Managing Capital Investments at the Indian Health Service

A “How-To” Guide for An Analysis of Alternatives

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A "How-To" Guide for Analysis of Alternatives

PURPOSE

This guide is intended for use by Indian Health Service (IHS) project managers and project team members when conducting an analysis of alternatives for meeting an investment's objective and supporting the mission requirements of the organization.[1] The guide's purpose is to provide a basic, easy to use, step-by-step method for identifying and analyzing investment alternatives consistent with the policies and requirements of the Office of Management and Budget (OMB) and IHS. It is not intended to be a comprehensive reference guide.

The guide is divided into two sections. The first section—The Basics—provides the background and explanation for the analysis of alternatives. The second section—The Analysis—describes the process and contents of the analysis of alternatives. The guide also contains an example of an analysis of alternatives for an investment (see Appendix A).

The guide is a generic guide. It is intended to be used by project managers of all projects. However, it does provide specific guidance for project managers who are required to complete an OMB Circular No. A-11 Exhibit 300.

THE BASICS

What Is an Analysis of Alternatives?

The analysis of alternatives is an evaluation tool that helps stakeholders and agencies identify and select investments that will achieve essential mission performance goals and objectives with minimal risk, lowest life-cycle costs, and greatest benefit to the organization.

Why Conduct an Analysis of Alternatives?

An analysis of alternatives provides a consistent method for identifying, understanding, and evaluating investment alternatives and for selecting the best investment. The analysis of alternatives is used to select information technology investments that will support core mission functions that must be performed by the federal government and demonstrate projected returns on capital investment

[1] Because this guide supports the capital planning and investment control process, the term "investment" is defined as being a project, program, system, or other asset that falls under the purview of the CPIC process.

that are clearly equal to or better than alternative uses of available public resources.[2]

The Clinger Cohen Act requires that each federal agency must have a documented capital investment program that defines:

- how the agency will *select* a capital investment;
- how the agency will *control* the investment, once it is initiated, to achieve intended cost, schedule, and performance outcomes; and
- how the agency will *evaluate* the performance of the investment, once it is operational, to ensure that it continues to maintain a positive return on investment (ROI).

The analysis of alternatives supports all three phases of the capital planning and investment control (CPIC) process: select, control, and evaluate. The analysis of alternatives is the process by which the solution to a set of objectives (requirements) is chosen. The documented analysis of alternatives directly furnishes the information required in the OMB Circular A-11 Exhibit 300 business case that justifies the selection of the chosen solution, and it indirectly contributes both to identifying the development and implementation milestones and activities and to establishing the performance goals for the operational solution.

The analysis of alternatives directly supports the select phase of the CPIC process by recommending the project or program solution, the budget for it, and the justification through benefits and financial ROI. From the approach selected, acquisition activities and measurable milestones can be developed to feed the earned-value management system (EVMS) that is required by OMB. The EVMS will be used to monitor and control (control phase) the development and implementation of the selected alternative. The analysis of alternatives includes an estimate of the benefits (and ROI) of the chosen solution. Once implemented, actual performance is measured against the estimated performance (benefits) projected in the analysis of alternatives. The analysis of alternatives estimates expected outcomes (performance). After implementation, actual performance is measured against these projections to determine if the value received from the project or program (evaluate phase) met expectations.

An alternatives analysis for major projects is required by OMB Circulars A-130 and A-11, the Department of Health and Human Services (HHS), and IHS. OMB requires a formal analysis of alternatives and annual reporting of progress before approving the requested investment funding.[3] Information about an analysis of alternatives must be provided to OMB in the business case presented in the OMB

[2] OMB Circular A-11, *Part 7: Planning, Budgeting, Acquisition, and Management of Capital Assets*, Section 300.5, June 2008.

[3] OMB does not specify the elements of an analysis of alternatives, but the life-cycle costs and benefits must be presented in the Exhibit 300. The date of each investment's analysis of alternatives (or planned date if one has not yet been conducted) must be furnished in the Exhibit 300.

Circular A-11 Exhibit 300. The agency's documented analysis of alternatives from which the information is extracted does not have to be submitted to OMB unless OMB asks for it. The analysis of alternatives represents 10 percent of the OMB business case evaluation score for project approval and funding. To receive the maximum score of 5, the analysis of alternatives must include the baseline (status quo) and at least three viable alternatives that are compared consistently, and it must provide the reasons for, and benefits of, the alternative selected.[4]

HHS policy states that an "alternatives analysis is an essential element of the management review of new, changed, or enhanced programs that contain an IT component to ensure that the development and design approach adequately balances the sometimes conflicting goals of meeting business needs, architectural standardization, and cost control."[5] An analysis of alternatives is required as part of the business case.

The terms "cost-benefit analysis" and "benefit-cost analysis" may be used interchangeably; "benefit-cost analysis (BCA)" is the terminology currently used by OMB.

An alternatives analysis is required for major projects, but an alternatives analysis should not be conducted just to meet these mandated requirements. An alternatives analysis is a component of good management procedure and project management responsibility. It is a tool applicable to both large and small projects. Performing an alternative analysis ensures that appropriate questions and concerns are addressed to support the project direction decision. The alternatives analysis provides the baseline documentation to demonstrate that good project management processes and techniques were followed in identifying and selecting the project solution.

What Are the Steps in Conducting an Analysis of Alternatives?

The analysis of alternatives is approached sequentially using the six steps in Figure 1. This section summarizes each step. Appendix A provides an example of how the analysis of alternatives is to be conducted and documented. To be considered complete and properly documented, the analysis of alternatives should contain at least all of the information needed to complete the Analysis of Alternatives requirements of the OMB Exhibit 300. Even if an OMB Exhibit 300 is not required for a specific project, the project information probably rolls up into a and OMB Exhibit 300 for a major IHS Information Technology (IT) investment, such as the Resource and Patient Management System (RPMS), and the analysis of alternative data becomes part of the data for the major IT investment OMB Exhibit 300.

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[4] OMB Circular A-11, *Part 7: Planning, Budgeting, Acquisition, and Management of Capital Assets*, July 2005. As of the date of this document, 2005 is the last year that OMB publically defined the criteria that they use in scoring the business case (Exhibit 300).

[5] HHS-IRM-2003-0002, *HHS IRM Policy for Conducting Information Technology Alternatives Analysis*, Section 1, "Purpose," June 13, 2003.

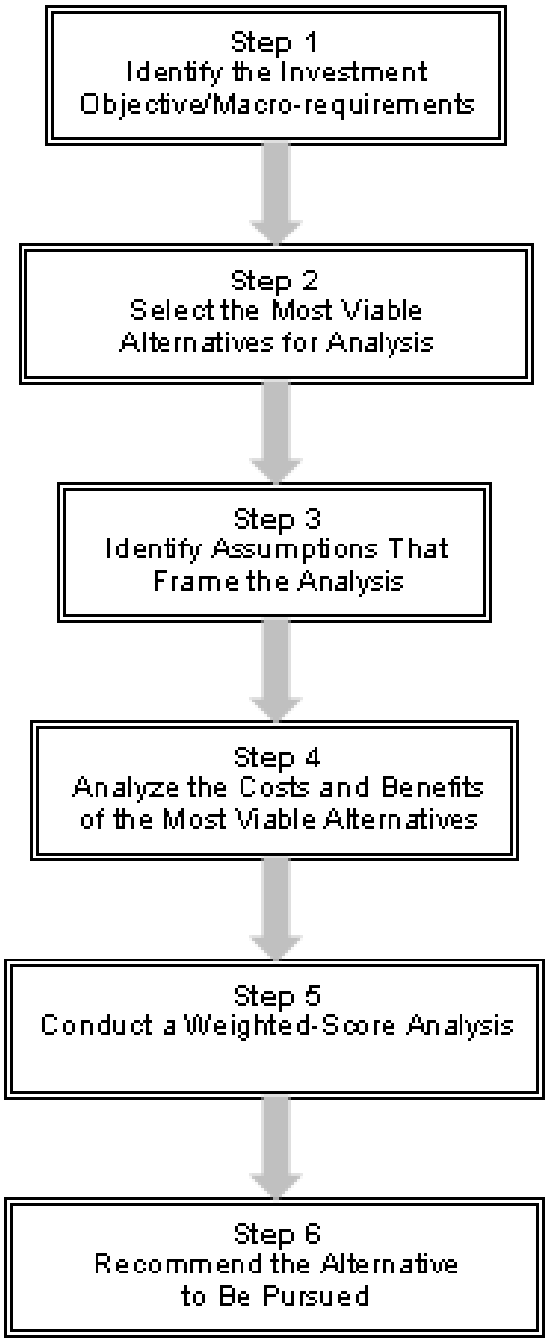

Figure 1. Steps for Conducting an Analysis of Alternatives

THE ANALYSIS

Step 1: Identify the Investment Objective/Macro-requirements

The business objective and the high level business and functional requirements that the investment is to accomplish are the bases for identifying and evaluating alternatives. The objective and the macro-requirements are constant across all alternatives. They—along with the project description, justification, background, and status—provide the context for understanding the need for the investment.

For new projects, the planning information, legislation, and agency project documentation can be used to identify the investment objective. At this point in the project, a full functional requirements document is not required. However, the macro-requirements need to be defined to assist in properly evaluating the capability of the potential alternatives to meet the project objectives.

For projects that have already been started, regardless of the life-cycle phase (planning, acquisition, or operations and maintenance), an existing OMB Exhibit 300, post-implementation review, operational analysis, a previous analysis of alternatives, existing requirements documents, or other project documentation can be the initial source of investment information.[6] The OMB Exhibit 300 should reference other documents and activities that can be pursued for additional information in describing the investment and its objective.

Chapter 1 of the example analysis of alternatives (Appendix A) should contain the investment objective, the high level business and functional requirements that the investment is to accomplish, background information, and other introductory information.

Step 2: Select the Most Viable Alternatives for Analysis

After the investment objective and macro-requirements are clearly understood and documented, alternative solutions to meeting the objective can be identified. The initial list of possible solutions must include those required by HHS and OMB, such as to maintain the status quo as a baseline, as well as possible solutions identified through brainstorming and market research. Possibilities should reflect a review of the agency mission and strategic goals to verify that the investment objective is still valid and has not been overcome by events or changed by legislation or administrative direction. The IHS Enterprise Architect should also be consulted to determine if there are business processes or technical solutions in IHS or HHS that will satisfy the objective. In general, the alternatives considered

[6] The terminology that is being used for the project life-cycle is the terminology that is being used in the OMB Exhibit 300, and is not necessarily consistent with the terminology in the HHS Enterprise Project Life-Cycle (EPLC) documentation.

are not specific software solutions, such as application X developed by company A versus application Y developed by company B, but rather alternative ways to satisfy the requirement, such as reuse of Department of Veterans Affairs (VA) software, use of commercial off-the-shelf software, commercial development (outsource), in-house development, a change in the business processes, etc.

Market research is an OMB requirement. It is also a good management practice. A search of solutions available or used in the private sector and in other federal, state, and local government organizations should be conducted. The process may use a survey, phone calls, an official request for information, professional and trade association contacts, etc., and is to be documented along with the results of the search.

The initial list may contain 10 to 15 possible alternatives and perhaps even more; there is no set number. Chapter 2 of the example (Appendix A) identifies the alternatives required by HHS for initial consideration. It also contains a table presenting a sample list of alternatives; the list shows the breadth of alternative solutions to be considered.

Neither the list in the HHS guidance nor the list in Table 2-1 should be considered exhaustive or independent[7]. Other options may be identified as a result of the market survey, technical capability requirements, or business and financial analysis. Also, alternatives may be identified that are a combination of the alternatives listed. For example, an alternative may be to implement a new system (listed in both the HHS guidance and Table 2-1 as an alternative to be considered). However, the analysis cannot be completed with only this information. How the new system is obtained and implemented must be known to estimate the costs and identify the risks. Whether to "build" or "buy" the new system must be evaluated. These options (build or buy) are listed as alternatives under "use in-house resources" and "outsource," but they are not complete with only this explanation. The in-house versus outsource question applies to what is being furnished such as a new system, modification to an existing system, or continued operation and maintenance of an existing system. This example illustrates the need for identifying the alternatives to be considered at a level that enables definition of the approach and estimation of the cost.

A similar example of refining the alternatives for evaluation through a combination of actions is the use of existing systems and processes found in other agencies, the private sector, or within the agency. The use of another system will usually not achieve 100 percent of the functionality or operational capability required or desired. A viable alternative may be the use of another system but this use must be combined with related factors in the total analysis. These other factors may include business process reengineering, development of interfaces to external data or systems, or development of additional capability to supplement requirements that otherwise will not be met. Alternatives selected for evaluation

[7] HHS-IRM-2003-0002, *HHS IRM Policy for Conducting Information Technology Alternative Analysis,* June 13, 2003.

are a result of an analysis that matches the objectives to be accomplished by the solution with an approach that can be described at a level that allows estimation of the resources needed and benefits to be obtained. If the alternative approach cannot be described or the costs and benefits cannot be derived, the alternative has not been defined with enough detail.

Only the most viable of the alternatives on the initial list—but a minimum of three plus the baseline (status quo)—should undergo detailed analysis, which includes a benefit-cost analysis (BCA) and often a weighted-score analysis. Therefore, alternatives on the initial list that are not viable must be identified and eliminated from further consideration. The alternatives that are eliminated from further analysis do not have to be eliminated by a quantitative analysis, but the reason/logic for their elimination should be explained. The project manager may select the process to use in reducing the number of alternatives. Some elimination decisions may be straightforward and easily explained. For complicated or complex decisions, a method such as the weighted-score analysis may be used here as it is in step 5. However, the criteria may be different in this step; for example, cost comparison data may not be available yet.

Chapter 2 of the documented analysis of alternatives should explain the process that is being used, including the market research that was used to develop the initial list of alternatives. It also should present the initial list of alternatives and the key questions and other considerations used to determine which alternatives should be evaluated further. Next, Chapter 2 should identify the alternatives selected to undergo the BCA and weighted-score analysis. Finally, it should explain the rationale for eliminating the remaining alternatives from further consideration.

Step 3: Identify Assumptions That Frame the Analysis

The alternatives to meeting the investment objective must be equitably compared. This does not mean that the objective must be met the same way by each alternative or that the quality of the results must be the same. It does, however, mean that the differences must be measured and analyzed equitably. For example, an alternative that costs more than another alternative, but delivers higher quality, can be compared; however, to do this, the benefits of the increased quality must be quantified by monetary value.

Assumptions may vary among alternatives. The assumptions will affect costs, benefits, or both. The differences in these assumptions must be evaluated and compared with monetary results. Often, factors other than the best benefit for the cost affect the choice of alternative. The budget is an example of this. An analysis of alternatives must be prepared in accordance with OMB guidance[8] and agency guidance, but frequently the best alternative cannot be pursued because the funding for it is not available. The investment objective and best value drive the

[8] OMB Circulars A-11 and A-94.

recommendation of the alternative to be pursued based on a financial analysis; however, this does not necessarily mean that this alternative will be selected. For example, the budget may restrict the alternatives to be considered or may create a need for modification of the recommended alternative or implementation plan.

Chapter 3 of the analysis of alternatives should present the assumptions that drive the alternative evaluation criteria and the constraints that limit them. Chapter 3 is only for assumptions that are applicable to *all* alternatives; assumptions unique to a specific alternative are presented in Chapter 4 under the section discussing that specific alternative. Assumptions applicable to all alternatives fall into four areas:

- *Global assumptions.* These assumptions address the investment objective and project definition.

- *Life-cycle assumptions.* These assumptions apply throughout the life of the project. They address the project life and the project management processes used during its life, such as the number of years for the life of the project.

- *Cost assumptions.* These assumptions address cost components such as number of hours for a full-time equivalent (FTE), e.g. a staff person; inflation rate; the algorithm for calculating government salaries, benefits, and overhead; the availability of real estate for space rental or purchase; the hardware and commercial software markets and potential impact on pricing; and comparison directed by OMB Circular A-76.

- *Benefit assumptions.* These assumptions address both quantitative and non-quantitative benefits. Quantitative benefits are benefits for which a monetary value can be calculated. Quantitative benefits are a component of the benefit-cost analysis. Examples of quantitative benefits include savings from reduced processing time, reduced cost for rework due to increased accuracy, and elimination of duplicative expense for data entry or other duplicative activities. Both direct and indirect benefits are to be included. Direct benefits are those realized by the organization that owns the investment. Indirect benefits are those realized outside the organization, such as the general public. Most importantly, quantitative benefits should be specifically defined as those that represent cost savings and those that represent cost avoidance. This distinction is specifically required in the OMB Exhibit 300. Even if the project does not require preparation of an OMB Exhibit 300, it may be part of a larger investment, such as the Resource and Patient Management System (RPMS), which is required to complete an OMB Exhibit 300 and needs the identification of the type of benefits for that purpose.

- Non-quantitative benefits cannot be assigned a monetary value but nevertheless contribute to achieving the business objective and therefore should be part of the decision process. They are a component of the

weighted-score analysis. Examples of non-quantifiable benefits are greater sharing of information and knowledge, increased patient confidence, improved communications with oversight organizations, etc. A description of the non-quantitative benefits is specifically required in the OMB Exhibit 300. Even if the project does not require preparation of an OMB Exhibit 300, it may be part of a larger investment, such as the Resource and Patient Management System (RPMS), which is required to complete an OMB Exhibit 300 and needs the information to do so.

