CENTER FOR PUBLIC TECHNOLOGY

Information Technology Investments—Metrics for Business Decisions

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EXECUTIVE SUMMARY

The Information Resource Management Commission (IRMC) functions within the Office of the Governor with the power and duties specified in G.S. 147-33.78(b). The IRMC was established to provide increased emphasis for strategic information technology planning and policy development. One of the integral components of the IRMC is the project certification process. It provides state agencies with a consistent, predictable, measurable, and repeatable means for presenting information technology initiatives that require approval. The General Assembly increased the importance of information technology procurement by outlining information technology portfolio-based management in G.S. 147-33.85(a), including that agencies justify information technology investments on the basis of sound business cases.

The Center for Public Technology, a part of the Institute of Government at the University of North Carolina–Chapel Hill, was established in July 2000 in response to requests for technical assistance in the area of information technology from North Carolina governments. The focus of the Center for Public Technology is applied, seeking to actively collect and disseminate information regarding technology. The goal is to increase governmental skills and organizational capacity to improve services and strengthen communities.

This report represents the final step in Phase One of an agreement between the Center for Public Technology and the IRMC to develop a business case methodology for determining the expected financial and operational impacts of an information technology investment. A key component of the overall project mission is the use of a study team, providing the necessary leadership for developing and implementing a business case methodology for complying with information technology portfolio-based management. Listed below are the major findings of Phase One by category and the general recommendations for a business case methodology.

Major Findings from North Carolina Projects

- A formal business case analysis was not required by the IRMC for project approval during 1999 and most of 2000; however, sixteen of the thirty-six projects reviewed contained a business case analysis. An additional three projects that were underway cited a business case analysis as forthcoming. Beginning in the third quarter of 2000, the IRMC began emphasizing the requirement for business case analysis for project certification.

- The current IRMC requirement for certification entails a "one size fits all" approach to conducting business case analysis. There was no relationship between the sixteen projects with a business case analysis and the complexity of an initiative (cost being used as the proxy for complexity) or the stage of an initiative (research, feasibility, planning, or development).

- A business case methodology template is available at the IRMC Web site for agencies preparing a business case analysis. Currently, it is unclear if or how the template is being used by agencies for project approval.

Major Findings from State Survey

- States often invest in information technology for reasons of accountability and for complying with state and federal regulations.

- States typically develop business case metrics (which can be defined as measures, made over time, that communicate vital information about the performance of a process, or a system of performance measures designed to evaluate an entity's success) for specific purposes. The most common scenario is for agencies to obtain approval for information technology investments from a centralized body.

- A continuum exists among states for approving information technology investments, ranging from a decentralized format where agencies use their budgetary process for project approval to a centralized format where agencies use an information technology oversight body for project approval.

Major Findings from the Private Sector

- Private organizations use business case metrics for a variety of reasons when analyzing an investment in information technology, including the use of market analysis.

- While many organizations espouse the virtues of assessing qualitative benefits from information technology initiatives, most continue primarily to use traditional financial techniques and tools, despite their limitations, to evaluate and prioritize investments in information technology.

- Because information technology has thoroughly permeated organizations, measuring its direct contribution to the bottom line, project by project, has become more and more difficult. However, firms across the board are

approaching financial analysis and evaluation of information technology investments more rigorously than ever.

General Recommendations

- Develop a three-tiered set of business case methodologies that are scaled to the size and complexity of an initiative. These methodologies should be Web-supported. Specific tools should include:

  Tier 1 (least complex/cost): Total Cost of Ownership;

  Tier 2 (middle/cost): Total Cost of Ownership, Payback Period, Benefit/Cost Ratio, Internal Rate of Return, and Return on Investment;

  Tier 3 (most complex/cost): Applied Information Economics.

- The tier requirements are phased to the initiative's life cycle, requiring that business case metrics be completed during the planning phase and refined as the initiative moves through the various stages of its remaining life cycle.

- Convene a task group chaired by a member of the Office of the State Controller to develop accounting reports/tools to more easily track the financial metrics identified by the business case methodologies.

- Develop an in-depth training program and technical assistance program for agency program, business, IT, and legislative staff on the adopted business case methodologies.

