Value Measuring Methodology

How-To-Guide

CIO Council, Best Practices Committee

Letter from the Co-Chairs
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Washington, DC

The Federal Chief Information Officer (CIO) Council is responsible for the coordination, integration, and operation of information management and technology practices throughout the Federal Government. The CIO Council Best Practices Committee is chartered to provide members of the Federal Information Technology (IT) community with in-depth examples and practical guidance to successfully formulate, manage and maintain the portfolio of initiatives to ensure that the investments made in IT yield the anticipated benefit. This may include streamlining and transforming the operating processes of the agencies, making transactions with government less costly and simpler, making government more accountable and transparent to the public, while reducing the costs associated with operating government.

Key to achieving this ambitious objective is the need for sound investment management. To this end, in March 2002, our Committee released our first report entitled "A Summary of First Practices and Lessons Learned in Information Technology Portfolio Management." The objective of that report was "to provide lessons learned and insights from leading IT portfolio management practitioners to be used by Government officials, budget and planning specialists, program managers and the Federal and contractor communities that help to execute Government functions."

The Best Practices Committee is pleased now, to release this report, "The Value Measuring Methodology: Highlights," and its companion publication, "The Value Measuring Methodology: How-To-Guide." The report carries forward the focus on the objective of sound investment management. They provide a specific, pragmatic, implementation-focused mission accomplishment and compliance with current Federal regulations and OMB guidance. The Guides provide the methodology to evaluate and select initiatives, which yield the greatest benefit to the Government.

We extend our gratitude to Best Practices Committee volunteers, General Services Administration (GSA), Social Security Administration (SSA), General Accounting Office (GAO) and Office of Management and Budget (OMB) representatives who participated in the field-testing of the methodology contained in the Guide, and helped put the report together.

We would be pleased to receive your comments on the value of this process to your agency.

Sue Rachlin and John Marshall
Co-Chairs, Best Practices Committee
Federal CIO Council

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I. Foreword

In July 2001, the Social Security Administration (SSA), in cooperation with the General Services Administration (GSA), undertook the task of developing an effective methodology to assess the value of electronic services (e-services). Their aim was to formulate a methodology that would be compliant with current Federal regulations and OMB guidance, applicable across the Federal Government, and pragmatically focused on implementation.

To assist in this effort, Booz Allen Hamilton analysts and thought-leaders associated with Harvard University's John F. Kennedy School of Government were asked to conduct a study that culminated in the January 2002 publication *Building a Methodology for Measuring the Value of e-Services*. That report reflected the findings of the study effort including interviews with representatives of state and Federal Government, the private sector, think tanks, and the academic community. The report presented the first version of the Value Measuring Methodology (VMM), its supporting theories, and philosophy.

Since the release of the report, GSA and SSA have continued to apply and refine VMM. GSA worked further with Booz Allen Hamilton and the John F. Kennedy School of Government to develop an abridged "Highlights" report and a technical step-by-step "How-To-Guide" to be used by individuals applying the methodology. Electronic Data Systems (EDS) performed an independent review of VMM on behalf of the CIO Council Best Practices Committee.

VMM has been improved and tested in a real work environment. The "Highlights" document provides high-level information so that VMM users may understand the methodology. More detailed information on implementation of the methodology is found in the "Value Measuring Methodology: How-To-Guide."

THIS GUIDE IS DESIGNED TO PROVIDE AN UNDERSTANDING OF THE PLANNING PROCESS THAT LEADS TO SOUND BUSINESS DECISIONS.

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II. Introduction

The purpose of the Value Measuring Methodology (VMM) is to define, capture, and measure value associated with electronic services unaccounted for in traditional Return-on-Investment (ROI) calculations, to fully account for costs, and to identify and consider risk. Developed in response to the changing definition of value brought on by the advent of the Internet and advanced software technology, VMM incorporates aspects of numerous traditional business analysis theories and methodologies, as well as newer hybrid approaches.

VMM is designed to be used by organizations across the Federal Government to steer the development of an e-Government initiative, assist decision-makers in choosing among investment alternatives, provide the information required to manage effectively and to maximize the benefit of an investment to the Government, to direct users (e.g., citizens, other government organizations, employees), and to society as a whole. It provides the flexibility to predict and communicate the value of a proposed e-Government initiative to multiple stakeholders.

VMM has been applied to two cross-agency initiatives managed by GSA (e-Authentication and e-Travel), and two SSA applications that directly serve citizens ("Check Your Benefits" and a proposed "Deferred Application Process" for Supplemental Security Income recipients and applicants). The lessons learned by both agencies have been incorporated into the development of this guide and shared with others in a variety of awareness building events. In each instance, the depth and breadth of the information, along with supporting documentation, have presented a clear, multi-dimensional picture of value. In applying the methodology to e-Authentication and e-Travel, GSA performed the level of planning and analysis required to advance both initiatives through the budget process and to put in place appropriate program management controls.

TRADITIONAL BUSINESS PLANNING AND ANALYSIS TECHNIQUES MUST BE AUGMENTED TO ADDRESS THE NEW ELECTRONIC POSSIBILITIES FOR TRANSFORMING GOVERNMENT SERVICES.

Under perfect conditions, VMM would be used at the very conception of an e-Government initiative. However, it may also be used for initiatives that have entered into a more advanced stage of development. The rigorous and structured planning and thinking that is required by VMM can be of use to program managers at any point during the lifecycle of a program, whether it is used to justify spending, re-evaluate objectives and performance, or validate management controls. Cross-functional groups (decision-makers, analysts, technologists, business line staff, acquisition specialists, policy

makers, program managers, customer representatives, and stakeholders) should be involved throughout the process.

VMM PROCESSES ARE APPLICABLE TO ANY ENVIRONMENT WHERE ALTERNATIVES NEED TO BE DEFINED AND ANALYZED IN ORDER TO SELECT INITIATIVES FOR INVESTMENT.

The remainder of this document illustrates both the benefit and VMM via the following structure:

Section III	Demonstrates the value gained from using the VMM methodology to analyze e-Government and other investments.
Section IV	Outlines the VMM process and explains the value of each step of the methodology.
Section V	Delves into the specifics of the methodology, elaborates on the actions and resources required to complete a VMM analysis, highlights key concepts, and shares best practices and real-life lessons learned from past implementations of VMM.
Section VI	Provides technical information in support of the How-to-Guide.
Sections VII & VIII	Contain References and Acknowledgements respectively.

III. Value Proposition

VMM is based on public and private sector business and economic analysis theories and best practices. It provides the structure, tools, and techniques for comprehensive quantitative analysis and comparison of value (benefits), cost, and risk at the appropriate level of detail. The following conveys the Value Proposition of VMM more fully.

A Decision Framework

The "Essential Factors" framework provides several perspectives on value, such as value to customers, as well as risk and cost structures. (See Chapter IV, Overview of VMM Steps). Properly applied, VMM produces an outline, guiding the process for the selection, design, analysis, and management of an investment. The framework delivers the following benefits:

Properly applied, VMM produces an outline, guiding the process for selection, design, analysis, and management of an investment.

- It provides senior management with the information necessary to communicate agency, government-wide or focus-area priorities, and to establish consistent measures for evaluating existing or proposed initiatives
- It gives program staff visibility into the relevant needs and priorities of stakeholders and customers
- It considers risk and risk mitigation planning early in the development process, before the alternatives are defined
- It provides value measures (including metrics and targets) that capture project value, guide alternatives definition, and facilitate on-going performance and results-based management

A Method for Quantifying and Comparing Value, Cost, and Risk

VMM provides the insight necessary to create a baseline and to identify and assess alternatives. VMM:

- Allows measurement and comparison of baseline and ongoing evaluations of value, risk, and cost
- Provides a quantitative understanding of value through calculation of metrics, including ROI

- Provides a clear picture of how value and cost are affected by risk
- Allows strategic selection of initiatives to include in an organization's investment portfolio
- Provides insight into the interrelationship of value, cost, and risk
- Produces quantified measures of value, cost, and risk to guide the continuing selection, management, and evaluation of an investment
- Provides a better understanding of variables to justify an investment or alternative course of action
- Addresses the needs of stakeholders, including the public through analysis of alternatives
- Supports development of an IT investment portfolio that balances value, cost and risk

Useful Information Derived from the Analysis

To share information and build consensus among stakeholders, including organizations with funding authority, VMM documents:

VMM generates products to share information and build consensus among stakeholders, including organizations with funding authority.

- Effective results-based program management controls
- The data and analytical requirements of the OMB Exhibit 300
- Lessons learned to improve performance measurement and organizational decision-making
- Information in a structured manner to facilitate quick response and *ad hoc* reporting under changing conditions

In sum, VMM satisfies the need for a new, more thorough and rigorous analytical approach to investment evaluation, planning, and management. This approach includes the perspectives of all stakeholders, direct users, government partners, or other parties that would be affected by the investment. It succeeds in comprehensively and quantitatively capturing the impact that possible investment alternatives would have on each of these parties. In addition, it quantitatively captures the effect that risk and uncertainty have on the project and the analysis. In each of these ways, VMM distinguishes itself as an improvement on traditional cost-benefit methodologies.

IV. Overview of VMM Steps

This section provides a high-level overview of the four steps that form the VMM framework. The terminology used to describe the steps should be familiar to those involved in developing, selecting, justifying, and managing an IT investment.

Step 1: Develop a Decision Framework	Step 2: Alternatives Analysis	Step 3: Pull the Information Together	Step 4: Communicate and Document
TASKS	**TASKS**	**TASKS**	**TASKS**
1) Identify and define value structure 2) Identify and define risk structure 3) Identify and define cost structure 4) Begin documentation	1) Identify and define alternatives 2) Estimate value and cost 3) Conduct risk analysis 4) Ongoing documentation	1) Aggregate the cost estimate 2) Calculate the return on investment 3) Calculate the value score 4) Calculate the risk score 5) Compare value, cost, and risk	1) Communicate value to customers and stakeholders 2) Prepare budget justification document 3) Satisfy ad hoc reporting requirement 4) Use lessons learned to improve processes

Develop a Decision Framework

What is a decision framework?

A decision framework provides a structure for defining the objectives of an initiative, analyzing alternatives, and managing and evaluating on-going performance.

Why create a decision framework?

Just as an outline defines a paper's organization before it is written, a decision framework creates an outline for designing, analyzing, and selecting an initiative for investment, and then managing the investment. The framework can be a tool that management uses to communicate its agency, government-wide, or focus-area priorities.

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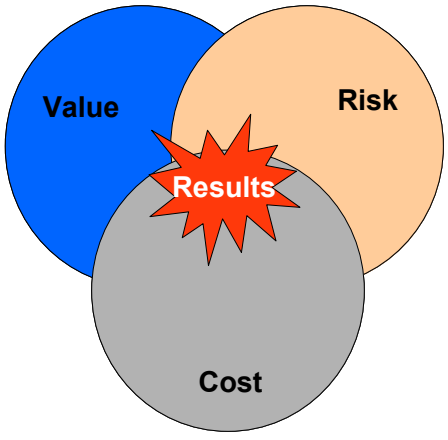
The framework facilitates establishing consistent measures for evaluating current and/or proposed initiatives. Program managers may use the decision framework as a tool to understand and prioritize the needs of customers and the organization's business goals. In addition, it encourages early consideration of risk and thorough planning practices; directly related to effective e-Government initiative implementation.

When should the decision framework be developed?

The decision framework should be developed as early as possible in the development of an e-Government initiative. Employing the framework at the earliest phase of development makes it an effective tool for defining the benefits that an initiative will deliver, the risks that are likely to jeopardize its success, and the anticipated costs that must be secured and managed.

The decision framework is also helpful later in the development process as a tool to validate the direction of an initiative, or to evaluate an initiative that has already been implemented.



What is the foundation of the decision framework?

The decision framework consists of **value** (benefits), **cost**, and **risk** structures. Each of these three elements must be understood to plan, justify, implement, evaluate, and manage an investment.

What are the tasks and outputs involved with creating a sound decision framework?

TASKS:

1) **Identify and Define Value Structure**
2) **Identify and Define Risk Structure**
3) **Identify and Define Cost Structure**
4) **Begin Documentation**

OUTPUTS:

- **Prioritized Value Factors**
- **Defined and prioritized measures within each Value Factor**
- **Risk factor inventory (initial)**
- **Risk tolerance boundary**
- **Tailored Cost Structure**
- **Initial documentation of basis of estimate of cost, value, and risk**

Task 1 - Identify and Define the Value Structure

What is the Value Structure?

The Value Structure describes and prioritizes benefits in two layers. The first, considers an initiative's ability to deliver value within each of the five Value Factors (Direct User Value, Social Value, Government Financial Value, Government Operational and Foundational Value, and Strategic/Political Value). The second layer delineates the measures to define those values.

The Value Structure describes and prioritizes benefits.

Why is it important to develop a Value Structure?

By defining the Value Structure, managers gain a *prioritized* understanding of the needs of direct users, government stakeholders, and society. This task also requires the definition of metrics and targets critical to the comparison of alternatives and performance evaluation.

By defining the initiative's Value Structure, managers gain a *prioritized* understanding of the needs of direct users, government stakeholders, and society

How is the Value Structure developed?

The Value Factors consist of five separate, but related, perspectives on value. As defined in the table below, each Factor contributes to the full breadth and depth of the value offered by an e-Government initiative.

Value Factor	Definitions and Examples
Direct Customer (User)	Benefits to users or groups associated with providing a service through an electronic channel *Example: Convenient Access*
Social (non-User/Public)	Benefits to society as a whole *Example: Trust in government*
Gov't/Operational Foundational	Improvements in Government operations and enablement of future initiatives *Example: Cycle Time; Improved Infrastructure*
Strategic/Political	Contributions to achieving strategic goals, priorities and mandates *Example: Fulfilling the organizational mission*
Government Financial	Financial benefits to both sponsoring and other agencies *Example: Reduced cost of correcting errors*

Prioritization of the Value Factors

Because the Value Factors are usually not equal in importance, they must be "weighted" in accordance with their importance to executive management. For cross-agency initiatives, the weight and priority of these factors should be defined by those responsible for shaping e-Government and overseeing investment decisions across the Federal Government (e.g., focus-area portfolio managers). Decisions on weight and priority should reflect the vision of e-Government in the U.S., as defined by the Executive Office of the President. In other cases, prioritization should be undertaken at the highest appropriate level of agency management.

A measure must include the identification of a metric, a performance target, and a normalized scale.

Identification, definition, and prioritization of the measures

Identification, definition, and prioritization of measures of success must be performed within each Value Factor. Valid results depend on project staff working directly with representatives of user communities and partner agencies to define and array the measures in order of importance. These measures are used to define alternatives, and also serve as a basis for alternatives analysis, comparison, and selection, as well as on-going performance evaluation.

In some instances, measures may be defined at a higher level to be applied across a related group of initiatives, such as government-wide or across a focus-area portfolio. These standardized measures then facilitate "apples-to-apples" comparison across multiple initiatives. This provides a standard management "yardstick" against which to judge investments.

Whether a measure has been defined by project staff or at a higher level of management, it must include the identification of a metric, a target and a normalized scale. The normalized scale provides a method for integrating objective and subjective measures of value into a single decision metric. The scale used is not important; what *is* important is that the scale remains consistent.

The measures within the Value Factors are prioritized by representatives from the user and stakeholder communities during facilitated group sessions.

Task 2 - Identify and Define Risk Structure

Why is risk part of a decision framework?

Risk that is not identified cannot be mitigated or managed.

The risk associated with an investment in an e-Government initiative may degrade performance, impede implementation, and/or increase costs. Risk that is not identified cannot be mitigated or managed causing a project to fail either in the pursuit of funding or, more dramatically, during implementation. The greater the attention paid to mitigating and managing risk, the greater the probability of success.

What is the purpose of the Risk Structure?

The Risk Structure serves a dual purpose. First, the structure provides the starting point for identifying and inventorying potential risks factors that may jeopardize an initiative's success and ensures that plans for mitigating their impact are developed and incorporated into each viable alternative solution.

Second, the structure provides agency management the information it needs to communicate their organization's tolerance forrisk. Risk tolerance is expressed in terms of cost (what is the maximum acceptable cost "creep" beyond projected cost) and value (what is the maximum tolerable performance slippage).

How is the risk structure identified?

Risks are identified and documented during working sessions with technical staff, policy staff and/or representatives of partner agencies. Issues raised during preliminary planning sessions are discovered, defined and documented. The result is an initial risk inventory.

How are risk tolerance boundaries defined?

To map risk tolerance boundaries, selected knowledgeable senior agency staff are polled to identify at least five data points that will define the highest acceptable level of risk for cost and value.

Task 3 - Identify and Define the Cost Structure

A Cost Structure is a hierarchy of elements that are used to develop a cost estimate.

What is a Cost Structure?

A Cost Structure is a hierarchy of elements created specifically to accomplish the development of a cost estimate, and is also called a Cost Element Structure (CES).

Why is a Cost Structure important?

The most significant objective in the development of a Cost Structure is to ensure a complete, comprehensive cost estimate and to reduce the risk of missing costs or double counting. An accurate and complete cost estimate is critical for an initiative's success. Incomplete or inaccurate estimates can result in exceeding the budget for implementation requiring justification for additional funding or a reduction in scope. The Cost Structure developed in this step will be used during Step 2 to estimate the cost for each alternative.

An accurate and complete cost estimate is critical to an initiative's success.

When should a Cost Structure be developed?

Ideally, a Cost Structure will be produced early in the development of an e-Government initiative, prior to defining alternatives. However, a Cost Structure can be developed after an alternative has been selected or, in some cases, in the early stage of implementation. Early structuring of costs guides refinement and improvement of the estimate during the progress of planning and implementation.

How is a Cost Structure built?

Each element of cost associated with delivering value in each of the Value Factors is the basis for the Cost Structure.

A "standard" e-Government CES, such as the one provided in the "Technical Definitions," is the starting point for development of a VMM Cost Structure. This "standard" structure must be tailored to the specific e-Government initiative under analysis to capture the particular requirements. Each element of cost associated with delivering value in the Value Factors is the basis for the Cost Structure. As alternatives are defined, the Cost Structure may be modified to incorporate each alternative. However, only one Cost Structure or CES encompassing the elements of costs associated with all alternatives should be used in the analysis of alternatives.

Task 4 - Begin Documentation

Why is documentation important?

Documentation of the elements leading to the selection of a particular alternative above all others is the "audit trail" for the decision. The documentation of assumptions, the analysis, the data, the decisions and the rationale behind them, are the foundation for the business case and the record of information required to defend a cost estimate or value analysis.

Why is it important to begin documentation early during the development of the decision framework?

From the first conceptual discussions of how to employ e-Government to transform a process, information is gathered, salient issues articulated, and assumptions made. These assumptions will help define cost, value, and risk and provide the context or rationale for a decision. Therefore, they must be preserved through documentation to inform subsequent decisions.

What type of information should be documented?

Early documentation will capture the conceptual solution, desired benefits, and attendant global assumptions (e.g., economic factors such as the discount and inflation rates). The documentation also includes project-specific drivers and assumptions, derived from tailoring the structures.

Is there a method for documenting the basis for the estimate?

The basis for the estimate, including assumptions and business rules, should be organized in an easy-to-follow manner that links to all other analysis processes and requirements. This will provide easy access to information supporting the course of action, and will also ease the burden associated with preparing investment justification documents such as an OMB Exhibit 300. As an initiative evolves through the life cycle, becoming better defined and more specific, the documentation will also mature in specificity and definition.

Alternatives Analysis – Estimate Value, Costs, and Risk

What is an Alternatives Analysis?

An alternatives analysis is an estimation and evaluation of all value, cost and risk factors leading to the selection of the most effective plan of action to address a specific business issue (e.g., service, policy, regulation, business process or system). An alternative that must be considered is the "base case." The base case is the alternative where no change is made to current practices or systems. All other alternatives are compared against the base case, as well as to each other.

An alternatives analysis is an estimation and evaluation of all value, cost and risk factors leading to the selection of a plan that best addresses the business issue.

What is the business value of performing an alternatives analysis?

An alternatives analysis requires a disciplined process to consider the range of possible actions to achieve the desired benefits. The rigor of the process to develop the information on which to base the alternatives evaluation yields the data required to justify an investment or course of action. It also provides the information required to support the completion of the budget justification documents (e.g., OMB Exhibit 300). The process also produces a baseline of anticipated value, costs and risks to guide the management and on-going evaluation of an investment.

An alternatives analysis requires a disciplined process to consider the range of possible actions to achieve desired benefits.

What analyses are incorporated into an alternatives analysis?

An alternatives analysis must consistently assess the value, cost, and risk associated with more than one alternative for a specific initiative. Alternatives must include the base case and accommodate specific parameters of the decision framework. VMM, properly used, is designed to avoid "analysis paralysis."

An alternatives analysis must consistently assess the value, cost and risk associated with more than one alternative for a specific initiative.

The estimation of cost and projection of value uses ranges to define the individual elements of each structure. Those ranges are then subject to an uncertainty analysis. The result is a range of expected values and cost. Next, a sensitivity analysis identifies the variables that have a significant impact on this expected value and cost. The analyses will increase confidence in the accuracy of the cost and predicted performance estimates. However, a risk analysis is critical to

determine the degree to which other factors may drive up expected costs or degrade predicted performance.

When should an alternatives analysis be conducted?

An alternatives analysis is not a one-time effort; it must be conducted periodically throughout the lifecycle of an initiative.