Step 4: Analyze the Costs and Benefits of the Most Viable Alternatives

The BCA is by far the largest and most complicated element of the analysis of alternatives. Several spreadsheets (e.g., Excel worksheets) may be needed to support the tables for cost and benefit data. The types of spreadsheets are as follows:

- Assumptions and common data such as general schedule (GS) and locality pay rates, benefits, and overhead; hours per FTE; inflation rate and net present value discount rate and discount factors; and supporting numerical data for the cost element and benefit calculation of each alternative.

- Costs for each alternative.

- Benefits for each alternative. Benefits can be extremely hard to quantify, and not all benefits need to be quantifiable. Typical benefits include savings in personnel time, savings in utilities, savings in space, lower operating costs, lower maintenance costs, potential future operating costs that will be avoided, functional benefits derived from more timely or more complete information, savings at other levels of the organization or at other agencies as a result of this alternative, etc.

- ROI and net present value (NPV) for each alternative by year and totaled for the investment analysis life-cycle. This spreadsheet would contain a summary of the information contained on the prior two types of spreadsheets.

- Comparisons of the alternatives' life-cycle costs.

Chapter 4 of the analysis of alternatives should present the costs, quantifiable and non-quantifiable benefits, ROI, NPV, and payback period. It also should compare the ROIs of the evaluated alternatives across the project life-cycle.

The analysis of alternatives uses tables to collect data for costs and benefits for each alternative and to display the data for comparison. The data are then summarized and analyzed. Table 1 is an example of a financial analysis summary. A summary table will be developed for each of the alternatives (minimum four - status quo plus three

additional viable alternatives). Depending upon the complexity of the project, additional spreadsheets may be needed to calculate the amounts for costs and benefits. Item (1), annual costs, and item (2), annual benefits, are the totals from other spreadsheets. Item (3), midyear discount factor, is calculated based on a standardized percentage for the discount rate. Items (4) through (10) are calculated based on items (1) through (3).

Table 1. Example of a Financial Analysis Summary for One Alternative ($ million)

Item	FY11[9]	FY12	FY13	FY14	FY15	FY16	FY17	Total
(1) Annual costs	2.502	2.621	2.747	2.877	3.016	3.160	3.312	20.234
(2) Annual benefits	1.718	2.901	3.353	5.042	5.852	6.300	6.514	31.680
(3) Midyear discount factor	0.9764	0.9308	0.8873	0.8458	0.8063	0.7687	0.7328	
(4) Discounted costs (DC)	2.443	2.439	2.437	2.434	2.432	2.429	2.427	17.040
(5) Discounted benefits (DB)	1.678	2.700	2.975	4.264	4.718	4.843	4.773	25.951
(6) Discounted net benefits (DB − DC)	−0.765	0.261	0.538	1.831	2.287	2.414	2.347	8.911
(7) Cumulative net benefits (NPV)	−0.765	−0.504	0.033	1.864	4.151	6.564	8.911	
(8) Benefit/cost ratio	0.687	1.107	1.221	1.752	1.940	1.994	1.967	1.523
(9) ROI (%)	−31.3%	10.7%	22.1%	75.2%	94.0%	99.4%	96.7%	52.3%
(10) Payback period (years)			2.94					

The 10 items are explained below:

(1) *Annual costs*. Annual costs are captured by nine cost elements (program staff, training and administration, contract services, software, hardware, equipment, facilities, security, and risk and other) within the three life-cycle phases (planning, acquisition, and maintenance). The maintenance phase is also called steady-state or operations and maintenance. The last line in each of these tables is the total life-cycle cost by year. These are the costs to be used in (1), annual costs, by year.

(2) *Annual benefits*. Each benefit is identified by year. The last line in each of these tables is the total benefits by year. Benefits should be identified either as cost savings or as cost avoidance. These are the benefits to be used in (2), annual benefits, by year.

(3) *Midyear discount factor*. The discount rate is used to discount future costs and benefits to achieve a net present value. The use of net present value and the discount rate (interest rate) to calculate it provide a common unit of measurement to address the value of money in different time periods

[9] Normally, the first year of the financial analysis is the budget year, not the year that the analysis of alternatives is being prepared. Although OMB wants sunk costs identified (sunk costs are funds that have already been expended on the investment), these should not be considered in the analysis.

and provide a reference for comparing the value of this project with other uses of the funds (what you could get if the funds were invested elsewhere at the specified interest rate). OMB Circular A-94 states:

> **The standard criterion for deciding whether a government program can be justified on economic principles is *net present value*—**the discounted monetized value of expected net benefits (i.e., benefits minus costs). Net present value is computed by assigning monetary values to benefits and costs, discounting future benefits and costs using an appropriate discount rate, and subtracting the sum total of discounted costs from the sum total of discounted benefits. Discounting benefits and costs transforms gains and losses occurring in different time periods to a common unit of measurement. Programs with positive net present value increase social resources and are generally preferred. **Programs with negative net present value should generally be avoided.**[10]

The discount rate is updated each year, normally in January, as an update to OMB Circular A-94.[11] The discount rate to use may be "real" or "nominal." Use of the nominal discount rate and including inflation in the cost estimates is the recommended approach for IHS analyses of alternatives.

A real discount rate does not include inflation. A real discount rate may be more accurate for comparing net present value in a benefit-cost analysis because it removes the uncertainty of what the inflation rate may be in future years. However, budget submissions require inflation adjustments. If the benefit-cost analysis is also to be used for budget estimates as most of them are, inflation will have to be added to the costs shown in the analysis before they are submitted in the budget request. The other choice is to include inflation in the analysis. If inflation is used in the analysis, the nominal discount rate will be used to calculate the NPV. Use of the nominal discount rate and including inflation in the cost estimates is the recommended approach for IHS analyses of alternatives.

The example presented in Table 1 above includes inflation in the costs and benefits. The discount factor was based upon a nominal rate of 4.9 percent for a seven-year life-cycle, per OMB A-94 Appendix C for 2007 (Although the nominal discount rate was revised in January 2008 to 4.4% for a seven year analysis period, the example was not changed to reflect this revised discount rate).

[10] OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,* Section 5.a.

[11] OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Appendix C.

A midyear discount factor was used. This means that the funds are spent relatively evenly throughout the year or that the average expenditure rate approximates spending in the middle of the year. The formula is:

$$\text{Midyear discount factor} = 1/\,(1 + i)^{(n - 0.5)}$$

where:

i = interest rate (discount rate)
n = year.

The minus 0.5 moves the average time from the beginning of the year to the middle of the year. FY11 is the first year of the analysis. The calculation for year 1 (n = 1), FY11, using a nominal discount rate of 4.9 percent per OMB Circular A-94 for 2007 for a seven-year life-cycle (i = 0.049) is:

$$1/\,(1 + 0.049)^{(1 - 0.5)} = 1/\,(1.049)^{0.5} = 0.9764.$$

(4) *Discounted costs*. Discounted costs, item (4), are the present value of the future costs. To calculate future costs at the present value, item (1), annual costs, is multiplied by item (3), midyear discount factor. Using FY11 as an example,

$$\text{Discounted costs} = \text{item (4)}_{FY11} = \text{item (1)}_{FY11} \times \text{item (3)}_{FY11}.$$

$$\text{Item (4)}_{FY11} = 2.502 \times 0.9764 = 2.443.$$

(5) *Discounted benefits*. Discounted benefits, item (5), are the present value of the future benefits. To calculate future benefits at the present value, item (2), annual benefits, is multiplied by item (3), midyear discount factor. Using FY11 as an example,

$$\text{Discounted benefits} = \text{item (5)}_{FY11} = \text{item (2)}_{FY11} \times \text{item (3)}_{FY11}.$$

$$\text{Item (5)}_{FY11} = 1.718 \times 0.9764 = 1.678.$$

(6) *Discounted net benefits*. The discounted net benefits, item (6), are the annual NPV. They are determined for each year by subtracting item (4), discounted costs, from item (5), discounted benefits. Using FY11 as an example,

$$\text{Discounted net benefits} = \text{Item (6)}_{FY11} = \text{item (5)}_{FY11} - \text{item (4)}_{FY11}.$$

$$\text{Item (6)}_{FY11} = 1.678 - 2.443 = -0.765.$$

The negative sign (−) means the costs for the project for this year are greater than the benefits received from it.

(7) *Cumulative net benefits (NPV)*. The cumulative net benefit, item (7) for FY11–FY17, is the cumulative NPV of the benefits for the life of the project. Item (7) is the total of the annual net benefits, or the sum of all items (6) for FY11–FY17. This life-cycle NPV is a primary calculation used in evaluating the financial feasibility of the project and in determining the pay back period for the investment.[12]

Life-cycle NPV = sum of annual NPVs.

For FY11–FY17, Item (7) = ∑items (6) for all years FY11 through FY17.

Item (7) = 8.911.

The cumulative net benefits through a specific year are the sum of the annual net benefits through that year–sum of items (6) through that year, or the cumulative net benefits through the previous year, item (7), plus the discounted net benefit for the given year, item (6). Using FY14 as an example,

Cumulative net benefits through FY14 = cumulative net benefits through FY13 + discounted net benefits for FY14 = 0.033 + 1.831 = 1.864.

(8) *Benefit/cost ratio*. This ratio, item (8), is calculated by dividing item (5), discounted benefits, by item (4), discounted costs. A ratio of 1.000 means one dollar of benefit for every dollar spent: the break-even point. A ratio less than 1.000 means costs are exceeding benefits. Using FY11 as an example,

Benefit/cost ratio = discounted benefits ÷ discounted costs.

Item $(8)_{FY11}$ = item $(5)_{FY11}$ ÷ item $(4)_{FY11}$.

Item $(8)_{FY11}$ = 1.678 ÷ 2.443 = 0.687.

(9) *ROI (%)*. The return on investment, item (9), is the benefit minus the cost, or the net benefit, item (8) minus item (5), divided by the cost, item (5). Another way of expressing this is that it is item (8), the benefit/cost ratio, minus 1.000, expressed as a percentage. A negative percentage means the project costs exceed the benefits (a "loss" in financial terms). Zero is the break-even point; costs have been recovered by the benefits. A positive number indicates benefits exceed costs. **There is no quantitative reason**

[12] See explanation of net present value under item (3), midyear discount factor.

to fund a project that does not produce a positive ROI. A bank account that receives 7 percent interest means the principal is paid back along with an additional 7 percent of the principal; the same is true for the alternatives analysis. A project with a 10 percent ROI means the cost (principal) has been recovered and the total benefits equal the cost plus an additional 10 percent of the cost. Using FY11 as an example,

ROI = Benefit/cost ratio − 1.000 expressed as a percentage.

Item $(9)_{FY11}$ = item $(8)_{FY11}$ − 1.000 expressed as a percentage.

Item $(9)_{FY11}$ = 0.687 − 1.000 = −0.313, or −31.3%.

For the life of the project,
Item $(9)_{Total}$ = 1.523 − 1.000 = 0.523, or 52.3%.

ROI, item (9), can also be calculated without using the discounted benefit/cost ratio by subtracting the discounted costs, item (4) from the discounted benefits, item (5), thereby obtaining the net benefits, and then dividing that difference by the discounted costs, item (4). The answer is expressed as a percent. Using FY11 as an example,

ROI = (discounted benefits − discounted costs) ÷ discounted costs.

Item $(9)_{FY11}$ = (item $(6)_{FY11}$ − item $(5)_{FY11}$)/item $(5)_{FY11}$.

Item $(9)_{FY11}$ = (1.678 − 2.443)/2.443 = −0.765/2.443 = −.313, or −31.3%.

For the life of the project:
Item $(9)_{Total}$ = (25.951 − 17.040)/17.040 = 8.911/17.040 = 0.523, or 52.3%.

(10) *Payback period (years).* **The payback period is the point in time when the cumulative benefits received are equal to the cumulative costs.** The calculations are based on item (7) cumulative net benefits (NPV). The payback period occurs in the year in which cumulative net benefits are positive (this means the cumulative net benefits exceeded the cumulative costs during that year). To determine when during the year the payback period was reached, add the absolute values of the previous year (when the cumulative NPV was still negative) to the cumulative NPV of the year in which it turned positive. Divide that total into the value of the previous year (when it was negative). Ignore the negative sign (use absolute value); add this fraction to the number of years that cumulative net benefits were negative. This is the payback period in years. For this example,

Cumulative NPV, item (7), is −0.504 in FY12 and turns positive at 0.033 in FY13. NPV is negative for 2 years (FY11 and FY12) plus a fraction of the third year.

To calculate the fraction, ignore the negative sign (absolute values used). Add 0.504 (NPV for FY12) + 0.033 (NPV for FY13) = 0.537.

Divide 0.537 into 0.504 (last year of negative NPV); 0.504 ÷ 0.537 = 0.94 (use 2 decimal places). The cumulative net benefits were negative for 2 years (FY11 and FY12). These 2 years plus 0.94 of the third year = 2.94 years for the payback period.

The process for Table 1 is repeated for each of the alternatives, but the analysis is not complete there. Assumptions were made about the variables (parameters). A sensitivity analysis should be conducted to determine the degree to which changes in parameters can influence the recommended alternative.

- A parameter is considered to be "not sensitive" if it requires a decrease of 50 percent or an increase of 100 percent to cause a change in the selected alternative.
- A parameter is considered "sensitive" if a change between 10 percent and 50 percent causes a change in the selected alternative.
- A parameter is considered to be "very sensitive" if a change of 10 percent or less causes a change in the selected alternative.

The result of the sensitivity analysis does not necessarily change the recommended alternative, but it identifies how important the accuracy of the parameters are and the potential impact that a change in the parameters can have on the ROI of the recommended alternative.

A traditional benefit-cost analysis disregards sunk costs (money that has already been expended on an investment) and achieved benefits (benefits that have already been achieved by an investment). The decision should be based upon what can be managed – planned costs and benefits. However, for an investment that is in a mixed-cycle, which is an investment that is partly in development and partly in operation, HHS is reporting total investment life-cycle costs (including sunk costs) and life-cycle benefits (including already achieved benefits) to OMB (presumably at OMB's direction) as part of the life-cycle analysis reported in the OMB Exhibit 300. Although this makes the alternative costs consistent with the summary of spending table for the OMB Exhibit 300, it is inconsistent with using the analysis of alternatives for good decision making. Accordingly, **life-cycle costs and life-cycle benefits should also be calculated** to make the analysis useful for OMB Exhibit 300 reporting, also.

Step 5: Conduct a Weighted-Score Analysis

The BCA identifies costs and quantifiable benefits of the project; however, additional qualitative, or intangible, information is included in the alternative selection process. The NPV or ROI should be used as the primary financial decision-making criterion. However, the use of NPV or ROI as the basis for recommending an alternative may be in conflict with the requirement that costs for the selected alternative be within a predetermined budget. NPV is calculated as the life-cycle difference between benefits and costs (both discounted). A large NPV may have large benefits and large costs. These costs may exceed the available funding level, making the selection of the alternative improbable even though the NPV is high. Obtaining a large NPV favors large projects in which both costs and benefits are high. This may be in conflict with budget constraints.

NPV shows the dollar value of the investment, and ROI indicates the rate (%) returned on the investment. Alternatives may have the same NPVs but different ROIs, depending on the actual values of the costs and the benefits. For example, an alternative costing $1 million with $2 million in benefits has an NPV of $1 million, as does an alternative that costs $10 million and has benefits of $11 million. The first alternative has a much higher ROI. Similarly, alternatives with different NPVs may have the same ROIs. For example, an alternative costing $1 million with $2 million in benefits has the same ROI as an alternative costing $10 million with $20 million in benefits. The first alternative has an NPV of $1 million, and the second alternative has an NPV of $10 million. The financial analysis is an important part of the selection of alternatives, but not the only consideration.

A total business case analysis includes other criteria in addition to the NPV and ROI. These criteria are both financial and non-financial. Weighted scoring is used as the business analysis tool. The selected alternative may not have the highest business case value; however, it must score well in comparison with the highest-scoring alternative, and it usually must be within the budget if a project budget has already been established. The selected alternative may not have the highest NPV; however, the NPV should be positive (there are occasional mandated projects that may not have a positive NPV but which still have to be implemented).

The weighted-score analysis involves assessing how well each alternative satisfies each of several criteria and assigning a raw score reflecting that assessment. Typically, raw scores have a standard scale ranging from 0, indicating that the alternative does not satisfy the criterion, to 10, indicating that the alternative fully satisfies the criterion. A weight is then applied to each raw score to reflect the relative importance of the criterion. Finally, the weighted scores for all of the criteria for each alternative are summed and compared.

The criteria used in the weighted-score analysis include quantitative items as well as qualitative or intangible information that should also be part of the decision

process. HHS has established the following criteria for use in an alternatives analysis weighted evaluation:[13]

- **Mission.** The elements of the OPDIV mission to be supported (i.e., business needs).
- **Requirements.** Specific requirements that the new project must support.
- **Schedule.** Phasing, durations and milestones.
- **Cost.** Full life-cycle costs to include design, development, testing, training, migration, implementation, and operations and maintenance both in total and by fiscal year.
- **Security.** Conformance with government and industry security standards.
- **Risk.** Assessment of cost, schedule, security, technical, and overall risk.
- **Enterprise Compliance.** Conformance with the HHS enterprise approach to IT management (architecture, standards, licenses, migration strategies, etc.).

Although HHS has specified the criteria to be used in the weighted-score analysis, it has given the project manager the flexibility to use different criteria and weights.[14] However, if the project manager uses different criteria, he or she must provide the rationale for the changes in the criteria from the HHS criteria. Numerous other criteria may be used and for many reasons. NPV or ROI may be used instead of cost (or used with it). Cost may be important if there is a predefined budget, but NPV or ROI may be used if the most cost-effective solution is being sought independent of the budget or before a budget is requested. NPV and ROI are used for best value; cost is used to meet budget constraints. Technical approach is another criterion that may be important for some projects. If innovative solutions are being sought or if alternatives present varying technical approaches, technical approach may be included as a criterion. If technical scores are used elsewhere, they may be converted to scores in the weighted-score analysis.