- Develop a training/orientation program for senior department and line/staff managers that include essential legal, financial/budgetary, IT architectural, and IT project management issues in effect in North Carolina state government. This orientation should be offered (possibly required) for all agencies contemplating an initiative involving an information technology investment.

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BACKGROUND

The Information Resource Management Commission (IRMC) functions within the Office of the Governor with the power and duties specified in G.S. 147-33.78(b). The IRMC was established to provide increased emphasis for strategic information technology planning and policy development. One of the integral components of the IRMC is the project certification process. It provides state agencies with a consistent, predictable, measurable, and repeatable means for presenting information technology initiatives that require approval based on the following guidelines:

- Total project expenditures are $500,000 or more, or
- The project is a strategic initiative, regardless of budget, or
- The project uses new or innovative technology, regardless of budget, or
- The project is designated for certification by the IRMC.

The General Assembly increased the importance of information technology procurement by outlining information technology portfolio-based management in G.S. 147-33.85(a). The purposes of this management application are to:

- Ensure that agencies link agency information technology investments with their own business plans.
- Facilitate risk assessment of information technology projects and investments.
- Ensure that agencies justify information technology investments on the basis of sound business cases.
- Ensure that agencies facilitate development and review of information technology performance related to business operations.
- Identify projects that can cross agency and program lines in order to leverage resources.
- Assist in state government-wide planning for common, shared information technology infrastructure.

The IRMC, along with the Office of Information Technology Services, is pursuing this mandate by incorporating it in the project certification process. The ultimate goal is for agencies to use sound business practices in the daily management of their own information technology portfolios.

The Center for Public Technology, a part of the Institute of Government at the University of North Carolina–Chapel Hill, was established in July 2000 in response to requests for technical assistance in the area of information technology

from North Carolina governments. The focus of the Center for Public Technology is applied, seeking to actively collect and disseminate information regarding technology. The goal is to increase governmental skills and organizational capacity to improve services and strengthen communities. The objectives of the Center for Public Technology include:

- Provide education and training for state and local government leaders, public managers, and staff professionals on the strategic use of technology and its application to the service of government.
- Facilitate and provide technical assistance on technology related matters to state and local government.
- Foster an environment that uses technology to support innovation, change, and leadership.
- Work on applied research projects that help state and local governments develop strong economies and make the best use of information technology.
- Support the working partnerships among units of government, state and local, and The University of North Carolina System.

The project, involving both the Center of Public Technology and the IRMC, builds upon the mission of the Institute of Government, the objectives of the Center for Public Technology, and the legislative mandate to manage the state's information technology assets in a manner that is portfolio-based.

This effort involves applied research and will require technical assistance, training, and support for innovation, change, and leadership in successive phases. Jane Smith Patterson, Executive Director of the Rural Internet Access Authority (RIAA) and the IRMC Advisory Member, manages the overall project engagement. She also chairs the study team as it seeks to fulfill its mission of providing project guidance, in coordination with Woody H. Yates, Executive Director of the IRMC and in concert with members of the Institute of Government.

PROJECT MISSION

The overall project is designed to develop a business case methodology and process to determine the expected financial and operational impacts of information technology investments on governmental units. The project will develop evidence-based, business decision methodologies and tools to accurately gauge the total cost of ownership, the payback period, the internal rate of return, and the benefit/cost ratio of technology initiatives prior to their inception.

PROJECT OVERVIEW

Developing business metrics for North Carolina governments to use in the measurement of information technology strategy is a complex endeavor. This report represents the initial phase of the effort. It assesses the current practices and methodologies used by North Carolina state agencies and other states related to obtaining costs of service delivery, information technology return on investment, and life cycle costing. The purpose is to identify the current methodologies and tools being used by organizations to structure their information technology portfolios. It also provides a framework for identifying "best practices" among other states and private industry for analyzing information technology investments.

The first step was to create a study team to guide the overall project. The purpose of the team is to guide the project as it develops, to identify the critical areas for success, to review the information prepared by the project staff members, and to assist with implementing the recommendations. The divergent backgrounds of study team members are a direct response to the scope and the complexity of this project.

