity-Based Costing

Activity-Based Costing (ABC) is a method of measuring the cost and performance of activities, products, and customers. ABC apportions costs to products or services according to the actual activities and resources consumed, e.g., in production, marketing, sales, delivery, and service. ABC was developed to replace conventional cost systems since automation has made indirect costs (a.k.a. overhead) a significant cost factor in addition to labor and materials.

8.7.1 Uses:

ABC can be used to accurately measure the costs of both activities (e.g., systems) and cost objects, (e.g., products or customers). ABC can also be used to measure the *performance of an activity*. As a result of this measurement, organizations can use the information collected to improve performance and the value received by customers.

8.7.2 Measurement Approach:

ABC focuses on activities that use an organization's resources. An activity is a unit of work in an organization that consumes resources. Examples of activities include: providing support to customers, maintaining systems, processing orders. Examples of resources are: salaries of staff performing the activity and the people supporting it, office space, materials, direct system costs, system overheads etc.

ABC has two views: a *cost assignment* view that looks at the costs of a particular activity; and a *process* view that looks at the performance of that activity.

The Cost Assignment View determines the costs of an activity and relates them to a business' cost objects. A cost object is the reason a company Performs the activity (e.g., a product or customer).

Resource costs are assigned proportionately to the activities using them. Measures are identified for the frequency of use of an activity, e.g., for the "Hands on Support" activity, such a measure might be "number of trouble calls".

Each activity cost is prorated using a measure of the frequency it is used by a particular cost object.

The Process View looks at the same activity from a different perspective. Its goal is to measure the performance of an activity and to identify ways performance can be improved:

Cost drivers are identified. These are factors that determine the workload and effort of an activity and the resources it needs. For example, the credit checking activity in a credit department is driven by the number of sales prequalifications. An activity may have multiple cost drivers.

Performance measures for the activity are defined. These indicate how well an activity meets the needs of its internal or external customers, e.g., number of customer complaints, number of errors.

The performance measures of one activity often become the cost drivers of the next activity in the process.

Performance improvement comes from using both views and has three steps:

1. Analyze activities: understanding why work is done, and how well it is done will help eliminate waste and strengthen position.
 - identify nonessential activities
 - analyze significant activities
 - compare to best practices
 - examine links between activities
2. Dig for drivers; look for things that require you to perform nonessential activities or to perform below par; look for causes of waste
3. Measure what matters; identify the mission; communicate the objectives; develop the measures

8.7.3 Strengths:

ABC is a process of continuous improvement. It helps set strategic priorities and implement chosen strategies. Companies have used it to improve profitability, as the basis for directing investments to business areas with the greatest improvement potential, and to manage supplier relationships.

8.7.4 Weaknesses:

ABC provides only an "as-is" snapshot of current activities and conditions. ABC measures costs during the current period only. It does not address long-term issues.

8.7.5 Examples

Assigning Costs to Activities & Cost Objects

System Support Overhead Costs (\$1,000,000)

Activity	Proportion	Cost
Process Changes	25%	\$250,000
Hands on Support	50%	\$500,000
Maintain Documentation	25%	\$250,000

Cost of System Support per System

System A

System B

Activity Drivers	<i>Number</i>	<i>Cost</i>	<i>Number</i>	<i>Cost</i>
Change Requests	75	\$187,500	25	\$62,500
Trouble Calls	500	\$294,110	350	\$25,880
Programs	30	\$57,690	100	\$192,300
Cost per System		\$539,300		\$280,680

8.8 Integrated Performance Measurement

Integrated Performance Measurement (IPM) focuses on the strategic measurement of a system's success. By revealing the most strategically important problems to be solved or opportunities to be taken advantage of, IPM leads to continuous improvement along strategic lines.

8.8.1 Uses:

IPM helps users to develop performance *measures* for a system which are appropriate for multiple levels of an organization and which are specifically linked with organizational strategy. IPM can help IM/IT managers to evaluate their current IT performance to learn about how it could be improved.

8.8.2 Measurement Approach:

Performance measurement of IT involves evaluating:

- whether the system is effective
- whether system is efficient
- how the enterprise is organized to do the work surrounding the system.

