Customizing an Evaluation Methodology For Federal Agency IT Investment Decision-making Using Expert Choice and the AHP Approach

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By

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Abstract

The Office of Management and Budget in the Executive Office of the President has directed that Federal agencies evaluate their information technology investment management (ITIM) model with a prescribed post implementation (PIR) review process. However, other methods for evaluation exist, including the Balanced Scorecard (BSC) and Applied Information Economics (AIE). This paper reports on an exercise using the analytic hierarchy process (AHP) decision-making methodology to derive preferences for evaluating different phases and levels in the ITIM model. The results showed that the preferred evaluation alternative differed depending on which part of the process model was being evaluated. The implication for policy is that Federal agencies may want to adopt a combination of methods for evaluating the Federal ITIM process.

Executive Summary

The Office of Management and Budget (OMB) in the Executive Office of the President is that organization charged with regulatory oversight for investment management throughout the US Federal government. The General Accounting Office (GAO), auditing arm of the Congress, provides assessment guides and services in those areas regulated by OMB.

OMB has directed that Federal agencies will use a structured Post-Implementation Review (PIR) methodology to evaluate and to improve their IT investment management process.[i] The PIR approach calls for a fixed schedule of reviews that cover not only the performance of the asset but also the effectiveness of the investment process.

However, alternative evaluation approaches for such processes exist. These include:

a. Balanced Scorecard (BSC), which balances short term vs. long term objectives, financial vs. non-financial measures, leading vs. lagging measures, and external vs. internal perspectives.

b. Applied information economics (AIE), which addresses measuring degrees of uncertainly for each variable in a return on investment (ROI) analysis, computing the value of information, and modeling utilization and cancellation in cost-benefit arguments.

With the goal of developing the best possible investment evaluation approach - and using the BSC and AIE as possible alternatives to the PIR for evaluating Federal agency IT investment management - we adopted the GAO framework for assessing IT investment decisions (See Table 1 on page 4). We then constructed an AHP model and made pair-wise comparisons prioritizing objectives in the Process, Data, and Decision levels of the model for all three phases of the IT investment management process: Select, Control, and Evaluate. We then compared preferences for each of the alternatives for each of the covering objectives in the model.

Our findings were that while the PIR approach rated the highest overall (synthesis with respect to goal: PIR .483; BSC .287; AIE .230), a combination of the alternatives was preferred over the range of covering objectives. Sensitivity analysis reveals the results hold for significant changes in preference scores.

Preferred Evaluation Alternatives

	Select Phase	Control Phase	Evaluate Phase
Process	**AIE**/PIR	**PIR**/AIE	**PIR**/BSC
Data	**PIR**/AIE	**PIR**/BSC	**BSC**/PIR
Decisions	**AIE**/PIR	**PIR**/BSC	**BSC**/PIR
Overall for Phase:	**AIE**/PIR	**PIR**/AIE	**PIR**/BSC

Key: **First Choice**/Second Choice
AIE: Applied Information Economics
BSC: Balanced Scorecard
PIR: Post Implementation Review

Introduction

Investments in information technology (IT) can have a dramatic impact on Federal agency organizational performance. Well-managed IT investments that are carefully selected and focused on meeting mission needs can dramatically improve government performance while reducing costs. Likewise, poor investments, those that are inadequately justified or whose costs, risks, and benefits are poorly managed, can hinder and even restrict agency service to its citizens.

Despite making a huge investment in IT, many government agencies are still hampered by inaccurate data and inadequate systems. Too often, federal IT investment projects have cost too much, produced too little, and failed to significantly improve mission performance. Yet there is also general agreement that the government's ability to improve its service and performance will depend heavily upon how well IT can be integrated into fundamental business/mission needs.

Over the past decade, both Congress and the Executive Branch have become more focused on improving agency performance in all areas but especially in investment management. Several recent management reforms, including revisions to the Paperwork Reduction Act (PRA), the Clinger-Cohen Act (formerly the Information Technology Management Reform Act (ITMRA)), the Government Performance and Results Act (GPRA), and the Chief Financial Officers (CFO) Act, have introduced requirements emphasizing the need for federal agencies to significantly improve their management processes, including how they select and manage IT resources. For instance, a key goal of the Clinger-Cohen Act of 1996 is that agencies should have processes and information in place to help ensure that IT projects are being implemented at acceptable costs, within reasonable and expected time frames, and are contributing to tangible, observable improvements in mission performance. Moreover, these agency processes should be institutionalized throughout the organization, and should be used for all IT-related decisions. The ultimate goal of these various legislative reforms is for agencies to make better decisions that will measurably increase the performance of the organization.[ii]