An alternatives analysis must be carried out periodically throughout the life cycle of an initiative. For example, OMB may require an alternatives analysis for an established initiative to ensure that it continues to be the best method for delivering a service and is being managed and operated in the most effective manner.

The following list provides an overview of how the business value resulting from an alternatives analysis changes depending on where in the life cycle the analysis is conducted.

- Strategic Planning (pre-decisional)
  - How well will each alternative perform against the defined value measures?
  - What will each alternative cost?
  - What is the risk associated with each alternative?
  - What will happen if no investment is made at all (base case)?
  - What assumptions were used to produce the cost estimates and value projections?

- Business Modeling and Pilots
  - What value is delivered by the initiative?
  - What are the actual costs to date? Do estimated costs need to be re-examined?
  - Have all risks been addressed and managed?

- Implementation and Evaluation
  - Is the initiative delivering the predicted value? What is the level of value delivered?
  - What are the actual costs to date?
  - Which risks have been realized, how are they affecting costs and performance, and how are they being managed?

What are the tasks and outputs involved with conducting an alternatives analysis?

TASKS:

1) **Identify and Define Alternatives**
2) **Estimate Value and Cost**
3) **Conduct Risk Analysis**
4) **Ongoing Documentation**

OUTPUTS:

- **Viable alternatives for e-Government solutions**
- **Cost and value analyses**
- **Risk analyses**
- **Tailored basis of estimate documenting value, cost, and risk economic factors and assumptions**

Task 1 - Identify and Define Alternatives

Why is it important to identify more than one alternative?

There are many ways that government can use electronic delivery channels, such as the Internet, to reduce cost or better satisfy their mission. The challenge of this task is to identify viable alternatives that have the potential to deliver an optimum mix of both value and cost efficiency. Decision makers must be given, at a minimum, two alternatives plus the base case to make an informed investment decision.

How should alternatives be identified?

The starting point for developing alternatives should be the information in the Value Structure and preliminary drivers identified in the initial basis of estimate (see Step 1). Using this information will help to ensure that the alternatives and, ultimately, the solution chosen, accurately reflect a balance of performance, priorities, and business imperatives. Successfully identifying and defining alternatives requires cross-functional collaboration and discussion among the managing agency, partner agencies, business line staff, technologists and engineers, and policy staff.

Successfully identifying and defining alternatives requires cross-functional collaboration and discussion.

What is a base case?

The base case explores the impact of identified drivers on value and cost if an alternative solution is not implemented. That may mean that current processes and systems are kept in place or that organizations will build a patchwork of incompatible, disparate solutions. There should always be a base case included in the analysis of alternatives.

Task 2 - Estimate Value and Cost

Why is it important to estimate value and cost accurately?

Comparison of alternatives, justification for funding, creation of a baseline against which on-going performance may be compared, and development of a foundation for more detailed planning requires an accurate estimate of an initiative's cost and value. The more reliable the estimated value and cost of the alternatives, the greater confidence one can have in the investment decision.

How are value and cost estimated?

The first activity to pursue when estimating value and cost is the collection of data. Data sources and detail will vary based on an initiative's stage of development. Organizations should recognize that more detailed information may be available at a later stage in the process and should provide best estimates in the early stages rather than delaying the process by continuing to search for information that is likely not available.

To capture cost and performance data, and conduct the VMM analyses, a VMM model should be constructed. The model facilitates the normalization and aggregation of cost and value, as well as the performance of uncertainty, sensitivity, and risk analyses. Analysts populate the model with the dollar amounts for each cost element and projected performance for each measure. These predicted values, or the underlying drivers, will be expressed in ranges (e.g., low, expected, or high). The range between the low and high values will be determined based on the amount of uncertainty associated with the projection.

Initial cost and value estimates are rarely accurate. Uncertainty and sensitivity analyses increase confidence that likely cost and value have been identified for each alternative.

Task 3 - Conduct Risk Analysis

Risk analysis considers the probability that specific factors will negatively affect the realization of the initiative's projected costs and benefits.

What is a Risk Analysis?

A risk analysis considers the probability and potential negative impact of specific factors on an organization's ability to realize projected benefits or estimated cost.

Why is it important to perform a Risk Analysis?

The only risks that can be managed are those that have been identified and assessed. OMB Exhibit 300 requires that risk be considered and analyzed in each of eight specific categories: organizational and change management, business, data and information, technical, strategic, security, privacy, and project.

The only risks that can be managed are those that have been identified and assessed.

Even after diligent and comprehensive risk mitigation during the planning stage, some level of residual risk will remain that may lead to increased costs and decreased performance. A rigorous risk analysis will help an organization better understand the probability that a risk will occur and the level of impact the occurrence of the risk will have on both cost and value. Additionally, risk analysis provides a foundation for building a comprehensive risk management plan.

Task 4 - On-going Documentation

What type of information needs to be documented?

Alternative e-Government solutions or approaches are formed based on the planning and analysis in Step 1. Inherent in these activities is the need to document the assumptions and research that compensate for gaps in information or understanding. For each alternative, the initial documentation of the high-level assumptions and risks will be expanded to include a general description of the alternative being analyzed, a comprehensive list of cost and value assumptions, and assumptions regarding the risks associated with a specific alternative. This often expands the initial risk inventory.

Pull Together the Information

What is the business value associated with "pulling the information together?"

The estimation of cost, value and risk provide important data points for investment decision-making. However, when analyzing an alternative and making an investment decision, it is critical to understand the relationships among them.

The relationships among cost, value and risk are key to defining the soundest investment.

What are the tasks and outputs associated with fulfilling Step 3?

TASKS:

1) **Aggregate the Cost Estimate**
2) **Calculate the Return on Investment**
3) **Calculate the Value Score**
4) **Calculate the Risk Scores (Cost and Value)**
5) **Compare Value, Cost, and Risk**

OUTPUTS:

- **Cost estimate**
- **Return on Investment metrics**
- **Value score**
- **Risk scores (cost and value)**
- **Comparison of cost, value, and risk**

Task 1 – Aggregate the Cost Estimate

What is the importance of a cost estimate?

A complete and valid cost estimate is critical to determining whether or not a specific alternative should be selected. It also is used to assess how much funding must be requested. Understating cost estimates to gain approval, or not considering all costs, may create doubt as to the veracity of the entire analysis. An inaccurate cost estimate might lead to cost overruns, create the need to request additional funding, or reduce scope.

How is a total cost estimate calculated?

The total cost estimate is calculated by aggregating expected values for each cost element.

Task 2 - Calculate the Return-on-Investment

What is a Return-on-Investment metric?

Return-on-Investment (ROI) metrics express the relationship between the funds invested in an initiative and the financial benefits the initiative will generate for the Government. Simply stated, it expresses the financial "bang for the buck."

ROI metrics express the relationship between funds invested and financial benefits.

What is the business value of calculating ROI?

One of the greatest potential benefits of e-Government and the concept of simplified and unified government processes and systems, is the expected reduction of the overall cost to conduct the business of government. Although it is not considered the only measure upon which an investment decision should be made, ROI is, and will continue to be, a critical data point for decision-making.

Task 3 - Calculate the Value Score

What is a value score and what is its business value?

The value score quantifies the full range of value that will be delivered across the five value factors as defined against the prioritized measures within the decision framework. The interpretation of a value score will vary based on the level from which it is being viewed. At the program level, the value score will be viewed as a representation of how alternatives performed against a specific set of measures. They will be used to make an "apples-to-apples" comparison of the value delivered by multiple alternatives for a single initiative. For example, the alternative that has a value score of 80 will be preferred over the alternative with a value score of 20, if no other factors are considered. At the organizational or portfolio level, value scores are used as data points in the selection of initiatives to be included in an investment portfolio. Since the objectives and measures associated with each initiative will vary, decision-makers at the senior level use value scores to determine what percentage of identified value an initiative will deliver. For example, an initiative with a value score of 75 is providing 75% of the possible value the initiative has the potential to deliver. In order to understand what exactly is being delivered, the decision-maker will have to look at the measures of the Value Structure.

How is the value score calculated?

Consider the value score as a simple math problem. The scores projected for each of the measures within a value factor should be aggregated according to their established weights. The weighted sum of these scores is a *factor's* value score. The sum of the factors' value scores, aggregated according to their weights, is the *total*value score.

Task 4 - Calculate the Risk Scores

What is a risk score?

After considering the probability and potential impact of risks, risk scores are calculated to represent a percentage of overall performance slippage or cost increase.

What is the business value of calculating risk scores?

Risk scores provide decision-makers with a mechanism to determine the degree to which value and cost will be negatively affected and whether that degree of risk is acceptable based on the risk tolerance boundaries defined by senior staff. If a selected alternative has a high cost and/or high value risk score, program management is alerted to the need for additional risk mitigation, project definition, or more detailed risk management planning. Actions to mitigate the risk may include establishment of a reserve fund, a reduction of scope, or refinement of the alternative's definition. Reactions to excessive risk may also include reconsideration of whether it is prudent to invest in the project at all, given the potential risks, the probability of their occurrence, and the actions required to mitigate them.

Risk scores determine the degree to which value and cost will be negatively affected and whether the risk is acceptable.

Task 5 - Compare Value, Cost and Risk

What is the business value of comparing value, cost, and risk?

Tasks 1-4 of this step analyze and estimate the value, cost, and risk associated with an alternative. In isolation, each data point does not provide the depth of information required to ensure sound investment decisions.

To make good decisions, decision-makers must consider how cost, value, and risk interact.

Previous to the advent of VMM, only financial benefits could be compared to investment costs through the development of an ROI metric. When comparing alternatives, the consistency of the decision framework allows the determination of how much value will be received for the funds invested. Additionally, the use of risk scores provides insight into how all cost and value estimates are affected by risk.

How are value, cost, and risk compared?

By performing straightforward calculations, it is possible to model the relationships among value, cost and risk:

- The effect risk will have on estimated value and cost
- The Government's financial ROI
- If comparing alternatives, the value "bang for the buck" (total value returned compared to total required investment)
- If comparing initiatives to be included in the investment portfolio, senior managers can look deeper into the decision framework, moving beyond overall scores to determine the scope of benefits through an examination of the measures and their associated targets.

Communicate and Document

What is the business value associated with communicating and documenting the value of an initiative?

Regardless of the projected merits of an initiative, its success will depend heavily on the ability of its proponents to generate internal support, to gain buy-in from targeted users, and to foster the development of active leadership supporters (champions). Success or failure may depend as much on the utility and efficacy of an initiative as it does on the ability to communicate its value in a manner that is meaningful to stakeholders with diverse definitions of value. The value of an initiative can be expressed to address the diverse definitions of stakeholder value in funding justification documents and in materials designed to inform and enlist support.

Success or failure may depend on the ability to communicate an initiative's value to stakeholders.

How do the planning and analyses associated with Steps 1-3 support the ability to communicate value?

Using VMM, the value of a project is decomposed according to the different Value Factors. This gives project level managers the tools to customize their value proposition according to the perspective of their particular audience. Additionally, the structure provides the flexibility to respond accurately and quickly to project changes requiring analysis and justification.

What are the tasks and outputs associated with Step 4?

TASKS:

1) **Communicate Value to Customers and Stakeholders**
2) **Prepare Budget Justification Documents**
3) **Satisfy *ad hoc Repo*rting Requirements**
4) **Use Lessons Learned to Improve Processes**

OUTPUTS:

- **Documentation, insight, and support:**
  - **To develop results-based management controls**
  - **For Exhibit 300 data and analytical needs**
  - **For communicating initiatives value**
  - **For improving decision making and performance measurement through "Lessons Learned"**
- **Change and *ad hoc* reporting requirements**

Task 1 – Communicate Value to Customers and Stakeholders

Why communicate the results of VMM analysis to customers and stakeholders?

Leveraging the results of VMM analysis can facilitate relations with customers and stakeholders. VMM makes communication to diverse audiences easier by incorporating the perspectives of all potential audience members from the outset of analysis. Since VMM calculates the potential value that an investment could realize for all stakeholders, it provides data pertinent to each of those stakeholder perspectives that can be used to bolster support for the project. It also fosters substantive discussion with customers regarding the priorities and detailed plans of the investment. These stronger relationships not only prove critical to the long-term success of the project, but can also lay the foundation for future improvements and innovation.

Task 2 – Prepare Budget Justification Documents

How does VMM support OMB funding justification documents?

OMB A-11 Exhibit 300 requires comprehensive analysis and justification to support funding requests. OMB will not fund IT initiatives that have not proven:

1) Their applicability to executive missions
2) Sound planning
3) Significant benefits
4) Clear calculations and logic justifying the amount of funding requested
5) Adequate risk identification and mitigation efforts
6) A system for measuring effectiveness
7) Full consideration of alternatives
8) Full consideration of how the project fits within the confines of other government entities and current law

The VMM framework feeds directly into the fulfillment of these OMB funding requirements. After completion of the VMM, one will have data required to complete or support completion of OMB budget justification documents.

Task 3 – Satisfy *ad hoc* Reporting Requirements

How can VMM help satisfy *ad hoc* reporting needs?

Once a VMM model is built to assimilate and analyze a set of investment alternatives, it can easily be tailored to support *ad hoc* requests for information or other reporting requirements. In the current, rapidly changing political and technological environment, there are many instances when project managers and other government officials need to be able to perform rapid analysis. For example, funding authorities, agency partners, market pricing fluctuations, or portfolio managers might impose modifications on the details (e.g., the weighting factors) of a project investment plan; many of these parties are also likely to request additional investment-related information later in the project life-cycle. VMM's customized decision framework makes such adjustments and reporting feasible under short time constraints.

Task 4 – Use Lessons Learned to Improve Processes

How can lessons-learned from VMM be used to improve agency processes?

Lessons learned through the use of VMM can be a powerful tool when used to improve overall organizational decision-making and management processes. For example, in the process of identifying metrics, one might discover that adequate mechanisms are not in place to collect critical performance information. Using this lesson to improve measurement mechanisms would give an organization better capabilities for 1) gauging the project's success and mission-fulfillment, 2) demonstrating progress to stakeholders and funding authorities, and 3) identifying shortfalls in performance that could be remedied.

NOTES

V. VMM, Step-By-Step Techniques and Tools

This section details instructions and best practices associated with each step of VMM. It was designed as a How-To-Guide for applying VMM and its associated techniques and tools.

The diagrams below provide a roadmap to this section of the guide. The left-hand box provides an outline of the chapter's content. The right-hand box introduces the many visual elements used within the text to indicate where descriptive and instructive elements augment the general explanatory text.

Outline

Step 1 Develop a Decision Framework

Task 1 – Identify and Define Value Structure
Task 2 – Identify and Define Risk Structure
Task 3 – Identify and Define Cost Structure
Task 4 – Begin Documentation

Step 2 Alternatives Analysis

Task 1 – Identify and Define Alternatives
Task 2 – Estimate Value and Cost
Task 3 – Conduct Risk Analysis
Task 4 – Ongoing Documentation

Step 3 Pull Together the Information

Task 1 – Aggregate the Cost Estimate
Task 2 – Calculate the Return-on-Investment
Task 3 – Calculate the Value Score
Task 4 – Calculate the Risk Scores
Task 5 – Compare Value, Cost and Risk

Step 4 Communicate and Document

Task 1 – Communicate Value to Customers and Stakeholders
Task 2 – Prepare Budget Justification Documents
Task 3 – Satisfy Ad-Hoc Reporting Requirements
Task 4 – Use Lessons Learned to Improve Processes

Key Descriptive Elements for each Step

Detailed direction on how to apply VMM to evaluate an e-Government initiative.

Key Concepts – Brief definition of terms and methods

Best Practices – Recommended tools, techniques, and tips for using VMM successfully

VMM in Action – Real-world examples of how VMM is applied

Summary – Synopsis of key information

Required Resources – Staff resources, data resources, and tools required for a step or task

Step 1 - Develop a Decision Framework (Value, Risk, Cost)

What are the parts of a decision framework?
A decision framework is composed of three elements: **value** (benefits), **risk**, and **cost**. Each element affects the others and all must be understood to plan, justify, evaluate, and manage an investment.

What is the business value of creating a decision framework?
The business value of a decision framework, applied rigorously, is that it results in planning, evaluating, selecting, and implementing the most effective and efficient initiative. Managers use the decision framework to understand, prioritize, and communicate business goals and client requirements to stakeholders and to establish consistent measures for evaluating on-going performance of current or proposed initiatives. Use of the framework also leads to early consideration of project risk factors and the development of sound acquisition and program management plans.

What are the tasks and outputs associated with creating a sound decision framework?
Step 1 consists of four tasks and four associated outputs as illustrated in the table below.

Step 1	
Tasks	**Outputs**
1. Identify and Define Value Structure	• Prioritized Value Factors; defined and prioritized measures within each Value Factor
2. Identify and Define Risk Structure	• Risk factor inventory and risk tolerance boundary
3. Identify and Define Cost Structure	• Tailored cost element structure
4. Begin Documentation	• Initial documentation of basis for cost, value and risk

A summary discussion of the tasks covered in this chapter and the resources required to fulfill them appears at the close of this chapter.

Task 1 – Identify and Define the Value Structure

In Task 1, the Value Structure, which is part of the decision framework, is identified and defined in two layers. The Value Structure is applied to determine and to compare the range of benefits delivered by e-Government initiatives across agencies. The Value Structure provides the mechanism to define the value of an alternative and to establish the priorities of Factors and measures. This task is accomplished by:

- Prioritizing the Five Value Factors (see task description below). These priorities should reflect the relative importance of each factor to the organization.
- Identifying, Defining, and Prioritizing the Measures for evaluation of the initiative's benefits.

Prioritize the Value Factors

There are five Value Factors that are part of every Value Structure. They are: Direct User Value, Social Value, Government Financial Value, Government Operational Value, and Strategic/Political Value. These Value Factors should be defined consistently to allow for equitable comparisons of initiatives within a single agency or across multiple agencies.

Each Value Factor should be assigned a weight according to the priorities of the organization. For cross-agency initiatives, the weight and priority of these factors should be defined by those responsible for shaping e-Government and for overseeing investment decisions across the Federal Government (e.g., focus-area portfolio managers). The decisions on weight and priority should reflect the vision of e-Government in the U.S. as defined by the Executive Office of the President. For other initiatives, prioritization should be undertaken at the highest appropriate level of agency management and their support should be evident to all those participating in, and using the results of the process.

KEY CONCEPT:

SETTING PRIORITIES (Weighting)

When developing, managing, or assessing an initiative, policy-makers and decision-makers must understand what is important, and also determine a hierarchy of importance. The following questions must be answered: Providing what type of value to whom is most important, and how important is it in relation to other values?

Recommended Tools and Techniques

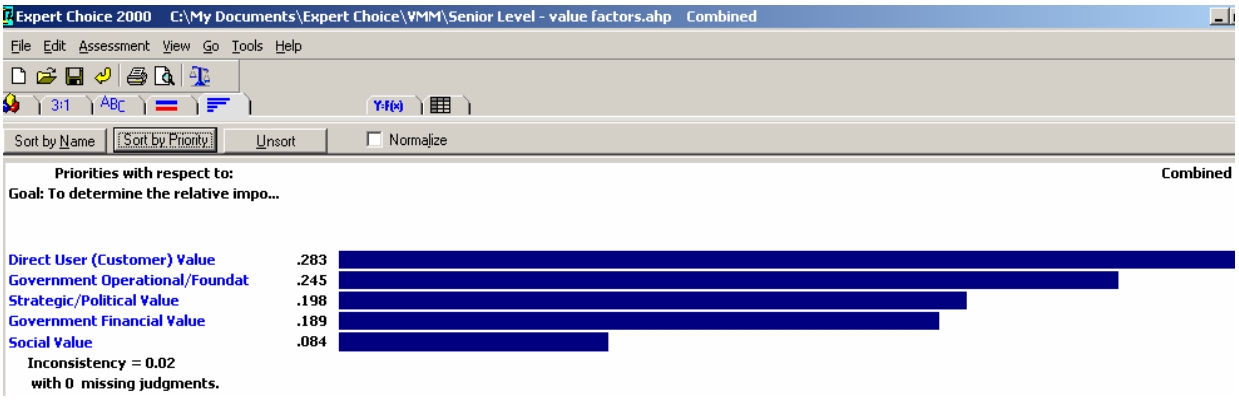
Using an automated Analytical Hierarchy Process (AHP)-based tool, as shown in the following VMM in Action box, to support in the decision process significantly improves the likelihood that the outcome of the prioritization will reflect multiple perspectives. AHP mathematically determines the relative importance of criteria and is a proven method employed widely in government and industry. During sessions employing an AHP tool, a trained facilitator leads participants through a process of focused discussion and decisions on pairs of criteria (pair wise comparisons). Each participant votes using an electronic keypad, and the results are automatically displayed for all participants. A significant disparity among the participants requires that the facilitator initiate a discussion within the group asking that group members provide rationale for their decision. When the discussion ends participants are given an opportunity to vote again.

At the conclusion of a properly conducted AHP session, the following should be achieved:

- Participants have had the opportunity to provide their opinions, voice their concerns, and be exposed to information from others present
- Through the discussion and interaction, members are more “invested” in the process and supportive of the result
- An agreement among members has been created so the process can move forward to the next phase
- Decision factors with rationale are documented, building an audit trail of the decision process

VMM In Action

Prioritizing the Value Factors Using an AHP Decision Support Tool



The graphic depicts the result of an AHP Tool-assisted session conducted to prioritize the data derived for each of the five Value Factors. Two days prior to this session, the selected participants were sent a written brief on the process. The session began with discussion of the agenda and statement of objectives. The members then learned about VMM and the process. They were provided definitions of the Value Factors, and received a brief description of the AHP Tool.