The key to effective system performance measurement is to integrate financial and nonfinancial measures. This can be done by:

- using accounting measures of strategic variables when looking at IT performance at the top levels of the organization (i.e., measures that track results)
- using project measures of performance at the lowest levels of the organization (i.e., measures that track actions)
- using measures that track the relationship between actions and costs at middle levels of the organization.

To improve performance measurement, IPM uses a two-part Performance Measurement Questionnaire:

1. Current Performance Assessment identifies the current importance of various business performance factors, identifies the company's current ability to measure these factors, and appropriate IT measures can then be designed in keeping with desired current business performance.
2. Future Improvement Assessment identifies the long-run importance of improvement in various business performance factors and identifies the support by *current* systems and other company investments for these areas of improvement.

The effectiveness of current performance measures in measuring performance requirements can then be determined. Managers may also choose to invest in IT that will support current and future performance requirements.

8.8.3 Strengths:

IPM emphasizes consistency between and organization's strategies, its actions, and its performance measures. This approach communicates the organization's strategic objectives to every part of the company and lets every person understand how his or her actions and investment decisions contribute to achieving them. IPM addresses the future needs of the company by continually asking questions such as, "What will focusing on these measures lead to today? tomorrow?" and "What next?"

8.8.4 Weaknesses:

The usefulness of any IPM measure depends on the level of the organization and the time frame looked at. Thus, useful measurement systems will not be identical for any two locations, units, levels, or event time periods. This makes comparison of results difficult.

8.8.5 Examples

Example 1. Current Performance Assessment

Managers are first asked to rank business performance factors in order of their importance. In this study, 45 performance factors were identified and ranked.

Managers are then asked to indicate the *importance* they place on measuring various performance factors.

This example shows seven top performance factors (marked with an *), which are not being given appropriate importance by current company measures. It suggests that new measures need to be developed for these areas or that these factors need more emphasis.

Current Performance Factor Importance	Current Performance Factor Measurement Emphasis
<i>Top 25% (high to low, ranked 1 to 11)</i>	<i>Top 25% (high to low, ranked 1 to 11)</i>
1. New Product Introduction	1. Safety
2. Safety	2. Back Orders
3. Conformance to Specs	3. Yields
4. On-time Delivery*	4. Direct Labor Productivity
5. Vendor Quality*	5. Conformance to Specs
6. Sales Forecast Accuracy*	6. Department Budget Control
7. Research Effectiveness*	7. Unit Labor Costs
8. Meeting Production Schedule	8. Variances
9. Environmental Monitoring*	9. Meeting Production Schedules
10. Minimize Environmental Waste*	10. Controlling Capital Spending
11. Yields	11. Operations Product Costs

Example 2. Future Improvement Assessment

Managers were also asked to evaluate the support for areas of improvement that was provided by IT and other company investments.

31 business areas requiring improvement were identified and ranked in order of importance.

Ideally, the most important business areas requiring improvement would be those areas most supported by IT and other investments. In this case, four of the areas most important to the business (marked with an *) were among those receiving the least support from IT and other investments. This indicates that the agency should rethink the support and systems it provides to the top-ranked business areas.

Improvement Area Importance	Improvement Area Support	
<i>Top 25%</i> <i>(high to low, ranked 1 to 8)</i>	<i>Top 25%</i> <i>(high to low, ranked 1 to 8)</i>	<i>Bottom 25%</i> <i>(high to low, ranked 24 to 31)</i>
1. New Product Introduction	1. Customer Satisfaction	24. Managing Diversity
2. Sales Forecasting	2. Environmental Control	25. Job Responsibilities
3. Competitive Analysis	3. Direct Cost Reduction	26. Information System
4. Responses to Changes in Customer Demand	4. Regulatory Compliance	27. Response to Changes in Customer Demand*
5. Information Systems	5. Labor Efficiency	28. Performance Measurement
6. Process Technology	6. Inventory Management	29. Competitive Analysis*
7. Education and Training	7. Quality	30. Volume Flexibility
8. Corporate Information Management	8. Process Technology*	31. Sales Forecasting*

8.9 Information System Success Categories

These categories represent a comprehensive overview of possible types of Information System success. Within each category, a wide selection of success measures are given.