The IT investment decision-making approach is a fluid and dynamic process (Table 1). Both proposed and ongoing projects enter in to an IT investment disposition analysis, which examines the existing inventory of systems and applications to review existing costs, benefits, and risks associated with all IT investments. Selection decisions are made based on an analysis of where needs are greatest and in line with the organization's systems retirement and replacement plans and implementation strategy. Projects that are terminated or delayed as part of selection decisions are evaluated immediately to allow the organization to assess the impact on future proposals and to quickly benefit from lessons that are learned.

Table 1. The IT Investment Management Process

	SELECT	CONTROL	EVALUATE
Processes	Selection processes include: • screening new projects • analyzing and ranking all projects based on benefit, cost, and risk criteria • selecting a portfolio of projects • establishing project review schedules	Control processes include: • consistently monitoring projects • involving the right people • documenting all actions and decisions • feeding lessons learned back in to the Selection phase	Evaluation processes include: • conducting post-implementation reviews (PIRs) using a standard methodology • feeding lessons learned back in to the Selection and Control phases
Data	Selection data include: • evidence that each project has met project submission requirements • analyses of each project's costs, benefits, and risks • data on the existing portfolio • scoring and prioritization outcomes • project review schedules	Control data include: • measures of interim results • updated analyses of each project's costs, benefits, schedule, and risks	Evaluation data include: • measurements of actual vs. projected performance • documented "track record" (project and process)
Decisions	Selection decisions include: • determining whether projects met process-stipulated requirements • deciding upon the mixture of projects in the overall IT investment portfolio	Control decisions include: • deciding whether to cancel, modify, continue, or accelerate a project • aggregating data and reviewing collective actions taken to date	Evaluation decisions include: • assessing project's impact on mission performance and determining future prospects for the project • revising the Selection and Control phases based on lessons learned

The IT Investment Management Process Model[iii]

Select Phase

The IT investment management process begins with the Selection phase. In this phase, the organization determines priorities and makes decisions about which projects will be funded during the year. A starting point for the Selection phase is the screening process, in which projects being submitted for funding are compared against a uniform set of screening criteria and thresholds in order to determine whether the projects meet minimal requirements and to identify at what organizational level the projects should be reviewed.

The costs, benefits, and risks of all IT projects--proposed, under development, operational, etc.--are then assessed (usually by an independent group) and the projects are compared against each other and ranked or prioritized. As part of this process, weighting factors may be attached to the ranking criteria. These ranking criteria should, at a minimum, include cost, risk, and benefit factors, as well as an assessment of how well the project meets mission needs. Finally, a senior management decision-making body makes decisions about which projects to select for funding based on mission needs and organizational priorities. The systems and projects that are selected for funding make up the portfolio of IT investments.

The Selection phase helps ensure that the organization (1) selects those IT projects that will best support mission needs, and (2) identifies and analyzes a project's risks and returns before a significant amount of project funds are spent. A critical aspect of this phase is management understanding and participation and decision-making that are driven by accurate, up-to-date data and an emphasis on using IT to enhance mission performance.

Once selected, all of the projects in the portfolio are consistently controlled and managed. Progress reviews, in which the progress of projects is compared against projected cost, schedule, and expected mission benefits, are conducted at key milestones in each project's life cycle. The type and frequency of these reviews are usually determined based on the analyses of risk, complexity, and cost that went into selecting the project. If a project is late, over cost, or not meeting performance expectations, senior executives decide whether it should be continued, modified, or canceled, and actions are quickly taken to mitigate the effects of changes in risks and costs.

Control Phase

The Control phase helps ensure that as projects are developed and investment costs rise, that the project is continuing to meet mission needs, and if it is not or if problems have arisen, mitigating steps are quickly taken to address the deficiencies. Decisions made at the Control phase may include canceling the project, modifying it to better meet mission requirements, accelerating development of the project, or continuing its development as planned.

Evaluation Phase

Finally, once projects have been fully implemented, actual versus expected results are evaluated, to (1) assess the project's impact on mission performance, (2) identify any changes or modifications to the project that may be needed, and (3) revise the investment management processes based on lessons that were learned.