The project manager is responsible for determining how the raw scores will be assigned. The weighted score for each criterion is calculated as follows:

$$\text{weighted score} = \text{raw score} \times \text{weight}.$$

[13] HHS-IRM-2003-0002, *HHS IRM Policy for Conducting Information Technology Alternatives Analysis*, Section 4.6.1.3, June 13, 2003.

[14] HHS-IRM-2003-0002, *HHS IRM Policy for Conducting Information Technology Alternatives Analysis*, Section 4.6.1.3, June 13, 2003.

The top-scoring alternative is the leading candidate for being the recommended alternative; however, HHS guidance does not require that alternative with the top score is the selected alternative.[15]

Chapter 5 of the analysis of alternatives should describe the scoring criteria, present the raw and weighted scores for each alternative, and provide the scoring rationale for each criterion. The following paragraphs present an example of a weighted-score analysis. The purpose of the example is to show how the weighted-score analysis is to be conducted. This is hypothetical; the facts and discussion leading up to this analysis are not included. This information would be developed from the data in the chapters preceding the weighted-score analysis.

Table 2 presents the raw and weighted scores for each alternative of the hypothetical example. The criteria and weights in the HHS IRM Policy for Conducting Information Technology Alternatives Analyses were used. In the example, Alternative 2, the baseline or *Status Quo*, is the continuation of what is being done currently. Alternative 3, *Host*, moves the operation of the system to a new hosting facility and uses contract support for system maintenance. Alternative 4, *Government Operation*, supports the system with 100 percent government employees with no contract support. Alternative 4, *New Design*, completely replaces the current system with a new one.

The baseline score of 4,420 in this example is the highest weighted score; therefore, the baseline would most likely be presented as the recommended solution.

[15] Section 4.6.1.3 of HHS-IRM-2003-0002 says that "the top scoring alternatives will be selected for further comparison."

Table 2. Weighted Scores of Hypothetical Alternatives

Criterion	Weight	Alternative 2 Status Quo		Alternative 3 Host		Alternative 4 Government Operation		Alternative 4 New Design	
		Raw score	Weighted score	Raw score	Weighted score	Raw score	Weighted score	Raw score	Weighted score
Mission	100	8	800	8	800	8	800	10	1000
Requirements	90	7	630	7	630	7	630	10	900
Schedule	60	9	540	7	420	5	300	4	240
Cost	70	10	700	7	490	8	560	0	0
Security	80	7	560	7	560	8	640	8	640
Risk	70	8	560	7	490	5	350	4	280
Enterprise Compliance	90	7	630	7	630	8	720	8	720
Total		—	4,420	—	4,020	—	4,000	—	3,780

The rationale for the scores of our hypothetical example is as follows:

- *Mission.* How well an alternative supports the mission can usually be evaluated by comparing its relative support for the goals and objectives of the agency with the support of the other alternatives. This criterion can also be expanded to address the effect on business processes and functions, organizational, cultural, and other non-quantifiable aspects of the business environment and mission. A new design can be created that receives a 10, but this is not necessarily done; tradeoffs are often made to address cost and other factors. In this example, a 10 is given for mission support for a new design, Alternative 4. The baseline, Alternative 3, and Alternative 4 are each given an 8 based on their relative mission support when compared with Alternative 4. They receive the same score because all three solutions maintain the system functionality and mission support as it is now.

- *Requirements.* If a functional requirements document has been prepared, the scores for meeting the requirements can be based on a combination of how well each alternative meets each requirement and the relative importance of each requirement. This is especially appropriate for evaluating commercial off-the-shelf (COTS) packages or existing systems that are being considered. In the example used here, a 10 is given to Alternative 4 because a new design can be developed that meets all the requirements. The baseline and Alternatives 2 and 3 are each given a 7 based on meeting 70 percent of the requirements. They receive the same score because all three solutions maintain the system functionality as it is now.

- *Schedule.* Continuing the baseline introduces no new problems or issues. O&M is well defined, and the DME activities will be performed by a contractor who has successfully been working with the system for several years. There is the slight chance of unanticipated funding or contract issues so the baseline schedule is given a 9 (rather than a 10). The same contract would maintain the system and perform development, modernization, or enhancements (DME) under Alternative 3. The only change is to move the hosting site; Alternative 3 schedule is scored at 7. Having government employees 100 percent responsible for the system requires hiring and training a significant number of new staff members and making a transition from contractor support. These changes create a potential for significant schedule slippage; Alternative 4 is given a 5. A new design, Alternative 4, has even greater potential for schedule complications than Alternative 4. Not only are there the issues of who is running and maintaining the system, and how, but the system functionality may be changed, creating design complexity and the need for coordination among stakeholders who may have conflicting priorities. These factors may affect the schedule; Alternative 4 received a schedule score of 4.

- *Cost.* The cost scores were based on the estimated cost for each alternative in the BCA and ranked according to their relative differences. The alternative with the lowest cost receives a score of 10 and the other alternatives are compared to it. One point is deducted for each increase in cost of 10 percent (rounded), to a minimum of 0 (no negative scores).

  Example 1: The baseline is the least costly alternative; it receives a score of 10. Alternative 3 has costs 33.6 percent higher than the baseline and receives a score of 7 (33.6 percent rounds to 30 percent; 1 point for each 10 percent is 3 points: 10 − 3 =7).

  Example 2: Alternative 4 costs 17.8 percent more that the baseline and receives a score of 8 (17.8 percent rounds to 20 percent; 1 point for each 10 percent is 2 points; 10–2 = 8).

  Example 3: Alternative 4 costs 120 percent higher than the baseline. One point for each 10 percent is 12 points: 10–12 =–2. Zero is the lowest possible score so Alternative 4 receives a 0.

- *Security.* This criterion addresses access controls, firewall implementation, and use monitoring, as well as security responsibility, authority, and reporting. In our evaluation of the alternatives, the following aspects of security were considered:
  - Federal Information Security Management Act
  - Standards issued by the National Institute of Standards

  - Certification and accreditation
  - Technical capability and capacity.

  Security requirements can be best met when the processes and information required for security implementation, monitoring, analysis, and reporting are the responsibility of those accountable for the security program. For this reason, the scores are higher for the alternatives that place operational responsibility close to project management. The in-house alternative (Alternative 4) scored an 8 because all project components are controlled by IHS, but not a 10 because two different IHS components (the system project management office and the hosting organization) must coordinate for complete security. The baseline (status quo) received a 7 because it is very close to the in-house alternative; the contractors report directly to the system project management office and have several years of successful experience. Bringing the hosting to IHS with no other changes (Alternative 3) is similar to the status quo so it also scored a 7. A new design (Alternative 4) can be implemented by a combination of operational responsibilities that include outsourcing or using in-house resources. The final determination might influence the security score, but a score of 8 was assigned because security can be built into the new processes.

- *Risk.* The risk scores are based on a preliminary evaluation of the 19 risk elements for implementing the alternative and for operating the alternative over its system life. The risk of implementing and operating an alternative different from the status quo might be less than maintaining the status quo if the latter is unable to meet the business requirements or has obsolete technology, high operational costs, or other limitations or high-risk components. However, this is not the case. The baseline (status quo) poses the lowest risk; a score of 8 was assigned. The other alternatives pose a greater risk because risk increases as change increases. Thus, developing a new design (Alternative 4) poses the greatest risk (score of 4) because the application design, operations, hosting, and maintenance support will change. Risk scores of 7 and 5 were assigned, respectively, for moving the hosting (Alternative 3) and for moving the hosting while also shifting applications responsibility to government personnel (Alternative 4).

  A preliminary evaluation of the risks posed by each alternative was conducted using the 19 risk categories of OMB Circular A-11 Exhibit 300:

  - Schedule
  - Initial costs
  - Life-cycle costs
  - Technical obsolescence

  - Feasibility
  - Reliability of systems
  - Dependencies and interoperability
  - Surety (asset protection)
  - Risk of creating a monopoly for future procurements
  - Capability of the agency to manage the investment
  - Overall risk of investment failure
  - Organizational and change management
  - Business
  - Data/information
  - Technology
  - Strategic
  - Security
  - Privacy
  - Project resources.

- *Enterprise Compliance.* Generally, compliance can be best met when the processes and information required for compliance are the responsibility of those accountable for compliance and for reporting it. For this reason, higher scores were assigned for the alternatives that place operational responsibility close to project management. The in-house alternative (Alternative 4) received an 8 because all project components are controlled by IHS; it did not score a 10 because two different IHS components (the system project management office and the hosting organization) must coordinate for complete compliance. The baseline (status quo) received a 7 because it is very close to the in-house alternative (Alternative 4); the contractors report directly to system project management and have several years of successful experience. Bringing the hosting to IHS with no other changes is similar to maintaining the status quo and also scored a 7 (Alternative 3). A new design (Alternative 4) can be implemented by a combination of operational responsibilities that include outsourcing or using in-house resources. The final determination might influence the compliance score, but a score of 8 was assigned because compliance can be built into the new processes.

In addition to providing the necessary business functionality, the system must be able to meet the requirements and guidelines specified by executive directives, congressional legislation, and external oversight entities (such as the Inspector General and Government Accountability Office), as well as internal policy and standards. Therefore, each alternative's ability to comply with and be responsive to those needs was considered. The following are key requirements and guidelines with which the selected alternative must comply:

- Government-wide guidelines such as the Clinger-Cohen Act, Paperwork Reduction Act, Government Performance and Results Act, OMB Circular A-130, and Government Accountability Office
- IHS policy
- Mission support
- Technology standards.

Step 6: Recommend the Alternative to Be Pursued

Two analyses are used in the analysis of alternatives: the BCA and the weighted-score analysis. The BCA is quantitative, emphasizing the ROI, NPV, and payback period that justify the investment. OMB stresses the BCA; a proposed investment with a poor ROI or poor NPV is difficult to get approved. Often, experience, judgment, and subjective evaluations are required to produce quantifiable estimates. If the estimates are close, additional analyses may be needed to evaluate the significance of the differences. The potential variation in these estimates can be addressed through statistical confidence intervals in the calculations and by sensitivity analysis.

A sensitivity analysis evaluates the effects of different values in the cost or benefit calculations. Examples include different inflation rates and longer or shorter time to realize the benefits or changes in hardware or contract costs. Sensitivity analysis is valuable in evaluating risks. It will show the consequences of variations in the estimates.

Frequently, benefits or costs that are not quantifiable must be included in the total investment analysis. The weighted-score analysis is appropriate for both quantitative and qualitative analysis. The emphasis is on comparing the alternatives; the relative importance and relative values determine the outcome rather than individual assessments.

If the same alternative receives the highest score in both the BCA and weighted-score analysis, the recommendation is obvious. However, the facts, assumptions, and calculations should still be reviewed to ensure that the bases for the analyses were correct. When different alternatives score higher on each of the analyses, additional analyses and potential reconciliation should be undertaken. Areas such

as risk, sensitivity analysis, confidence intervals, cost and benefit assumptions, and rationale behind subjective values and relative weights should be reviewed. Results that are close may not be significantly different statistically. Results that are not statistically different will require an explanation as to how the alternative was selected. An even stronger explanation is required for the selection of an alternative when two different alternatives receive the highest scores in the two analyses and the results are statistically different.

An alternative may be selected that scores higher on the weighted-score analysis than the other alternatives, but lower than other alternatives on the BCA. However, the selected alternative must have a positive ROI and positive NPV to avoid the high risk of it not being approved by IHS, HHS, and/or OMB.

APPENDIX A. EXAMPLE OF AN ANALYSIS OF ALTERNATIVES

This appendix contains an example of an analysis of alternatives for an investment. The example is for a hypothetical Indian Health Service (IHS) project called the Prescription Automated Ordering System. The appendix is intended to show the process and type of data used in an analysis of alternatives.

When completed, the analysis of alternatives document will contain the information needed to meet the requirements of OMB,[16] HHS,[17] and IHS. The analysis of alternatives document contains the following chapters and addresses each of the steps of a comprehensive alternatives analysis:

- Chapter 1: Introduction.
  Addresses Step 1: Identify the investment objectives and macro-requirements. It also presents background information, the approach to the analysis, and the organization of the document.

- Chapter 2: Selection of Alternatives for Analysis.
  Addresses Step 2: Select the most viable alternatives for analysis.

- Chapter 3: Assumptions.
  Addresses Step 3: Identify assumptions that frame the analysis.

- Chapter 4: Benefit-Cost Analysis.
  Addresses Step 4: Analyze the costs and benefits of the most viable alternatives.

- Chapter 5: Weighted-Score Analysis.
  Addresses Step 5: Conduct a weighted-score analysis.

- Chapter 6: Conclusions and Recommendations.
  Addresses Step 6: Recommend the alternative to be pursued.

[16] OMB Circular A-11, *Part 7: Planning, Budgeting, Acquisition, and Management of Capital Assets*, June 2006, and OMB Circular A-11, Exhibit 300.

[17] HHS-IRM-2003-0002, *HHS IRM Policy for Conducting Information Technology Alternatives Analysis*, June 13, 2003.

Chapter 1
Introduction

The mission of the Indian Health Service is to assure a comprehensive health services delivery system for American Indians and Alaskan Natives with sufficient options to provide for maximum tribal involvement in meeting their health needs. The goal for the Indian Health Service is to raise the health level of the Indian and Alaskan Native people to the highest possible level.

To carry out its mission and to attain its goal, the Indian Health Service: (1) assists Indian tribes in developing their capacity to staff and manage their health programs through activities including health and management training, technical assistance, and human resource development; (2) facilitates and assists Indian tribes in coordinating health planning, in obtaining and utilizing health resources available through Federal, State, and local programs, and in health program evaluation; (3) provides comprehensive health care services, including hospital and ambulatory medical care, preventive and rehabilitative services, and development of community sanitation facilities; and (4) serves as the principal Federal advocate for Indians in the health field to assure comprehensive health services for American Indians and Alaska Natives.

The Rockville Service Unit (RSU) consists of the Rockville Native American Hospital (63 beds) and attached ambulatory care center, health care centers at Potomac and Bethesda, and field health clinics in Falls Church and Arlington.

The Rockville Native American Hospital provides general inpatient care, with intensive care, surgery, and obstetric services contracted to the adjoining Suburban Hospital and several private hospitals. The Rockville ambulatory care center provides outpatient care, with 125,000 visits per year. All support services are available at the center, with separate units organized for urgent care and appointment patients.

20% of all out-patient visits occur outside of Rockville, where the health care teams take a site-specific community-oriented approach to address major public health problems. These programs emphasize comprehensive continuing care, health promotion, and disease prevention.

The mission of the RSU is to promote individual and community health and well being in a culturally respectful and responsive manner. In support of its mission, RSU undertook an investment initiative—the Prescription Automated Ordering System (PAOS)—to support the ordering and tracking of prescriptions and for providing research and financial data for analysis. This document presents an analysis of the alternatives for the project. The purpose of the analysis is to ensure

that RSU selects the alternative that will achieve performance goals and objectives with minimal risk, lowest life-cycle costs, and greatest benefits to the agency.

BACKGROUND

RSU initiated the development of PAOS in 2005. PAOS is a web-based collection of front-end computer applications for ordering and tracking prescriptions that provide easy and controlled access to the back-end databases that store historical prescription information for analysis.

PAOS is in a mixed life cycle, with about 30 percent in the development, modernization, and enhancement (DME) phase and about 70 percent in the operations and maintenance (O&M) phase (steady state). IHS is conducting an analysis of alternatives to determine whether the current strategy for PAOS is efficient and cost-effective, or whether the strategy should be changed or replaced to maximize functionality and return on investment (ROI). This report conveys the results of that analysis.

REQUIREMENT

The main goal of PAOS is to serve as a centralized system for the timely collection of prescription ordering data and for the dissemination of data across IHS and its affiliates (medical monitors, local sites, and intramural and extramural investigators). The data collected and accessible through PAOS are related to the management of controlled drugs, prescription tracking, health care monitoring, and other health care regulatory activities.

For detailed requirements information, the Project Team used the PAOS Requirements Document. The Requirements Document describes both the project and product requirements. It outlines the technical, functional, performance and other requirements necessary to deliver the end business product.

APPROACH

The approach to the analysis of alternatives was as follows:

- Select alternatives for analysis
- Select assumptions that would frame the analysis
- Analyze the benefits and costs of the viable alternatives
- Conduct a weighted-score analysis.

As guidance, the *IRM Policy for Conducting Information Technology Alternatives Analysis*, issued by the Department of Health and Human Services (HHS) in June 2003 and Office of Management and Budget (OMB) Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs were used*. Such policy and guidance materials as the President's Management Agenda (PMA); OMB Circular A-76, *Performance of Commercial Activities*; Federal Activities Inventory Reform Act; and government-wide procurement strategy were also considered.

REPORT ORGANIZATION

This report is organized as follows:

- Chapter 2 describes the process used to select alternatives for analysis and identifies the alternatives selected for benefit-cost analysis (BCA) and weighted-score analysis.
- Chapter 3 establishes the global, life-cycle, cost, and benefits assumptions used in the analysis of alternatives.
- Chapter 4 contains the results of the BCA.
- Chapter 5 contains the results of the weighted-score analysis, which compares alternatives in several areas relevant to success.
- Chapter 6 presents our conclusion and recommendation as to which alternative will best meet the needs identified for PAOS.