8.9.1 Uses:

These categories can be used to plan a complete assessment (i.e., both financial and nonfinancial) of an individual system's impact on the organization. Individual categories can be used to develop a thorough assessment of a system's impact in a particular area (e.g., impact on quality).

8.9.2 Measurement Approach:

There are five major categories of information system success:

1. System Quality - This reflects the engineering-oriented performance characteristics of the system e.g., reliability, response time.
2. Information Quality - reflects the importance and utility of information presented by the system, e.g., information accuracy, relevance. Use - Where use of a system is optional, the amount of use can indicate its success e.g., frequency of use, number of requests for particular types of information
3. User Satisfaction - This measures whether users actually like a system and includes measures of both general satisfaction (e.g., happiness with a system) and specific satisfaction (e.g., communication with IM/IT). It is one of the most commonly-used measures of IM/IT success.
4. Individual Impact - This addresses how the system has improved individual performance e.g., decision-making, productivity, or work flow.
5. Organization Impact - This measure includes not only financial "bottom-line" impacts, but also impacts on productivity, competitive advantage and organization structure.

While these measures can be looked at individually, it is clear that they are interrelated as well. For example, systems must be used before they can affect individual performance. Individual performance must be affected before organizational performance will be changed. In short a thorough assessment of a system's success would include measures from each of these categories.

8.9.3 Strengths:

These categories provide a comprehensive view of the measurement of IM/IT Success.

These categories help organize a variety of measures of IM/IT success into a comprehensive whole and clarify how a confusing host of success measures fit together.

8.9.4 Weaknesses:

Many of the measures presented within the categories have not been studied empirically.

Different studies using different success measures selected from these categories will come up with different results, making it difficult to compare the success of different systems.

8.10 Value Management Framework

The Value Management Framework is a method of evaluating the impact of a system from a technical, economic, and an organizational perspective. The framework organizes findings at three different levels: individual, business unit, and corporate.

8.10.1 Uses

To assess the impact and benefits of a system after implementation.

8.10.2 Measurement Approach:

A system can be assessed in terms of its impact in two dimensions:

- Where its value comes from, i.e., does it have economic benefits?; did it change processes?; did the technology enable additional benefits?
- Where the value occurred, i.e., was the impact at an individual level, a business unit level, or an organizational level?

By joining these two dimensions into a framework, localized measures of performance can be linked with organizational performance. For example, giving a sales force laptop computers improves tracking of sales calls and expenditures by agent, leading to better management of the sales process by region, and finally, to a better understanding at the corporate level of how these measures relate to improved profit margin.

8.10.3 Strengths:

This framework emphasizes the importance of assessing a system's impact at multiple levels and from several perspectives. It points out that financial results and other high-level indicators of success are the end products of many intermediate business impacts. Failure to understand these provides executives with no ability to leverage unanticipated benefits or to learn from experience. This framework is a structure to evaluate the intermediate impacts of a system.

8.10.4 Weaknesses.

The framework does not help with the quantification of benefits.

8.10.5 Examples

Evaluation Of A Human Resource System

Impact Focus			
Source of Value	Technology Enabling Impact	Organizational Process Outcome	Economic Performance
Individual	On-line entry of job applications	- Improved access to data - Elimination of data entry step	- Reduced time to serve employee request - More time for other HR initiatives
Business Unit	- Easier access to information - Improved accuracy	- Elimination of claims verification process - Improved decision making	- Quicker compliance with government regulations - Reduced cost of placing employees
Organization	- Elimination of 14 payroll systems - Data and process standards	- Ability to restructure - Introduction of new benefits programs	Reduced cost of employee benefits

8.11 Earned Value

8.11.1 Description

The earned value approach is dictated in DoD Regulation 5000.2-R as the basis for the Cost/Schedule Control System Criteria (C/SCSC). It is a management technique that relates resources planning to schedules and to technical performance requirements. EV requires the contractor to plan, budget, and schedule all authorized effort in time-phased “planned value” increments constituting a “performance measurement baseline”. As work is accomplished, it is “earned” on the same basis it was planned.

8.11.2 Uses

To assess progress toward accomplishing project performance goals within cost and schedule constraints.