Alternatives for Evaluation

Applied Information Economics[iv] embraces the philosophy that everything – even so-called "intangibles" - are measurable and that risk and the value of information can be computed in actuarially and economically sound ways. It quantifies uncertainties with ranges of values and probabilities. It requires that cancellation be included as an option in cost-benefit analyses. With respect to the economic value of information this alternative addresses the following steps in mathematical terms:

(1) Information reduces uncertainty

(2) Less uncertainly improves decisions

(3) Improved decisions result in more effective action

(4) Effective action improve mission results

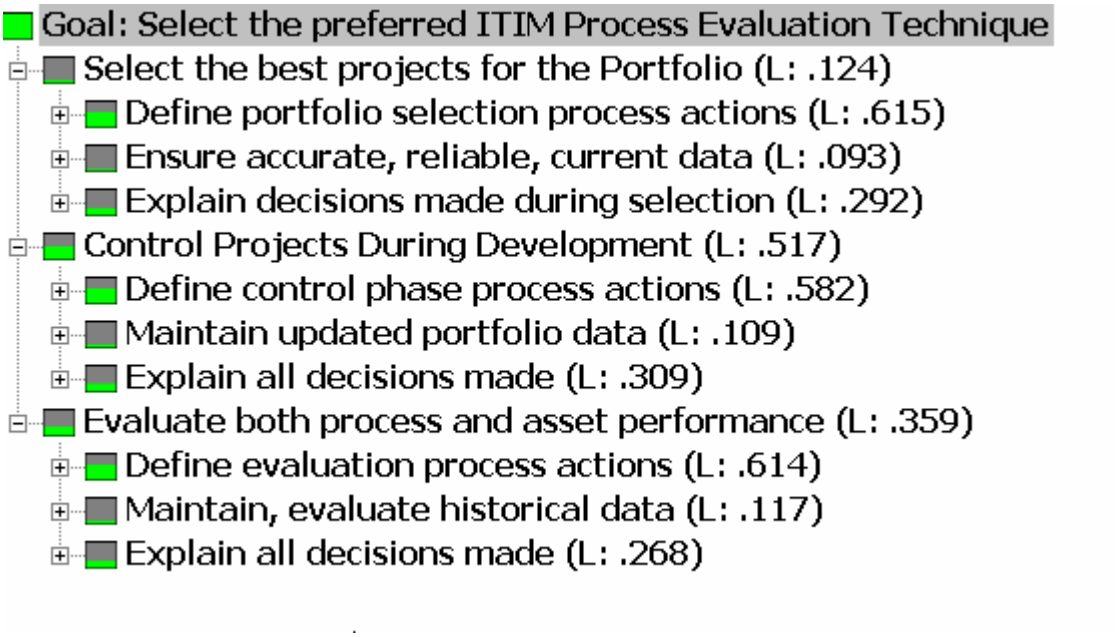
Balanced Scorecard [v] balances short term vs. long term objectives, financial vs. non-financial measures, leading vs. lagging measures, and external vs. internal perspectives. It attempts to capture value-creating activities not evident in financial measures. In addition to being an approach to developing families of performance measures, it can also be useful as a process or strategy implementation tool.[vi]

Post Implementation Reviews aim at evaluating what the GAO process model defines as the critical success factors for information technology investment management (ITIM). [vii] PIR's can include a family of performance measures modeled on the Balanced Scorecard. This alternative emphasizes the use of checklists for the proposed critical success factors and for the elements in the model.

The Analytic Hierarchy Process

We created a hierarchical model using the Expert Choice software program, which employs AHP. Our model was built from the top down, with the goal of selecting the preferred ITIM process evaluation technique. The treeview of the model is shown in Figure 1.The nodes of the AHP model were created from the levels and the phases of the ITIM process model. The alternatives considered were the proscribed post implementation review method, the balanced scorecard, and applied information economics.

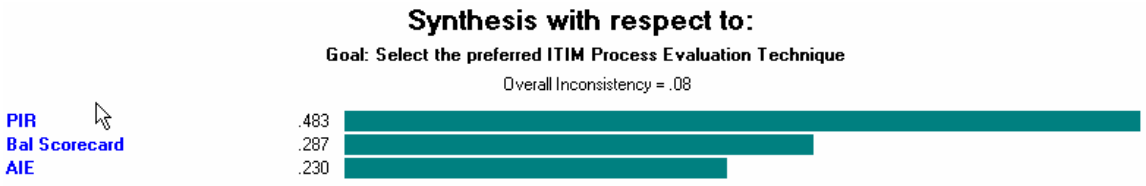
Figure 1 – Treeview of the AHP Model



Preferences were provided by the team using research of and experience with the development of ITIM processes for four Federal agencies (Department of Labor, Department of Housing and Urban Development, General Services Administration, Department of Justice) and pilot programs conducted by the Federal CIO Council on the Balanced Scorecard and Applied Information Economics.