Chapter 2
Selection of Alternatives for Analysis

In this chapter, the process used to select alternatives for analysis is described, the universe of alternatives that were considered is presented, and the specific alternatives with sufficient potential to warrant detailed analysis (BCA and weighted-score analysis) are identified. An explanation for eliminating the alternatives not selected for detailed analysis is also provided.

SELECTION PROCESS

Selecting the alternatives for analysis was a three-step process:

- Identify the universe of alternatives
- Eliminate nonviable alternatives
- From the viable alternatives, identify those that have the greatest potential and warrant detailed analysis.

As a guide for identifying the universe of alternatives, Section 4.6 of HHS's *IRM Policy for Conducting Information Technology Alternatives Analysis* was used. The policy specifies that HHS agencies must include five alternatives in the analysis (or must explain why specified alternatives were not included). Those alternatives are listed as follows:

- Status quo—do nothing differently; current baseline. There will be no changes to the current system/current plans.
- Integration—partial replacement. Other systems or exiting processes may be integrated to meet some of the requirements (such as through the use of modules).
- Interfacing—output hand-offs and add-ons. Some of the required functionality may be met outside the system/project; interfaces to transmit data will be used.
- New system—new requirements or full replacement of old system. The functional requirements and technical design will be approached as they would for a new business requirement.

- Duplicative efforts (systems)—similar systems exist. If there are duplicative systems used to meet similar requirements, the project resources (systems) may be shared.

Alternatives that would support the Federal Transition Framework (FTF), meet the requirements of OMB Circular A-94 and other OMB guidelines, or best support the mission and goals of HHS and IHS were also identified.

UNIVERSE OF ALTERNATIVES

Ten viable alternatives were identified. Table 2-1 lists them and identifies the alternatives that meet the requirements of HHS's IRM policy. The table also lists key questions that were addressed when considering which alternatives should be evaluated further.

Table 2-1. List of Alternatives

Alternative	Considerations
Maintain the status quo: outsource maintenance and operational support of the current system	This is the current scenario. Contractors host and operate the application and provide support for it. Does this outsourcing strategy meet the requirements of A-76, the Federal Activities Inventory Reform Act, and the administration's initiative for competitive procurements? This alternative meets the HHS alternative requirement for status quo.
Outsource maintenance of the current system, with IHS hosting	The application maintenance would be performed by a contractor while the IHS hosts it. Does this alternative provide efficient coordination without inefficient overlap of responsibilities? Does the government maintain adequate project management oversight and direction while supporting contractor design and operation? Are software and technology ownership identified and maintained without conflict?
Use in-house (government) resources for development and operational support	The hosting would be by the IHS and the application support would also be by government employees. This alternative will be evaluated and compared in much the same way as the traditional A-76 analysis. Are government in-house resources available or can they be acquired? Can this alternative be competitive with outsourcing?
Implement a commercial system	This alternative would be evaluated and compared in much the same way as the traditional A-76 analysis. Is there an existing commercial off-the-shelf (COTS) solution that can be used in lieu of the current or proposed solution or as a partial replacement for it? This alternative meets the HHS alternative requirement for integration.
Design and develop a new system	Have organizational functions or processes changed, or has technology advanced to the extent that a new design may be beneficial? This alternative meets the HHS alternative requirement for a new system.
Consolidate similar IHS applications	This alternative involves using an existing IHS application to meet the needs of PAOS. How distinctly different are the IHS processes and functions, and how much technical duplication exists? Can hardware, commercial software, and repeatable code and database structures be shared to reduce support requirements and cost? This alternative meets the HHS alternative requirement for duplicative efforts.

Table 2-1. List of Alternatives

Alternative	Considerations
Use a GOTS solution developed by another agency	This alternative involves using an existing application external to IHS, a government off-the-shelf (GOTS) solution, to meet the needs of PAOS. This may include developing functionality that is outside of, but interfaced with, the GOTS solution. Are there other government departments/agencies with similar needs that are already being met by a system that can be leveraged? This alternative meets the HHS alternative requirement for interfacing.
Develop a government-wide system	Are the needs of this project for this organization compatible enough with the needs of other agencies that a collaborative effort similar to other e-government efforts might be feasible? A functional needs assessment will determine to what extent, if any, a common system might be feasible.
Process data manually	This scenario would result in the termination of PAOS, but the processes would still be performed manually. The current process that is automated through PAOS would be performed by solely manual functions. Do the volume of transactions and processes, complexity of the functions, time and accuracy response requirements, and number and diversity of data access methods and locations make manual processing impractical?
Eliminate the system	This scenario would result in the termination of PAOS. Does the organizational mission still require the processes and functions performed by the system? Has a “sunset“ law or other legislation or executive decision affected the need for this system? Have organizational responsibilities or realignments affected the need for this system or significantly changed the requirements for it?

ALTERNATIVES SELECTED FOR DETAILED ANALYSIS

An initial assessment of each of the 10 alternatives was conducted, considering their alignment with the IHS mission, project size and complexity, market survey results, and viability. The following alternatives were selected for a BCA and weighted-score analysis:

- Maintain the status quo: outsource maintenance and operational support of the current system
- Outsource maintenance of the current system, with IHS hosting
- Use in-house (government) resources for development and operational support, with IHS hosting
- Design and develop a new system.

Chapters 4 and 5, respectively, present the results of the BCA and weighted-score analysis for these four alternatives.

ALTERNATIVES ELIMINATED FROM FURTHER ANALYSIS

Six of the 10 alternatives were eliminated from further analysis:

- *Eliminate the system.* The need for the system was validated through the IHS mission and PMA; therefore, this alternative was not viable.
- *Process data manually.* The amount of data and the effort required to meet functionality requirements made this alternatives impracticable.
- *Implement a commercial system.* Market surveys in FY00 and FY09 found no COTS packages available that could meet IHS needs.
- *Use a GOTS solution developed by another agency.* Market surveys found no single GOTS package that could meet PAOS requirements.
- *Develop a government-wide system.* The requirements for PAOS are unique enough to IHS that development of a government-wide system cannot be justified.
- *Consolidate similar IHS database applications.* No other applications at IHS could meet PAOS requirements.

The following subsections explain in more detail why these six alternatives were eliminated from further analysis.

Eliminate the System

OMB A-94 guidelines indicate that when evaluating a capital investment, doing nothing (buying nothing) should be considered as an alternative. The system should be evaluated to ensure that the need still exists. For example, “sunset“ legislation may fix the life of a program and, therefore, the life of the system supporting it. Also, the functions of the system may have been included in another system or project, or changes in organizational responsibility may have changed the system needs. A system needs assessment should be one of the first steps in the analysis of alternatives.

RSU still has a business need for PAOS. It supports the RSU mission to promote individual and community health and well being in a culturally respectful and responsive manner. No legislation, administration direction, or HHS goal or priority has minimized the need for PAOS. Also, PAOS directly supports FTF Goal for Federal Health Architecture by improving management of the data collected by using information technology. PAOS should not be eliminated.

Process Data Manually

Manual processing was evaluated to determine if the volume and complexity of processing, accuracy level, user interface, or response times created constraints that could not be accommodated by manual processing. The feasibility of manual processing does not mean that manual processing would have been the recommended alternative, only that manual processing would have been an alternative to be included among those for which a BCA was conducted. However, the requirements for volume, complexity, accuracy, user interface, and response times all exceeded the capacity of an acceptable manual system. Regardless of the number of personnel that could be made available or the efficiency of the manual processes, the amount of data, the time sensitivity of the data, and the number of database searches make manual processing impractical.

Implement a Commercial System

This alternative is a complete COTS solution. The alternative would use a commercially developed application that meets the business requirements now furnished by PAOS. The application and its hosting could be outsourced to an existing commercial source. Market surveys in FY09 did not identify any existing turnkey commercial sources that could meet the needs of PAOS. Some commercial support, such as commercial hosting and commercial database application development and support, is available. This combination of commercially available support is included in other alternatives that are being evaluated as part of the BCA and weighted-score analysis.

Use a GOTS Solution Developed by another Agency

The FY09 market survey included a search for both commercial and government systems. The search for government systems included NIH Institutes and Centers and the Department of Veterans Affairs (VA). RSU's prescription-related work requires numerous databases; however, none of those databases found meet the specific needs of PAOS.

Develop a Government-Wide System

PAOS is a valuable system for RSU, and its application concept has potential relevance at other agencies. However, the scope and requirements for PAOS are not large enough, complex enough, or consistent enough across agencies to justify the administrative personnel and resources overhead, collaboration complexity and time, integrated development costs (for use at multiple agencies), additional review and approval processes, and increased deployment efforts to make it a government-wide initiative.

Consolidate Similar Service Unit Database Applications

PAOS would not be enhanced by consolidation with any other IHS application. Most IHS applications are focused on treatment rather than prescription ordering and tracking. Also, they are built on architecture that will not adapt easily to the PAOS. Primarily, the architecture of the older applications precludes consolidating all database applications into one application; therefore this alternative was eliminated.

Chapter 3
Assumptions

To frame the analysis, numerous global, life-cycle, cost, and benefits assumptions were identified. The chapter describes those assumptions. Assumptions specific to a particular alternative are contained in Chapter 4 as part of the BCA.

GLOBAL ASSUMPTIONS

The following are the key global assumptions used in this analysis of alternatives:

- The analysis includes the requirements of the alternatives analysis portion of the A-11 Exhibit 300 business case.
- The analysis includes the alternatives identified in HHS's *IRM Policy for Conducting Information Technology Alternatives Analysis* (June 2003).
- The analysis will furnish the data needed in the alternatives analysis section of the HHS IT portfolio management tool (PMT, currently Primavera ProSight), including costs by required cost elements, by life-cycle phase, and by year, for each alternative for which a BCA is conducted.
- The analysis has two components: a benefit-cost analysis using OMB guidelines and a weighted-score analysis using HHS's *IRM Policy for Conducting Information Technology Alternatives Analysis* (June 2003).

LIFE-CYCLE ASSUMPTIONS

The analysis uses the following life-cycle assumptions and calculations:

- The analysis starts with FY11 so that the selection of the alternative can be made consistent with the next budget submission.
- The analysis is for a 7-year project life: FY11–FY17.
- The BCA will be presented by the life-cycle phases described in OMB Exhibit 300.[18]

[18] OMB Circular A-11, *Preparation, Submission, and Execution of the Budget*, Exhibit 300.

- One annual FTE is 1,776 hours of project time.
- Costs and benefits will be adjusted by an inflation rate of 3.4 percent.[19]
- Costs and benefits will be adjusted for mid-year net present value (NPV). Use of the mid-year value assumes that spending during the fiscal year is linear or that the average expenditure rate approximates spending in the middle of the year.
- The NPV discount rate will be 4.9 percent.[20]

COST ASSUMPTIONS

Costs are estimated based on several factors that include not just the cost of a specific service or product at one period in time, but costs over time and by specific categories or cost elements. The categories or types of costs are "cost elements"; they are standardized among all projects. The determinants for the amount of the cost within each of the cost elements are the "cost factors." Costs factors will be used to develop the costs; the factors will vary in both description and amounts within the cost elements for a project.

Cost Factors

Costs are not calculated for each year based simply on a standard inflation factor. Instead, costs are adjusted by year based on specific criteria, including distribution among life-cycle phases. Costs are calculated and adjusted annually as follows:

- Government personnel costs are estimated using the principles of OMB Circular A-76 to compute salary costs. The base General Schedule (GS) salary step 5 is multiplied by 1.3645 to include 36.45 percent for: retirement benefits (26.6 percent), insurance and health benefits (6.7 percent), Medicare benefit (1.45 percent), and miscellaneous fringe benefits (1.7 percent).[21] OMB Circular A-76 provides guidance that personnel costs, including the 36.45 percent for benefits, should then be multiplied by 1.12 to include a 12 percent overhead factor if the analysis is required to provide the full cost of government personnel.[22] **The 12 percent overhead is not included in the OMB Exhibit 300 submission** and is normally not applicable for most IHS analyses.

[19] OMB Circular A-76, *Performance of Commercial Activities*, Transmittal Memo 25.

[20] OMB Circular A-94, *Discount Rates for Cost-Effectiveness, Lease Purchases, and Related Analyses,* Appendix C, Revised, January 2006.

[21] OMB Memorandum M-07-02, "Update to Civilian Position Full Fringe Benefit Cost Factor, Federal Pay Raise Assumptions, Inflation Factors, and Tax Rates used in OMB Circular No. A-76, 'Performance of Commercial Activities,'" October 31, 2006.

[22] OMB Circular A-76 (Revised), Appendix E, Section B.4, November 14, 2002.

- Step 5 of the applicable GS grade is used for the base salary of government employees.[23] The latest table at the time that the analysis was conducted (hypothetically CY2009) has been increased by the inflation rate to derive the 2011 rates.

- Costs are increased annually by the inflation rate for each year of the project life.

- Contract employee costs are based on actual current costs (adjusted for inflation) or on industry average costs that include general and administrative (G&A) costs, overhead, and profit.

- Security is defined separately so that it can be reported in the OMB Exhibit 300.[24]

- Each alternative is risk adjusted per OMB requirements. The risk costs are discussed separately in the analysis of each alternative.

Cost Elements

The cost categories are divided into nine cost elements. These cost elements are consistent with those used in the PMT tables. Not all of the elements will be required; the elements required will vary depending upon project needs. The cost elements used will also vary among the life-cycle phases within a project.

- *Program staff.* This cost element is for the government personnel directly participating in developing the PAOS project. It includes staff members for program management and for those IT services furnished by government personnel, and it includes program staff members who are part of the alternative implementations (data migration, parallel operations, testing, document and process reviews, etc.). It does not include the normal business operations of the PAOS users.

- *Training and administration.* This cost element includes development of training materials specific to the PAOS processes implemented by the alternative and delivery of the training (such as web or classroom).

- *Contract services.* This cost element includes all services not performed by the PAOS government staff, including services from other government organizations and from commercial firms. Contracts and interagency agreements for all services such as development, testing, implementation, training, and O&M are included.

[23] Office of Personnel Management, Salary Table 2006-DCB, Effective January 2006.

[24] OMB Circular A-11, Part 7, "Planning, Budgeting, Acquisition, and Management of Capital Assets," July 2006.

- *Software.* This cost element is for commercial purchases, licenses, and annual user and maintenance fees. It does not include the cost of software developed for PAOS by in-house employees or through contract services; those costs are reported under program staff or contract services, respectively.

- *Hardware.* This cost element is for IT hardware unique or specific to the alternative. It does not include the standard desktop workstations and infrastructure that support all employees who use PAOS.

- *Equipment.* This cost element is for equipment other than IT equipment and hardware. IT equipment/hardware is reported under "hardware" and non-IT equipment/hardware is reported under "equipment."

- *Facility.* This cost element is for the facility associated only with the alternative. This includes technical support staff facility and IT operations areas, but not the space for PAOS users who are needed regardless of the alternative selected.

- *Security.* Security must now be reported separately as part of the OMB business case.[25] When security is an integral part of the solution and cannot be easily identified by a separate task or purchase, its cost is estimated by a percentage of the project cost. The estimated percentage is based on the level of security built into the system.

- *Risk and other.* This cost element is for assessing and mitigating the risks associated with each alternative and for including any costs not identified in the other cost elements. The level of risk varies among the alternatives; OMB requires that the risk be assessed and mitigated.[26]

BENEFITS ASSUMPTIONS

PAOS has been operational for several years. However, it is also undergoing development, modernization, and enhancement. Therefore, for the analysis, the benefits will be identified for the steady-state portion of PAOS (ongoing operations) and combined with the new benefits to be derived from the DME activities, which will vary with the specific alternative and implementation approach.[27] (This is consistent with the costs provided for ongoing operations and DME.) In other words, because the benefits of PAOS have already been evaluated as currently operated and are benefits for all four alternatives, the emphasis of the benefits analysis will be on the benefits of DME.

[25] See Note 6.

[26] See Note 6.

[27] Costs and benefits for only DME cannot be analyzed exclusive of the current functionality because the alternatives that would provide the additional functionality also require changes that affect how the current functionality is provided.

Benefits must be classified as “cost savings” or “cost avoidance.”

Operational Benefits

The operational benefits of PAOS are constant for all alternatives. The estimated ongoing annual benefits for PAOS (previously determined) are $1.607 million (using FY11 rates and incorporating the assumed annual inflation rate). The estimated benefits of the current operational capability of PAOS are based on the following:

- Elimination of duplicate data entry across several organizations and among multiple databases
- Reduction in time to search data (fewer sources, accessed more quickly)
- Reduction in the time required for gathering, formatting, and compiling information
- Improvement in data quality, which has reduced time for correction of errors and the subsequent cost impact of these corrections
- Increase in information sharing and collaboration, which has expedited analysis and decision making and resulted in more timely conclusions and solutions
- More meaningful data through standardization of data definitions and processing
- Faster and more accurate reporting (automated rather than manual)
- Ability to automate queries to minimize time-consuming manual searches
- Improvement in data management across several organizations responsible for science, administrative, and regulatory concerns
- Empowerment of staff members to make knowledgeable decisions by improving access to quality data.

DME Benefits

The amount of the annual DME benefits of PAOS is the same for all alternatives. The development or enhancements that will provide the benefits will be completed incrementally over several years. The benefits, therefore, will also be realized incrementally. Below are listed the quantifiable DME benefits and, for each, the assumptions and the estimated annual benefit based on FY11 rates and inflated by the assumed annual inflation rate:

- *Reduction in time required to populate missing data fields*. Incorporating business rules and alerts on mandatory or required data elements would reduce the number of data elements or null values that are entered. Data cleanup is ongoing to ensure complete and consistent data management and reporting. Providing automated data edits in PAOS would ensure the timely availability of accurate and complete data. It involves 60 prescription categories, each missing data in an average of four data fields. This real-time correction will save a GS-13 four hours per data field per prescription area (monthly) to populate the missing data. The estimated annual benefit is $0.842 million.