8.11.3 Measurement Approach:

The earned value approach measures cost and schedule variances by comparing the actual costs (in money and time) of work performed against the values projected in the project baseline. Work is planned, budgeted and scheduled in time-phased increments that provides an immediate, objective basis for comparing actual performance with projected. Measuring work in terms of performance capability achieved instead of effort expended can provide a totally integrated performance measurement system.

8.11.4 Strengths:

If done correctly, the earned value approach provides a continuous, integrated, objective yardstick of all three factors of project performance measurement.

8.11.5 Weaknesses.

- Relating work effort to capabilities achieved is often difficult.
- This approach is best suited to measuring technical performance rather than mission capabilities.

8.12 The Balanced Scorecard

8.12.1 Description:

The Balanced Scorecard is a set of financial and operational measures that provide a balanced presentation of both the financial and operational impacts of a system giving senior managers a comprehensive view of a system's value.

8.12.2 Uses:

To assess the value and impacts of an IT investment.

To help establish performance measures that relate clearly to the overall objectives of a system.

8.12.3 Measurement Approach:

Senior managers need to know the impact a system has had on a business' operations as well as its financial benefits. Both types of measures are equally important, and no single measure can address both these dimensions. The Balanced Scorecard focuses attention on four areas that are most critical to any business. Managers using it to evaluate an IT investment should ask the following questions:

1. How does *this system* make us look to our customers? Managers should articulate the system's goals in relation to customers' concerns, i.e., time, quality, service and performance, and price. They should then develop measures to assess the systems impact accordingly.
2. How does this system affect the critical operations that enable the company to meet its customers' needs? These would include processes that affect cycle time, quality, employee skills, and productivity.
3. How does this system enable the company to learn and grow? Managers should assess how the system improves the company's ability to launch new products, create more value for customers or improve operating efficiencies.
4. How does this system contribute to an Improvement of the bottom line? Operational improvements do not always lead, to improved financial performance, such as improved market share or cash flow. However, failure to do so should warn executives that they must rethink the company's systems strategy or implementation plans.

The Balanced Scorecard requires managers to articulate an overall vision for a system and to develop measures that are designed to evaluate how well this vision is achieved. As a result, measures will be different for each system. Example 1 lists some sample measures of ways in which a system might have both operational and financial impacts.

8.12.4 Strengths:

The Balanced Scorecard brings together, in a single management report many disparate elements of a company's competitive agenda: becoming customer-oriented; shortening response time; improving quality; emphasizing teamwork; reducing new product launch times; and managing for the long term.

This approach also helps managers to see whether improvement in one area has been achieved at the expense of another. By forcing senior managers to consider all important measures together, it therefore guards against suboptimization.

The measures emphasize strategy and vision, not control. They therefore keep executives looking forward, not backward.

8.12.5 Weaknesses:

It may not be easy to develop the necessary measures of performance or to collect the appropriate data. Systems may have to be modified to capture the information or new processes put in place to collect it.

APPENDIX A

IT Investment Baseline/Performance Agreement

Purpose/Concept:

DoD must establish a common framework/understanding for baselining IT investments. The Investment Baseline/Performance Agreement is the recommended approach. The Investment Baseline/Performance Agreements' performance parameters represent the minimum number needed to characterize the major drivers of operational effectiveness, suitability, schedule, technical progress and cost. This minimum number include the key outcome measures described in the requirements definition document.

The Investment Baseline/Performance Agreement will be used to enhance stability, control the cost growth and assess how well IT supports the achievement of mission goals. This framework is intended to fill the gaps and meet the requirements of ITMRA and OMB Circular A-11.

This framework provides the CIO, CFO, functional managers and PM/user with the means to obtain timely information, assess and manage risks, and maximize the value of IT investments. The intent of this framework is to track an IT investment from cradle to grave (From Mission Need through disposal.). The IT Investment Baseline will be used during a follow-on IT Investment Operational Assessment Program (To Be Established) that assesses performance, quality, compatibility, interoperability and identifies deficiencies.

The Investment Baseline/Performance Agreement is a combination of: (1) the Acquisition Program Baseline (APB required by DoD 5000-2R), (2) OMB's Circular A-11 revision 3's baseline requirements (which will be submitted with the budget for programs), and (3) additional measures identified in ITMRA.