Pairwise comparisons were used to develop priorities for objectives and preferences among alternatives for each objective. After making judgments about the relative priorities of objectives and sub-objectives and the preferences among alternatives, we ran a synthesis according to the goal (Figure 2). The results were a clear preference overall with respect to the goal for the proscribed post implementation review process, with an acceptable consistency index of .08.

Figure 2



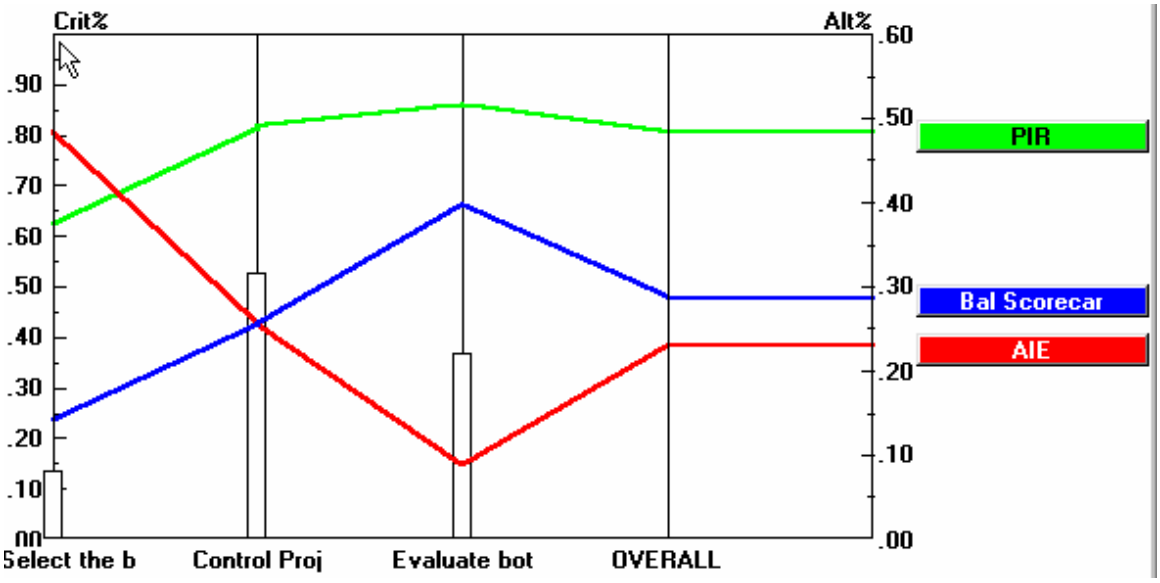
However, there were clear differences for preferences among alternatives throughout the different phases and levels of the ITIM model as shown in the results reported in Table 2.

Table 2 – Synthesis Chart

Node/Objective	PIR	BSC	AIE
Goal	**.483**	**.287**	**.230**
Select Phase	**.376**	**.141**	**.484**
Process	.424	.147	.429
Data	.444	.136	.420
Decisions	.234	.126	.640
Control Phase	**.489**	**.255**	**.256**
Process	.443	.219	.339
Data	.605	.219	.151
Decisions	.536	.325	.139
Evaluate Phase	**.515**	**.397**	**.088**
Process	.638	.272	.090
Data	.371	.539	.090
Decisions	.294	.624	.082