Total time spent introducing VMM, reviewing the use of the AHP Tool, discussing the Value Factors, and voting was approximately 90 minutes.

Although use of an AHP tool is certainly desirable, lack of such a tool is not a significant impediment to delivering valid results. Generating weighted/prioritized factors and the prioritization can be done manually with a facilitator leading the process. Not using the tool does not in itself affect the validity of the result. The process will proceed in the same way as if using the AHP tool. Without an AHP tool, a well-trained, skilled, experienced facilitator is even more important.

The following are critical success factors for conducting a prioritization session:

- Advance planning for the session is imperative. Each segment of the session should be well planned based on achieving specific objectives
- Advance preparation also is necessary for the session participants, so that understand their role in the process and are familiar with VMM, the Value Factors, and the prioritization process
- A skilled facilitator is needed to deal with different personalities and opinions, eliciting the best from each participant, while moving toward delivering the outcome on time
- Members selected for this activity should be empowered to make decisions for their organization, have significant experience in the areas they represent, and be able to effectively interact in group situations

Identify, Define, and Prioritize the Measures for Evaluation

In the next layer of the VMM Value Structure, users determine causative factors leading to success of the initiative or alternative for each Value Factor. This involves identifying, defining, and prioritizing measures of success for each Value Factor. The level of planning and rigor associated with the identification and definition of these measures largely will determine whether the Value Structure provides an accurate framework for assessing the value of an initiative.

Identify Measures

The objective of the measures is to define factors leading to success, as perceived by stakeholders, not to advance a particular agenda or solution. Measures of success, based on analysis using appropriate data sources and incorporating results of stakeholder collaboration, are used to define and assess alternatives, to guide management decision making, and to conduct on-going evaluations of implementation and delivery of the anticipated benefit.

Best Practices

Identifying Measures

- Determine the appropriate focus-area for the initiative
- Identify and understand the requirements of the user(s) and stakeholder(s)
- Determine the most appropriate way to measure the anticipated value delivered
- Create metrics based on what customers and stakeholders want and what is important to them.

Consider Value from the Customer Perspective. Input from customers and stakeholders reflect their requirements. An initiative built and managed on these user-focused measures is likely to more effectively satisfy the user, to be used more, to deliver greater value to more stakeholders and users, and therefore to deliver more value (both financial and non-financial) to the Agency and to the Government.

Discuss & Communicate. Structured, facilitated, focused discussion is important to make sure all the salient information has been discovered. Participation invests stakeholders in the process, and also provides anecdotal information that may be extremely effective in communicating value to decision-makers and funding authorities.

Senior management may choose to establish “standardized measures” to be used in the evaluation of all initiatives of a particular type (e.g., all initiatives in a particular focus area) or across a single organization (e.g., all GSA investments). This will allow them to accomplish two objectives: 1) compare a specific area of performance across initiatives and 2) provide clear direction and definition to program staff concerning priorities. Although the use of standardized measures can be an effective management tool, it should be remembered that these measures may not fully capture the business goals of a specific initiative.

The e-Government Task Force defined several performance measures applicable to all e-Government initiatives. These performance measures are embedded in the VMM

decision framework and therefore are not specifically considered standard measures. (To see how these measures map to the Value Factors, refer to Technical Definitions.)

KEY CONCEPT:

LEVELS OF STANDARDIZED MEASURES

- ***Agency-wide*** – defined by the highest level of agency leadership and applied consistently across the organization
- ***Government-wide*** – defined at the portfolio level (to be applied to all initiatives within a specific focus area) or enterprise-wide (to be applied to all initiatives regardless of focus area)

VMM in Action

Standardized Measures applied to the Government Financial Value Factor

When applying VMM to e-Travel or e-Authentication initiatives, senior staff from OMB and GSA determined that the following standardized measures should be created to gauge performance in the Government Financial Value Factor:

- The amount of money the Federal Government saves by implementing the initiative
- The amount of money the Federal Government avoids spending by implementing these initiatives

Redundancies and overlaps are normal when attempting to define the measures within the Value Factors. For example, an e-purchasing application is projected to drastically reduce the amount of time to process an invoice. Should this value be captured in the Government Financial Value Factor "bucket" or in the Direct User Value Factor "bucket"? When considering projected employee time savings, the value is captured in the Government Financial Value Factor since the government will save the cost associated with reducing the employee time to accomplish the task. For the Direct User Value Factor, measures may include acceptance rates, satisfaction levels, and ease of use.

Further, at times the same metric may apply to two different Value Factors.

Best Practices

Segmenting Direct User Value

The users of an e-Government initiative will include citizens, internal Government service staff serving clients, internal budget and finance staff. Each group has expectations of how their requirements should be satisfied. Therefore, to accurately identify measures for the Direct User Value Factor; the following is recommended:

- ***Identify and Segment Users into coherent groups useful for the analysis of the particular initiative*** (e.g., travelers, administrators, finance staff)
- ***Prioritize User Groups -*** determine the relative importance of each group based on the value of the benefit to the particular group. This will define which group will carry the most "weight" under this Value Factor. (It is possible that all user groups will be given the same weight.)
- ***Develop Measures For Each Group -*** identify measures of value for each individual group

For example, a reduction in the time to process an invoice could be categorized under Government Financial Value Factor as cost savings. However, the same metric may be categorized under Government Operational/Foundational Value, since the reduced total processing time resulting from reduction in the processing time for an invoice may be an organizational objective.

Measures must be identified for each of the Value Factors. There is no specific number of measures considered "best." The goal is to ensure that the measures clearly and completely define the desired benefits of an initiative, both financial and non-financial, from multiple points of view.

There may be too many measures for a single Value Factor if:

- There are so many redundancies in the measures that the same benefits are being counted multiple times
- Several measures can be combined
- Definitions of measures are difficult to distinguish from one another. The key is to define the unique measures.

There may be too few or no measures under a single Value Factor if:

- The anticipated value of the initiative is not well understood

Define the Measures

Measures are used to define alternatives, and also serve as a basis for alternatives analysis, comparison, and selection, as well as on-going performance evaluation. A measure's definition has four parts:

1. **Concise, Illustrative Name** – Use "plain" language that expresses the full breadth and focus of the measure. If it is difficult to name a measure, consider whether too many issues are bundled together.

2. **Brief Description** – Provide enough information to ensure that any reader will be able to understand exactly what is being measured. Avoid technical jargon and concisely describe the desired end-result.

3. **Performance Metric** – Determine the means for quantifying how well an initiative is delivering the anticipated value. Measurement of an initiative's effectiveness may require multiple metrics. Be sure that it is possible to gather information for proposed metrics. Great metrics are useless if you can not measure against them.

4. **Set Target and Establish a Normalized Scale** – Establish a "normalized scale" for each objective and subjective assessment of value. A normalized scale provides a method for integrating objective and subjective measures of value into a single decision metric. The scale used is not important; what *is* important is that the scale remains consistent.

Best Practices

Defining Measures

Setting Performance Targets - When setting performance targets, focus on the "end goal." Consider what the initiative needs to accomplish to achieve its purpose over the long term.

For example, assume the universe of potential users for an e-Government initiative is 250,000. Initially including a smaller group of 15,000 users is more prudent considering business, technology and/or security constraints. Your target for this metric should be 250,000, even though initial implementation will only target 15,000 and, therefore, score poorly. However, since this is a tradeoff that the organization is willing to make for a more stable and secure system, this measure is used to communicate and document this tradeoff. Retaining the 250,000-performance goal and documenting the 15,000 as an intermediate phase, ensures that the organization will continue to work toward the long run target of 250,000 users.

Understand the Differences

Each organization brings a unique view of client requirements, and the systems and processes required to satisfy those requirements. Therefore, when defining measures, take a holistic view of performance. Consider the unconstrained objectives of the initiative, rather than focusing on incremental improvements of a current baseline.

Avoid the use of words such as "increase in" or "decrease of"; rather say what must be achieved in concrete, measurable terms.

VMM In Action

Diagramming a Measure

Direct User Value Factor	
Concise, Illustrative Name	
24/7 Access to Real-Time Information & Services, Anytime & Anywhere	
Brief Description	
Are customers able to access real-time electronic travel services and policy information from any location 24 hours a day?	
Metrics and Scales	
	% of remote access attempts that are successful (10 points for every 10%)
	% of travel services available electronically 10 points = 25% 90 points = 75% (threshold requirement) 100 points = 100%
	Is data updated in the system in real time? No = 0 Yes = 100

Sample of Value Measures and Normalized Scales Used to Assess the Value of an e-Authentication project

Value Measures	0	10	20	30	40	50	60	70	80	90	100
Accessibility of e-Government services to Users	0	1	2	3	4	5	6	7	8	9	10
User Trust in Internet Transactions	None	Min-	Min	Min+	Some-	Some	Some+	Significant-	Significant	Significant+	Significant++
Application Owner Confidence in Identity of Users	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Speed & Ease of AO Deployment of Authentication Solutions	15	12	10	9	8	6.5	5	4	2	1.5	1
Users will have access to Multiple Applications	0	1	2	3	4	5	6	7	8	9	10
Allows AOs to comply with GISRA and other mandates	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Elimination of Redundant Engineering & Procurement Efforts	0	2.5	5	7.5	10	12.5	15	17.5	20	23	25
Provides the Infrastructure for Common Authentication Services	No										Yes
Ability to Evolve as New Technologies Emerge	0	1	2	3	4	5	6	7	8	9	10
Scalability	0	1	2	3	4	5	6	7	8	9	10
Architectural Flexibility	0	1	2	3	4	5	6	7	8	9	10
Common Cross-Agency Policy Establish for eAuthentication at all Levels	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Enables Expanded Use if E-services	0	3	6	9	12	15	18	21	23	25	50
Higher Confidence in the Government's Ability to Authenticate Users	0%	10%	20%	30%	40%	50%	60%	65%	70%	75%	80%
Reduction of Identity Fraud	0	1	2	3	4	5	6	7	8	9	10
Public Trust	None	Min-	Min	Min+	Some-	Some	Some+	Significant-	Significant	Significant+	Significant++
Advances President's E-Gov & Mgmt Agendas	0	3	6	9	12	15	18	21	23	25	50
Regulatory Compliance	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Fosters Interagency cooperation	Major-	gnifica	Some-	Slight-	Min-	None	Min+	Slight+	Some+	Significant+	Major+
Total Cost Savings to Investment	0.00	0.10	0.15	0.25	0.30	0.35	0.40	0.45	0.50	0.55	0.60
Total Cost Avoidance to Investment	0.00	1.00	1.50	2.00	2.50	3.00	4.00	4.50	5.00	5.50	6.00

Prioritize Measures

Prioritization of the Value Factors requires that senior staff have a strategic view of the purpose of e-Government initiatives within a particular focus area. However, the prioritization of the Value Measures requires more focused knowledge. By prioritizing the value measures, practitioners applying VMM gain additional insight into the objectives of their initiatives. They gain an understanding of the hierarchy of values their program must deliver from the point of view of direct users, society as a whole, and government operations. Understanding these priorities can help managers determine how resources should be allocated and how to best communicate the initiative's value to stakeholders and funding authorities.

Prioritizing Value Measures requires insights contributed from a range of business and technology subject matter experts. Still, those having insight into the needs and preferences of the user community may not have insight into, or an opinion about, cost savings and cost avoidance. Technical staff whose input is invaluable when discussing the Government Operational/Foundational Value Factor may not offer much insight into the Strategic/Political Value Factor.

Recommended Tools and Techniques

The tools and techniques used to prioritize the measures are the same as those used to prioritize the Value Factors: an AHP working session led by a trained facilitator. An automated tool is beneficial, but not required.

The successful prioritization process will establish a set of weights for evaluation and planning purposes. The process also will provide the opportunity for stakeholders with differing viewpoints to better understand each other and reach agreement. Agreement does not mean that by the end of the session every participant will be in consensus about every issue presented, but that participants agree to move ahead, have a better understanding of each viewpoint, have initiated the relationships to make an initiative "work," and feel that their point of view has been heard and appreciated.

An effective value measure prioritization session depends in large part on:

- The measures that are being considered. Measures should be distinct and reflect the activities that have to be measured to ascertain the progress or success of an initiative.
- The level of advance preparation by the participants.
- Skill and prior experience of the facilitator and participants using an AHP tool.
- The degree to which participants were involved in the identification and definition of the Value Measures prior to the session.

Best Practices

Prioritizing the Value Measures

Session Participants – Choosing skilled and knowledgeable participants who are well versed in the processes and functions being analyzed is critical for prioritizing the Value Measures. To represent all views and deliver a valid result, key members should be present at each session. Active, visible management support will ensure that this happens. If it is impossible to bring the right mix of people to the table for a prioritization working session, assign a surrogate of comparable knowledge and authority.

Sample prioritization working group participants is provided for example purposes only.

Value Factor	Users/ User Reps.	Program Mgmt.	Technical/ Engineering Staff	Employees	Admin Mgmt. Staff	Partner Agencies	Security/ Privacy Legal Experts
Direct User	●	●*					
Social	●	●				●	●
Government Operational			●	●	●	●	
Government Financial		●				●	
Strategic/ Political		●				●	●

** Invited to observe, not to participate in voting*

Which Point of View is Represented - If surrogates must be used to participate in an AHP working session, ensure they understand which "hat" they are wearing. Different stakeholders will view measures from different points of view and therefore will not prioritize them the same way. If individuals are confused or conflicted about whose perspective they are representing, it can significantly reduce the accuracy of the prioritization process.

Provide Information in Advance - Provide participants with an advance copy of measures. This will save significant amounts of time during the sessions and facilitate more meaningful discussion.

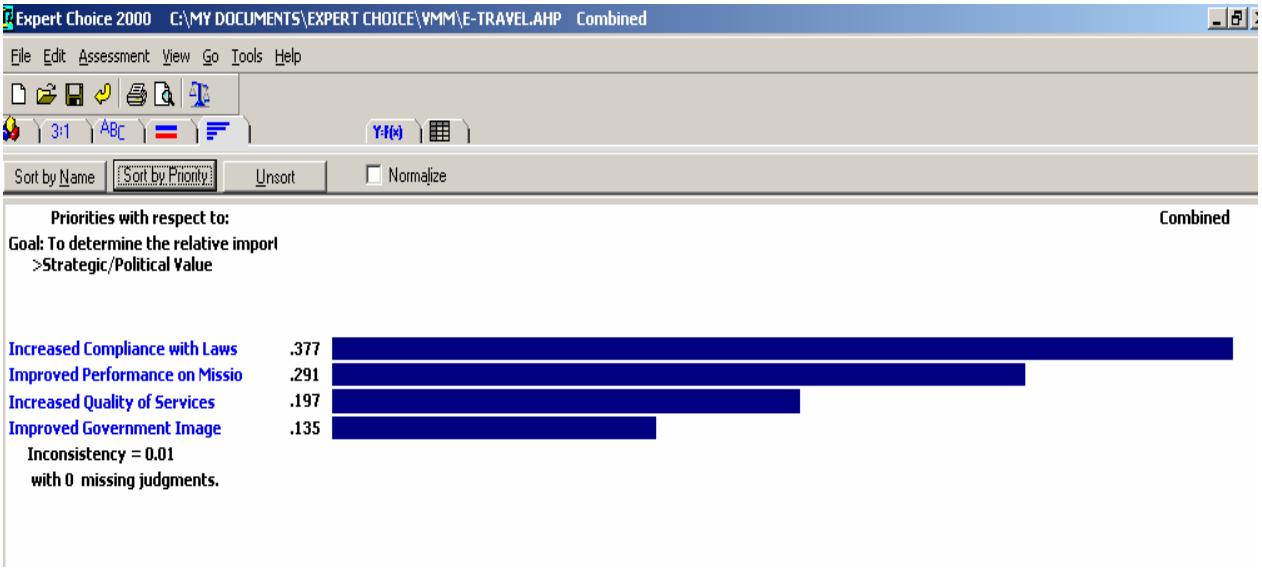
Level the Playing Field - Provide participants with a scenario or set of assumptions that will help them stay focused on the scope of the initiative being considered. This can greatly mitigate the risk of confusion and voting inconsistencies among participants.

VMM In Action

Prioritizing Value Measures Using a Decision Support Tool

The sample screen depicts the outcome of a session conducted to prioritize the Value Measures of the Strategic/Political Factor for an e-Travel initiative. At the start of the session, participants were provided a short briefing containing a high-level description of VMM, a brief description of the AHP Tool, and a detailed description of the Value Measures.

For this particular example, total time spent introducing VMM, reviewing how to use the AHP Tool, discussing and voting on Value Measures across all the Value Factors, was approximately 3.5 hours. Duration of prioritization sessions will vary according to the number of measures per Value Factor.



Task 2 – Identify and Define Risk

Imagine buying a one-dollar lottery ticket for the chance to win $1 million. Even if the odds are very high against winning, the most that the player will lose is one dollar. If the player bought a winning ticket, the one-dollar investment will provide a million dollar return. The consideration to purchase that ticket changes if the odds of winning and the pay-off ratio remain the same, but the ticket price is $100. What if the ticket price is $1,000 or $10,000? How will the decision-making process change if the jackpot amount might be smaller than expected? Would you consider purchasing a lottery ticket for $100 if you were told that the jackpot was between $100 and $300? What information would you need to know before you made the decision to purchase the ticket?

The Risk Structure serves a dual purpose. It provides agency management the means to communicate their organization's tolerance for risk. Risk tolerance is expressed in terms of cost and value. The structure also provides the starting point for identifying and inventorying potential risks. This considers factors that may jeopardize an initiative's success and ensures that plans for mitigating their impact are developed and incorporated into each viable alternative solution.

Risk is expressed in terms of cost (what is the maximum acceptable cost "creep" beyond projected cost) and value (what is the maximum tolerable process performance slippage.)

When considering an e-Government investment, decision-makers will be faced with numerous considerations. However, the e-Government investment will have neither a guaranteed price, nor a guaranteed return. Even after the most thorough analysis, some level of risk will remain that may cause costs to increase and overall performance to decrease.

Identify and Document Risk

Risk that is not identified cannot be mitigated. Risk not mitigated can cause a project to fail either in pursuit of funding or, more dramatically, during and after implementation. As more services are delivered electronically, using multiple channels including the Internet, and more organizations collaborate to deliver more efficient and responsive service, the level of risk increases. Accordingly, Federal oversight is increasingly focused on whether risks have been identified, defined, mitigated, and managed.

Throughout the planning and evaluation of an initiative, variables that could degrade performance, impede implementation, or drive up costs should be identified. Issues discovered should be defined and documented, resulting in an initial risk inventory. For example, imagine that a need has been identified to provide clients with Federal benefit information over the Internet. It is obvious that risks associated with privacy and authentication will arise. What will happen if citizens choose not to use the service because they fear that their private information will not be secure?

Risks can be identified early in the lifecycle through discussions with technical and policy staff and/or representatives of partner agencies. Identifying and documenting a

risk inventory builds confidence that all aspects of risk are being considered and plans for mitigating impact are being incorporated into each alternative solution. The greater awareness and attention paid to risk throughout the development process, the greater the likelihood that residual risk, the risk remaining after all possible mitigation efforts, will be minimized.

Define the Risk Tolerance Boundaries

Realized risk increases cost and decreases value. An early consideration in the development of a project is the level of risk considered tolerable. Setting cost and value risk tolerance boundaries provides agency management the means to communicate their organization's tolerance for risk.

As anticipated value increases or anticipated cost decreases, the amount of tolerable risk also increases. This relationship is expressed as a curve for both cost and value risk boundaries. An e-Government initiative should fall within the acceptable risk tolerance boundary range of cost and value in order to be considered for funding.

KEY CONCEPT:

RISK

Risk increases cost and reduces performance, effectively reducing the value delivered by an initiative. Within VMM, level of risk is quantified.

Risk is considered differently at different stages in the development of an e-Government initiative:

1) **Risk Inventory** – Identifying risk factors and documenting risks to ensure all aspects of risk have been considered. Plans for mitigating the impact of the specific risk factor is incorporated into each alternative solution under consideration.
2) **Risk Tolerance Boundary –** The risk tolerance boundary is determined and defined by senior management to communicate a range of acceptable cost and value risk. It is also documented.
3) **Risk Mitigation** – Identifying measures to mitigate the effect of risk. Measures are identified during the conceptual development and planning of an initiative (e.g., incorporate authentication protocols to maintain the privacy of customer data, develop a project management plan, fund and implement in useful segments).
4) **Risk Analysis** – Risk mitigation is unlikely to remove all risk from an initiative. A risk assessment is conducted to determine the probability and impact of remaining or residual risk. Results are documented.

Establishing cost and value risk tolerance boundaries requires interaction among a group of senior staff. These leaders must leverage their experience, knowledge, and vision in order to determine at which point the risk is too great to warrant the investment. To define the highest level of risk tolerance, the group should identify a series of two points at least five times for both cost and value. This is accomplished by asking that the group respond to questions such as:

- "Would you invest in an initiative with a predicted value score of X if the risk associated with that initiative is Y%?"

- "Would you invest in an initiative with a predicted cost of X if the risk associated with realizing that cost is Y%?