The Investment Baseline/Performance Agreement will be used to track, (1) the accomplishment of the Operational Requirement through the use of an established Program baseline cost, schedule and operational performance goals/outcomes and (2) the accomplishment of the acquisitions/contracts through the use of an established acquisition/contract baseline cost, schedule and acquisition/contract performance goals/outcomes using the Earned Value Management Framework. The assessment of the acquisition/contract baseline will be used to determine the successful accomplishment of the Operational Requirement/Program baseline.

The Investment Baseline/Performance Agreement is recommended as an update or appendix to the APB (DoD 5000-2R Acquisition Program Baseline).

INVESTMENT BASELINE/PERFORMANCE AGREEMENT

OPERATIONAL CAPABILITY

Mission Goal(s):

Program Name:

Program

Objectives:

(Functional Area Supported)

Current Operational Capability:

**Enhanced Operational:
Capability Requirements**

**Enhanced Operational Capability
Performance Measures of Effectiveness
& Efficiency: Define Measures**

Benefits Assessed:

- Return on Investment:
(quantitative/qualitative)
- Net Present Value:
- Quality
- Internal Rate of Return:
- Compatibility
- Interoperability

Annual Maintenance:

- Annual Operations & Support Costs

Risks & Deficiencies:

- Failed Performance Goals/Measures

Strategic Match: {Strategic matching assesses the degree to which the proposed project corresponds to established corporate and business strategies and goals, emphasizing the close relationship between IT planning and corporate planning}

Conduct Operational Benefits Assessment Program/ Post Deployment

PROGRAM COST & SCHEDULE

Program Costs:

Then Year
Base Year
Approved Budget Amount
Average Unit Procurement Cost
Life Cycle Cost
Sunk Cost
Cost to Complete

Program Schedule:

Program Initiation
Major Milestone Decision Points
Initial Operating Capability
Critical System Events
FY 19PY Accomplishments
FY 19CY Planned Program
FY 19BY1 Planned Program
FY 19BY2 Planned Program

Risks & Benefits:

Risks Assessed:

- **Strategic Uncertainty** {assessment of the degree to which the business strategy is likely to succeed}
- **Technological Uncertainty** {assesses a project's dependence on new or untried technologies which may involve a single technology or a combination of new technical skillsets, hardware or software tools. A project may be inherently risky if it requires the introduction of an untried technology}
- **IT Infrastructure Risks** {essentially an environmental assessment, involving factors such as data administration, communications and distributed systems. It assess the degree to which the entire IT organization is both required and prepared to support the project}
- **Organizational Risks** {an assessment of the degree to which an IT project depends on new or untested non-IT corporate or business skills, management capabilities or experience}

Strategic Impacts :

- **Management Information Assessment** {examines a project's contribution to management's need for information on core activities, e.g., activities directly involved in the realization of mission goals}
- **Competitive Response** {evaluates the degree of business risk associated with NOT undertaking the project}
- **Strategic Information Systems Architecture** {assesses the degree to which the proposed project fits into the overall Information Resource Management Strategic Planning direction, and assumes the existence of a long-term IT plan}

Variance From Program Baseline Goals

Variance in total program cost - (10% or more above baseline)

Variance in total program schedule - (10% or more behind baseline)

Variance in operational capability performance indicators - (report on whether the program has deviated at all from performance goals and measures specified in this baseline/contract)

Corrective Actions:

Describe proposed corrective actions for each variance from baseline goals noted above.

Proposed Revisions to Baseline Goals:

Describe and justify any revisions to goals set forth in the original baseline agreement.

ACQUISITION/CONTRACT BASELINE

Total Procurements:

Earned Value Management Framework {this framework is required for every Primary Acquisition, all sub-acquisitions will report the progress of their acquisition baselines to the Prime. Earned Value needs to be tracked over time to be useful to decision makers (i.e. each contractual vehicle needs to be evaluated monthly)}

Acquisition Baseline Cost & Schedule Goals {show the dollar amount of the project that will be completed each year. Identify and discuss how many months it will take to complete the acquisition, important components, and important milestones within that time}

FY 19PY Accomplishments

FY 19CY Planned Program

FY 19BY1 Planned Program

FY 19BY2 Planned Program

Cost Performance Index (CPI)

Schedule Performance Index (SPI)