- *Reduction in data correction requirements.* An indirect benefit of implementing business rules would reduce the data correction time. Each quarter, 60 business reports are submitted and reviewed. Business rules could trigger a message informing the submitter of incomplete or required data. Pick-lists with valid values would provide better control over the data that are being submitted. Correction time will be reduced for a GS-13 by an estimated 10 hours per quarter when data and completion checks are incorporated. The estimated annual benefit is $0.175 million.

- *Automation of current manual synchronization.* Data must now be synchronized manually between PAOS and other systems throughout the year (about 10 times per year). Developing an interface that would automatically synchronize data between these systems would eliminate the need to synchronize these data manually. Currently, 50 data elements and milestones are manually entered and cross-checked in the systems. Synchronization involves 91 areas with 4 elements per area, for a total of 364 synchronizations. It is assumed that the time will be reduced by 4 hours per synchronization for a GS-13 when the databases are interfaced. The estimated annual benefit is $0.199 million.

- *Reduction in follow-up correspondence time*. Each prescription category requires development of a standard set of correspondence, which is now done manually. Assuming 300 prescription categories are active each year and each has an average of 10 pieces of correspondence, automation of prescription-related correspondence will save a GS-13 0.5 hour per piece of correspondence. The estimated annual benefit is $0.110 million.

- *Reduction in time to gather internal and external data for status reporting.* Creating a central tracking screen in PAOS would reduce the time required to gather, format, and compile the mandatory documents needed for prescription status reporting. Currently, 10 prescription-related documents are tracked by various organizations and systems for each protocol. About 1,500 status reports that contribute to the prescription program are produced annually. It is assumed that the time required by a GS-13 will be reduced by 8 hours per report when collection of all data related to the internal and external prescription ordering project is

centralized and the data can be extracted directly from PAOS. The estimated annual benefit is $0.877 million.

- *Automation of queries for required and ad hoc reporting of data*. A query module with standard and ad hoc reporting would assist the staff with generating and responding to an average of 13 queries per quarter per staff member (five staff members). It is assumed that, by standardizing these reports and providing a simple interface to generate new reports, a GS-13 employee will save about 24 hours per query. The estimated annual benefit is $0.456 million.

- *Automation of current manual administrative and accounting functions.* Data must be shared between PAOS and administrative and accounting systems continually to ensure ordering and payment consistency and accuracy. This involves 1,500 prescription-related documents that now need manual attention. When the database sharing is automated, It is assumed that a savings of 1.5 hours per prescription document for a GS-13 to identify inconsistencies and prepare a notification and savings of another 3 hours for a GS-13 to reenter the correct data. The estimated annual benefit is $0.493 million.

- *Automation of tracking*. Each year aggregated patient demographic data are reported to IHS's population tracking system. It is estimated that, as 50 different prescription reports are generated annually, a GS-13 will save about 8 hours per report when the data can be organized, extracted, and aggregated by automated tracking. The estimated annual benefit is $0.029 million.

- *Reduction in consultation time.* Each prescription program requires an average of six review cycles. The milestones reached at each review cycle must be reviewed by medical consultants for each of the 10 new prescription programs that require review each year. Automation of milestone tracking and furnishing of data would save a GS-13 approximately 4 hours per review. The estimated annual benefit is $0.018 million.

- *Reduction in changes to other integrated systems (databases).* Six databases are changed six times per year, at an average cost of $5,000 per database per change. Integration or consolidation of the databases into a single PAOS enterprise system will eliminate this need. The estimated annual benefit is $0.180 million.

Chapter 4
Benefit-Cost Analysis

This chapter presents the benefit-cost analysis of the status quo and three alternatives for PAOS:

- Alternative 1—maintain the status quo: outsource maintenance and operational support of the current system
- Alternative 2—outsource maintenance of the current system, with IHS hosting
- Alternative 3—use in-house (government) resources for development and operational support, with IHS hosting
- Alternative 4—design and develop a new system.

ALTERNATIVE 1—MAINTAIN THE STATUS QUO

Under this alternative, the DME and maintenance of PAOS will continue to be outsourced, as will operational support, including the commercial operating software, facility, and hosting support. Management of contract support is by IHS personnel, who allocate hours from their full-time schedule. The following subsections present the costs, benefits, and ROI for this alternative.

Costs

Table 4-1 presents the costs for the status quo. Costs that are applicable to both the acquisition and O&M phases without being clearly distinguishable between them are estimated at 30 percent acquisition and 70 percent O&M. Planning costs are small and therefore not broken out separately. The cost elements were defined in Chapter 3 and global assumptions were presented. The following explains the cost elements specific to this alternative:

- *Program staff.* Two GS-14s share project management responsibility. PAOS represents 80 percent of the workload of each. One GS-9 employee supports PAOS at 60 percent. The analysis begins with FY11, but the latest GS pay schedule was for 2009. The inflation rate of 3.4 percent[28] was used twice to estimate the 2011 GS salaries.[29] If the GS-14 step 5

[28] See Chapter 3 Assumptions, Life-Cycle Assumptions.

[29] GS salaries do not change with the fiscal year; they change in January. The difference for this analysis is minor enough to not be included.

salary in 2009 was $103,594 and the GS-9 salary was $50,839., the 2011 salary, including benefits of 36.45 percent[30] for each, is:

- GS-14 = (103,594) (1.034) (1.034) (1.3645) = $151,129 annually.
- GS-09 = (050,839) (1.034) (1.034) (1.3645) = $74,167 annually.

Two GS-14 salaries at 80 percent each is $241,807 and one GS-9 at 60 percent is $44,500 or $286,407 total. As stated in the introduction to this section, 30 percent is for acquisition and 70 percent for O&M. In millions, as required by OMB reporting, this is $0.086 for acquisition and $0.200 for O&M.

- *Training.* Training is included in the current contracts, but training is not significant enough to be a separate contract item. Training is provided individually, as needed, by the help desk or contract personnel.
- *Contract services.* Because PAOS is outsourced, IT support contracts are the largest part of the PAOS budget.
- *Software.* Software is included in the current contracts.
- *Hardware (IT).* IT hardware is included in the current contracts.
- *Equipment (non*-IT). No equipment is needed.
- *Facilities.* Contractor facilities are included in the contracts, and government employee facilities are included in other funding.
- *Security.* The security costs are for evaluations, studies, reports, and corrective action.
- *Risk and other.* PAOS has been successfully operating and meeting requirements. The status quo presents no changes that introduce additional risk. Risk is minimum, estimated at 5 percent.
- *Tribal Costs.* There are no costs expected to be bourn by the tribes.

Training, software, hardware, equipment, facilities, and tribal costs have no separate costs identified by their cost element; therefore, the tables have zeroes as entries for them.

[30] See Chapter 3, Assumptions, Cost Assumptions, Cost Factors.

Table 4-1. Alternative 1—Maintain the Status Quo: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Planning costs								
Program staff								0.000
Training								0.000
Contract services								0.000
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security								0.000
Risk and other								0.000
Tribal Costs								0.000
Subtotal								0.000
Acquisition costs								
Program staff	0.086	0.089	0.092	0.095	0.098	0.101	0.105	0.666
Training and administration								0.000
Contract services	0.888	0.817	0.685	0.591	0.621	0.652	0.685	4.939
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.016	0.017	0.017	0.018	0.018	0.019	0.020	0.124
Risk and other	0.049	0.046	0.040	0.035	0.037	0.039	0.040	0.286
Tribal Costs								0.000
Subtotal	1.039	0.968	0.834	0.739	0.774	0.811	0.850	6.016
Maintenance costs								
Program staff	0.200	0.207	0.214	0.221	0.229	0.237	0.245	1.553
Training and administration								0.000
Contract services	1.155	1.328	1.568	1.774	1.863	1.956	2.054	11.698
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.037	0.039	0.040	0.041	0.043	0.044	0.046	0.290
Risk and other	0.070	0.079	0.091	0.102	0.107	0.112	0.117	0.677
Tribal Costs								0.000
Subtotal	1.462	1.652	1.913	2.139	2.241	2.349	2.462	14.219

Table 4-1. Alternative 1—Maintain the Status Quo: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Total life-cycle costs								
Program staff	0.286	0.296	0.306	0.316	0.327	0.338	0.350	2.219
Training and administration								0.000
Contract services	2.043	2.145	2.253	2.365	2.484	2.608	2.739	16.637
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.053	0.055	0.057	0.059	0.061	0.063	0.065	0.415
Risk and other	0.119	0.125	0.131	0.137	0.144	0.150	0.158	0.964
Tribal Costs								0.000
Total	2.502	2.621	2.747	2.877	3.016	3.160	3.312	20.234

Benefits

Table 4-2 presents the benefits for the status quo. The existing benefits will continue and 10 new benefits will be implemented in future years[31]. A definitive schedule for all DME efforts for FY11–FY17 has not yet been developed. The sequence of activities and time to implement them will affect when the benefits will first be realized. Implementation estimates are being made based on two of the 10 benefits from DME being first realized in each of 5 years beginning in FY12. This allows one year for DME efforts, with the benefits being realized in the following year.

The benefits calculations in Chapter 3 are based on FY09 dollars; benefits must be increased by the inflation rate for each year after FY09. For example, the benefit of reducing the time required to populate missing data fields will begin in FY12, 3 years after FY09; therefore, the FY12 initial value must be increased three times from the base FY09 year:

$$\text{FY12 (start)} = (0.842)\ (1.034)\ (1.034)\ (1.034) = 0.930$$

This same procedure is used for all benefits. The value will be inflated each year after FY09 (until its initial entry into the table), and the inflation rate will continue to be applied each year after it is entered in the table. Realization of the DME benefits begins in the following years:

[31] Chapter 3, Assumptions, Benefits Assumptions lists each benefit and the expected annual monetary value.

- FY12
  Reduction in time required to populate missing data fields
  Reduction in data correction requirements

- FY13
  Automation of current manual synchronization
  Reduction in follow-up correspondence time

- FY14
  Reduction in time to gather internal and external data for status reporting
  Automation of queries for required and ad hoc reporting of data

- FY15
  Automation of current manual administrative and accounting functions
  Automation of tracking

- FY16
  Reduction in consultation time
  Reduction in changes to other integrated systems (databases).

The sequence and times may vary; however, the benefits below and timing for them are reasonable expectations.

Table 4-2. Alternative 1—Maintain the Status Quo: Benefits ($ million)

Benefit	Type of Benefit	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Currently implemented benefits	Cost avoidance	1.718	1.777	1.837	1.900	1.964	2.031	2.100	13.327
Time to populate missing data	Cost avoidance		0.930	0.962	0.995	1.029	1.063	1.100	6.079
Data correction	Cost avoidance		0.194	0.200	0.207	0.214	0.222	0.229	1.266
Data synchronization	Cost avoidance			0.228	0.236	0.244	0.252	0.261	1.220
Follow-up correspondence	Cost avoidance			0.125	0.130	0.134	0.138	0.143	0.670
Data gathering	Cost avoidance				1.036	1.071	1.108	1.145	4.361
Automation of queries	Cost avoidance				0.539	0.557	0.576	0.596	2.268
Automation of administration and accounting	Cost avoidance					0.603	0.623	0.644	1.870
Automation of tracking	Cost avoidance					0.036	0.037	0.038	0.111
Reduced consulting time	Cost avoidance						0.022	0.023	0.045
Reduced changes to other systems	Cost avoidance						0.227	0.235	0.463
Total		1.718	2.901	3.353	5.042	5.852	6.300	6.514	31.680

Return on Investment

Table 4-3 presents the ROI and payback period for the status quo.[32] The annual ROI for the project over its life is 52.3 percent and the payback period is 2.94 years. This means that costs will equal benefits in 2.94 years; this is the "break-even" point.

Table 4-3. Alternative 1—Maintain the Status Quo: ROI ($ million)

Item	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Annual costs	2.502	2.621	2.747	2.877	3.016	3.160	3.312	20.234
Annual benefits	1.718	2.901	3.353	5.042	5.852	6.300	6.514	31.680
Midyear discount factor	0.9764	0.9308	0.8873	0.8458	0.8063	0.7687	0.7328	NA
Discounted costs (DC)	2.443	2.439	2.437	2.434	2.432	2.429	2.427	17.040
Discounted benefits (DB)	1.678	2.700	2.975	4.264	4.718	4.843	4.773	25.951
Discounted net benefits (DB–DC)	−0.765	0.261	0.538	1.831	2.287	2.414	2.347	8.911
Cumulative net benefits	−0.765	−0.504	0.033	1.864	4.151	6.564	8.911	
Benefit/cost ratio	0.687	1.107	1.221	1.752	1.940	1.994	1.967	1.523
ROI (%)	−31.3%	10.7%	22.1%	75.2%	94.0%	99.4%	96.7%	52.3%
Payback (years)			2.94					

ALTERNATIVE 2—OUTSOURCE MAINTENANCE OF THE CURRENT SYSTEM, WITH IHS HOSTING

This alternative retains the contract support for DME and O&M of PAOS. PAOS would be hosted at IHS. In other words, the DME and support contract would stay as it is now, but the operation of PAOS would be moved to IHS. PAOS project management would still be performed by part-time IHS personnel as it is under the status quo alternative. The following subsections present the costs, benefits, and ROI for this alternative.

Costs

Table 4-4 presents the costs for Alternative 2. Costs that are applicable to both the acquisition and O&M phases without being clearly distinguishable between them are estimated at 30 percent acquisition and 70 percent O&M. Planning costs are small and therefore not broken out separately. The cost elements were defined in Chapter 3 and global assumptions were presented. The following explains the cost elements for this alternative:

[32] The *"How to" Guide for Analysis of Alternatives* explains how the ROI and payback period are calculated. See Step 4: Analyze the Costs and Benefits of the Most Viable Alternatives, items (9) and (10).

- *Program staff.* Two GS-14 project managers share responsibility. PAOS will represent 100 percent of the workload of each. Two GS-9 employees will support PAOS at about 60 percent each. This is an increase over the status quo because of the coordination needed for transfer of the hosting site and interface for private contractors with the government facility once it is transferred. The analysis begins with FY11, but the latest GS pay schedule was for 2009. The inflation rate of 3.4%[33] was used twice to estimate the 2011 GS salaries.[34] GS-14 step 5 salary in 2009 was $103,594; GS-9 was $50,839. The 2011 salary, including benefits of 36.45 percent[35] for each, is:

  - GS-14 = (103,594) (1.034) (1.034) (1.3645) = $151,129 annually.

  - GS-09 = (050,839) (1.034) (1.034) (1.3645) = $074,167 annually.

  Two GS-14 salaries at 100 percent each is $302,259, and two GS-9 salaries at 60 percent is $86,034 or $388,293 total. As stated in the introduction to this section, 30 percent is for acquisition and 70 percent for O&M. In millions, as required by OMB reporting, this is $0.116 for acquisition and $0.272 for O&M.

- *Training and administration.* Training will be included through contract support but is not significant enough to be a separate contract item. Training will be provided individually, as needed, by the help desk.

- *Contract services.* PAOS application support is outsourced to a private contractor. Even though IHS is a government facility, the IHS hosting costs are listed under contract services because the costs would be paid for through a reimbursable agreement with the PAOS program.

  - The current DME contract is unchanged under this alternative; however, operations will be separated from maintenance. The costs for maintenance and the costs for operations are not identified separately in the current contract; they are estimated at about 50 percent each. Therefore, the contract is reduced by 50 percent in this alternative (IHS will host PAOS).

  - PAOS will need three servers at about $25,000 each. Their purchase is assumed to be through IHS so their cost is included in the IHS reimbursable contract (agreement) and prorated as part of the annual cost.

[33] See Chapter 3 Assumptions, Life-Cycle Assumptions.

[34] GS salaries do not change with the fiscal year; they change in January. The difference for this analysis is minor enough to not be included.

[35] See Chapter 3, Assumptions, Cost Assumptions, Cost Factors.

  - Operational staffing will not be dedicated to PAOS. It will be 25 to 50 percent of 6 to 12 operations personnel. It is estimated that a total of 3.0 full-time equivalents (FTEs) at a GS-13 level are required.

- *Software.* Software is included in the contract.
- *Hardware (IT).* IT hardware is included in the IHS reimbursable agreement.
- *Equipment (non-IT).* No equipment is needed.
- *Facilities.* Contractor facilities are included in the contract and government employee facilities are included in other funding.
- *Security.* The security costs are for evaluations, studies, reports, and corrective action.
- *Risk and other.* PAOS has been successfully operating and meeting requirements. Moving the hosting site to IHS, without changing the application being hosted, is a small risk. Risk is estimated at 5 percent.
- *Tribal Costs.* There are no costs expected to be bourn by the tribes.

Training, software, hardware, equipment, facilities, and tribal costs have no separate costs identified by their cost element; therefore, the tables have zeroes as entries for them.