Polling during a facilitated group working session allows for structured discussion and encourages buy-in. An automated polling tool may be used during the session to allow for private voting, thus reducing social pressure that may affect the vote.

Best Practices

Using Risk Tolerance Boundaries

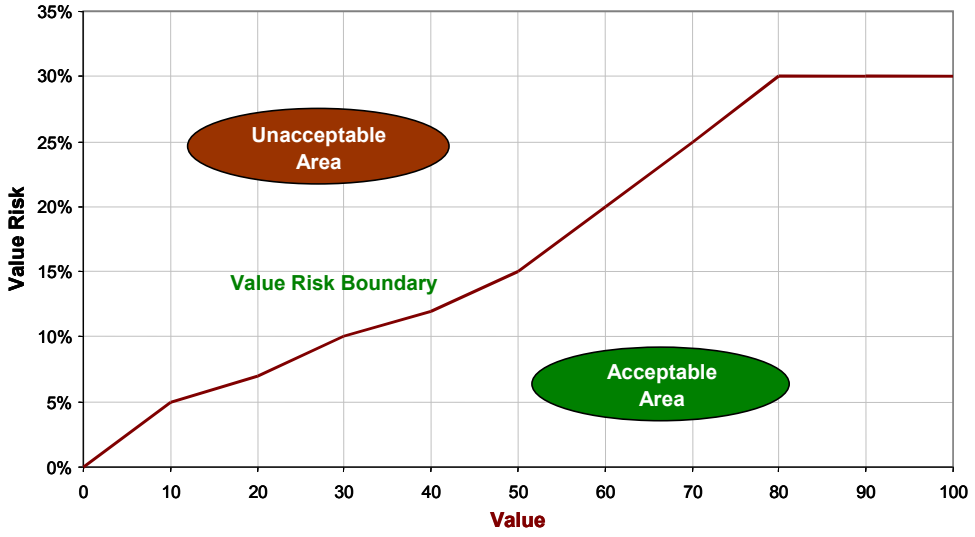
Senior decision-makers or focus-area portfolio managers may communicate a range of acceptable risk by first setting risk tolerance boundaries. When evaluating alternatives and creating a portfolio of investments, select initiatives that fall within the range of acceptable risk for cost and value. Balance high-risk/high-value return investments with lower-risk/lower-value return investments. Balancing the risk reduces total portfolio risk exposure and promotes responsible innovation.

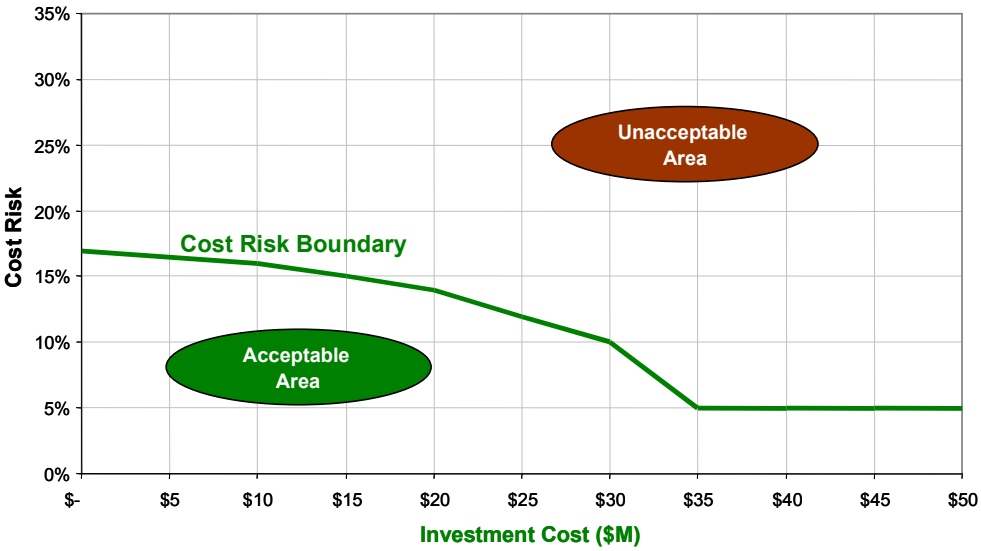
VMM In Action

Risk Tolerance Boundaries

The graphs below depict hypothetical value and cost risk tolerance boundaries. Note that the risk tolerance boundary defines an area representing a range of acceptable risk. That range is broader, incorporating a higher percentage of risk (performance slippage), as value increases and as cost decreases. *These graphs are being provided for illustration purposes only.*

The total estimated time needed to introduce the concept of a risk tolerance boundary, and poll a group of senior staff to establish both the value and cost tolerance boundaries is approximately 1.5 hours.





Task 3 - Identify and Define the Cost Structure

The Cost Structure and the Value Structure are similar. The Value Structure establishes a framework for assessing the value of an initiative while the Cost Structure provides the framework for determining the costs of an initiative. For the Value Structure, program managers identify and define specific measures within the Value Factors to ascertain the total benefit of an initiative. Within the Cost Structure, analysts identify and define specific cost elements used to capture the total cost of an initiative. The Cost Structure developed in this step will be used to estimate the cost for each alternative. For both value and cost, the objective is to provide a structure for analysis that is accurate, complete, comprehensive, and reduces the risk of double-counting or missing elements.

The most significant objective in the development of a Cost Structure is to ensure a complete, comprehensive cost estimate and to reduce the risk of missing costs or double counting. An accurate and complete cost estimate is criticalfor an initiative's success. Incomplete or inaccurate estimates lead to initiatives exceeding cost estimates for implementation requiring justification for additional funding or a reduction in scope.

Customizing a Cost Structure is key to estimating the cost of an initiative and also generates questions that help to drive the planning process. For example, while analyzing alternative solutions, the operating philosophy of a proposed initiative might lack the level of detail required to determine associated costs. Also, the technical architecture might lack the level of detail necessary to define cost drivers (e.g., the number of units required) or might lack a key planning element (e.g., communications plan).

The information and understanding of an initiative's purpose and objectives gained during the development of the

KEY CONCEPT:

COST STRUCTURE

The Cost Structure, also called a Cost Element Structure (CES), is the foundation of a cost estimate. To serve this purpose, it must be based on a thorough understanding of an initiative and associated cost estimates, ensuring that nothing is left out or double counted. The Cost Structure establishes a hierarchical structure or "family tree" of detailed cost elements, for example:

2.0 System Acquisition & Implementation
- 2.1 Procurement
  - 2.1.1 Hardware
  - 2.1.2 Software
  - 2.1.3 Customized Software
- 2.2 Personnel
  - 2.2.1 Government
    - 2.2.1.1 Additional Program Management Oversight
    - 2.2.1.2 Process Redesign (BPR)
    - 2.2.1.3 System Integration
      - 2.2.1.3.1 Interoperability for Business Line Owners
      - 2.2.1.3.2 System Integration

Individual low-level cost elements are aggregated into mid-level cost summary groups, and then rolled up into higher-level cost groups.

The total cost estimate is the sum of the value of each cost element.

Value Structure forms the foundation for customizing an e-Government Cost Structure. A standard e-Government CES, such as the one provided in "Technical Definitions," can be used as a starting point for identifying the full range of costs associated with a specific e-Government initiative. Consider whether the costs associated with delivering value in each of the Value Factors has been captured. If a standard CES is not customized based on the initiative's particular business objectives, performance requirements, and challenges, the organization will run the risk of either under-funding or not funding activities critical to the success of the initiative (e.g., process redesign, outreach or marketing, training).

The level of detail in the cost element title and description is important to locate elements within the Cost Structure that seem to repeat. For example, training may appear as a cost element under several cost groups. This may be a case of double counting, or, it may be a reflection of similar activities repeated through the development, implementation, and operation of an initiative or program.

Best Practices

Customizing a Cost Structure or CES

To ensure that the final cost estimate is comprehensive and complete, DO NOT rely solely upon a standard CES or CES developed for another initiative. Not all e-Government initiatives can be broken down into the same cost elements.

View costs through the lens of the Value Factors to help identify costs not typically associated with an IT investment.

- ***Direct User Value –*** What support do users need to use the system – training, marketing, access (e.g., kiosks), and incentives?
- ***Social Value –*** What needs to be done to ensure positive performance, public awareness, advertising, public relations, and development of a communications plan?
- ***Government Operational Value –*** A customer-centric organization may still require a "brick and mortar" presence, or paper forms. It may be necessary to maintain legacy systems and processes during transitions to, or in tandem with, electronic processes.

As alternative solutions are defined, additional cost elements may be identified at the third or fourth level of detail and added to the Cost Structure. Not all alternatives will have costs in each of these elements. However, the same Cost Structure should be used as the "template" for evaluating all alternatives. Maintaining the consistency of the Cost Structure will facilitate the comparison of cost estimates among alternatives.

Task 4 - Begin Documentation

From the first conceptual discussions of how to employ e-Government, salient issues and assumptions that define the way in which the cost, value, and risk elements interact must be documented. These assumptions provide the context or rationale for a decision and therefore must be preserved to inform subsequent decisions.

The rationale behind the assumptions creates the foundation for the basis of estimate and provides the information required to defend a cost estimate or value analysis. The basis for the estimate, including assumptions and business rules, should use an easy-to-follow documentation structure that links to all other analytical processes and requirements. This practice will provide easy access to information supporting courses of action. It will ease the burden associated with preparing investment justification documents such as an OMB Exhibit 300. As an initiative evolves through the life cycle, becoming better defined and more specific, the documentation too, will mature in specificity and definition.

Best Practices

"Prove It"

To ensure that the final cost estimate is comprehensive and complete, DO NOT rely solely upon a standard CES or CES developed for another initiative. Not all e-Government initiatives can be broken down into the same cost elements.

What is the ***most fundamental*** difference between a cost estimate or performance projection that is based on data and logical assumptions, and one that has been pulled from the air? One can be defended. The other cannot.

Documenting assumptions provides an audit trail of decision-making and analysis.

Best Practices

Basis for Estimate

The basis for estimate is developed during Step 1 (global assumptions) and Step 2 (alternative specific information) and includes the following parts:

Part 1 - High-level description of the alternative (complete for each alternative)

Part 2 - Cost Assumptions

Schedule – High-level overview of the proposed implementation schedule for the particular alternative.

Economic Factors - Assumptions and economic factors used across all the alternatives' categories and cost functions.

- Document economic factors used consistently for all alternatives.

  The list of factors below was developed for an e-government initiative and is presented here for illustration only.

  For comparative purposes, discounted costs were provided to represent future expenditures in today's dollars in consideration of the time value of money. The quantitative estimates for this project were based on the following general assumptions:

  - While costs will continue indefinitely, changes in equipment costs, workload, and other environmental factors are likely at some point in the future. To compare alternatives, a standard ten-year lifecycle (FY02-FY11) is used..
  - OMB A-94 inflation factors (1.95% for budgetary purposes) and nominal discount rate (5.1% for comparative purposes on the project) were chosen for analysis.
  - All contractor rates were loaded with overhead and benefits and were based on the GSA IT schedule price list. It also was assumed that there are 2087 work hours in a given year (based on OMB A-76 guidance).
  - Government labor rates were based on 2002 rates for Step 9 specified GS level. Benefit and Overhead rates of 32.45% and 12% were applied to the government salary based on OMB A-76 guidance.
  - Sunk or prior year costs are not included in the estimates.
  - Hardware and software equipment was based on technical recommendations. Costs for hardware and software was produced via research and/or vendor supplied information.

- Economic factors specific to individual alternatives (to be completed for all alternatives.)

Investment and Operations & Maintenance Streams – Provides a summary table and detailed breakdown of the hardware, software, and personnel assumptions that are the basis for the alternative-specific cost estimate. Organize this section as follows to facilitate the fulfillment of reporting requirements, including those associated with OMB Exhibit 300:

1.0 Planning and Development
2.0 Acquisition
3.0 Operations and Maintenance

Part 3 - Value Assumptions

Provides a list of assumptions that form the basis for value projections. Value assumptions may be derived from the process of defining the Value Structure and included in the initial basis of estimate. In this section, document research efforts (e.g., sources of information) and assumptions used to select and define measures (e.g., rationale behind the selection of specific metrics and targets). For each initiative, organize Value Assumptions as follows:

- Business drivers and assumptions, to develop the Value Structure
- Business drivers, assumptions, resources used (complete for all alternatives) to predict the performance of individual alternatives.
  - Direct User Value
  - Social Value
  - Government Financial Value
  - Government Operational Value
  - Strategic and Political Value

Part 4 - Risk Assumptions

Documents in two parts the risk definitions and assumptions made in development of risk management and mitigation plans:

- Global Risks – Risks and associated assumptions that affect all alternatives solutions
- Alternative Specific Risks – Risks and associated assumptions specific to each alternative

Summary Step 1

The decision framework provides broad parameters for the evaluation of e-Government initiatives. Details within those parameters are developed through the collection of information from stakeholders, partners, and customers. Tailoring the decision framework is a collaborative process. This step contains development of three structures and ongoing documentation:

Value Structure

- Prioritizes the Five Value Factors at the first layer of the decision framework
- Defines and prioritizes measures for Five Value Factors at the second layer of the decision framework. The definition of a measure must include:
  - A concise, illustrative name
  - Brief description
  - Metric (including targets)
  - Scale (based on the normalized scale of 0-100 with 100 being the best possible score)
- Considers the use of standardized measures defined by senior management (at the agency, portfolio, or enterprise-wide levels) for all projects

Risk Structure

- Develops an initial inventory of risk
- Establishes the risk tolerance boundary set by senior management to communicate a range of acceptable risk

Cost Structure

- Begins with an understanding of business imperatives and performance expectations
- Defines the costs associated with a specific initiative
- Tailors a standard e-Government CES or a CES developed for a different initiative to meet the specific requirements of an initiative

Documentation

In addition to the development of a decision framework, this Step includes the following:

- Documentation of assumptions and business rules, and basis of estimate, for the initiative under development
- Documentation of economic factors, as well as drivers and assumptions associated with cost, value, and risk

	Step 1 Required Resources		
Task 1 Activities	**Staff**	**Data**	**Tools**
Prioritize the Value Factors	• e-Government Leaders at the Highest Possible Level of Government (e.g., OMB, GAO) or the Highest Level within an Organization • Trained Facilitator	• Expert Opinion • "Best Practice" in public and private sectors	• Decision Tool • Facilitator
Identify, Define, and Prioritize the Measures	• Representatives from each Direct User Group • Staff Representatives from: - Technical/ Engineering - Program Management - Policy - Business Line - Budget/CFO • "Partner" Agencies • Trained Facilitator	• Expert Opinion • Executive and Agency Level Guidance (e.g., PMA, Strategic Plans, Performance Plans, e-Gov't Strategy, current initiatives) • Business Unit Guidance (Goals, Objectives, Performance Plans) • Existing Information and User Insights (Polls, e.g., ACSI, Hart Teeter; focus groups) • Focus groups • Private and Public Sector Benchmarks (Best Practices)	• Decision Tool • Facilitator
Task 2 Activities			
Identify and Define Risk Structure	• Program Management • Technical/ Engineering • Policy • Business Line • Partner Agency Representatives • Analyst	• Expert Opinion • Government Lessons Learned • Private Sector Best Practices	• N/A
Define the Risk Tolerance Boundary	• Senior-Level Agency Decision-Makers or Portfolio Managers • Trained Facilitator	• Expert Opinion • Government/ Agency Policy	• Polling Tool • Facilitator
Task 3 Activities			
Identify and Define the Cost Structure	• Program Management • Technical/ Engineering • Budget/CFO Staff • Partner Agency Representatives • Analyst	• Standard Cost Element Structure	• N/A
Task 4 Activities			
Begin Documentation	• Program Management • Technical/Engineering • Analyst	• Value Structure • Expert Opinion • OMB • Government/Industry Best Practices/ Benchmarks • Historical Data	• N/A

NOTES

Step 2 - Alternatives Analysis (Estimate Value, Risk, Cost)

In Step 1, the decision framework was tailored to reflect the needs and priorities of a specific e-Government initiative. The Value Structure defined the benefits the initiative must deliver; the Risk Structure defined a range of tolerable risk and an initial inventory of risk associated with the initiative; and the Cost Structure defined a tailored CES. Finally, documentation for the initiative began with the creation of an initial basis of estimate. The great challenge of Step 2 is to use all of this information to develop alternatives and determine how they will perform within the defined parameters.

What is the business value of performing an alternatives analysis?
A VMM alternatives analysis uses the value, cost, and risk structures to establish and evaluate a potential investment against alternative methods to achieving the same functional need. This analysis requires a disciplined decision process to consider the range of possible actions to achieve the envisioned benefits. The rigor of this analytical process yields the data required to justify an investment or course of action. It also provides the information required to support the completion of the budget justification document (e.g., OMB Exhibit 300). In addition, the process produces a baseline of anticipated value, costs, and risks to guide the management and on-going evaluation of an investment.

What are the tasks and outputs associated with Task 2?
At the end of Step 2, decision-makers will have the costs, risks, and performance information about each alternative necessary to develop decision metrics.

Step 2	
Tasks	**Outputs**
1. Identify and Define Alternatives	• Viable alternatives for e-Government solutions
2. Estimate Value and Cost	• Cost and value analyses
3. Conduct Risk Analysis	• Risk Analysis
4. Ongoing Documentation	• Tailored basis of estimate documenting value, cost and risk, economic factors and assumptions

A summary discussion of the tasks covered in this chapter and the resources required to fulfill them appears at the close of this chapter.

Task 1 – Identify and Define Alternatives (Estimate Value, Costs and Risk)

There are many ways to apply electronic service delivery to yield substantial reduction in cost while also increasing value. This task focuses on identifying practical alternatives that when implemented, have the potential to deliver an optimum mix of value, cost, and risk.

The starting point for developing alternative solutions is the information in the Value Structure. The preliminary value drivers identified in the initial basis of estimate (see Step 1) also are important. This information forms the basis for identifying and defining alternative solutions that address user needs, satisfy government service providers, and benefit society at large. Following the VMM process will result in alternatives that accurately reflect the balance of performance, priorities, and business imperatives related to each initiative. Discussions with user groups elicit important information from each stakeholder organization and achieve agreement so the project can move forward. Collaboration facilitates accomplishment of e-Government principles, such as breaking down boundaries and building consensus across organizations.

Best Practices

Identifying and Defining Solution Alternatives

Collaboration, Communication, Coordination

Developing an initiative in isolation, without the involvement of all stakeholders, is unlikely to build consensus or address the full range of processes, policies, and technical issues associated with an e-Government initiative. Definition of alternative e-Government solutions is best tackled through the collaboration, communication, and coordination of individuals representing a variety of points of view.

As alternatives are defined, participants gain additional insight into factors creating or increasing risk. It is important to define alternatives that mitigate these risks to the maximum extent possible. Risks and associated risk mitigation strategies should be documented. Residual risk, or the risk remaining after mitigation strategies have been fully applied, will be analyzed in Task 2 of this Step.

The Base Case

Every initiative under consideration and all assessments of e-Government alternatives under consideration must include a base case. The base case captures the affect on both value and costs over time if an investment is not made. Each alternative, including the base case, is analyzed against the parameters of the decision framework. The base case explores the impact of identified drivers on both value and cost today and into the

future if an alternative solution is not implemented. That might mean that current processes and systems are kept in place or that different organizations will build a patchwork of incompatible, disparate solutions.

KEY CONCEPT:

The Base Case

To define the base case, the analyst must ask:

"What will happen if a new initiative is not funded?"

The base case is more than a still picture of the status quo. It projects the effect of maintaining current systems, processes, or ways of doing business while attempting to keep pace with changing levels of demand and workforce (e.g., retirement /attrition) at current levels of service quality and customer satisfaction.

For some e-Government initiatives, there may seem to be no base case since the services or capabilities proposed are not currently offered. In this situation, the base case will still be the result of doing nothing. Using the structures of the decision framework provides decision-makers with a means for comparing alternatives to the base case. These omparisons also serve as a vehicle for communicating the initiatives' value to agency management, partner agencies and organizations monitoring and funding authorities and users.

VMM In Action

The Base Case

A cross-agency e-Authentication initiative is proposed. Alternatives are presented and analyzed using VMM. There are currently no government-wide e-Authentication capabilities and, therefore, no status quo. To establish the Base Case, ascertain the result if one of the proposed government-wide e-Authentication alternatives were not implemented. In this situation assume that government organizations will likely develop their own electronic authentication capabilities. Below is a narrative description of Alternative 1, the Base Case "Discrete Authentication" used for the analysis of an e-Authentication initiative.

"Each e-Government initiative must dedicate the resources to develop its own authentication solution. This scenario results in each of the 23 e-Government initiatives needing a discrete authentication solution to verify the identity of system users. These solutions will differ based on the nature of the data exchanged. Data deemed sensitive (e.g., privacy, financial) might require more advanced authentication solutions while others may pursue password and PIN solutions."

Task 2 - Estimate Value and Cost

Comparison of alternatives, justification of funding, creation of a baseline against which on-going performance may be compared, and development of a foundation for more detailed planning require an accurate estimate of an initiative's cost and value. The more reliable the estimated value and cost of alternatives, the greater confidence decision makers can have in the investment decision.

Using VMM, both cost and value are subject to quantitative analyses. Dollar values are estimated for each element of the Cost Structure. Performance is projected against the measures defined for the five Value Factors and is scored on a normalized scale. In both cases, uncertainty and sensitivity are analyzed using the same methods and tools.