Acquisition Baseline Performance Goals

{summarize the performance goals of the acquisition as stated in the statement of work and describe the relationship of the acquisition to the overall operational capability}

Variance from Acquisition Baseline Goals

1. Variance in Acquisition Cost: {identify whether the current acquisition cost estimate is 10 percent or more above the baseline goals. Discuss and give reasons for the variance}
2. Variance in Acquisition Schedule: {identify whether the current schedule estimate is 10 percent or more behind. Discuss and give reasons for the variance}
3. Variance in Acquisition Performance goals: {identify whether performance goals deviate at all from the performance goals stated in the statement of work. Discuss and give reasons for the variance}

Proposed Revisions To Acquisition Baseline Goals

{Program Manager may propose revisions to the acquisition baseline cost, schedule and performance goals if current estimates indicate they are not achievable. The proposed revisions must be justified, with an estimated probability of achieving the new goals. The CIO, CFO and Functional Sponsor must approve any changes to the acquisition baseline goals.}

Effectiveness and Suitability Performance Indicators:

Technical Evaluation Criteria

Technical performance measures to be evaluated during the test and evaluation phase of the system development; also documented in the Test and Evaluation Master Plan.

VALIDATION

CIO_____

CFO_____

Functional Proponent _____

Project Manager_____

DEFINITIONS

Program Costs Definitions:

Then Year: Dollars that include the effects of inflation or escalation and/or reflect the price levels expected to prevail during the year at issue.

Base Year: A reference period which determines a fixed price level for comparison in economic escalation calculations and cost estimates. The price level for the base year is 1.00.

The following is an example of both Base Year (BY) and Then Year (TY):

	TY FY95	BY FY96	TY FY97	TY FY98
Escalation Index:	.985	1.00	1.15	1.30
Fiscal Impact:	\$98.5	\$100.0	\$115.0	\$130.0

Approved Budget Amount: The total approved budget authority provided by law to enter into obligations that will result in immediate or future outlays. The budget amount is provided by fiscal year and appropriation.

Average Unit Procurement Cost: Includes recurring flyaway, rollaway, sailaway costs (including nonrecurring production costs) adjusted for data, training, support equipment, and initial spare costs.

Total Procurement Quantities: The total number of fully configured end items a DoD component intends to buy through the life of the program. This quantity may extend beyond the FYDP years but shall be consistent with the current program.

Life Cycle Cost: The total cost to the government of acquisition and ownership of that system over its useful life. It includes the cost of development, acquisition, support, and, where applicable, disposal.

Program Schedule Definitions:

Program Initiation: The start of a defined effort funded by RDT&E and/or procurement appropriations with the expressed objective of providing a new or improved capability in response to a stated mission need or deficiency.

Major Milestone Decision Points: The point when a recommendation is made and approval sought regarding starting or continuing (proceeding to the next phase) an acquisition program.

Milestones are: 0 (Concept Direction), I (Concept Approval), II (Development Approval), III (Production Approval), and IV (Major Upgrade Decision).

Initial Operating Capability: The first attainment of the minimum capability to effectively employ a weapon, item of equipment, or system of approved specific characteristics, and which is manned or operated by an adequately trained, equipped, and supported military unit or force.

Critical System Events: Interim milestones in the acquisition process that review a systems capability, either operational, technical, or other, that must be questioned before a system's overall suitability can be known, and which are of primary importance to the Milestone Decision Authority in reaching a conclusion on allowing the system to advance to the next phase.

Other:

Earned Value (EV): A management technique that relates resources planning to schedules and to technical performance requirements. EV requires the contractor to plan, budget, and schedule all authorized effort in time-phased "planned value" increments constituting a "performance measurement baseline". As work is accomplished, it is "earned" on the same basis it was planned.

Return On Investment (ROI): Net income divided by investment, or operating revenues divided by operating costs.

Net Present Value: A time value of money tool intended to support the choice of cash flow alternatives. The present value of a series of future cash flows is the value that it would be necessary to invest at the present time at a specified interest rate to be able to make the future cash disbursements and receipts of the cash flow and completely exhaust the investment balance.

Internal Rate of Return: The discount rate that results in a present value of zero in cash flow.

APPENDIX B

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