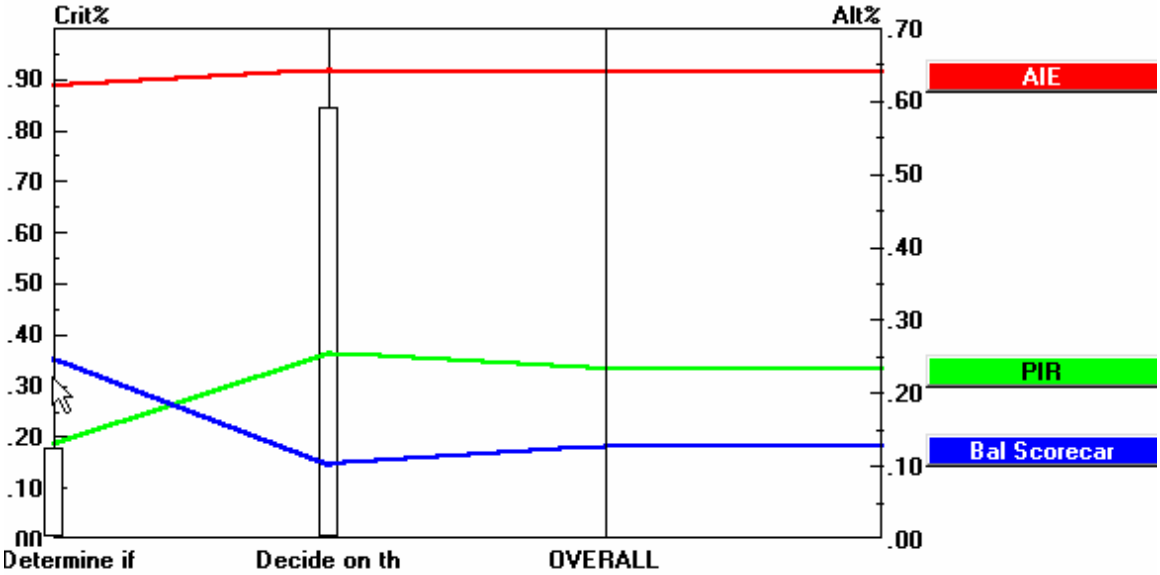
We next tested the sensitivity of the decisions to changes in priorities. Sensitivity analysis reveals the results hold for significant changes in preference scores with respect to the goal.

Figure 3 – Performance Sensitivity Analysis
With respect to Goal



However, some nodes reveal a robust sensitivity for preferences for alternatives other that those for the Goal. For example, Figure 4 shows the performance sensitivity analysis in favor of the AIE alternative for the node representing the Decisions level in the ITIM Select Phase.

Figure 4 – Performance Sensitivity Analysis: Decisions in the Select Phase



Conclusions and Recommendations

The currently mandated approach for evaluating the Federal IT investment management process was in fact the preferred alternative overall. However, when focusing at the level of the actions, data, and decisions for each phase in the ITIM process AHP analysis revealed a mix of preferences for evaluation alternatives:

Table 3 - Preferred Evaluation Alternatives

	Select Phase	Control Phase	Evaluate Phase
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Recommendations suggested by this analysis include revising current guidance for the post implementation review process being used to evaluate the Federal ITIM process. Expanding that guidance to include Balanced Scorecard and Applied Information Economic approaches in the evaluation methodology would be preferred.

Endnotes

[i] See the OMB Capital Programming Guide, the supplement to OMB Circular A-11, Part 3.
[ii] Assessing Risks and Returns: A Guide for Evaluating Federal Agencies' IT Investment Decision-making, GAO/AIMD-10.1.13, February 1997, p. 1.
[iii] Ibid. This guide also offers a glossary of terms and a proposed structure for presenting the results of completed evaluations.
[iv] See www.hubbardresearch.com
[v] The Balanced Scorecard by Robert S. Kaplan and David P. Norton, HBR Press, 1996.
[vi] The Strategy Focused Organization by Robert S. Kaplan and David P. Norton, HBR Press, 2001.

[vii] GAO/AIMD-10-1-13. To be successful, an IT investment management process should generally include the following critical success factors:

Key organizational decision-makers are committed to the process and are involved throughout each project's life cycle.

-- Projects are assessed jointly by IT, financial, and program managers.

The investment management process is repeatable, efficient, and conducted uniformly and completely across the organization.

-- The process includes provisions for continually selecting, managing, and evaluating projects in the investment portfolio.

Decisions are made consistently throughout the organization.

-- Decisions at any level of the organization are made using uniform decision criteria.

-- Decisions are driven by accurate and up-to-date cost, risk, and benefit information.

-- Decisions are made from an overall mission focus (there is an explicit link with the goals and objectives established in the organization's strategic plan or annual performance plans and with the organization's information technology architecture).

Accountability and learning from previous projects is reinforced.

The emphasis is on optimizing the portfolio mix in order to manage risk and maximize the rate of return.

The process incorporates all IT investments, but recognizes and allows for differences between various project types (mission critical, administrative, infrastructure) and phases (new, under development, operational, etc.).