Table 4-4. Alternative 2—Outsource Maintenance of the Current System, with IHS Hosting: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Planning costs								
Program staff								0.000
Training and administration								0.000
Contract services								0.000
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security								0.000
Risk and other								0.000
Tribal Costs								0.000
Subtotal								0.000

Table 4-4. Alternative 2—Outsource Maintenance of the Current System, with IHS Hosting: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Acquisition costs								
Program staff	0.116	0.120	0.125	0.129	0.133	0.138	0.142	0.903
Training and administration								0.000
Contract services	1.240	1.129	0.952	0.808	0.851	0.896	0.944	6.820
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.016	0.017	0.017	0.018	0.018	0.019	0.020	0.124
Risk and other	0.069	0.063	0.055	0.048	0.050	0.053	0.055	0.392
Tribal Costs								0.000
Subtotal	1.442	1.329	1.148	1.002	1.052	1.105	1.161	8.240
Maintenance costs								
Program staff	0.272	0.281	0.291	0.300	0.311	0.321	0.332	2.107
Training and administration								0.000
Contract services	1.498	1.755	2.086	2.390	2.515	2.648	2.785	15.677
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.037	0.039	0.040	0.041	0.043	0.044	0.046	0.290
Risk and other	0.090	0.104	0.121	0.137	0.143	0.151	0.158	0.904
Tribal Costs								0.000
Subtotal	1.898	2.178	2.537	2.869	3.012	3.164	3.321	18.979

Table 4-4. Alternative 2—Outsource Maintenance of the Current System, with IHS Hosting: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Total life-cycle costs								
Program staff	0.388	0.401	0.415	0.429	0.444	0.459	0.474	3.011
Training and administration								0.000
Contract services	2.739	2.884	3.038	3.198	3.366	3.544	3.729	22.497
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.053	0.055	0.057	0.059	0.061	0.063	0.065	0.415
Risk and other	0.159	0.167	0.175	0.184	0.194	0.203	0.213	1.296
Tribal Costs								0.000
Total	3.339	3.508	3.685	3.871	4.065	4.269	4.482	27.218

Benefits

Table 4-5 presents the benefits for Alternative 2. The existing benefits will continue and 10 new benefits will be implemented in future years.[36] A schedule for DME efforts for FY11–FY17 has not yet been developed. Implementation estimates are being made based on moving the hosting site in FY11 and, in FY12, starting the DME activities that will bring additional benefits. The new benefits will be first realized in FY13. This allows one year for DME efforts, with the benefits being realized in the following year.

The benefits calculations in Chapter 3 are based on FY09 dollars; benefits must be increased by the inflation rate for each year after FY09. For example, the benefit of reducing the time required to populate missing data fields will begin in FY13, 4 years after FY09; therefore, the FY13 initial value must be increased four times from the base FY09 year:

$$\text{FY13 (start)} = (0.842)\ (1.034)\ (1.034)\ (1.034)\ (1.034) = 0.962.$$

This same procedure is used for all benefits. The value will be inflated each year after FY09 (until its initial entry into the table), and the inflation rate will continue to be applied each year after it is entered in the table. Realization of the DME benefits begins in the following years:

[36] Chapter 3, Assumptions, Benefits Assumptions lists each benefit and the expected annual monetary value.

- FY13
  Reduction in time required to populate missing data fields
  Reduction in data correction requirements
  Automation of current manual synchronization

- FY14
  Reduction in follow-up correspondence time
  Reduction in time to gather internal and external data for status reporting
  Automation of queries for required and ad hoc reporting of data

- FY15
  Automation of current manual administrative and accounting functions
  Automation of tracking

- FY16
  Reduction in consultation time
  Reduction in changes to other integrated systems (databases).

The sequence and times may vary; however, the benefits below and timing for them are reasonable expectations.

Table 4-5. Alternative 2—Outsource Maintenance of the Current System, with IHS Hosting: Benefits ($ million)

Benefit	Type of Benefit	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Currently implemented benefits	Cost avoidance	1.718	1.777	1.837	1.900	1.964	2.031	2.100	13.327
Time to populate missing data	Cost avoidance			0.962	0.995	1.029	1.063	1.100	5.148
Data correction	Cost avoidance			0.200	0.207	0.214	0.222	0.229	1.073
Data synchronization	Cost avoidance			0.228	0.236	0.244	0.252	0.261	1.220
Follow-up correspondence	Cost avoidance				0.130	0.134	0.138	0.143	0.545
Data gathering	Cost avoidance				1.036	1.071	1.108	1.145	4.361
Automation of queries	Cost avoidance				0.539	0.557	0.576	0.596	2.268
Automation of administration and accounting	Cost avoidance					0.603	0.623	0.644	1.870
Automation of tracking	Cost avoidance					0.036	0.037	0.038	0.111
Reduced consulting time	Cost avoidance						0.022	0.023	0.045
Reduced changes to other systems	Cost avoidance						0.227	0.235	0.463
Total		1.718	1.777	3.228	5.042	5.852	6.300	6.514	30.430

Return on Investment

Table 4-6 presents the ROI and payback period for Alternative 2.[37] The annual ROI for the project over its life is 8.2 percent, and the payback period is 5.75 years. This means that costs will equal benefits in 5.75 years; this is the "break-even" point.

Table 4-6. Alternative 2—Outsource Maintenance of the Current System, with IHS Hosting: ROI ($ million)

Item	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Annual costs	3.339	3.508	3.685	3.871	4.065	4.269	4.482	27.218
Annual benefits	1.718	1.777	3.228	5.042	5.852	6.300	6.514	30.430
Midyear discount factor	0.9764	0.9308	0.8873	0.8458	0.8063	0.7687	0.7328	NA
Discounted costs (DC)	3.260	3.265	3.270	3.274	3.277	3.281	3.284	22.912
Discounted benefits (DB)	1.678	1.654	2.864	4.264	4.718	4.843	4.773	24.794
Discounted net benefits (DB–DC)	−1.583	−1.611	−0.406	0.990	1.441	1.561	1.489	1.882
Cumulative net benefits	−1.583	−3.194	−3.600	−2.609	−1.169	0.393	1.882	
Benefit/cost ratio	0.515	0.507	0.876	1.303	1.440	1.476	1.453	1.082
ROI (%)	−48.5%	−49.3%	−12.4%	30.3%	44.0%	47.6%	45.3%	8.2%
Payback (years)						5.75		

ALTERNATIVE 3—USE IN-HOUSE (GOVERNMENT) RESOURCES FOR DEVELOPMENT AND OPERATIONAL SUPPORT, WITH IHS HOSTING

This alternative uses government resources to support PAOS. DME and maintenance of the system will be by government employees and the hosting would be at IHS. The following subsections present the costs, benefits, and ROI for this alternative.

Costs

Table 4-7 presents the costs for Alternative 3. Unlike the status quo and Alternative 2, the transition to an in-house system requires planning resources significant enough to be addressed separately. The resources required by life cycle phases will vary by year, both by the actual amount and by the proportion of total resources. Planning resource requirements will be greater in the beginning years

[37] The *"How to" Guide for Analysis of Alternatives* explains how the ROI and payback period are calculated. See Step 4: Analyze the Costs and Benefits of the Most Viable Alternatives, items (9) and (10).

of the project and will decrease as the project moves through acquisition and into operations and maintenance. The following explains the cost elements for this alternative:

- *Program staff.* The project management staff will be a GS-15 project manager and two GS-14 managers (one for IT and one for business requirements). The project staff will be responsible for both the DME and O&M of PAOS. The staff needs are estimated at eight: three database administrators and five computer specialists (three GS-14s and five GS-13s). The staff will also provide training, as needed, and help desk support. Administrative support may be from several employees; however, the total will be 1.7 FTE at GS-9. PAOS team membership, committees, and other user participation will come from several different employees that in the aggregate, will represent 1.0 FTE at GS-15, 2.0 FTE at GS-14, and 3.0 FTEs at GS-13.

  The analysis begins with FY11, but the latest GS pay schedule was for 2009. The inflation rate of 3.4 percent[38] was used twice to estimate the 2011 GS salaries.[39] GS-15 step 5 salary in 2009 was $121,856; GS-14 was $103,594; GS-13 was $87,664; and GS-9 was $50,839. The 2011 salary, including benefits of 36.45 percent[40] for each, is:

  - GS-15 = (121,856) (1.034) (1.034) (1.3645) = $177,771 annually.
  - GS-14 = (103,594) (1.034) (1.034) (1.3645) = $151,129 annually.
  - GS-13 = (087,664) (1.034) (1.034) (1.3645) = $127,890 annually.
  - GS-09 = (050,839) (1.034) (1.034) (1.3645) = $74,167 annually.

  Two GS-15 FTE is $355,543; seven GS-14 FTE is $1,057,906; eight GS-13 FTE is $1,023,118, and 1.7 GS-9 FTE is $126,084. For FY11, the project manager estimates 30 percent for the planning phase, 30 percent for the acquisition phase, and 40 percent for the operations and maintenance phase. In millions, as required by OMB reporting, the $2.560 total is allocated $0.768 for planning, $0.768 for acquisition, and $1.024 for operations and maintenance. This same process is used in the out years. The number of staff is constant in the out years, but the distribution among the life-cycle phases shifts from planning and acquisition to maintenance.

[38] See Chapter 3 Assumptions, Life-Cycle Assumptions.

[39] GS salaries do not change with the fiscal year; they change in January. The difference for this analysis is minor enough to not be included.

[40] See Chapter 3, Assumptions, Cost Assumptions, Cost Factors.

- *Training and administration.* Training is not significant enough to be a separate contract item. Training is provided individually, as needed, by the help desk.

- *Contract services.* Government personnel will be hired and trained to assume responsibility for PAOS. During this time, PAOS will continue to operate with its current method of contract support. A year of transition costs is included for contract support. PAOS will be hosted at IHS.

- *Software.* Software will be furnished by the IHS reimbursable agreement.

- *Hardware (IT).* IT hardware is included in the IHS reimbursable agreement.

- *Equipment (non-IT).* No equipment is needed.

- *Facilities.* No contractor facilities are needed. Government employee facilities are included in other funding for those employees who are not new employees dedicated to the PAOS project. For this alternative, space for 11 additional employees is furnished at $25 per square foot per year. The average space is 135 square feet, including a proportionate allocation for shared common space.

- *Security.* The security costs are for evaluations, studies, reports, and corrective action.

- *Risk and other.* PAOS has been successfully operating and meeting requirements. There is little risk to the application system as it currently exists. Also, moving the hosting site to IHS without changing the application is a small risk. However, moving responsibility for future changes (for which there are a significant number) and for maintenance of the system to a new staff introduces risk. The overall risk for this alternative is estimated at 10 percent.

- *Tribal Costs.* There are no costs expected to be bourn by the tribes.

Training, software, hardware, equipment, and tribal costs have no separate costs identified by their cost element; therefore, the tables have zeroes as entries for them.

Table 4-7. Alternative 3—Use In-House (Government) Resources for Development and Operational Support, with IHS Hosting: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Planning costs								
Program staff	0.768	0.794	0.684	0.566	0.439	0.303	0.156	3.709
Training and administration								0.000
Contract services								0.000
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities	0.012	0.012	0.011	0.009	0.007	0.005	0.002	0.058
Security								0.000
Risk and other	0.077	0.081	0.069	0.057	0.045	0.031	0.016	0.377
Tribal costs								0.000
Subtotal	0.858	0.887	0.764	0.632	0.490	0.338	0.175	4.144
Acquisition costs								
Program staff	0.768	0.794	0.821	0.707	0.731	0.605	0.626	5.052
Training and administration								0.000
Contract services	0.135	0.140	0.145	0.125	0.129	0.107	0.110	0.890
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities	0.012	0.012	0.013	0.011	0.011	0.009	0.010	0.078
Security	0.016	0.017	0.017	0.018	0.018	0.019	0.020	0.124
Risk and other	0.093	0.096	0.100	0.086	0.089	0.074	0.077	0.615
Tribal costs								0.000
Subtotal	1.024	1.059	1.095	0.947	0.979	0.814	0.842	6.760
Maintenance costs								
Program staff	1.024	1.059	1.231	1.556	1.755	2.118	2.346	11.089
Training and administration								0.000
Contract services	1.471	0.326	0.338	0.374	0.387	0.427	0.441	3.763
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities	0.016	0.016	0.019	0.024	0.027	0.033	0.036	0.172
Security	0.037	0.039	0.040	0.041	0.043	0.044	0.046	0.290
Risk and other	0.255	0.144	0.163	0.200	0.221	0.262	0.287	1.531
Tribal costs								0.000
Subtotal	2.803	1.584	1.791	2.195	2.433	2.883	3.156	16.845

Table 4-7. Alternative 3—Use In-House (Government) Resources for Development and Operational Support, with IHS Hosting: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Total life-cycle costs								
Program staff	2.559	2.646	2.736	2.829	2.926	3.025	3.128	19.850
Training and administration								0.000
Contract services	1.606	0.466	0.482	0.499	0.516	0.533	0.551	4.654
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities	0.040	0.041	0.042	0.044	0.045	0.047	0.049	0.308
Security	0.053	0.055	0.057	0.059	0.061	0.063	0.065	0.415
Risk and other	0.426	0.321	0.332	0.343	0.355	0.367	0.379	2.523
Tribal costs								0.000
Total	4.684	3.530	3.650	3.774	3.902	4.035	4.172	27.748

Benefits

Table 4-8 presents the benefits for Alternative 3. The existing benefits will continue and 10 new benefits will be implemented in future years.[41] Implementation estimates are based on PAOS support transition from contractor to government personnel during FY11 and on the move of the hosting site to IHS in FY11. DME activities that will bring additional benefits will resume in FY12. The new benefits will be first realized in mid-FY13. This is about 6 months later than in Alternative 2 because of the estimated learning curve and residual transition issues from replacing contract personnel with government personnel.

The benefits calculations in Chapter 3 are based on FY09 dollars; benefits must be increased by the inflation rate for each year after FY09. For example, the benefit of reducing the time required to populate missing data fields will begin in FY13, 4 years after FY09; therefore, the FY13 initial value must be increased four times from the base FY09 year:

$$\text{FY13 (start)} = (0.842)\ (1.034)\ (1.034)\ (1.034)\ (1.034) = 0.962.$$

The benefits accrue for only one-half of the year. The FY13 benefit of reducing the time to populate missing data is 0.962 x 0.5 = 0.481.

This same procedure is used for all benefits. The value will be inflated each year after FY09 (until its initial entry into the table) and the inflation rate will continue

[41] Chapter 3, Assumptions, Benefits Assumptions lists each benefit and the expected annual monetary value.

to be applied each year after it is entered in the table. Realization of the DME benefits begins in the following years:

- FY13 (50 percent of the year)
  Reduction in time required to populate missing data fields
  Reduction in data correction requirements
  Automation of current manual synchronization

- FY14
  Reduction in follow-up correspondence time
  Reduction in time to gather internal and external data for status reporting
  Automation of queries for required and ad hoc reporting of data

- FY15
  Automation of current manual administrative and accounting functions
  Automation of tracking

- FY16
  Reduction in consultation time
  Reduction in changes to other integrated systems (databases).

The sequence and times may vary; however, the benefits below and timing for them are reasonable expectations.

Table 4-8. Alternative 3—Use In-House (Government) Resources for Development and Operational Support, with IHS Hosting: Benefits ($ million)

Benefit	Type of Benefit	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Currently implemented benefits	Cost avoidance	1.718	1.777	1.837	1.900	1.964	2.031	2.100	13.327
Time to populate missing data	Cost avoidance			0.481	0.995	1.029	1.063	1.100	4.667
Data correction	Cost avoidance			0.100	0.207	0.214	0.222	0.229	0.972
Data synchronization	Cost avoidance			0.114	0.236	0.244	0.252	0.261	1.106
Follow-up correspondence	Cost avoidance				0.130	0.134	0.138	0.143	0.545
Data gathering	Cost avoidance				1.036	1.071	1.108	1.145	4.361
Automation of queries	Cost avoidance				0.539	0.557	0.576	0.596	2.268
Automation of administration and accounting	Cost avoidance					0.603	0.623	0.644	1.870
Automation of tracking	Cost avoidance					0.036	0.037	0.038	0.111
Reduced consulting time	Cost avoidance						0.022	0.023	0.045
Reduced changes to other systems	Cost avoidance						0.227	0.235	0.463
Total		1.718	1.777	2.532	5.042	5.852	6.300	6.514	29.735

Return on Investment

Table 4-9 presents the ROI and payback period for Alternative 3.[42] The annual ROI for the project over its life is 2.52 percent and the payback period is 6.66 years. This means that costs will equal benefits in 6.66 years; this is the "break-even" point.

Table 4-9. Alternative 3—Use In-House (Government) Resources for Development and Operational Support, with IHS Hosting: ROI ($ million)

Item	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Annual costs	4.684	3.530	3.650	3.774	3.902	4.035	4.172	27.748
Annual benefits	1.718	1.777	2.532	5.042	5.852	6.300	6.514	29.735
Midyear discount factor	0.9764	0.9308	0.8873	0.8458	0.8063	0.7687	0.7328	NA
Discounted costs (DC)	4.574	3.286	3.239	3.192	3.147	3.102	3.057	23.596
Discounted benefits (DB)	1.678	1.654	2.247	4.264	4.718	4.843	4.773	24.177
Discounted net benefits (DB–DC)	−2.896	−1.632	−0.992	1.072	1.572	1.741	1.716	0.581
Cumulative net benefits	−2.896	−4.528	−5.520	−4.447	−2.876	−1.135	0.581	
Benefit/cost ratio	0.367	0.503	0.694	1.336	1.499	1.561	1.561	1.025
ROI (%)	−63.3%	−49.7%	−30.6%	33.6%	49.9%	56.1%	56.1%	2.5%
Payback (years)							6.66	

ALTERNATIVE 4—DESIGN AND DEVELOP A NEW SYSTEM

This alternative is a new design of PAOS. The design is based on current PAOS functionality; future DME efforts are not yet sufficiently defined to be part of the new design. Once the new design is implemented, DME efforts will continue throughout its life. Both the costs and realization of benefits reflect the new design and future staggered DME efforts. Hosting is projected for IHS.