Collect Data

Data collection efforts should begin as early in the development process as possible and should continue until estimates and projections are complete. The process entails the following steps:

- Understand the program
- Identify potential issues (e.g., schedule, performance, etc.)
- Identify candidate cost drivers
- Identify data types and potential sources
- Gather data

Collection of data can be a time-consuming and costly activity. Changes in requirements, alternative solutions, difficult to locate or questionable data, and frequently changing alternative specifications can make for an arduous process. Analysts must be ready for these challenges and be prepared to work with information that does not explicitly "fit" the specifications of the initiative being evaluated. For example, private sector benchmarks are not often applied to government initiatives because of differences in size, scope, and mission. However, they can and should be used as a starting point for discussion and modeling when government benchmarks or actual data points are not available. They may also serve as a "best practice" when looking for innovation and process transformation.

Information required for estimating costs and projecting value includes:

- **Schedule** –the implementation strategy driving the timing of investments. The level of schedule detail improves as the initiative matures through the life cycle.

- **Operations & Maintenance Philosophy** – how the initiative will be deployed, how it will operate (functions eliminated, changed, added), required staffing (reductions, displacement, additions, management oversight and "governance") and how the initiative will be maintained over the course of its lifecycle, including required technology, and technology refreshment.
- **Technical** – costs and performance data (e.g., Section 508 "electronic and information technology access for the handicapped" solutions, reliability, speed, data integrity, vulnerability, security requirements).
- **Historical/Current Data** – (e.g., cost associated with the base case)
- **Environmental Drivers** – (e.g., number of users, demand forecasts, workforce retirement/attrition projections)

Construct a VMM Model

A VMM model provides a means to estimate costs, project value, analyze uncertainty and risk, and conduct sensitivity analyses. The model is built using the decision framework's three structures—value, risk, and cost—and the assumptions on which the estimate is based. The model should include separate worksheets for calculating the cost estimate and value scores for each alternative. Structure the cost estimate worksheets by listing cost elements, then add up the dollar amounts to arrive at total dollar figures for each of the major categories and a grand total for all categories.

Best Practices

Data Collection

Matching information and phase of development

Data sources and detail will vary based on an initiative's stage of development. Organizations should recognize that more detailed information may be available at a later stage in the process and should initially provide best estimates rather than delaying the process by continuing to search for information that is likely not available. Expert opinion, benchmarks, and "best practices" should be used for estimating initial projections. Thorough documentation of the basis for the estimate will provide for improving the estimate as more reliable information becomes available, either through location of additional sources or the maturation of the initiative through the life cycle. (See Step 2, Task 2)

Consider the Source - Ensure the Quality of Data

- Vendor supplied data may reflect marketing strategy more than the actual cost or performance of their products.
- Costs or performance projections posted on the Internet are not necessarily reliable. Consider the website owner and timeliness of the information. Confirm the data independently whenever possible.

The same operation is used to calculate and produce the Value Scores. Enter scores for each measure. The scores are translated into the normalized scale according to the parameters previously established.

Using an automated tool to do probability simulations, the model yields uncertainty and sensitivity analyses. The results engender confidence in the validity of value projections and cost estimates. The VMM model also should calculate how costs will increase and value decrease based on an assessment of the impact and probability of identified risks.

Populate the Model

Analysts will apply the information from the analysis to populate the model with the estimated dollar amounts for each cost element and projected performance for each measure. These predicted values, or the underlying cost and value drivers, will be expressed in ranges (e.g., low, expected, and high). The range between the low and high values will be determined based on the level of uncertainty associated with the projection. The goal is to develop a range that provides a 90% level of certainty that the actual cost or actual performance falls between the low and high points.

Best Practices

Cost and Value Analysis

- Consistency is critical. The process for producing the estimate or projection must be clear, logical, and coherent so that the results can be explained and the estimate's projections improved with better information.
- A cost estimate or value projection is, by definition, a subjective determination. Independent review, within time constraints, enhances the value of the result.
- Take time to educate the system architects on the information required, and elicit their support and their insights in providing the most reliable data possible given the maturity of the project.
- Defending the estimates and projections is an integral part of the process. Look at the analysis and the derived data and determine whether a convincing case can be presented. "Reverse engineer" the audit trail and determine if "it all hangs together."
- Are the estimates/projections credible? Do those most knowledgeable of the process undergoing change consider that the estimates are credible and will lead to implementable results?
- Producing a good cost estimate or value projection is an iterative process. Be prepared for ongoing updating and improvement based on better or more detailed information and/or closer review by knowledgeable people.
- The only way to know with 100% certainty how much an initiative costs or how it will perform is retrospectively. The real question to ask when estimating costs and predicting performance is not how right you are, but how wrong you might be.

Normalize Data

To allow for aggregation and for comparison, all data must be normalized. Costs are already normalized because they are projected using the same unit of measure, constant dollars. However, value measure projections must also be normalized through translation onto the normalized scale. (See normalized scales defined in Step 1.)

VMM In Action

Predicting Performance

Example 1: This measure was established for an e-Travel initiative in the Direct User Value Factor.

Value	10	20	30	40	50	60	70	80	90	100
Average # hours from receipt of customer feedback message to response	48.00	44.67	41.33	38.00	34.67	31.33	28.00	24.67	21.33	18.00

Analysts projected the low, expected, and high performance for that measure.

	Low	**Expected**	**High**
Average # hours from receipt of customer feedback message to response	38	24	18

The model translated those projections onto the normalized scale.

Value	10	20	30	40	50	60	70	80	90	100
Average # hours from receipt of customer feedback message to response	48.00	44.67	41.33	38.00 **40**	34.67	31.33	28.00	24.67 **82**	21.33	18.00 **100**

Low = 38.00
Expected = 24.00
High = 18.00

Example 2: This measure was established for Alternative 2 in the Direct User Value Factor. The normalized scale set for this measure was binary.

Normalized Value Scale

Value Points	0	10	20	30	40	50	60	70	80	90	
Duplicative Entry of Data	**Yes**										NO

Conduct Uncertainty and Sensitivity Analyses

Despite our best effort, initial estimates and projections are usually not accurate within an acceptable percentage of error. Thus, it is a best practice to analyze the uncertainty and sensitivity of cost and value estimates.

KEY CONCEPT:

Analyses

After getting several estimates, you decide to have your bathroom renovated. During construction, the following occurs:

- The plumber discovers that all the pipes must be replaced. (Although the plumber did not previously mention this possibility, your prime contractor notes that it wasn't a surprise based on the age of the house.)
- The carpenter realizes that instead of just replacing the wallboard in the tub area, all the wallboard in the room has to be replaced. (The prime contractor reminds you that he had mentioned the possibility of needing more materials.)

As a result, the final cost of the bathroom renovation is 40% greater than the original estimate.

What if you conducted prior analysis of the contractor's cost estimate?

- *Uncertainty Analysis*: Would it have helped to more accurately estimate the potential range of costs for wallboard?
- *Sensitivity Analysis*: Would it have made a difference if the variables with the greatest impact on the overall cost had been identified and considered further when budgeting for the project?
- *Risk Analysis*: Would it have been prudent to consider the age of the house and that old bathrooms have old plumbing with the high probability that all the plumbing would need to be replaced (high impact)?

Uncertainty Analysis

Uncertainty analysis helps to determine the "expected/anticipated" value in order to estimate cost or a value projection. The analysis does not reduce the level of uncertainty, but improves confidence by determining, through simulations, a range of likely outcomes.

The method of choice for conducting uncertainty analyses is Monte Carlo simulation. Automated tools can calculate an expected range of results for multiple alternative scenarios by selecting random values from within the range identified for each

"uncertain" model input (e.g., estimated costs, value projections, cost drivers), repeating this process for a high number of iterations, and then computing aggregated results.

Conducting an uncertainty analysis requires the following:

Identify the Variables: Develop a range of value for each variable. This range expresses the level of uncertainty about the projection. For example, an analyst may be unsure whether an Internet application will serve a population of 100 or 100,000. It is important to be aware of and express this uncertainty in developing the model in order to define the reliability of the model in predicting results accurately.

Identify the Probability Distribution for the Selected Variables: For each variable identified, assign a probability distribution. There are several types of probability distributions (see "Technical Definitions"). A triangular probability distribution is frequently used for this type of analysis. In addition to establishing the probability distribution for each variable, the analyst must also determine whether the actual amount is likely to be high or low.

Run the Simulation: Once the variables' level of uncertainty is identified and each one has been assigned a probability distribution, run the Monte Carlo simulation. The simulation provides the analyst with the information required to determine the range (low to high) and "expected" results for both the value projection and cost estimate. The output of the Monte Carlo simulation produces a range of possible results and defines the "mean," the point at which there is an equal chance that the actual value or cost will be higher or lower. The analyst then surveys the range and selects the expected value.

KEY CONCEPT:

Uncertainty Analysis

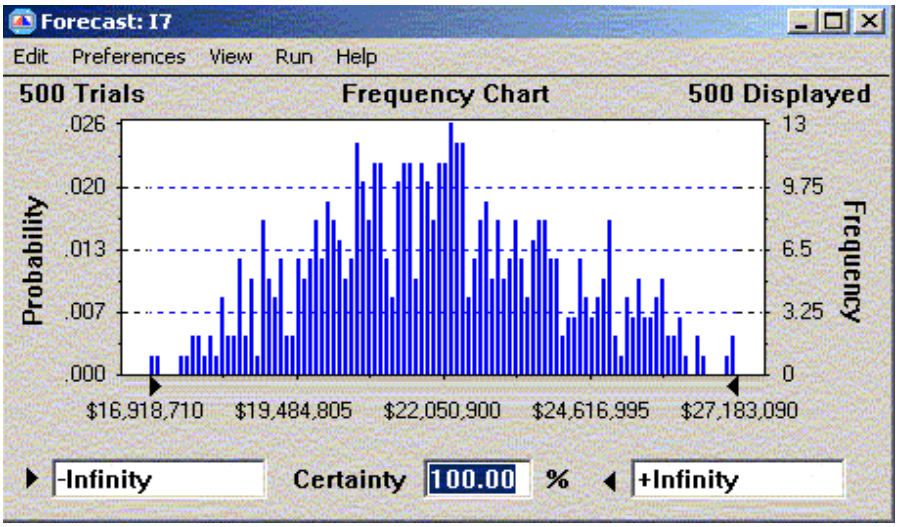
"[An Uncertainty Analysis is] a systematic [investigation] of the range of probable costs [and benefits] about a point estimate based on considerations of requirements, cost estimating, and technical uncertainty. The intent of such an analysis is to provide additional information for use in making decisions. Such an analysis is not expected to improve the precision of the point estimate, but rather to place it in perspective with respect to various contingencies."[1]

Source: *Glossary of Terms – Version 1.0," Society of Cost Estimating and Analysis, 15 September 1994.*

VMM In Action

Uncertainty Results

Below is a sample generated by running an automated Monte Carlo simulation on the VMM Model.



Sensitivity Analysis

Sensitivity analysis is used to identify the business drivers that have the greatest impact on potential variations of an alternative's cost and its returned value. Many of the assumptions made at the beginning of a project's definition phase will be found inaccurate later in the analysis. Therefore, one must consider how sensitive a total cost estimate or value projection is to changes in the data used to produce the result. Insight from this analysis allows stakeholders not only to identify variables that require additional research to reduce uncertainty, but also to justify the cost of that research.

The information required to conduct a sensitivity analysis is derived from the same Monte Carlo simulation used for the uncertainty analysis.

KEY CONCEPT:

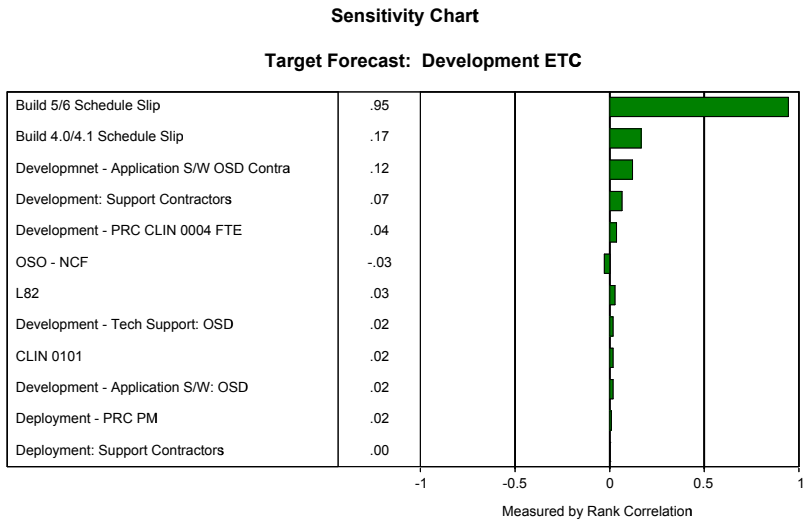
Determine the impact of additional information

Those variables that have the greatest impact on the overall result of a cost estimate or value projection are called "sensitive variables." Whether to invest time and resources to reduce the uncertainty associated with a sensitive variable will be based largely on the variable's expected impact.

VMM In Action

Sensitivity Analysis

The following is a sample sensitivity chart. Based on this chart, it is clear that "Build 5/6 Schedule Slip" is the most sensitive variable.



Task 3 - Conduct Risk Analysis

The only risks that can be managed are those that have been identified and assessed. A rigorous risk analysis will help organizations better understand the probability that a risk will occur and the level of impact that the occurrence of the risk will have on both cost and value. Additionally, a risk analysis provides a foundation for building a comprehensive risk mitigation plan.

After subjecting the cost estimates and value projections to a Monte Carlo simulation and defining the most probable values, examine additional factors that will impact the realization of the estimates. Those factors are potential risks.

To determine the type of action required to mitigate the risk, an understanding of the effect of the realized risk on cost and value projection is important. Ascertaining the most appropriate course of action requires knowledge of the probability and impact of

the risk. The interaction between probability and impact determines the effect of risk on a particular variable. Thus, conducting a risk analysis requires four steps:

- Establish the risk and probability scale
- Identify the risks
- Identify and score elements and values that may be impacted by the risk
- Calculate the risk-adjusted cost estimate and value projection.

Establish the Risk Impact and Probability Scale

The impact and probability of risk are rated as low, medium or high. Working with the program management and technical staff, develop a scale that converts these scores to a percentage.

KEY CONCEPTS:

Interaction of Impact and Probability = Level of Risk

Scenario: Crossing the street in a suburban neighborhood

Risk: Getting hit by a car
The effect of the risk, should it occur, is high. Injury or death could be the result. However, the probability of being hit by a car on a suburban side street is low. After considering the information, the person will likely cross the street, but will mitigate risk by looking both ways first.

Scenario: Crossing the racetrack during the Indy 500

Risk: Getting hit by a car
The effect of the risk, should it occur, is high. Injury or death could be the result. The probability of getting hit by a car on a racetrack during a race is very high. The person is unlikely to choose to cross the racetrack.

Scenario: Stuffing 2,000 envelopes

Risk: Getting a paper cut
While stuffing 2,000 envelopes, the likelihood is high that the person doing the stuffing will get a paper cut. However, the consequences of a paper cut are minimal. The person will likely continue to stuff envelopes without any risk mitigation strategy (e.g., wearing rubber gloves) in place.

VMM In Action

Risk Scale

The risk/probability scale used in the assessment of an e-Travel initiative is shown below. The "High, Medium and Low" on the left refers to risk level labels used to categorize both the probability of the risk occurring and the risk's likely impact on cost and value if it did occur.

For probability, each level of risk (high, medium, low) correlates to the percent likelihood that the risk would occur; for example, a risk that has high probability of occurring would be estimated to occur 50% of the time. For impact, each risk level is assigned a numerical value that represents the percentage amount by which the expected cost or value would be impacted if it the risk occurred; for example, a risk rated to have medium impact on cost would cause cost to increase by 15% if it occurred. These risk ratings work together to calculate the expected impact of each risk on the initiative.

Risk	Probability	Cost Impact	Value Impact
High	50%	25%	-25%
Medium	30%	15%	-15%
Low	25%	5%	-5%
	↑ Likelihood of Occurring	↑ Risk Causes Cost to Increase	↑ Risk Causes Value to Decrease

Identify and Define the Risk Factors

In Step 1, discussion, collaboration, and documentation of the information created the initial risk inventory. Some risks will be mitigated through the design of processes and systems. Other risks will remain despite thorough and conscientious planning.

It is impossible to prepare for a risk that has not been identified. Therefore, consider the full spectrum of risks, whether they seem probable or not. OMB has identified eight risk categories (organizational and change management, business, data and information, technical, strategic, security, privacy, and project) in OMB Circular A 11[1] (See "Technical Definitions" for definitions of these risk categories.). Analysts should work closely with program management, technical staff, and policy staff to ensure that the potential risks in each of these categories are thoroughly explored.

[1] OMB Circular A-11, issued June 27, 2002

VMM In Action

Defining Risk

In the assessment of an e-Travel initiative, risks were bundled into five categories: cost, technical, schedule, operational, and legal.

The following sample table demonstrates how a single "risk factor" is likely to impact multiple risk categories. Note the level of detail provided in the description. Specificity is critical to distinguish among risks and avoid double counting.

Selected e-Travel Initiative Risks by Risk Category	Cost	Tech	Shc.	Op.	Legal
Different agencies have different levels and quality of security mechanisms, which may leave government data vulnerable. Web-enabled system will have increased points of entry for unauthorized internal or external users and pose greater security risks.	X	X			
The e-Travel concept relies heavily on technology. Although, the private sector has reduced travel fees and operational costs by implementing e-Travel services, the commercial sector has not yet widely adopted/developed end-to-end solutions that meet the broad needs (single end-to-end electronic system) articulated by the e-Travel initiative. The technology and applications may not be mature enough to provide all of the functionality sought by the e-Travel initiative managers.	X	X	X	X	
Resistance to change may be partially due to fear of job loss, which may lead to challenges from unions.			X	X	X

Assess the Probability and Impact of Risk

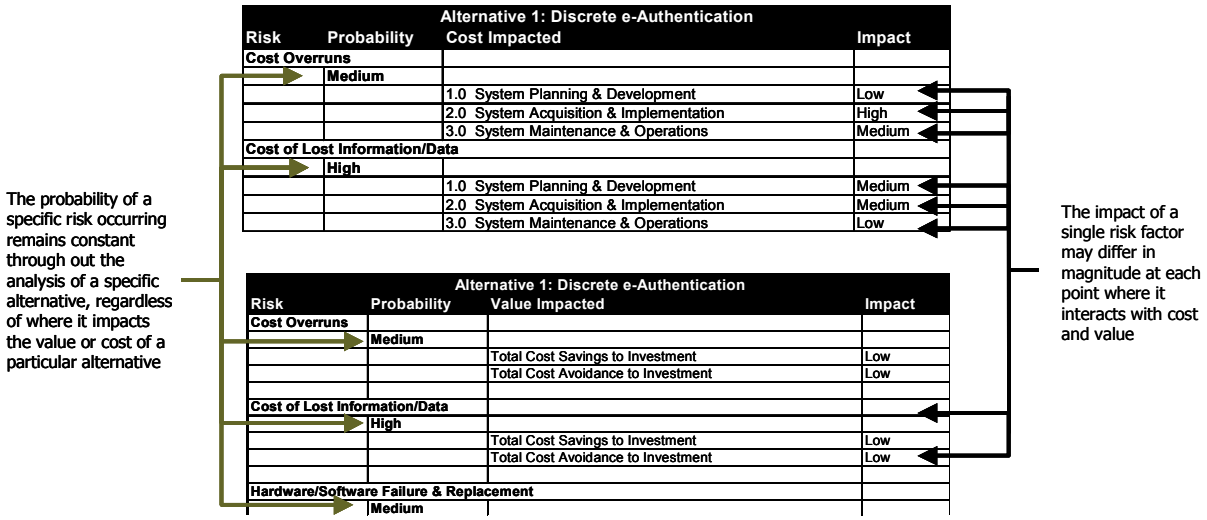
Once risks are identified, it is necessary to determine their probability of occurrence and impact on cost and value. This process should begin at the lowest levels of the Cost Structure and Value Structure hierarchies for each alternative. Give each relevant element or measure a risk probability and impact score using low, medium, or high. These descriptive scores must be converted mathematically and applied to the specified cost elements and value measures.

Based on the probability of occurrence and impact of the risk, risk adjusted expected value score and cost estimate are calculated (see Step 3).

VMM In Action

Assessing Probability and Impact

Below are excerpts from tables developed for the risk analysis of an e-Authentication initiative. Note that the impact and probability of risk were assessed for both cost and value.



Task 4 - On-going Documentation

The planning and analysis activities in Step 2 generate alternative e-Government solutions or approaches. Vendor data, expert opinion, and benchmarks are used to determine the cost and performance of alternative solutions. During this process, risk is considered from multiple perspectives to determine the effect of its occurrence.

The initial documentation of the basis of estimate, begun during Step 1, should be expanded in Step 2 to include a high-level description of the alternatives being analyzed and a complete and comprehensive list of both cost and value assumptions. In addition, expand on the initial risk inventory by documenting risk assumptions associated with specific alternatives. Take a collaborative approach to this activity. Provide enough time in the schedule for discussion and group consensus building. This collaboration will increase confidence in the assumptions and increase the accuracy and veracity of the estimates. This process is particularly important when considering the potential reach of an e-Government initiative incorporating the requirements and involving the budgets of multiple organizations.