The second step of the assessment involved a review of projects certified during 1999 and 2000 by the IRMC, examining the estimates and methodologies used in calculating total life cycle cost of ownership and return on investment. The purpose was to obtain an understanding of the current procedures for approving information technology projects, to examine the current requirements for project approval, and to identify the current methods being used to justify information technology investment decisions.

The third step of the assessment was a national survey to examine the methodologies and practices of other state governments, identifying the best practices currently being used for approving information technology investments. This step also included an examination of current practices used by the private sector for making investment decisions regarding information technology. Although this portion of the assessment was limited by proprietary information, it demonstrated the level of sophistication used by private organizations for developing business metrics and provided an overview of organizations that specialize in developing models and methodologies for analyzing information technology investments.

This report is the fourth step. Its purpose is to provide the key findings associated with each step, and to offer the recommendations for a second phase of the project.

The study team provided review and feedback in the creation of this report, and general consensus has been obtained for the recommendations contained herein.

STUDY TEAM

Appendix A contains the list of the study team members. The first meeting of the study team was held on July 16, 2001 to introduce the study team members to the purpose of the project and to review the agreement between the Center of Public Technology and the IRMC. Feedback was obtained from study team members on the various steps of this initial phase and on the issue of increasing capacity within governmental organizations.

The study team discussed at length the following variables that must be taken into account when analyzing a change in organizational capacity that results from information technology investments:

- Organization mission, goals, and objectives;
- Strategic planning and design;
- Business processes and the supportive technology used to deliver services;
- The human capital (in terms of number and skill-level) and relative effort;
- Time and timing;
- Risk associated with the change in information technology;
- Project costs and project benefits;
- Organizational and business process productivity measures;
- Organization project management experience and investment;
- Procurement and training;
- Impact on other agencies or governments; and
- Impact on clients/stakeholders and citizens.

The second meeting of the study team was held on August 1, 2001. The purpose of the meeting was to present the initial findings from the review of other state practices, to provide an update on the private sector, to present observations on approved information technology projects in North Carolina during 1999 and 2000, to review the current approval process, and to discuss the attributes of a model or a methodology for calculating selected business case metrics.

The study team indicated that the following attributes were important and should be included in the design of recommended methodologies and processes:

- Rely upon current business strategy used by other states and by private organizations when possible;

- Show results consistent with a balanced scorecard presentation;
- Not one size fits all, but tiered according to project cost or complexity;
- Flexible and scalable by size, function, and level of government;
- Simple to use;
- The method should develop in its utility, providing feedback throughout the project's life cycle;
- Understandable for users and audience;
- Web-based;
- Risk and probability adjusted; and
- Present clear cost and benefit data.

The third meeting was held on September 6, 2001 to discuss the recommendations for model development and for a second phase of the project. The primary purpose of the meeting was to ensure that general consensus was obtained from the study team before presenting the model framework to the IRMC. The study team continued to focus on the changes required in organizational culture for project success. In other words, if the model is not used for purposes other than project approval, its utility will be severely decreased.

BUSINESS CASE ANALYSIS

A business case is an analytical concept that is useful in making decisions under conditions where priorities must be made, economics are important considerations, and choices are limited by fiscal or other constraints. Business cases are typically used in conjunction with the theory of modern portfolio analysis, which involves the selection of the mix of investments from multiple options that best meet organizational goals and risk profiles given fiscal or other constraints. Business cases often contain the following four major components:

- Costs: These include initial investment and ongoing expenses and may involve concepts such as total cost of ownership (TCO) over the useful life of the investment. TCO costs may include items such as technology evaluation, capital outlay, operation and maintenance, and retirement.
- Benefits: These are expressed in monetary terms to the extent known, and intangible or non-monetary advantages are often included. Benefits may include items such as increased revenues and cost savings.
- Measure of value: A means of evaluating or judging an investment opportunity in economic terms, often based on the time sequencing of costs and benefits. These include techniques that recognize the time value of money, such as internal rate of return (IRR) and net present

value (NPV). Other measures may include return on investment (ROI), payback period, annual savings, and so forth.