To estimate the costs and benefits of the new design, a software life-cycle management model was used. The new design will take 34 months at a cost of $5.668 million. Maintenance of the new design will cost $0.924 million annually. These costs do not include the hosting facility or the government personnel to manage the system. DME efforts and their maintenance were added to the new design costs.

The following subsections present the costs, benefits, and ROI for this alternative.

[42] The "How to" Guide for Analysis of Alternatives, Step 4: Analyze the Costs and Benefits of the Most Viable Alternatives, items (9) and (10), explain how the ROI and payback period are calculated.

Costs

Table 4-10 presents the costs for Alternative 4. The following explains the cost elements for this alternative:

- *Program staff.* The new design is based on current functionality. The technical design and implementation should facilitate future DME and provide cost-effective O&M. Government participation will be highest during planning and acquisition and become less after the transition to the new design. The initial government staff is estimated at one project manager (GS-15) and four GS-14 managers for the program management office, business requirements, IT, and independent validation and verification; one GS-9 for administrative support at 100 percent and one at 55 percent; a GS-14 contracting officer at 50 percent for the first 3 years and 15 percent for the 4th year; and 2.0 FTEs (one at GS-15 and one at GS-14) for integrated program team and other participation. The program staff requirements decrease as the new design is implemented.

  The analysis begins with FY11, but the latest GS pay schedule was for 2006. The inflation rate of 3.4 percent[43] was used twice to estimate the 2008 GS salaries.[44] GS-15 step 5 salary in 2006 was $121,856; GS-14 was $103,594; and GS-9 was $50,839. The 2008 salary, including benefits of 36.45 percent[45] for each, is:

  - GS-15 = (121,856) (1.034) (1.034) (1.3645) = $177,771 annually.
  - GS-14 = (103,594) (1.034) (1.034) (1.3645) = $151,129 annually.
  - GS-09 = (050,839) (1.034) (1.034) (1.3645) = $074,167 annually.

  Two GS-15 FTE is $355,543; 5.5 GS-14 FTE is $831,212; and 1.55 GS-9 FTE is $114,959. For FY11, the project manager made estimates based on anticipated amounts of specific skills and grades needed in each life-cycle phase rather than a percentage as was done in Alternatives 1 and 2. In millions, as required by OMB reporting, $0.647 is needed for planning, $0.332 for acquisition, and $0.323 for operations and maintenance for a total of $1.301 million. This same process is used in the out years with adjustments made for the changing number of FTE.

- *Training and administration.* Training is included in the new design costs. Training after transition will be provided individually as needed by the help desk.

[43] See Chapter 3 Assumptions, Life-Cycle Assumptions.

[44] GS salaries do not change with the fiscal year; they change in January. The difference for this analysis is minor enough to not be included.

[45] See Chapter 3, Assumptions, Cost Assumptions, Cost Factors.

- *Contract services.* Because IHS does not have the government staff to develop a new design, the effort, including maintenance, is assumed to be performed by contract support. The current system will be maintained while the new system is being designed and implemented. The transition costs include 8 months for parallel operation after implementation. The hosting of the new PAOS will be at IHS. The reimbursable agreement is listed under contract support and is estimated at the same cost as in Alternatives 1 and 2.

- *Software.* Software is included in the contract.

- *Hardware (IT).* IT hardware is included in the IHS reimbursable agreement.

- *Equipment (non*-IT). No equipment is needed.

- *Facilities.* Contractor facilities are included in the contract, and government employee facilities are included in other funding.

- *Security.* The security costs are for evaluations, studies, reports, and corrective action.

- *Risk and other.* A new design has the inherent risk that it lacks proven successful performance. Designing a new system that will be running on a new platform, or at least in a new facility, adds to this risk. This risk is further increased by need to accommodate ongoing incremental DME efforts after implementation. The overall risk for this alternative is estimated at 20 percent.

- *Tribal Costs.* There are no costs expected to be bourn by the tribes.

Training, software, hardware, equipment, and tribal costs have no separate costs identified by their cost element; therefore, the tables have zeroes as entries for them.

Table 4-10. Alternative 4—Design and Develop a New System: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Planning costs								
Program staff	0.647	0.473	0.334	0.251	0.144	0.118	0.122	2.089
Training and administration								0.000
Contract services	0.500	0.350	0.200	0.100				1.150
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security								0.000
Risk and other	0.229	0.165	0.107	0.070	0.029	0.024	0.024	0.648
Tribal costs								0.000
Subtotal	1.376	0.988	0.641	0.421	0.173	0.142	0.147	3.887
Acquisition costs								
Program staff	0.332	0.538	0.640	0.259	0.178	0.165	0.171	2.283
Training and administration								0.000
Contract services	2.000	2.000	1.667		0.621	0.652	0.685	7.626
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.016	0.017	0.017	0.018	0.018	0.019	0.020	0.124
Risk and other	0.470	0.511	0.465	0.055	0.164	0.167	0.175	2.007
Tribal costs								0.000
Subtotal	2.818	3.066	2.789	0.332	0.981	1.003	1.050	12.040
Maintenance costs								
Program staff	0.323	0.343	0.324	0.713	0.548	0.520	0.537	3.307
Training and administration								0.000
Contract services	1.155	1.328	1.800	2.327	1.489	1.539	1.592	11.230
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.037	0.039	0.040	0.041	0.043	0.044	0.046	0.290
Risk and other	0.303	0.342	0.433	0.616	0.416	0.421	0.435	2.965
Tribal costs								0.000
Subtotal	1.819	2.051	2.596	3.697	2.495	2.524	2.610	17.792

Table 4-10. Alternative 4—Design and Develop a New System: Costs ($ million)

Cost element	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Total life-cycle costs								
Program staff	1.301	1.354	1.297	1.222	0.870	0.803	0.830	7.678
Training and administration								0.000
Contract services	3.655	3.678	3.667	2.427	2.110	2.191	2.277	20.006
Software								0.000
Hardware								0.000
Equipment								0.000
Facilities								0.000
Security	0.053	0.055	0.057	0.059	0.061	0.063	0.065	0.415
Risk and other	1.002	1.018	1.004	0.742	0.608	0.612	0.634	5.620
Tribal costs								0.000
Total	6.012	6.106	6.026	4.450	3.649	3.669	3.807	33.719

Benefits

Table 4-11 presents the benefits for Alternative 4. The existing benefits will continue and 10 new benefits will be implemented in future years.[46] The new design and implementation will take 34 months, with another 8 months of parallel operation and transition. Full cutover will be about mid-FY13. The DME efforts that have been on hold will begin again with the first set of additional benefits being realized about a year later, in mid-FY14.

The benefits calculations in Chapter 3 are based on FY09 dollars; benefits must be increased by the inflation rate for each year after FY09. For example, the benefit of reducing the time required to populate missing data fields will begin in FY14, 5 years after FY09; therefore, the FY14 initial value must be increased five times from the base FY09 year:

$$\text{FY13 (start)} = (0.842)\ (1.034)\ (1.034)\ (1.034)\ (1.034)\ (1.034) = 0.995.$$

The benefits accrue for only one-half of the year. The FY14 benefit of reducing the time to populate missing data is 0.995 x 0.5 = 0.497.

This same procedure is used for all benefits. The value will be inflated each year after FY09 (until its initial entry into the table) and the inflation rate will continue to be applied each year after it is entered in the table. Realization of the DME benefits begins in the following years:

[46] Chapter 3, Assumptions, Benefits Assumptions lists each benefit and the expected annual monetary value.

- FY14 (50 percent of the year)
  Reduction in time required to populate missing data fields
  Reduction in data correction requirements
  Automation of current manual synchronization

- FY15
  Reduction in follow-up correspondence time
  Reduction in time to gather internal and external data for status reporting
  Automation of queries for required and ad hoc reporting of data

- FY16
  Automation of current manual administrative and accounting functions
  Automation of tracking
  Reduction in consultation time
  Reduction in changes to other integrated systems (databases).

The sequence and times may vary; however, the benefits below and timing for them are reasonable expectations.

Table 4-11. Alternative 4—Design and Develop a New System: Benefits ($ million)

Benefit	Type of Benefit	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Currently implemented benefits	Cost avoidance	1.718	1.777	1.837	1.900	1.964	2.031	2.100	13.327
Time to populate missing data	Cost avoidance				0.497	1.029	1.063	1.100	3.689
Data correction	Cost avoidance				0.104	0.214	0.222	0.229	0.769
Data synchronization	Cost avoidance				0.118	0.244	0.252	0.261	0.874
Follow-up correspondence	Cost avoidance					0.134	0.138	0.143	0.416
Data gathering	Cost avoidance					1.071	1.108	1.145	3.325
Automation of queries	Cost avoidance					0.557	0.576	0.596	1.729
Automation of administration and accounting	Cost avoidance						0.623	0.644	1.267
Automation of tracking	Cost avoidance						0.037	0.038	0.075
Reduced consulting time	Cost avoidance						0.022	0.023	0.045
Reduced changes to other systems	Cost avoidance						0.227	0.235	0.463
Total		1.718	1.777	1.837	2.618	5.213	6.300	6.514	25.978

Return on Investment

Table 4-12 presents the ROI and payback period for Alternative 4.[47] The annual ROI for the project over its life is −28.1 percent. This means the costs are not

[47] The "How to" Guide for Analysis of Alternatives, Step 4: Analyze the Costs and Benefits of the Most Viable Alternatives, items (9) and (10), explain how the ROI and payback period are calculated.

recovered and, therefore, there is not a payback period. Benefits never exceed costs, so there is not a "break-even" point.

Table 4-12. Alternative 4—Design and Develop a New System: ROI ($ million)

Item	FY11	FY12	FY13	FY14	FY15	FY16	FY17	Total
Annual costs	6.012	6.106	6.026	4.450	3.649	3.669	3.807	33.719
Annual benefits	1.718	1.777	1.837	2.618	5.213	6.300	6.514	25.978
Midyear discount factor	0.9764	0.9308	0.8873	0.8458	0.8063	0.7687	0.7328	NA
Discounted costs (DC)	5.870	5.683	5.347	3.764	2.943	2.820	2.789	29.216
Discounted benefits (DB)	1.678	1.654	1.630	2.215	4.204	4.843	4.773	20.996
Discounted net benefits (DB–DC)	−4.193	−4.029	−3.716	−1.549	1.261	2.022	1.984	-8.220
Cumulative net benefits	−4.193	−8.222	−11.938	−13.488	−12.227	−10.204	−8.220	
Benefit/cost ratio	0.286	0.291	0.305	0.588	1.429	1.717	1.711	0.719
ROI (%)	−71.4%	−70.9%	−69.5%	−41.2%	42.9%	71.7%	71.1%	-28.1%
Payback (years)								none

COMPARISON OF ALTERNATIVES

This section contains tables comparing the total life-cycle costs, benefits, and ROIs of the status quo and three alternatives. Table 4-13 compares costs, Table 4-14 compares benefits, and Table 4-15 compares ROIs. No new information is developed in this section; this section is presented for ease of comparison among the alternatives.

Table 4-13. Comparison of Alternatives: Life-Cycle Costs ($ million)

Cost element	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Program staff	2.219	3.011	19.850	7.678
Training and administration				
Contract services	16.637	22.497	4.654	20.006
Software				
Hardware				
Equipment				
Facilities			0.308	
Security	0.415	0.415	0.415	0.415
Risk and other	0.964	1.296	2.523	5.620
Total	20.234	27.218	27.748	33.719

Table 4-14. Comparison of Alternatives: Life-Cycle Benefits ($ million)

Benefit	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Currently implemented benefits	13.327	13.327	13.327	13.327
Time to populate missing data	6.079	5.148	4.667	3.689
Data correction	1.266	1.073	0.972	0.769
Data synchronization	1.220	1.220	1.106	0.874
Follow-up correspondence	0.670	0.545	0.545	0.416
Data gathering	4.361	4.361	4.361	3.325
Automation of queries	2.268	2.268	2.268	1.729
Automation of administration and accounting	1.870	1.870	1.870	1.267
Automation of tracking	0.111	0.111	0.111	0.075
Reduced consulting time	0.045	0.045	0.045	0.045
Reduced changes to other systems	0.463	0.463	0.463	0.463
Total	31.680	30.430	29.735	25.978

Table 4-15. Comparison of Alternatives: Life-Cycle ROIs ($ million)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Costs	20.234	27.218	27.748	33.719
Benefits	31.680	30.430	29.735	25.978
Discounted costs (DC)	17.040	22.912	23.596	29.216
Discounted benefits (DB)	25.951	24.794	24.177	20.996
Discounted net benefits (DB – DC)	8.911	1.882	0.581	−8.220
Benefit/cost ratio	1.523	1.082	1.025	0.719
ROI	52.3%	8.2%	2.5%	−28.1%
Payback period (years)	2.94	5.75	6.66	No payback

SENSITIVITY ANALYSIS

The processes of this chapter would be repeated for at least three parameters for the sensitivity analysis. The tables in this chapter would be the same except for the differences caused by the changes in the parameters. A sensitivity analysis of this hypothetical project would consist of identifying parameters from the 10 benefits, parameters from among the cost elements, or a combination, and then developing new calculations and documenting the observations and sensitivity level based on HHS guidance.

Chapter 5
Weighted-Score Analysis

The BCA identifies costs and quantifiable benefits of the project but does not include the qualitative or intangible information that should also be considered in the decision process. Therefore, in addition to the BCA, a weighted-score analysis of the status quo and three alternatives was conducted. This analysis includes both qualitative and quantitative (BCA) criteria to identify the solution to be recommended for supporting the IHS PAOS project. This analysis is consistent with HHS's *IRM Policy for Conducting Information Technology Alternatives Analysis*.

SCORING CRITERIA

Seven criteria for the weighted-score analysis were used.[48] Two of these (cost and benefit/cost ratio) are quantitative and are identified in the BCA. The other five (implementation, business environment, compliance, risk, and security) are qualitative judgments. The project team assessed how well each alternative satisfied each criterion, assigning a score (raw score), ranging from 0 (low) to 10 (high). The scores were then weighted to reflect the relative importance of the seven criteria; the weights total 100 percent. The weighted score is calculated by multiplying the raw score by the weight:

$$\text{Weighted score} = \text{raw score} \times \text{weight}.$$

Each criterion and the approach to assigning scores are described below:

- *Cost.* The alternative with the lowest cost receives a score of 10 and the other alternatives are compared to it. One point is deducted for each increase in cost of 10 percent (rounded), to a minimum of 0 (no negative scores).

  Example 1: An alternative with costs 33.6 percent higher than the least costly alternative would receive a score of 7 (33.6 percent rounds to 30 percent; 1 point for each 10 percent is 3 points: $10 - 3 = 7$).

  Example 2: An alternative with costs 17.8 percent higher than the least costly alternative would receive a score of 8 (17.8 percent rounds to 20 percent; 1 point for each 10 percent is 2 points: $10 - 2 = 8$).

[48] Criteria that are different from those shown in the Guide, Analysis, step 5 are deliberately used in this example to show the flexibility of the guidance and appropriateness of other criteria.

- *Benefit/cost ratio.* Points are assigned based the benefit-to-cost ratio, as shown in Table 5-1. A score of 10 for the maximum was used in this analysis to be consistent with the range for the other criteria.

Table 5-1. Point Scale

Points	Benefit/cost ratio
0	Less than 1.0
1	1.0 to 1.19
2	1.20 to 1.29
3	1.30 to 1.39
4	1.40 to 1.49
5	1.50 to 1.59
6	1.60 to 1.69
7	1.70 to 1.79
8	1.80 to 1.89
9	1.90 to 1.99
10	2.00 and above

- *Implementation.* This criterion addresses the effort and impact—including the difficulty, lost productivity, learning curve, and potential disruption—to make the alternative operational. The following are major implementation concerns:
  - Migration (hardware, software, communications, data)
  - Contract transition (services/support)
  - Technical support/platform training
  - Work disruption
  - Operational continuity/contingency.
- *Business environment.* This criterion addresses the effect, on business processes and functions, of potential business process reengineering, cultural adjustments, and other non-quantifiable aspects of the business environment. Specifically, the following were considered in our assessment of the PAOS alternatives:
  - Business processes/functions
  - Organizational structure
  - User orientation/training

  - Cultural impact.

- *Compliance.* In addition to providing the necessary business functionality, PAOS must be able to meet the requirements and guidelines specified by executive directives, congressional legislation, and external oversight entities (such as the Inspector General and Government Accountability Office), as well as internal policy and standards. Therefore, each alternative's ability to comply with and be responsive to those needs was considered. The following are key requirements and guidelines with which the selected alternative must comply:

  - Government-wide guidelines (such as Clinger-Cohen Act, Paper-work Reduction Act, Government Performance and Results Act, OMB Circular A-130, Government Accountability Office)

  - IHS policy

  - Mission support

  - Technology standards.

- *Risk.* A preliminary evaluation of the risks posed by each alternative was conducted using the 19 risk categories of OMB Circular A-11 Exhibit 300:[49]

  - Schedule

  - Initial costs

  - Life-cycle costs

  - Technical obsolescence

  - Feasibility

  - Reliability of systems

  - Dependencies and interoperability

  - Surety (asset protection)

  - Risk of creating a monopoly for future procurements

  - Capability of the agency to manage the investment

  - Overall risk of investment failure

[49] A risk assessment was conducted on the current PAOS project (status quo).