Summary – Step 2

During Step 2, the analysis generates and evaluates solution alternatives.

The analysis of the alternatives produces project performance estimates for each value measure, estimated costs for each element, and an assessment of the probability and impact of residual risk. This process identifies specific drivers and assumptions associated with the value, cost, and risk of each alternative. It projects and normalizes performance measures for each value. As part of the process, uncertainty and sensitivity analyses are conducted to raise the confidence in estimate ranges and identify variables that merit additional analysis. A risk analysis is also conducted to identify, define, and determine the probability and affect of risk on value and cost.

This work requires attention to detail and the careful documentation of assumptions and supporting information. It requires collaboration among technology staff representatives, policy makers, program managers, and others representing the multiple internal and external organizations that must collaborate to build effective e-Government solutions.

At the end of Step 2, decision-makers will have the information necessary to answer basic questions applicable to various development phases:

Initiative in early stage of concept development:

- How well will alternatives perform as compared with defined value measures?
- What is the cost of alternative initiatives?
- What is the risk associated with alternative solutions?
- What is the result of selecting the base case (i.e., make no investment and retain the current state?)
- What assumptions were made for estimating projected cost and value?

Alternative initiative has been selected and is being tested:

- What value is being delivered by the selected initiative?
- What are the actual implementation costs to date? Do any previously estimated costs need to be re-examined?
- Have all risks been addressed and managed? Have additional risks appeared? Are previously defined mitigation techniques still valid and complete?

Selected alternative initiative is fully operational:

- What value is the initiative actually delivering? How does the delivered value compare with the anticipated value?
- What are the actual vs. projected costs to date?
- How are realized risks affecting cost and performance?
- Have any competing alternatives become evident during implementation and deployment?

Task 1 Activities	Step 2 Resources Required		
	Staff	**Data**	**Tools**

Identify & Define Alternatives	• Program Management Staff
	• Partner Agencies
	• Technical/ Engineering Staff
	  - Policy Staff
	  - Analysts (Budget, Risk, Cost)
	  - Business Line Staff
	• Acquisition Specialists
		• Public Sector Lessons Learned
		• Private Sector Best Practices
			• N/A

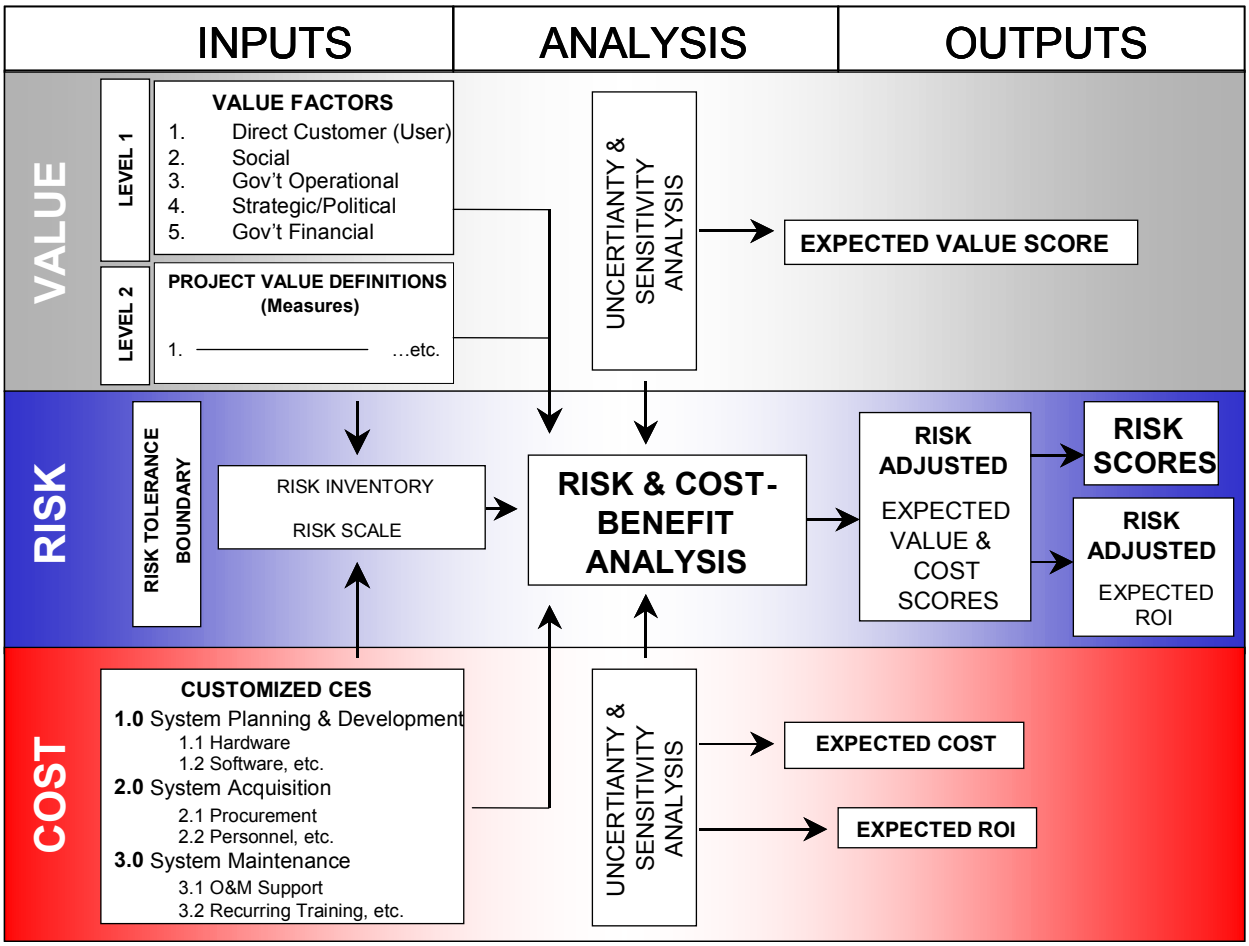
Task 2 Activities			
Collect Data	• Business Analyst • Program Management • Technology /Engineering Staff • Business Line Staff	• Literature (Published and Internet –posted) • Vendors • Historical Cost Data • Personnel Cost Data	• Internet • Other research tools, as applicable
Construct a Model	• Business Analyst	• Value, Cost, and Risk Structures • Basis of Estimate	• Spreadsheet • Monte Carlo simulation tool
Populate the Model	• Business Analyst • Program Management Staff • Technical/Engineering Staff • Business Line Staff	• Collected Data	• Spreadsheet • COTS Cost Estimating Software
Normalize Data	• Business Analyst	• Projected Performance • Normalized Scales	• Spreadsheet
Uncertainty Analysis	• Business Analyst	• Projected Performance • Estimated Costs	• Spreadsheet • Monte Carlo simulation tool
Sensitivity Analysis	• Business Analyst	• Monte Carlo simulation output	• Spreadsheet
Task 3 Activities			
Establish the Risk Impact & Probability Scale	• Program Management • Technical, Policy, Legal, Security Subject Matter Experts • Analyst	• Public Sector Lessons Learned • Private Sector Best Practices	• Spreadsheet
Identify and Define the Risk Factors	• Program Management • Technical, Policy, Legal, Security Subject Matter Experts • Analyst	• Public Sector Lessons Learned • Private Sector Best Practices	• Spreadsheet
Assess the Probability and Impact of Risk	• Program Management • Technical, Policy, Legal, Security Subject Matter Experts • Analyst	• Public Sector Lessons Learned • Private Sector Best Practices	• Spreadsheet
Task 4 Activities			
On-going Documentation	• Analyst	• Analysis & Planning to Date	• N/A

NOTES

3 Step 3 – Pull Together the Information

In Step 2, the analyses necessary to build confidence in cost estimates and value projections are conducted. Results of the analyses are adjusted to account for uncertainty and are further analyzed to define the probability and impact of identified risks. In Step 3, these elements are brought together in order to understand how they relate to one another. This is accomplished through the development of value and risk scores, as well as decision metrics that compare value to investment and financial ROI.

The process of assembling the information is captured in the flow diagram below.



What is the business value of pulling the information together?
By applying the VMM decision framework to the analyses described herein, the value of the alternatives are articulated and the risk lowered for the investment under consideration.

What are the outputs of Step 3?

The outputs of Step 3 are listed in the table below.

Step 3	
Tasks	**Outputs**
1. Aggregate the Cost Estimate	• Cost Estimate
2. Calculate the Return-on-Investment	• Return on Investment
3. Calculate the Value Score	• Value Score
4. Calculate the Risk Scores	• Risk Scores
5. Compare Value, Cost, and Risk	• Comparison of Value, Cost, and Risk

A summary discussion of the tasks covered in this chapter and the resources required to fulfill them appears at the close of this chapter.

Task 1 - Aggregate the Cost Estimate

Understanding the relationship among cost, value, and risk is the key to determining the most sound investment. The cost estimate is calculated by aggregating the expected value of each cost element.

VMM In Action

Cost Estimate

This summary table was excerpted from a VMM model constructed for the assessment of a cross-agency e-Government initiative.

Cost Elements ($ Million, Inflated)	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007 & Beyond	TOTAL
1.0 System Planning & Development	**$ 4.6**	**$ 0.5**	**$ 0.1**	**$ 0.1**	**$ -**	**$ -**	**$ 5.2**
1.1 Hardware	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1.2 Software	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1.3 Development Support	$ 3.0	$ -	$ -	$ -	$ -	$ -	$ 3.0
1.4 Studies	$ 0.6	$ -	$ -	$ -	$ -	$ -	$ 0.6
1.5 Other	$ 0.9	$ 0.5	$ 0.1	$ 0.1	$ -	$ -	$ 1.6
2.0 System Acquisition & Implementation	**$ 6.2**	**$ 8.5**	**$ 16.4**	**$ 13.7**	**$ -**	**$ -**	**$ 44.8**
2.1 Procurement	$ 1.2	$ 4.2	$ 12.8	$ 8.7	$ -	$ -	$ 26.9
2.2 Personnel	$ 4.8	$ 3.5	$ 0.7	$ 0.7	$ -	$ -	$ 9.7
2.3 Training	$ 0.3	$ 0.9	$ 2.8	$ 4.2	$ -	$ -	$ 8.2
3.0 System Maintenance & Operations	**$ 1.6**	**$ 8.7**	**$ 22.2**	**$ 43.8**	**$ 48.4**	**$ 270.9**	**$ 395.5**
3.1 Hardware	$ 0.0	$ 0.0	$ 0.2	$ 0.6	$ 1.0	$ 5.3	$ 7.1
3.2 Software	$ 1.6	$ 5.0	$ 17.9	$ 37.7	$ 39.9	$ 211.5	$ 313.7
3.3 O&M Support	$ -	$ 1.6	$ 2.0	$ 3.1	$ 4.9	$ 40.3	$ 51.9
3.4 Recurring Training	$ -	$ 1.7	$ 1.8	$ 2.0	$ 2.2	$ 11.7	$ 19.3
3.5 Other Operations & Maintenance	$ -	$ 0.4	$ 0.4	$ 0.4	$ 0.4	$ 2.0	$ 3.5
TOTAL LIFECYCLE COST	**$ 12.4**	**$ 17.7**	**$ 38.6**	**$ 57.6**	**$ 48.4**	**$ 270.9**	**$ 445.6**

Based on the analysis conducted to date, the expected total investment cost associated with Alternative 2: e-Travel is $ 50.0 million with total life-cycle cost (FY 02 - FY 11) of $ 445.6. The expected range for investment is $ 46.3 to $ 54.4 and for life-cycle is $ 405.5 to $ 486.0.

Systems, Planning, and Development funds (or funds from the particular program desiring the changed process) are usually used to define the strategies and alternatives for transforming a process, based on the program's requirements. These funds plus the System Acquisition and Implementation funds represent the required Investment funding.

System Maintenance and Operations funds (sometimes referred to Operations and Support or Operations and Maintenance) support recurring expenses, including the cost for operating the current system until the new system is phased in and fully implemented.

The ranges presented are the result of the Uncertainty Analysis conducted in Step 2.

Task 2 - Calculate the Return-on-Investment

Reduction in overall cost is a major benefit that can realize by simplifying and unifying processes and systems. Although not the only measure upon which an investment decision should be made, ROI is critical for decision-making.

Accurate measurement of financial benefits accruing to government as a result of process improvements requires understanding the technology proposed to support the initiative, as well as its business processes and management requirements. For example, organizations must determine whether an initiative that provides the opportunity for self-service will reduce staff or simply re-distribute staff.

To produce a comprehensive and complete analysis of an initiative, the estimated cost of the proposed initiative is compared with the current cost of providing the same or analogous service.

ROI calculations express the relationship between the funds invested in an initiative and the financial benefits the initiative will generate. Specific ROI metrics include benefit-to-cost ratio (BCR), savings-to-investment ratio (SIR), internal rate of return (IRR), and net present value (NPV). The calculation of ROI feeds directly into the Government Financial Value Factor. Therefore, the ROI metric selected must correspond with the value measure selected for the Government Financial Value Factor. For further information regarding these metrics, please refer to the “Technical Definitions” section in this document.

Task 3 - Calculate the Value Score

When considering an initiative, Value Scores are used to make consistent comparisons of the value delivered by competing alternative. At the organizational or portfolio level, Value Scores are used as data points in the selection of initiatives to be included in an investment portfolio.

Consider the Value Score as a simple math calculation. The scores projected for each of the measures within a Value Factor should be aggregated according to their established weights. The weighted sum of these scores is a *factor's* Value Score. The sum of the factors' Value Scores, aggregated according to their weights, is the *total* Value Score.

Key Concept

Value Score

The Value Score is the aggregate of all "expected/anticipated" value received from an initiative for each factor according to previously defined weights.

The way in which a Value Score is interpreted will vary based on the level at which it is being viewed.

At the program level, Value Scores are: • Viewed as a representation of how each alternative performed against a specific set of measures • Used to make a consistent comparison of the value delivered by multiple alternatives for a single initiative	***Example:*** The alternative that has a Value Score of 80 will be preferred (in terms of VALUE ONLY) over the alternative with a Value Score of 70.
Since the objectives and measures associated with each initiative will vary, decision-makers at the organizational or portfolio levels will use Value Scores to: • Determine the percentage of potential value an alternative will deliver when implemented • Help determine which initiatives should be included in an investment portfolio	***Example:*** An initiative with a Value Score of 75 is providing 75% of the value the initiative has the potential to deliver. In order to understand what exactly is being delivered, the decision-maker will have to review the measures for the value structure. This will provide the information required to compare one initiative to another.

VMM In Action

Adding up the Value Score

The table below was an output of the value analysis prepared for an e-Authentication cross-agency initiative. It demonstrates how a value score is calculated.

Alternative 1: Discrete e-Authentication Measure Value	Weight	Normalized Score	Weighted Score
Direct User Value	**28%**	**Subtotal →**	**12.84**
User Trust in Internet Transactions	26%	30	2.18
Application Owner Confidence in Identity of Users	25%	95	6.65
Speed & Ease of AO Deployment of Authentication Solutions	23%	20	1.29
Users will have access to Multiple Applications	13%	0	0.00
Accessibility of e-Government services to Users	11%	70	2.16
Allows AOs to comply with GISRA and other mandates	2%	100	0.56
Government Foundation/Operational	**25%**	**Subtotal →**	**5.99**
Common Cross-Agency Policy Establish for eAuthentication at all Levels	47%	2	0.29
Provides the Infrastructure for Common Authentication Services	15%	0	0.00
Ability to Evolve as New Technologies Emerge	13%	100	3.25
Architectural Flexibility	11%	60	1.65
Scalibility	8%	40	0.80
Elimination of Redundant Engineering & Procurement Efforts	6%	0	0.00
Strategic/Political Value	**20%**	**Subtotal →**	**13.06**
Fosters Interagency cooperation	39%	50	3.90
Advances President's E-Gov & Mgmt Agendas	31%	80	4.96
Regulatory Compliance	21%	100	4.20
Public Trust	9%	0	0.00
Government Financial Value	**19%**	**Subtotal →**	**0.00**
Total Cost Savings to Investment	60%	0	0.00
Total Cost Avoidance to Investment	40%	0	0.00
Social Value	**8%**	**Subtotal →**	**5.86**
Reduction of Identity Fraud	42%	80	2.69
Enables Expanded Use if E-services	41%	80	2.62
Higher Confidence in the Government's Ability to Authenticate Users	17%	40	0.54
Total	**100%**	**TOTAL →**	**37.74**
Range (after uncertainty & sensitivity analysis)		**31.42 to 42.26**	

Task 4 - Calculate the Risk Scores

In Task 3 of this Step, the probability of occurrence and impact of each identified risk factor was applied to areas of cost and value. Risk scores are calculated by comparing expected cost and expected value to risk-adjusted cost and risk-adjusted value for a specific alternative. These scores provide information to understand how the individual risk impacts add up to overall risk.

Risk scores provide decision-makers with a mechanism to determine the degree of negative impact to value and cost, and whether risk falls within the risk tolerance boundary defined by senior staff. A high cost and/or value risk score may alert program management to the need for additional planning including establishment of a

contingency fund, a reduction in project scope, refinement of the alternative's definition, or reconsideration of whether it is prudent to move forward with the investment given the current environment.

VMM In Action

Risk Scores

The risk (performance slippage or cost increase) impacting the value and cost of an alternative is expressed as the Risk Score. The example below is from the analysis of Alternative 2 for an e-Authentication initiative.

Alternative 2: Consolidated	Expected (Before Risk)	Risk Adjusted	Absolute Difference	Risk Score (Diff./Exp.)
Value	72.75	68.04	4.71	6.5%
Investment Cost (PV)	$262.80	$361.50	$98.70	37.6%

Task 5 - Compare Value, Cost, and Risk

Developing and using a model helps to visualize the effect of risk on expected/anticipated value and cost. It also is possible to determine the government's financial ROI and, when comparing alternatives, to calculate the value received for the funds invested by dividing the value of an initiative by the level of investment. If this information is used to determine which initiatives to include in an investment portfolio, portfolio managers review the decision framework by examining the measures and their associated targets, and moving beyond overall scores to determine the level of benefit.

Value, cost and risk as discreet elements do not provide the depth of information required to ensure sound investment decisions. Decision makers must consider how each element interacts with the others. With this information, decision makers can make tradeoffs to optimize value, minimize cost and reduce risk.

Comparing Value and Cost

Calculate the value received for funds invested in an alternative by dividing the Value Score of an alternative by the investment cost of the alternative. This comparison is possible since each alternative was analyzed against the same decision framework.

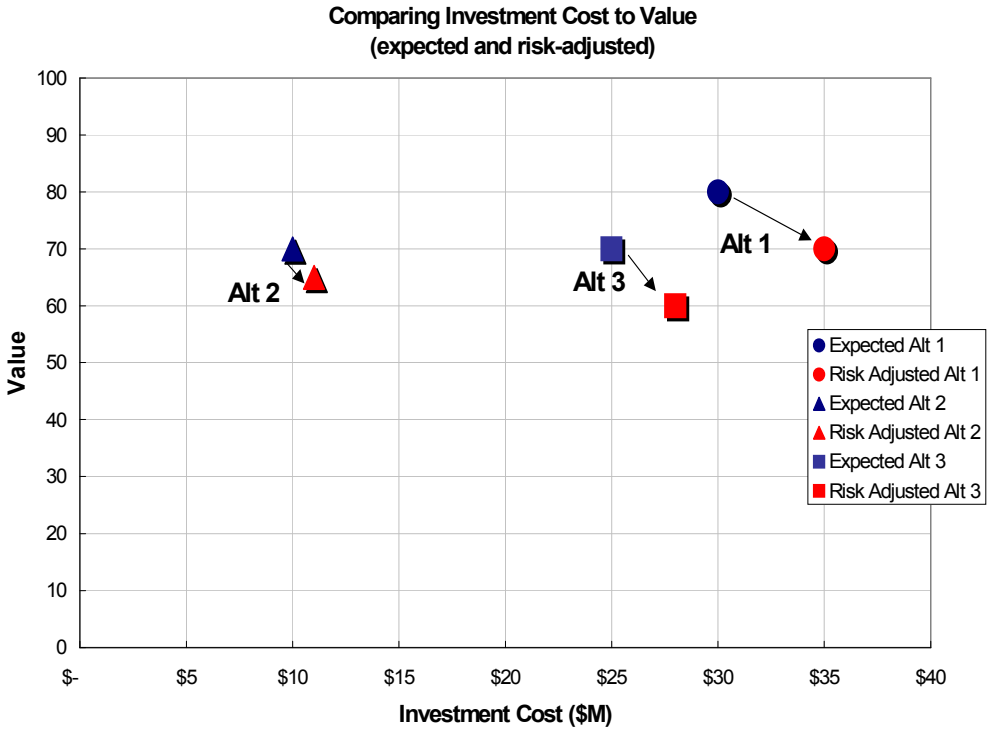
When comparing the three alternatives listed below, decision-makers may consider looking at the value per dollar to determine which alternative will give them the greatest amount of value or "bang for their buck."

	Value Score	Investment Cost (M$)	Value/$M Calculation	Value per Million $
Alternative 1	80	$30	80/$30M	2.7
Alternative 2	70	$10	70/$10M	7.0
Alternative 3	70	$25	70/$25M	2.8

The Value Scores and costs listed in the table are based on a hypothetical alternatives analysis.