- Justification: The net of the above considerations, which means priority-sequencing decisions are made on total business impact factors (such as financial, operational, internal, and external). A project with a lower measure of economic value may receive higher priority due to non-financial considerations, such as support of business strategy, compliance with legal or regulatory requirements, business risk reduction, new business opportunity, political mandates, and so on.

While the concepts underlying business cases are constant, the level of sophistication and the intricacy of techniques employed for analysis may vary with the complexity, risks, and size of the investment being considered. While simpler and less costly investment opportunities may be addressed with order-of-magnitude estimates and spreadsheets, more involved, riskier, and more expensive investments may require sophisticated tools and complicated mathematical and statistical techniques for analysis and evaluation.

These advanced computational tools and techniques include Monte Carlo simulation, risk adjusted returns, and value of information analysis (VIA). Monte Carlo simulation provides probability distributions for monetary and economic value results. Risk adjusted returns express the economic results in relation to a risk/return profile (that is the return commensurate with the person's or organization's tolerance for the associated risk). The VIA statistical technique focuses on the factors that are most important to the economic results of a business case in terms of degree of accuracy of data. That is, a small change in these factors will result in a big variation of the economic value of the business case (sensitivity analysis), and these factors usually have a large uncertainty in data (such as wide probability distribution for possible values).

Regardless of the level of accuracy and degree of sophistication of the business case model, the decision ultimately may be determined by non-economic factors. Non-quantifiable considerations, such as political expediency or business strategy, may outweigh the economic value, irrespective of the degree of care and method of expressing it.

Potential Uses of Business Cases

For information technology initiatives or investments, the beginning-to-end life cycle typically involves four major phases, which are:

- Strategic business and information technology planning.

- Project concept and planning.
- Project development and implementation.
- System or technical infrastructure operation and retirement.

Normally, the four phases are conducted sequentially in the order given, and a succeeding phase will not begin until the preceding one has been completed satisfactorily. The potential use of business cases to support major decision-making activities in each of the phases is described below.

Strategic Business and IT Planning

In the private sector and in many governmental settings, business cases are used primarily for planning and budgeting in which information technology investments are selected from a fact-based prioritization approach based on a business case control process. Business cases are used to demonstrate—on the basis of reliable data and credible analysis—that proposed investments will produce economic or other benefits that make the costs worthwhile. Business cases recognize the need to justify projects economically before investing in them. For major long-term information technology initiatives, business cases should include the incremental approach for implementation efforts, so that the risks of doing many things over longer time periods are spread across smaller, more manageable and shorter-scheduled subprojects to realize a time-phased stream of benefits and economically valuable results. That is, large-scale projects should provide favorable business results incrementally over a series of smaller time periods versus the full return of benefits that does not materialize until the end of a long time line.

A major use of business cases in this phase is to ensure that information technology plans and proposed investments are directly linked to business plans. This is accomplished by ensuring the following:

- Information technology investments are aligned with business strategies and strategic priorities.
- Information technology investments support business goals and objectives.
- The optimum mix of information technology investments is selected to meet business strategies within fiscal and other constraints.

Project Concept and Planning

This phase assumes that information technology initiatives have been selected and approved from a strategic business perspective. Accordingly, the major use of

business cases here is to link project plans and approaches to the business objectives that must be obtained. This is accomplished by ensuring the following:

- The scope, complexity, and cost of initiatives match business requirements. That is, the project plan, technical approach, timetable, and resources are in line and reasonable given expectations for business goals and technical performance (including system or infrastructure capabilities and benefits).
- The risks are known and steps are taken to mitigate them for agency and state risk/benefit profiles. That is, the project plan, technical approach, timetable, and resources are in line and reasonable given the degree of acceptable risks.
- Benefits are being maximized through business process improvements and other efficiency steps enabled by the wise use of technology.

Business cases may be used to evaluate more detailed aspects of project implementation plans and approaches, including technical decisions. The business case concept, combined with the discipline of a rational process for evaluating options and selecting best alternatives based on economic and other germane criteria, can be employed to perform "what if" analyses for deciding on project approaches, work plans, and technologies. Even technical decisions can be analyzed and supported, based on the findings and results of business cases that consider all relevant issues.