  - Organizational and change management
  - Business
  - Data/information
  - Technology
  - Strategic
  - Security
  - Privacy
  - Project resources.

- *Security.* This criterion addresses access controls, firewall implementation, and use monitoring, as well as security responsibility, authority, and reporting. The following aspects of security were considered:
  - Federal Information Security Management Act
  - Standards issued by the Indian Health Service
  - Certification and accreditation
  - Technical capability and capacity.

WEIGHTED SCORES AND SCORING RATIONALE

Table 5-2 presents the raw and weighted scores for each alternative. Based on the criteria and scores assigned, the status quo had the highest total score: 775.

Table 5-2. Weighted Scores of Alternatives

Criterion	Weight	Alternative 1: Status Quo		Alternative 2: Outsource		Alternative 3: In-house		Alternative 4: New Design	
		Raw score	Weighted score	Raw score	Weighted score	Raw score	Weighted score	Raw score	Weighted score
Cost	20	10	200	7	140	6	120	3	60
Benefit/cost ratio (ROI)	20	5	100	1	20	1	20	0	0
Implementation	15	10	150	8	120	6	90	4	60
Business environment	15	7	105	7	105	7	105	9	135
Compliance	10	7	70	7	70	8	80	8	80
Risk	10	8	80	7	70	5	50	4	40
Security	10	7	70	7	70	8	80	8	80
Total	100	—	775	—	595	—	545	—	455

The rationale for the scores is as follows:

- *Cost.* The status quo had the lowest cost ($20.234 million)[50] and, therefore, received a score of 10. Alternative 2 had a cost of 27.218 million, which is 34.5 percent higher than the status quo; 34.5 percent rounds to 30 percent; 1 point for each 10 percent is 3 points: 10 − 3 =7 as a score for Alternative 2. The same process is used to compare the status quo with Alternatives 2 and 3.

- *Benefit/cost ratio.* The status quo had a benefit/cost ratio of 1.523.[51] Using Table 5-1, a ratio between 1.50 and 1.59 receives a score of 5. The table is used to look up the scores for the benefit-cost ratios of the other three alternatives.

- *Implementation.* The lower or smaller the size, scope, complexity, disruption, level of effort, and transition activity, the higher the score. The status quo alternative requires no implementation; it is "business as usual," so it received a 10. The alternative to move the hosting to IHS is a minor move to an existing and proven successful environment with no change in the application; a score of 8 was assigned. Replacing the applications software contractors with government employees while also moving the hosting facility introduces much greater complexity, a score of 6 was assigned. The new system design has the potential to change the PAOS operational processes, perhaps change some of its functionality, and replace the application and support contractors as well as move the hosting facility. This alternative has the greatest change and greatest amount of implementation complexity, resulting in a score of 4.

[50] See Table 4-15 for cost comparisons (or see the Total line of Table 4-13).

[51] See Table 4-15 for the benefit/cost ratios of the alternatives.

- *Business environment.* The highest score—9—was assigned to Alternative 4for its ability to support the business environment, because a new design can incorporate the latest and most comprehensive business requirements and use the technology that best supports the business. A new design can also optimize the performance and capacity that may have decreased over years of incrementally building fragmented business functions. In addition, the new design can have the functional and technical flexibility to meet anticipated future needs. These advantages are reduced somewhat by the new training requirements and perhaps a shift from a business culture that is widely accepted. The other three alternatives will retain the current application in its current business operational status. This status, does, however, meet the basic business requirements and is, or will be, on a platform that can accommodate the anticipated growth and changes. Therefore, a score of 7 was assigned to the other three alternatives.

- *Compliance.* Generally, compliance can be best met when the processes and information required for compliance are the responsibility of those accountable for compliance and for reporting it. For this reason, the higher scores were assigned for the alternatives that place PAOS operational responsibility close to PAOS project management. The in-house alternative received an 8 because all project components are controlled by IHS; it did not score a 10 because two different IHS components must coordinate for complete compliance (PAOS project management and the IHS hosting facility). The status quo alternative received a 7 because it is very close to the in-house alternative; the contractors report directly to PAOS project management and have several years of successful experience. Bringing the hosting to the IHS with no other changes is similar to maintaining the status quo and also scored a 7. A new design can be implemented by a combination of operational responsibilities that include outsourcing or using in-house resources. The final determination might influence the compliance score, but a score of 8 was assigned because compliance can be built into the new processes.

- *Risk.* The risk scores are based on a preliminary evaluation of the 19 elements for implementing the alternative and for operating the alternative over its system life.[52] The risk of implementing and operating an alternative different from the status quo might be less than maintaining the status quo if the latter is unable to meet the business requirements or has obsolete technology, high operational costs, or other limitations or high-risk components. However, this is not the case with PAOS. The status quo poses the lowest risk (a score of 8 was assigned). The other alternatives pose a greater risk because risk increases as change increases. Thus,

[52] An exhaustive risk assessment was not conducted, in which a risk management tool is applied across all 19 risk elements for all of the alternatives, because the time and expense for such an assessment (which includes risk identification, quantification, and identification of mitigation strategies) are resource prohibitive. However, a risk assessment was previously conducted of the current PAOS system (minimum risk was determined).

developing a new design poses the greatest risk (4) because the application design, operations, hosting, and maintenance support will change. Risk scores of 7 and 5 were assigned respectively, for moving the hosting to IHS and for moving the hosting to IHS while also shifting applications responsibility to government staff (in-house alternative).

- *Security.* The scoring for security is similar to that for compliance. Security requirements can be best met when the processes and information required for security implementation, monitoring, analysis, and reporting are the responsibility of those accountable for the security program. For this reason, the scores are higher for the alternatives that place PAOS operational responsibility close to PAOS project management. The in-house alternative scored an 8 because all project components are controlled by IHS, but not a 10 because two different IHS components must coordinate for complete security (PAOS project management and the IHS hosting facility). The status quo received a 7 because it is very close to the in-house alternative; the contractors report directly to PAOS project management and have several years of successful experience. Bringing the hosting to the IHS with no other changes is similar to the status quo so also scored a 7. A new design can be implemented by a combination of operational responsibilities that include outsourcing or using in-house resources. The final determination might influence the security score, but a score of 8 was assigned because security can be built into the new processes.

Chapter 6
Conclusions and Recommendations

The BCA was a quantifiable analysis using known costs and measurable benefits in the determination of cost and ROI. The weighted-score analysis was a comprehensive analysis that included the cost and ROI, plus qualitative factors—implementation effort and impact; business environment; compliance with external and internal requirements, policy, and standards; risk; and security—that must be considered when deciding on the best alternative.

Considering the results of the BCA, Alternative 1—maintain the status quo—has the lowest cost and also provides the highest ROI of the four alternatives subjected to detailed analysis. In addition, the Alternative 1 of 775 in the weighted-score analysis was the highest score among the alternatives.

For the continued support of PAOS, it is recommended that the status quo be maintained. This alternative uses contractor support for the development, modernization, and enhancement of the PAOS application, for its operations and maintenance, and for its hosting.

APPENDIX B. ANALYSIS OF ALTERNATIVES CHECKLIST

This appendix is a checklist for preparing or reviewing the analysis of alternatives portion of the business case, including submission in OMB Circular A-11, Exhibit 300. The purpose of the checklist is to ensure that the analysis of alternatives meets the requirements of OMB,[53] HHS,[54] and IHS. The analysis of alternatives document should contain the information that can be extracted and summarized to fully address the Exhibit 300, Analysis of Alternatives section.

The checklist addresses the following areas, which includes those needed to respond to the Analysis of Alternatives section of the OMB Exhibit 300:[55]

- Market research to identify alternatives
- Description of the alternative solutions identified and alternatives selected for benefit-cost analysis
- Cost elements and cost assumptions
- Quantitative benefits
- Investment return
- Selection of the alternative
- Financial summary
- Date of the benefit-cost analysis.

[53] The Exhibit 300 requirements are for the BY2008 submission and may be changed in future years. OMB Circular A-11, *Part 7: Planning, Budgeting, Acquisition, and Management of Capital Assets*, June 2006, and OMB Circular A-11, Exhibit 300.

[54] HHS-IRM-2003-0002, *HHS IRM Policy for Conducting Information Technology Alternatives Analysis,* June 13, 2003.

[55] OMB Circular A-11, Exhibit 300.

Table B-1. Checklist for Analysis of Alternatives

Area	Consideration	Suggested action
Market research	The first step in conducting an alternatives analysis is to ensure that the project objective is defined and scoped to maximize the potential that there are feasible alternatives from which a solution is selected. The market survey will determine what solutions exist.	Market research can be formal such as issuing a request for information (RFI) that invites responses about approaches for a solution that can help develop a request for proposals (RFP); this can include an "industry day" to better define the project scope and increase the probability of identifying cost-effective and technically feasible solutions. Market research can also be less structured such as reviewing literature from trade journals and associations, conducting surveys (written or phone), or contacting other federal agencies with similar needs. The intent at this point is to identify potential solutions for consideration, not to select a solution, and especially not to select a limited or proprietary solution. All viable alternatives will be evaluated in the next steps.
Alternative solutions identified and alternatives selected for BCA	Develop an initial list of possible alternatives. The list must include those required by HHS (for example, maintain the status quo) as well as possible solutions identified through brainstorming and market research. From the initial list, identify the most viable alternatives for detailed analysis. In addition to the baseline (status quo), a minimum of three alternatives must be included in the BCA. If the status quo is not viable, it establishes the baseline for costing, unless the project contains all new functionality.	The market research, project team, and other government and private searches and consultation assistance can be used to identify viable alternatives such as these or a combination of them: • Status quo: Is the current process meeting requirements and can it continue to meet them? • Turnkey outsourcing: Can the project requirements and goals be met by complete outsourcing? • COTS (commercial off-the-shelf): Is there a "packaged" commercial solution that might be adopted regardless of where it is run and maintained? • GOTS (government off-the-shelf): Is there a "packaged" government solution that might be adopted regardless of where it is run and maintained? • Government-wide sharing (new system): Is there sufficient government-wide need to pursue a new collaborative development. • Cross-servicing at another agency: Can another agency perform the services needed? • Intra-agency sharing: Is there a comparable need within the agency that makes consolidation or collaboration feasible? • In-house development and operation: Can the solution be adequately accomplished using 100% government staff and government-owned resources? • New design (regardless of how it is accomplished or by whom): Can the project requirements be met best by abandoning any existing processes and starting with a new design? • Manual processing: Are the volume, complexity, response time, and accuracy requirements too significant or too costly to be done manually? • System elimination: Do the organizational mission and functional requirements still require these processes. Is a "sunset law" applicable?

Area	Consideration	Suggested action
Cost elements	Life-cycle cost must be reported by cost element at the following level of detail: • Project costs divided into logical groups (cost elements) that can be tracked through the budget, finance, and project management processes • Project costs by year for each cost element, and by the three life-cycle phases specified by OMB: planning, acquisition, and operations and maintenance (steady state) • Project costs by cost element by life-cycle phase by year for each alternative.	Below are the most typical groups (cost elements) by which costs are identified: • Program staff: Government FTE. • Training and administration: Training and administration that is not part of the contract support contract. • Contract services: Services and technology furnished by contract. • Software: Government owned or leased. If part of a contract support/services contract, leave it under contract support. • Hardware: Government owned or leased. If part of a contract support/services contract, leave it under contract support. Hardware usually refers to IT. • Equipment: Non-IT physical devices and assets such as cabinets, beds, vehicles, and medical apparatus. • Facilities: Include both IT facility space and utilities, and space and utilities for staff. • Security: Can be based on a percentage of cost if not otherwise available. Also include compliance enforcement costs such as certification and accreditation (C&A), FISMA activities, and audit/review corrections. • Risk and other: OMB requires the alternatives to be risk adjusted. Use the 19 risk areas as a guide. (Identification of security and risk as separate cost elements is an OMB requirement.) The input, through the PMT, into the OMB Exhibit 300 requires that costs be identified by life-cycle phase (planning, acquisition, and operations and maintenance) by year for each of these cost elements, as shown in Appendix A.
Cost assumptions	Cost assumptions are made to define the cost model; ensure consistent parameters across all alternatives; and identify areas where incomplete, unknown, or multiple potential responses are uniformly determined.	Cost assumptions should address • data sources (previous cost estimates, labor rates, equipment costs, services, models); • data exclusions or incompleteness (for clarification as to what was used in the costing model); and • methods used to calculate and project costs (inflation, discount rate, personnel overhead, equipment life expectancy).

Area	Consideration	Suggested action
Quantitative benefits	Although a project is evaluated on more than just its quantifiable benefits, the benefit/cost ratios or ROIs are important considerations when evaluating the project. A lack of quantifiable benefits will significantly weaken the business case for the project.	Quantitative benefits should be identified, estimated, and categorized as either cost savings or cost avoidance. The higher the benefit/cost ratio or ROI, the higher the evaluation scores; therefore, it is important to include all quantifiable benefits, not just enough for a positive ROI. The following are examples of quantitative benefits: • Reduced processing costs • Future cost avoidance • Reduced cost for error correction (due to accuracy improvement) • Reductions in delays/costs of business activities (due to better and/or faster information). • More cost-effective resource allocation (due to better project management information).
Return on investment	The ROI is to be calculated using inflation for each year for both costs and benefits and using net present value (NPV) adjustments for each year for costs and benefits.	The following ROI definition is suggested: "ROI is defined as the cumulative discounted benefits minus the cumulative discounted costs divided by the cumulative discounted costs. The answer is expressed as a percentage." This is the same as the benefit/cost ratio minus one, expressed as a percentage.
Selection of the alternative	The selection of the alternative is based on both the qualitative analysis and the other factors that are to be identified, discussed, and included in the analysis of alternatives document. The BCA results are very important but are not the only criteria to be evaluated.	In explaining why the alternative was selected, emphasize comparisons with the cost elements of other alternatives and comparison of the benefits. Often the benefits are the same for all alternatives. This makes the costs element comparisons even more important. In addition to the BCA, emphasize the criteria in the weighted-score analysis (if it exists). These areas include relative comparisons of both quantifiable and non-quantifiable criteria such as the following: • Cost • Benefit/cost ratio (ROI) • Implementation (ease and issues) • Business environment (impact on) • Compliance (agency and government-wide governance) • Risk (based on 19 areas) • Security (FISMA, NIST, and agency requirements). The input, through the PMT, into the OMB Exhibit 300 requires that the selected alternative be identified and the reasons for selection be given. A separate question requires that the qualitative benefits of the selected alternative be given.

Area	Consideration	Suggested action
Financial summary	The financial summary is taken from BCA.	For the selected alternative, present the following in a table by year for the total project life: • Costs • Benefits • Annual discount factor; discount rate is in OMB Circular A-94 (if spending is distributed throughout the year rather than at the beginning or end of the year, use a midyear discount factor) • Discounted costs • Discounted benefits • Discounted net benefits • Cumulative net benefits • Benefit/cost ratio • Return on investment (ROI %) • Payback period (years). The input, through the PMT, into the OMB Exhibit 300 requires that all alternatives be described and that life-cycle costs and benefits be given for each.
Date of BCA	A BCA is required for all investments for which an Exhibit 300 is prepared (if an Exhibit 300 is required, a BCA is also required).	The following information will assist with determining the appropriateness of the BCA date: • Frequency. As a guideline, a new BCA should be prepared about every 5 years. • Updates. The BCA should be updated at the end of a life-cycle phase or when there is a major change in the project direction and/or funding. • Documentation. The BCA may be a separate document but usually is part of the analysis of alternatives document. • Verification. The date given for the BCA must be supported by a document that provides the information required in this checklist. • References. The two primary reference documents for a BCA and analysis of alternatives are OMB Circular A-11, *Part 7: Planning, Budgeting, Acquisition, and Management of Capital Assets*, and OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*. The input, through the PMT, into the OMB Exhibit 300 requires that the date of the alternatives analysis be given. If an analysis has not been conducted, an explanation is required and the anticipated date of completion must be given.

APPENDIX C. NET PRESENT VALUE SPREADSHEET

The attached page contains a Microsoft Excel spread sheet that can be used to calculate costs, benefits, and net present value if you have an electronic copy of this document.

In the spreadsheet below, there are separate tabs for:

- the return on investment (ROI) calculations
- the financial assumptions extracted from the latest versions of OMB Circulars A-76 and A-94
- the benefits for each of four alternatives, and
- the cost for each of four alternatives.

As can be seen in the spreadsheet, the costs and benefits need only be calculated for the base year (in this case, FY2007). The spread sheet extrapolates the costs and benefits for the out years. If costs are different for the out years, they can (and should) be manually adjusted. Similarly, if benefits are not realized in the base year, they can (and should) be manually adjusted. The imbedded formulas can be used when the costs and/or the benefits have stabilized, and the only changes are those due to inflation.

The following spreadsheet should be updated for your analysis. In particular, items like the government salary should be updated, the years of the analysis, the discount rate, etc. Although the formulas are there, the basic information still needs to be made current.

Alternative 4

	Cost Element	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014	Total
Planning										
1	Program Staff (FTE costs)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	Training & Admin Support		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	Contract Services		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	Software		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Hardware		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	Facilities		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	Security		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	Risk & Other		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sub-Total		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Acquisition										
1	Program Staff (FTE costs)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	Training & Admin Support		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	Contract Services		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	Software		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Hardware		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	Facilities		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	Security		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	Risk & Other		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sub-Total		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Maintenance										
1	Program Staff (FTE costs)		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	Training & Admin Support		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	Contract Services		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	Software		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	Hardware		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	Facilities		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	Security		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	Risk & Other		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Sub-Total		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Figure C-1. Net Present Value Spreadsheet