With a decision based solely on these numbers, the decision maker would choose to move forward with Alternative 2.

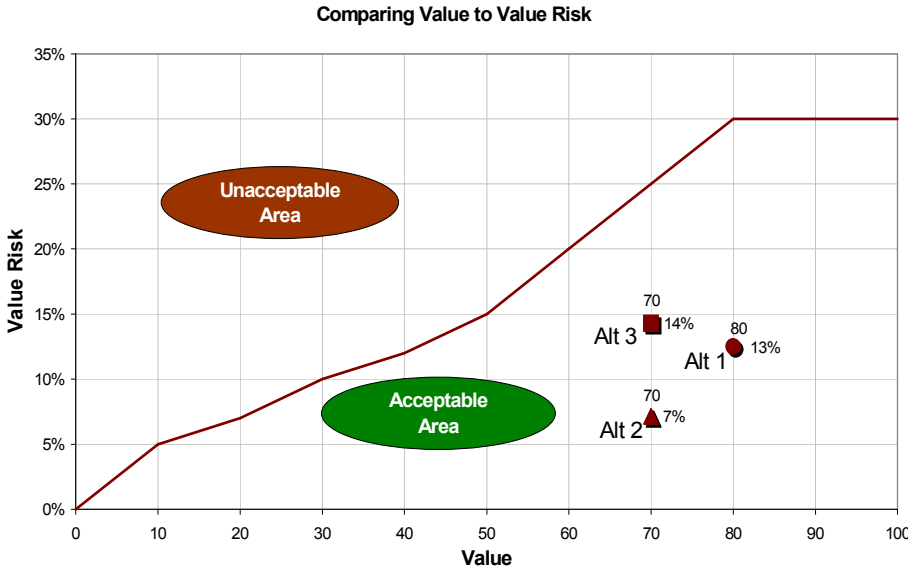
This relationship also is depicted graphically in the chart. The chart illustrates that for significantly less money, Alternative 2 will deliver the same value as Alternative 3, and slightly less than Alternative 1. The decision maker must decide whether the tradeoff in value is worth the savings in investment.



This type of comparison is not appropriate at the portfolio or organizational levels where each initiative under consideration has been analyzed using a tailored decision framework. Decision makers at the organization's portfolio level will need more detail to determine value in order to understand the scope and impact of an investment.

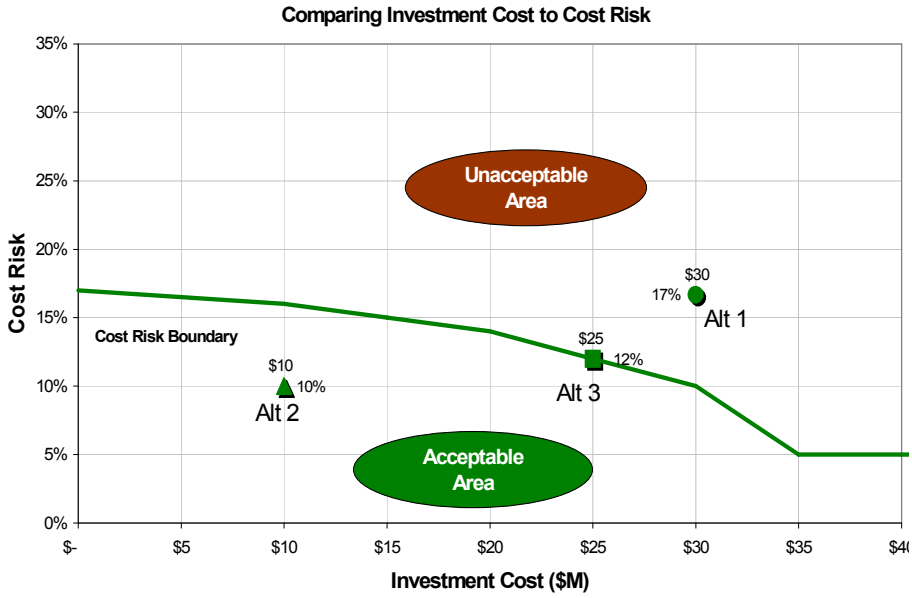
Comparing Value and Cost to Risk

When the value and cost risk scores are calculated, determine whether the results fall within the organization's risk tolerance boundary for value and cost. An example of this concept is depicted in the charts to the right and those below.



In this example, the risk associated with all of the Value Scores fall within the acceptable area. Alternative 2 is the alternative with lowest value risk.

The only alternative that falls within the cost risk boundary is Alternative 2. Alternative 3 is on the borderline and Alternative 1 well outside.



If a particular initiative or alternative does not fit within either boundary, determine the means to reduce the risk to tolerable levels. Maintaining separation between cost and value risk scores provides an immediate indication of where risk is having the most significant impact.

If the value risk falls outside of the tolerance boundary, decision makers should consider:

- The manner in which the metrics were defined. Were users and stakeholders involved directly when designing and prioritizing the measures?
- The manner in which the alternative was designed. Was a cross-functional team involving policy staff, business line staff, technology staff etc., involved in the process to define the Alternative?
- The value risk mitigation strategies. Do all risks have a risk mitigation strategy?
- The manner in which the alternative is described. Can the project's description and controls be refined to better focus the analysis to the important factors?

If the cost risk falls outside of the tolerance boundary, consider:

- The manner in which data was collected. Were information sources reliable? Were costs validated through additional sources?
- The manner in which the scope of the Alternative was defined. Is the Alternative trying to do too much? Is the initiative too all-encompassing?
- The cost risk mitigation strategies. Do all risks have a risk mitigation strategy?

Summary – Step 3

Step 3 explores the relationship among the value, cost, and risk associated with an alternative. The cost of each alternative and the value scores are aggregated. Applying the appropriate ROI metric identified in the Government Financial Value Factor, costs then are compared with financial benefits returned to the Government. Cost and value also are compared. Finally, value and risk scores are calculated and compared against the value and cost risk tolerance boundaries.

Task 1-5 Activities	Step 3 Resources Required		
	Staff	Data	Tools
Aggregate the cost estimate	• Analyst	• Cost Structure and Analysis	• Spreadsheet
Calculate the Return on Investment	• Analyst	• Cost Structure and Analysis • Government Financial Value Analysis	• Spreadsheet
Calculate the value score	• Analyst	• Value Structure and Analysis	• Spreadsheet
Calculate the risk scores	• Analyst	• Value Structure and Analysis • Cost Structure and Analysis • Risk Analysis	• Spreadsheet
Compare value, cost and risk	• Analyst	• Value Structure and Analysis • Cost Structure and Analysis • Risk Analysis	• Spreadsheet

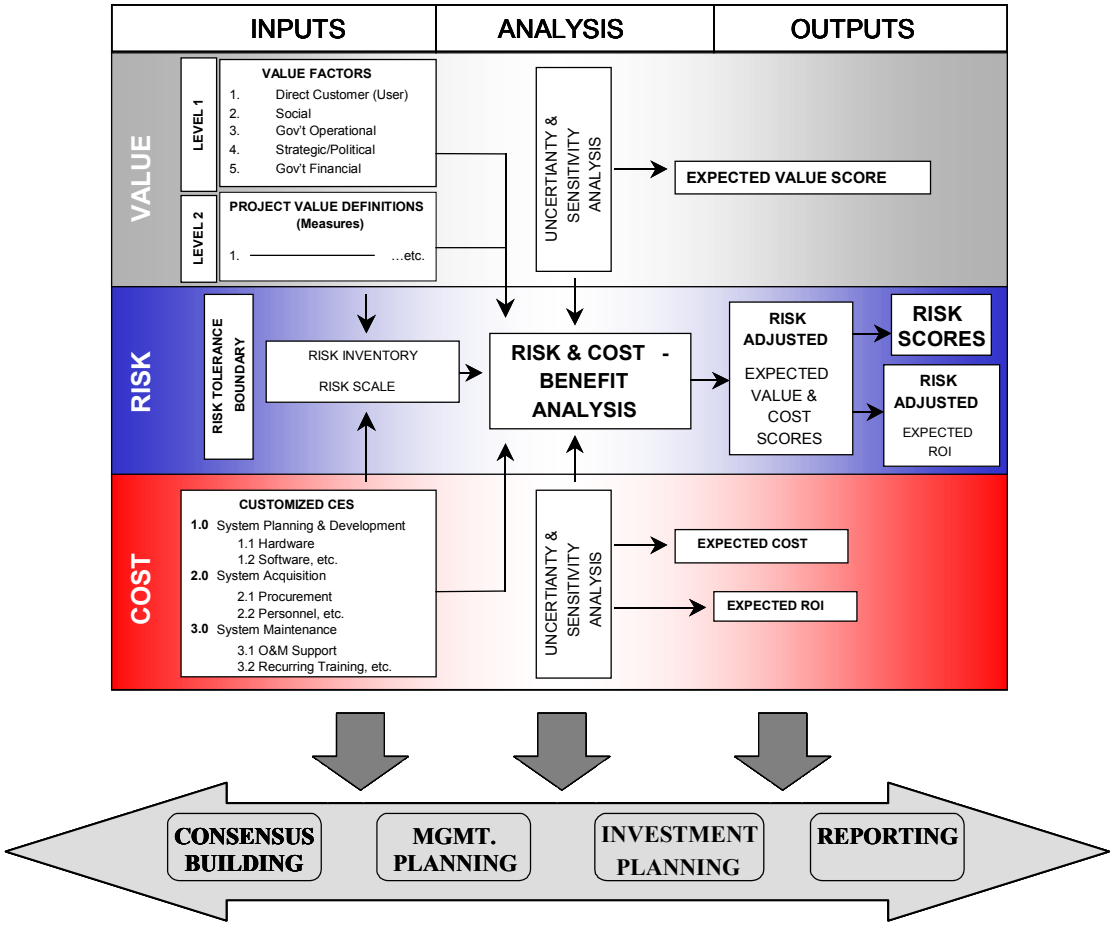
NOTES

Step 4 - Communicate and Document

Why is it important to focus on communication and documentation?
To move an initiative toward implementation, an organization's leadership should have the information and supporting documentation to justify a course of action to supporters and skeptics. This justification requires communicating the value of the initiative to stakeholders, including customers, each with potentially differing perceptions of value. Sustained progress requires ongoing demonstration that the initiative continues to deliver the promised financial and non-financial benefits. Progress also depends on program managers' responsiveness to changes in priorities, requirements, and corrections resulting from "lessons learned."

What is the business value of using the decision framework and analyses of value, cost, and risk?
Using the structure of the decision framework and the "audit trail" that documents the thought process, assumptions, and process for prioritization, managers are able to:

- Develop appropriate results-based management controls to ensure progress and to adjust course when necessary
- Communicate value to all stakeholders, being sensitive to all points of view or agendas
- Respond quickly, effectively, and accurately to new information and to make improvements



What are the key outputs of Step 4?
The outputs of Step 4 including the following:

Step 4	
Tasks	**Outputs**
1. Communicate Value to Customers and Stakeholders	• Documentation and supporting information for effectively communicating the value of an initiative to multiple stakeholders
2. Prepare Budget Justification Documents	• Documentation and supporting information for the data and analytical requirements of OMB Exhibit 300
3. Satisfy *ad hoc* Reporting Requirements	• Capability to quickly respond to change and *ad hoc* reporting requirements
4. Lessons Learned to Improve Process	• Documentation and insight required to improve the effectiveness of overall organizational program management controls and business processes

A summary discussion of the tasks covered in this chapter and the resources required to fulfill them appears at the close of this chapter.

Task 1 - Communicate Value to Customers and Stakeholders

Perception of value changes as perspectives change. From the perspective of senior management, the view is strategic. How does this initiative support the organization's Strategic Plan? From another point of view, citizens are concerned with how complicated and time-consuming it is to apply for and receive benefits, as well as the security of personal information, and the wise spending of their tax dollars. An organization's CFO will wonder how an initiative will impact their budget, as well as whether and when the projected return will materialize.

Regardless of the projected merits of an initiative, its success will depend heavily on the ability of its proponents to access funding, to generate internal support, to gain buy-in from targeted users, and to foster the development of active supporters (champions) within the organization. Success may depend as much on the utility and efficacy of an initiative as it does on the ability to communicate its value in a manner that is meaningful to all stakeholders with diverse definitions of value. The value of an initiative to diverse stakeholders, as gained via VMM, can be leveraged in funding justification documents and in materials designed to inform and enlist support.

Using VMM, the value of a project is allocated to the different Value Factors. Project managers can customize the value proposition, clearly articulating the needs of a particular point of view, how those needs will be addressed, and the level of performance that can be expected.

Communications to customers and stakeholders should be based on the diversity of the audience, referring to the Value Factors from various points of view and priorities.

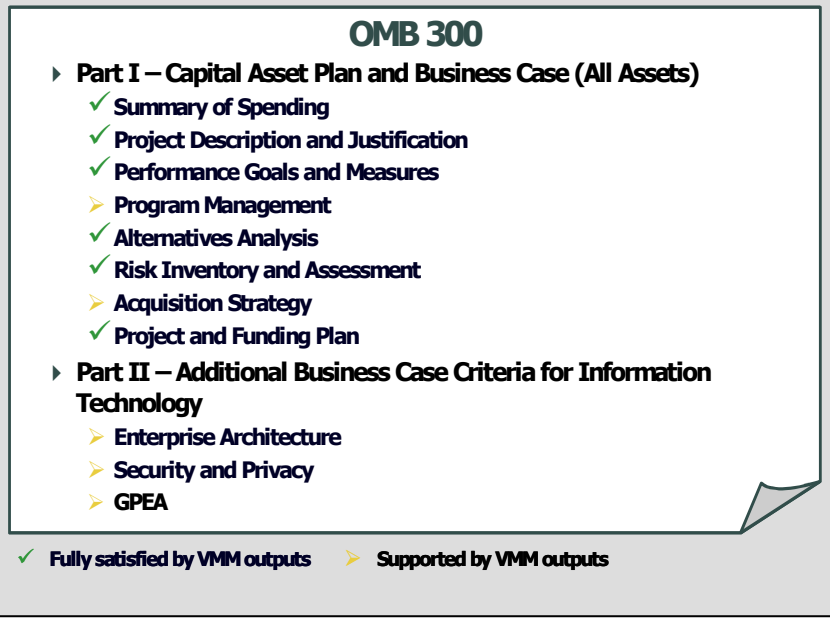
Task 2 - Prepare Budget Justification Documents

OMB will withhold funding of IT initiatives that are not justified by a sound business case. OMB A-11, Exhibit 300 requires comprehensive and rigorous analysis and justification to support funding requests.

Using VMM, analysts develop and assess alternative solutions, determine costs, risks and value, and create a foundation for on going program management. Outputs of VMM satisfy or support each section of Exhibit 300, as shown in the graphic to the right.

Best Practices

Applying VMM Outputs and Insights to OMB Exhibit 300



Task 3 - Satisfy Ad Hoc Reporting Requirements

Changes in the political landscape or current events can have a significant impact on the comparison of value to cost, as well as on the decisions to advance a particular initiative over others. Project management can expect to be tasked with rapid responses to questions concerning the justification of an initiative or inquiries regarding the impact of additional information, fluctuations in funding, or priorities. Use the tailored decision framework to make adjustments and formulate the basis for the response. Adjustments of weighting factors, risk, or alternatives may be necessary. The better the framework and the information it contains, the easier it will be to respond to *ad hoc* requests.

Task 4 - Use Lessons Learned to Improve Processes

Lessons learned through the development of the decision framework and analysis of alternatives should be documented early and continue throughout the life cycle to improve overall organizational decision-making and management processes.

For example, in the process of identifying measures and metrics, program managers may discover that critical information needed to accurately measure results is not currently collected by the organization. Providing this type of feedback to appropriate members of the organization can improve future performance measurement.

Summary – Step 4

During this step, decision-makers will use the insight derived from planning and analyzing an e-Government initiative, using the structures of the decision framework to communicate value to customer and stakeholder groups. The VMM structure is used as a tool to support accurate and timely responses to issues, including changes in organizational priorities, direction, and the development of effective results-based program management controls.

Tasks 1-4 Activities	Step 4 Resources Required		
	Staff	Data	Tools
Communicate value to customers and stakeholders	• Analyst • Program Manager	• VMM Outputs	• Spreadsheet
Prepare budget justification documents (e.g., OMB 300)	• Analyst • Program Manager	• VMM Outputs	• Spreadsheet
Satisfy ad-hoc reporting requirements	• Analyst • Program Manager	• VMM Outputs	• Spreadsheet
Use lessons learned to improve processes	• Analyst • Program Manager	• VMM Outputs	• Spreadsheet

NOTES

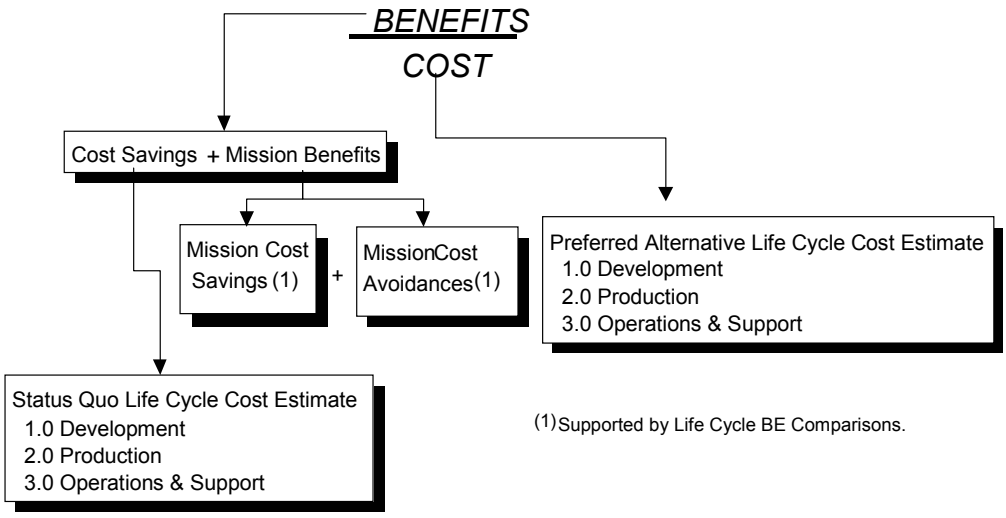
VI. Technical Definitions

Analytic Hierarchy Process (AHP) - AHP Is a proven methodology that uses comparisons of paired elements (comparing one against the other) to determine the relative importance of criteria mathematically.

Benchmark - A measurement or standard that serves as a point of reference by which process performance is measured. (source: GAO)

Benefit - A term used to indicate an advantage, profit, or gain attained by an individual or organization. (source: GAO)

Benefit to Cost Ratio (BCR) - The computation of the financial benefit/cost ratio is done within the construct of the following formula: *Benefits ÷ Cost*. It may be defined in the manner shown in the graphic to the right.



Best Practices - The processes, practices, or systems identified in public and private organizations that performed exceptionally well and are widely recognized as “best in class” improving a organization's performance and return on investment in specific areas. Successfully identifying and applying best practice information and tailoring the information to the organizational environment can reduce business expense and improve organizational efficiency. (source: GAO)

Business Case - A structured decision package for organizational decision-makers. A business case includes an analysis of business process performance and associated needs or problems, proposed alternative solutions, assumptions, constraints, and a risk-adjusted cost-benefit analysis. (source: GAO)

Cost - A term used to indicate the expenditure of funds for a particular investment alternative over an expected time period. Cost may include direct and indirect initial costs plus any periodic or continuing costs for operation and maintenance. (source: GAO)

Cost Element Structure (CES) - A hierarchical structure created to facilitate the development of a cost estimate. May include elements that are not strictly products to be developed or produced, e.g., Travel, Risk, Program Management Reserve, Life Cycle Phases, etc.

Sample Cost Element Structure

1.0 System Planning & Development
- 1.1 Hardware
- 1.2 Software
  - 1.2.1 Licensing Fees
- 1.3 Development Support
  - 1.3.1 Government
    - 1.3.1.1 Program Management Oversight
    - 1.3.1.2 System Engineering Architecture Design
    - 1.3.1.3 Change Management & Risk Assessment
    - 1.3.1.4 Requirement Definition & Data Architecture
    - 1.3.1.5 Test & Evaluation
  - 1.3.2 Contractor
    - 1.3.2.1 Program Management Oversight
    - 1.3.2.2 System Engineering Architecture Design
    - 1.3.2.3 Change Management & Risk Assessment
    - 1.3.2.4 Requirement Definition & Data Architecture
    - 1.3.2.5 Test & Evaluation
- 1.4 Studies
  - 1.4.1 Security
  - 1.4.2 Accessibility (508 Strategy)
  - 1.4.3 Data Architecture
  - 1.4.4 Network Architecture
- 1.5 Other
  - 1.5.1 Facilities
  - 1.5.2 Travel

2.0 System Acquisition & Implementation
- 2.1 Procurement
  - 2.1.1 Hardware
  - 2.1.2 Software
  - 2.1.3 Customized Software
- 2.2 Personnel
  - 2.2.1 Government
    - 2.2.1.1 Additional Program Management Oversight
    - 2.2.1.2 Process Redesign(BPR)
    - 2.2.1.3 System Integration
    - 2.2.1.4 System Engineering
    - 2.2.1.5 Test & Evaluation
    - 2.2.1.6 Data Conversion
  - 2.2.2 Contactor
    - 2.2.2.1 Additional Program Management Oversight
    - 2.2.2.2 Process Redesign(BPR)
    - 2.2.2.3 System Integration
    - 2.2.2.4 System Engineering
    - 2.2.2.5 Test & Evaluation
    - 2.2.2.6 Data Conversion
- 2.3 Training

3.0 System Maintenance & Operations
- 3.1 Hardware
  - 3.1.1 Maintenance
  - 3.1.2 Upgrades
  - 3.1.3 Lifecycle Replacement
- 3.2 Software
  - 3.2.1 Maintenance
  - 3.2.2 Upgrades
  - 3.2.3 License Fees
- 3.3 O&M Support
  - 3.3.1 Government
    - 3.3.1.1 Program Management Oversight
    - 3.3.1.2 Operations
    - 3.3.1.3 Security
    - 3.3.1.4 Helpdesk
  - 3.3.2 Contractor
    - 3.3.2.1 Program Management Oversight
    - 3.3.2.2 Operations
    - 3.3.2.3 Security
    - 3.3.2.4 Helpdesk
- 3.4 Recurring Training
- 3.5 Other Operations & Maintenance

Cost Estimate - The estimation of a project's lifecycle costs, time-phased by fiscal year, based on the description of a project or system's technical, programmatic, and operational parameters. A cost estimate may also include related analyses such as cost-risk analyses, cost-benefit analyses, schedule analyses, and trade studies.