Project Development and Implementation

Even with well-managed and high-performance projects (those that are on time, on budget, and delivering expected results and capabilities), unforeseen events and circumstances must be addressed. Alternative approaches and optional reactions can be analyzed through the use of business cases that consider the economic and other impacts of viable courses of action. The end of the system design phase is an ideal time to review and update past business cases, because more precise and realistic information regarding key variables and risks is known. In extreme cases, project cancellation decisions can be made, rationalized, and explained by expressing the realities of the situation in a business case format.

System or Technical Infrastructure Operation and Retirement

Systems and infrastructure may last for several years. As a result, multiple large-scale upgrades and enhancements may be undertaken over time. These can be significant monetary and personnel investments; therefore, these "maintenance" projects should be evaluated and managed in much the same manner as new investment endeavors. Business cases can be used to justify these investments and

to select the best approach for implementing them based on economic and other pertinent criteria.

Another important potential use of business cases in this phase is to assist in determining the optimal time for retirement and/or replacement. Over time, due to high maintenance cost, technical obsolescence, or the emergence of opportunities for using personnel and money resources in other areas, the decision on retirement or continuance must be evaluated and justified. The business case concept may be useful in conducting this exercise.

NORTH CAROLINA

The primary purpose of the project certification process is to ensure that information technology initiatives are positioned as favorably as possible for success from business, project management, and technical perspectives. One element of that objective is to employ the business case concept to the extent required for ensuring that key initiative parameters are congruent with the business goals and purposes of the investment. That is, the initiative approach, work plan, costs, benefits, timetable, deliverables (technical and functional capabilities), technology, risks, and other relevant factors impacting its success and results are in line with and appropriate for its business objectives and intentions. The certification process also ensures that each initiative complies with the state and agency technical, security, and application architectures, and each conforms to the enterprise approach for the statewide management of information technology.

Project certification is not part of the state's budgeting process, which is conducted under the auspices of the Office of State Budget and Management. The activities of identifying viable information technology investments—analyzing, ranking, justifying, and selecting worthwhile initiatives—are expected (under normal circumstances) to be performed within the budgeting process. Only initiatives approved by agencies under the budgeting process or as a result of other circumstances (such as federal regulations, legislative mandates, or political initiatives) are submitted for certification.

Project certification is a comprehensive activity that is the beginning of an involved and ongoing process to ensure the quality and success of information technology initiatives from concept by the sponsoring agency through approval and implementation. This includes the preparation and submission of monthly status reports and the review of progress by the Information Technology Services/Information Resource Management staff. For larger, riskier, and more visible initiatives, independent, outside, third-party quality assurance reviews are conducted at critical points in the work plans to ensure that these efforts are

proceeding as scheduled, deliverables satisfy specifications, costs are accurately presented, and opportunities for improvements are identified. A closeout review is conducted after implementation to ensure that the installed infrastructure or system is being supported, anticipated capabilities are available, and expected benefits are accruing.

Methodology

A review of thirty-six projects that were approved by the IRMC in 1999 and 2000 was used to analyze the certification process, to examine the documents (Project Concept Document and Project Proposal Checklist) required for project submission, and to identify the business case metrics used to justify the financial return on information technology investments. The review did not include the Technical Architecture Submission Document. Appendix B contains the list of projects reviewed during the selected time period. Table 1 provides the number of projects reviewed by project type.

Table 1

Project Type	Definition	Projects Reviewed
Research	To explore options for developing new systems or work products.	0
Feasibility	To prove, or disprove, the appropriateness of the technology solution under existing constraints.	2
Planning	To outline the sequence of activities and resources needed to complete a work effort.	5
Development	To provide all tasks and activities necessary to build a software product.	25
Planning/ Development	To provide the outline and the final tasks and activities together.	4

Table 2 presents the projects by tiered amounts, representing the budget for implementation and not the total cost of ownership. The majority of projects approved during 1999 and 2000 by the IRMC exceeded a budgeted amount of $1 million. The nine projects below the $500,000 threshold for project approval represent strategic initiatives, innovative technology, or projects deemed necessary for approval by the IRMC.