Commercial Cost Estimating Tools:

PRICE S – is a parametric model used to estimate software size, development cost, and schedules, along with software operations and support costs. Software size estimates can be generated for source lines of code, function points or predictive objective points. Software development costs are estimated based on input parameters reflecting the difficulty, reliability, productivity, and size of the project. These same parameters are used to generate operations and support costs. Monte Carlo risk simulation can be generated as part of the model output. Government Agencies (e.g., NASA, IRS, U.S. Air Force, U.S. Army, U.S. Navy, etc.,) as well as private companies have used PRICE S.

PRICE H, HL, M – is a suite of hardware parametric cost models used to estimate hardware development, production and operations and support costs. These hardware models provide the capability to generate a total ownership cost to support program management decisions. Monte Carlo risk simulation can be generated as part of the model output. Government Agencies (e.g., NASA, U.S. Air Force, U.S. Army, U.S. Navy, etc.,) as well as private companies have used the PRICE suite of hardware models.

SEER-SEM (System Evaluations and Estimation of Resources-Software Estimating Model) – is a parametric modeling tool used to estimate software development costs, schedules, and manpower resource requirements. Based on the input parameters provided, SEER-SEM develops cost, schedule, and resource requirement estimates for a given software development project. The calculations are based on actual data from thousands of software development projects. SEER-SEM is widely used by both the Government Agencies (e.g., NASA, IRS, U.S. Air Force, SSA, etc.,) and the private companies.

SEER-H (System Evaluations and Estimation of Resources- Hybrid) – is a hybrid cost estimating tool that combines analogous and parametric cost estimating techniques to produce models that accurately estimate hardware development, production, and operations and maintenance cost. SEER-H can be used to support a program manager's hardware Life Cycle Cost estimate or provide an independent check of vendor quotes or estimates developed by third parties. SEER-H is part of a family of models from Galorath Associates, including SEER-SEM (which estimates the development and production costs of software) and SEER-DFM (used to support design for manufacturability analyses).

Customer - Groups or individuals who have a business relationship with the organization--those who receive and use or are directly affected by the products and services of the organization. Customers include direct recipients of products and services, internal customers who produce services and products for final recipients, and other organizations and entities that interact with an organization to produce products and services. (source: GAO)

Data Sources (by phase of development)

Phase	Suggested/Potential Data Sources
Strategic Planning	• Strategic and performance plans • Subject matter expert input • New and existing user surveys • Private/public sector best practices, lessons learned, and benchmarks • Enterprise architecture • Modeling and simulation • Vendor/market survey
Business Modeling & Pilots	• Subject matter expert input • Data from analogous government initiatives • New and existing user surveys for each business line • Private/public sector best practices, lessons learned and benchmarks • Refinement of modeling and simulation
Implementation & Evaluation	• Data from phased implementation • Actual spending/cost data • User group/stakeholder focus groups • Other performance measurement

e-Government Task Force Performance Measures - President Bush's e-Government Task Force has established a series of performance measures for all e-Government initiatives. The following table maps how these measures have been incorporated into the VMM approach:

	Direct User (Customer) Value	Social Value	Gov. Operational / Foundational Value	Gov. Financial Value	Strategic / Political Value	Strategic / Political Value	Risk (Risk Score)	VDI (value Score)	Cost Analysis	ROI
Customer service improvements	●									
Impact on desires of customer base	●									
Use of IT in re-engineering government processes*			●							
Continued funding requirements									●	
Collaboration with other agencies			●			●				
Maximizing (optimizing) resources				●				●	●	●
Overall return-on-investment				●				●	●	●
Statutory/other requirements mandating the proposed IT project					●					
Risks associated with the project							●			
Tangible and/or intangible benefits	●	●	●	●	●	●		●	●	●

* Best practice recommendation

Focus Area - The President's e-Government Task Force has grouped e-Government initiatives into four categories referred to as focus areas:

- *Government-to-Citizens (G2C)* – "Build easy to find, easy to use, one-stop points-of-service that make it easy for citizens to access high-quality government services."
- *Government-to-Business (G2B)* – "Reduce government 's burden on businesses by eliminating redundant collection of data and better leveraging e-business technologies for communication."
- *Government-to-Government (G2G)* – "Make it easier for states and localities to meet reporting requirements and participate as full partners with the federal government in citizen services, while enabling better performance measurement, especially for grants. Other levels of government will see significant administrative savings and will be able to improve program delivery because more accurate data is available in a timely fashion."
- *Internal Efficiency and Effectiveness (IEE)* – "Make better use of modern technology to reduce costs and improve quality of federal government agency administration by using industry best practices in areas such as supply-chain management, financial management and knowledge management, agencies will be able to improve effectiveness and efficiency, eliminating delays in processing and improving employee satisfaction and retention."

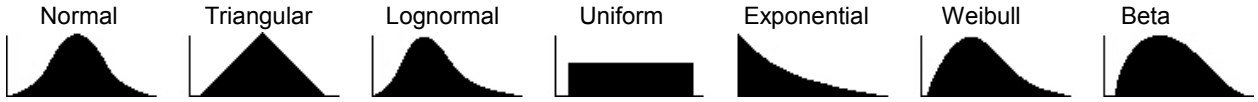
source: e-Government Strategy, 2/02

Internal Rate of Return (IRR) - The internal rate of return is the discount rate that sets the net present value of the program or project to zero. While the internal rate of return does not generally provide an acceptable decision criterion, it does provide useful information, particularly when budgets are constrained or there is uncertainty about the appropriate discount rate. (source: OMB)

Lifecycle Costs - The overall estimated cost for a particular program alternative over the time period corresponding to the life of the program, including direct and indirect initial costs plus any periodic or continuing costs of operation and maintenance. (source: OMB)

Monte Carlo Simulation - A simulation is any analytical method that is meant to imitate a real-life system, especially when other analyses are too mathematically complex or too difficult to reproduce. Spreadsheet risk analysis uses both a spreadsheet model and simulation to analyze the effect of varying inputs on outputs of the modeled system. One type of spreadsheet simulation is Monte Carlo simulation, which randomly generates values for uncertain variables over and over to simulate a model. (Monte Carlo simulation was named for Monte Carlo, Monaco, where the primary attractions are casinos containing games of chance.)

Analysts identify all key assumptions for which the outcome was uncertain. For the lifecycle, numerous inputs are each assigned one of several probability distributions. The type of distribution selected depended on the conditions surrounding the variable. During simulation, the value used in the cost model is selected randomly from the defined possibilities:



Net Present Value (NPV) - Consistent with OMB Circular A-94, NPV is defined as the difference between the present value of benefits and the present value of costs. The benefits referred to in this calculation must be quantified in cost or financial terms in order to be included.

[PV(Internal Project Cost Savings, Operational)
+ PV(Mission Cost Savings)]

- PV(Initial Investment)

Net Present Value

Polling Tools:

Option Finder – A real-time polling device, which permits participants, using handheld remotes, to vote on questions and have the results, displayed immediately with statistical information such as “degree of variance” and discussed.

Group Systems - A tool that allows participants to answer questions using individual laptops. The answers to these questions are then displayed to all participants anonymously, in order to spur discussion and the free flowing exchange of ideas. Group Systems also has a polling device.

Return-on-Investment (ROI) - A financial management approach used to explain how well a project delivers benefits in relationship to its cost. (source: GAO) Several methods are used to calculate a return on investment. Refer to Internal Rate of Return (IRR), Net Present Value (NPV), and Savings to Investment Ratio (SIR)

Risk - A term used to define the class of factors which (1) have a measurable probability of occurring during an investment’s life cycle, (2) have an associated cost or affect on the investment’s output or outcome (typically an adverse affect that jeopardizes the success of an investment), and (3) have alternatives from which the organization may chose. (source: GAO)

OMB Risk Categories - The most recent revision of OMB A-11, Exhibit 300 identified eight risk categories. These categories are defined below. (Note: These are preliminary definitions and are subject to the revision by OMB.)

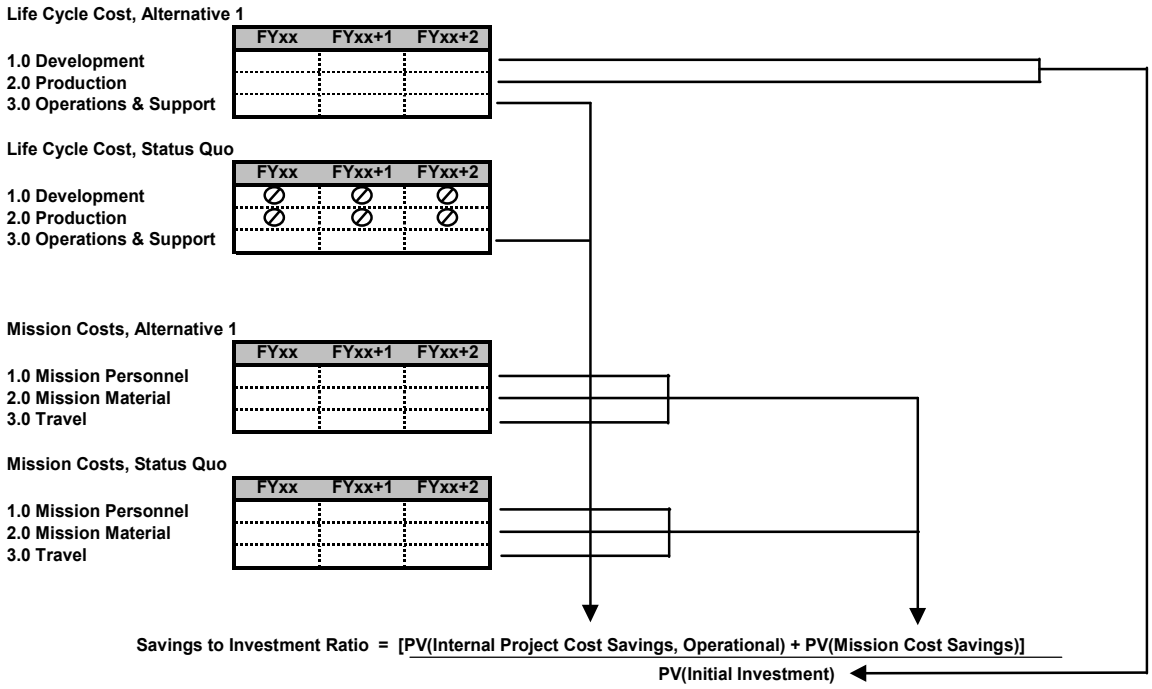
- ***Project Resources/Financial***: Risk associated with "cost creep," mis-estimation of lifecycle costs, reliance on a small number of vendors without cost controls, and (poor) acquisition planning.
- ***Technical/Technology*****:** Risk associated with immaturity of commercially available technology; reliance on a small number of vendors; risk of technical problems/failures with applications and its ability to provide planned and desired technical functionality.
- ***Business/Operational:*** Risk associated with business goals; risk that the proposed alternative fails to result in process efficiencies and streamlining; risk that business goals of the program or initiative will not be achieved; risk that the program effectiveness targeted by the project will not be achieved.
- ***Organizational and Change Management:***Risk associated with organizational/agency/government-wide cultural resistance to change and standardization; risk associated with bypassing, lack of use or improper use

or adherence to new systems and processes due to organizational structure and culture; inadequate training planning.

- ***Data/Information***: Risk associated with the loss/misuse of data or information, risk of increased burdens on citizens and businesses due to data collection requirements if the associated business processes or the project (being described in the 300) requires access to data from other sources (fed, state &/or local agencies).
- ***Security:*** Risk associated with the security/vulnerability of systems, websites, information and networks; risk of intrusions and connectivity to other (vulnerable) systems; risk associated with the misuse (criminal/fraudulent) of information; must include level of risk (hi, med, basic) and what aspect of security determines the level of risk, e.g. need for confidentiality of information associated w. the project/system, availability of the information or system, or reliability of the information or system.
- ***Strategic:*** Risk associated with strategic/government-wide goals (e.g., President's Management Agenda and e-Gov initiative goals)- risk that the proposed alternative fails to result in the achievement of those goals or in making contributions to them.
- ***Privacy***: Risk associated with the vulnerability of information collected on individuals, or risk of vulnerability of proprietary information on businesses.

Risk Analysis - A technique to identify and assess factors that may jeopardize the success of a project or achieving a goal. This technique also helps define preventive measures to reduce the probability of these factors from occurring and identify countermeasures to successfully deal with these constraints when they develop. (source: GAO)

Savings to Investment Ratio (SIR) - SIR represents the ratio of savings to investment. The "savings" in the SIR computation are generated by Internal Operational Savings and Mission Cost Savings. The flow of costs and cost savings into the SIR formula is as shown in figure below.



Sensitivity Analysis - Analysis of how sensitive outcomes are to changes in the assumptions. The assumptions that deserve the most attention should depend largely on the dominant benefit and cost elements and the areas of greatest uncertainty of the program or process being analyzed. (source: GAO)

Stakeholder - An individual or group with an interest in the success of an organization in delivering intended results and maintaining the viability of the organization's products and services. Stakeholders influence programs, products, and services. Examples include congressional members and staff of relevant appropriations, authorizing, and oversight committees; representatives of central management and oversight entities such as OMB and GAO; and representatives of key interest groups, including those groups that represent the organization's customers and interested members of the public. (source: GAO)

Value Measures - This table of sample measures was first presented in *Building a Methodology for Measuring e-Services*.

	Government to Citizen	Government to Government	Government to Business	Internal Efficiency and Effectiveness
Direct Customer (User) Value	• Quantify time saved	• Monetized customer time	• Monetized customer time • Regulatory burden costs	• Monetized employee time
	• Take-up rate • Contingent valuation • Customer satisfaction index • Click count • Time of day usage measurement • Abandonment rate • First-contact resolution • Complaints • Customer frustration (abandoned transactions divided by total completed transactions) • Creation of communities of interest			• Take-up rate • Employee satisfaction index • Click count • Attrition rates • Staff recruitment rates • Absenteeism • Complaints • Customer frustration (abandoned transactions divided by total completed transactions)
Social (Non-User/ Public) Value	• Movement to close the "digital divide" • Participation in the political process • Trust in government • Usage of electronic delivery channels outside of traditional business hours	• Sharing of information (e.g., threat, environmental, national security)	• Cost of doing business • Monitoring of regulatory compliance • Usage of electronic delivery channels outside of traditional business hours	• Visibility into the government process • Efficient use of taxpayer dollars
	• Consistent quality of service across delivery channels • Compliance with Section 508 • Compliance with Executive Order 13166 • Compliance with security and privacy policies (frequency of cyber-security assessments and testing of security controls, vulnerability scanning, and time to develop and implement corrective action plan) • Security and privacy policies and procedures that are consistent with current regulations and best practices • Continuity of operations plans			

	Government to Citizen	Government to Government	Government to Business	Internal Efficiency and Effectiveness
Government Financial Benefits	• Cost per step • Cost per transaction • Cost of materials • Costs of correcting errors • Workload • IT unit costs • Shared infrastructure • Workforce requirements • Facility costs • Costs associated with continued operation and maintenance of disparate legacy systems avoided • Costs associated with continued legacy business processes avoided • Costs associated with inefficient use of resources (failure to leverage economies of scale) avoided			
Government Operational/ Foundation Value	• Core processes mapped • Data accurate • Data unduplicated • Data entry timely • Employee productivity per customer • Errors corrected • Streamlined processes (number of steps, number of transactions) • On-time completion rate • Availability • Redundancy • Scalability • System reliability • Connect rate • Cycle time • Interoperability • Net congestion • Flexibility			
Strategic/ Political Value	• Partner satisfaction • Political image (number of positive press articles) • Community awareness • Negative/positive publicity • Legislative guidelines met • Percentage of business processes e-enabled (e-quotient) • Partnership with private sector and other government agencies (all levels) maximized • Use of COTS/GOTS software and systems maximized • Advancement toward meeting mission and strategic goals and objectives (government-wide and agency)			

Direct User Value Factor - e-Government initiatives impact the entire value chain. Regardless of the focus-area, each is likely to have multiple customers. In order to accommodate the needs of "front end" and "back end" users, measures in the Direct User Value Factor, should be segmented by user group.

The selection of a metric to measure user value must be consistent with the requirements of the user. What metric would be most appropriate for measuring whether or not an initiative reduces the amount of time users spend when conducting transactions with the government? Should that value be measured in units of time or units of time multiplied by the monetary value of that time? To answer that question, determine who is receiving the value. And what was the customers' concern? Was it saving money, or saving time?

Social Value Factor Measures -

Organizations must determine whether future effects on social value are so far into the future that the cost and value of the analysis is minimal. For example, observation and measurement of the impact of improvements in the oil drilling permit issuing process on the cost to drill and, ultimately, the consumer price for oil, relatively straightforward. Relating the effect of a particular e-service such as on-line change of address filing, with the reduction of smog in a particular community is much more complicated, costly and time consuming. Would the result of that analysis be valuable to the decision-maker? Probably not. Ultimately, determining which elements of social value to evaluate will be based on information derived from group discussions and posing the question to organization management.

Equity	• Quality of service is consistent regardless of delivery channel.
	• Electronic information and transactions have been made accessible to all members of society (compliance with Section 508 of the Rehabilitation Act and Executive Order 13166, "Improving Access to Services for Persons with Limited English Proficiency.")
	• Individuals without access to electronic channels are provided with alternative means of access.
Access to Government Information	• Estimated usage of electronic channels to access information or conduct transactions outside of traditional business hours. • Increased percentage of eligible people served.
Privacy/ Security	• Preservation of public trust through compliance with industry and government standards.

Below is a list of potential measures that are consistent with the President's Management Agenda and may be applied to nearly all e-Government initiatives across the federal enterprise:

- Stewardship of public funds;
- Prevention or detection of fraud, waste, or abuse; or
- Government accountability.

Government Financial Value -
Government financial benefits have a direct impact on organizational (service provider) and other federal government budgets. They are generally identified as either cost savings or cost avoidance.

Government Operational Value -
Government Foundational Value is created when measurable advancements are made in preparing government employees and processes, society, and infrastructure for the future demand and expansion of e-services. Early investments in e-services are burdened with the costs associated with building required infrastructure and skills. Cost analyses that do not incorporate foundational value can make calculating and demonstrating a short-term or even long-term value difficult or even impossible. Decisions made based on these calculations will stifle innovation and make progress toward transforming government sluggish at best. Organizations taking an enterprise-wide approach to e-Government will be able to demonstrate the foundational value of an investment by calculating how the infrastructure, skills, and processes being put in place will be leveraged by other services and by increasing levels of demand. It is paramount that organizations resist the temptation to forego analysis in this area particularly when they are attempting to secure funding for creating the technical foundation for e-services. The inability to provide a business case that communicates the synergy between government services/processes and IT infrastructure will reduce the likelihood of receiving funding.

Operational Value
• Develop capacity for future (e.g., bandwidth) • Build workforce of the future (the correct mix of skills for an increasingly digital environment)

Strategic/Political Value -
Captures benefits that move an organization— and/or the Government as a whole— towards fulfilling mission/strategic goals.

To measure the strategic and political value of an e-service initiative it is necessary to look beyond the boundaries of the initiative itself to gauge its ability to move an organization – and the government as a whole – toward fulfilling its mission. To accomplish this, an agency-wide strategic and performance plan, linked to the priorities set forth by the administration, must clearly articulate the organization's

goals and objectives in a manner that avoids platitudes and defines specific targets and goals. The strategic and political value of an initiative is measured by comparing its projected performance to the targets defined in the strategic plan. This process should be conducted from the point of view of the other Essential Factors in order to ensure that both internal and external benefits are considered. The closer the initiative moves the organization toward its goals, the higher its strategic and political value.

There will be circumstances under which the strategic value of an initiative cannot be fully evaluated against the strategic plan. This will be the case when the initiative was specifically mandated by an executive or congressional act or if the organization's strategic plan has not incorporated the reform goals of the President's Management Agenda and Blueprint for Change. In both of these cases, organizations should analyze each initiative's ability to move the organization toward meeting the stated objectives and goals.

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VII. References

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