Table 2

Tiered Amount (project budget)	Number of Projects
Less than $500,000	9
$500,000–$1,000,000	5
Greater than $1,000,000	22

Worksheets for two projects containing a cost/benefit analysis were obtained to examine the methodology used for justifying the projects and to receive feedback from the agencies on the approval process. The first cost/benefit analysis identified and quantified the costs associated with the project. Although the benefits clearly justified the project, they were not quantified, preventing a benefit/cost ratio or a payback period from being calculated. The project was approved and implemented.

The second cost/benefit analysis identified and quantified both the costs and benefits associated with the project. While no benefit/cost ratio was calculated (it would have been less than 1 if calculated), a payback period of five years was identified. The project was approved but eventually cancelled.

Findings

- A formal business case analysis was not required by IRMC for project approval during 1999 and most of 2000; however, sixteen of the thirty-six projects reviewed contained a business case analysis. An additional three projects that were underway cited a business case analysis as forthcoming. Beginning in the third quarter of 2000, the IRMC began emphasizing the requirement for business case analysis for project certification.

- The current IRMC requirement for certification entails a "one size fits all" approach to conducting business case analysis. There was no relationship between the sixteen projects with a business case analysis and the complexity of an initiative (cost being used as the proxy for complexity) or the stage of an initiative (research, feasibility, planning, or development).

- A business case methodology template is available at the IRMC Web site for agencies preparing a business case analysis. Currently, it is unclear if or how the template is being used by agencies for project approval.

- Components of a business case analysis are requested on the Project Concept Document and on the Project Proposal Checklist (system cost,

total cost of ownership, performance model, expected benefits, financial indicators, risk profile, and project management).

- The worksheets for completing the Project Concept Document and the Project Proposal Checklist are not required for project approval unless requested during the project approval process.

- No standardization among agencies existed during 1999 and 2000 in regard to gathering and using information for completing the Project Concept Document and the Project Proposal Checklist.

- Nine of the thirty-six projects reviewed provided a total cost of ownership and a life cycle period on the Project Concept Document. Four projects cited these metrics as forthcoming.

- Eleven of the thirty-six projects reviewed indicated on the Project Proposal Checklist that a cost/benefit analysis was completed. Five projects cited that a cost/benefit analysis was forthcoming.

- The focus for project approval during 1999 and 2000 was on the completion of the required documentation, not on the accuracy or reliability of the Project Concept Document and the Project Proposal Checklist.

- Once the quality assurance (QA) review is completed and the project is officially closed, no formalized tracking method is used for the operational and the financial performance of the project during its remaining life cycle.

- A risk assessment was completed for twenty-four of the thirty-six projects reviewed during 1999 and 2000; however, these assessments focused more on the technical architecture and the project management as opposed to the business case analysis.

STATE SURVEY

A key element of phase one was to determine the practices currently being used by other organizations, both public and private.

Methodology

The public component was accomplished by sending a national e-mail survey to the chief information officers of the fifty states. The following questions were included on the survey:

- Are the information technology investment practices centralized or decentralized in your state?
- Is there an oversight body that certifies or approves information technology projects?
- Does your state have a standard methodology or model for assessing the return on investment or the total cost of ownership for information technology investments?
- Do you have online resources about your methodology?

The survey produced twenty-four usable responses. Table 3 contains the twenty-four states that responded by the following categories: decentralized, hybrid, and centralized. The agencies in states that follow a decentralized format basically use their annual or biennial budget processes to obtain approval for information technology projects. Six states were placed into this category.

The states listed under the hybrid format in Table 3 use a dual process for approving information technology projects. One example is where a state requires agencies to obtain approval from a centralized body for the technical architecture associated with an information technology investment and allows the agencies to use their normal budgetary processes for project justification. Another variation of the hybrid format is where a state uses pooled technology funds. In this scenario, agencies must obtain approval from an oversight body for the technical architecture and project justification (business metrics) if pooled funds are involved. Otherwise, the agency uses its normal budgetary processes.

Table 3

Decentralized	**Hybrid**	**Centralized**
Alabama	California	Arizona
Arkansas	Connecticut	Colorado
Louisiana	Iowa	Maine
New Hampshire	Kansas	North Carolina
Rhode Island	Nevada	Oregon
Vermont	New Jersey	Utah
	New Mexico	Virginia
	South Dakota	Washington
	Tennessee	
	Wisconsin	

The states listed under the centralized category in Table 3 require agencies to obtain project approval from a centralized body or position before proceeding with

an information technology initiative. The project approval process normally includes the technical architecture component of the application and the project justification based on some form of business case metric. However, the validity of the business case metrics was not determined. In other words, the organizational culture of embracing and using the business case metrics beyond project approval was not determined.

Appendix C contains an overview of the project authorization, the required documentation, and the project monitoring process for thirteen states that responded to the survey. Table 4 presents the business case metrics used by the state of Iowa for an example of how a state justifies an investment technology initiative by calculating a return on investment.

Table 4

Iowa's Business Case Metrics	
Annual prorated cost	(total budget/useful life) + (annual cost of operation)
Total annual benefit	(annual baseline cost – future annual cost) + annual citizen benefit + annual other benefits
Return on investment (ROI)	(total annual benefit – annual prorated cost/total budget) x 100

The annual prorated cost in Table 4 is calculated first by amortizing the total initial investment over the project's estimated useful life and adding the annual cost of operation. The next calculation is the total annual benefit, which is primarily derived from future annual baseline cost minus the future annual cost.

Citizen benefits and other benefits are then added to the result for the total annual benefit. The advantage of this calculation is that both a hard dollar measure and a hard plus soft dollar measure can be calculated, defining soft dollars as estimates for intangible benefits. The final metric is the return on investment. It is calculated by subtracting the annual prorated cost from the total annual benefit, dividing by the total budget, and multiplying the result by 100 to convert to a percentage.

Another benefit of the Iowa model is the additional business metrics that can be calculated from this exercise. For example, the payback period can be calculated along with the benefit/cost ratio and the internal rate of return. This model also provides the framework for evaluation. An actual baseline can be calculated each year and compared to the original model to examine the accuracy of the business

case metrics. One state from the survey uses an agency's historical accuracy with business case metrics as part of the approval process for new information technology projects.

Best Practices

Table 5 provides an overview of best practices identified from the state survey. Each state has advantages and disadvantages associated with its respective model, suggesting that there is no one best way for analyzing an information technology initiative. However, the states shown in Table 5 have placed emphasis on certain business case metrics to increase the likelihood of making a sound business decision.

New Hampshire requires that information technology initiatives be tied to the agency's strategic business plan. This is a critical element given that organizations in the United States often view technology as the solution and not as a possible solution. The link to strategic planning ensures that the goals and the objectives of an agency guide the investment process.

Arizona uses a tiered system for its information technology investment process. The greater the investment, the more justification from the business case analysis is required. This prevents smaller projects from receiving the same amount of attention when compared to larger projects with more risk.

Table 5

Best Practices	
New Hampshire	Strategic business plan
Arizona	Tiered system
Colorado	Alternatives analysis
California	Risk assessment
Oregon	Net benefit (present value)
Tennessee	Cost/benefit analysis

Colorado places emphasis on an alternative analysis methodology for constructing a feasibility study for proposed information technology initiatives. The first step is to calculate a baseline for the current operating system, focusing on procedures, personnel, programs, data characteristics, and technical architecture. The costs and benefits are determined for each alternative and compared to the baseline. The final step is the evaluation process based on the economic analysis of alternatives.

The remaining states, California, Oregon, and Tennessee, are identified for the various components of their business case metrics. California has created a Web-based risk assessment methodology as part of analyzing an information technology investment. Oregon is one of the few states that includes net benefits and discounted net benefits as part of its business case metrics. Tennessee is included for its emphasis on cost/benefit analysis, including a detailed methodology for agencies to follow when calculating the various components of the model.

The results of the state survey provide an excellent source of information that can be used in developing business case metrics for the state of North Carolina. They also reinforce the need for sound business decisions within state agencies and the need for a central body to govern information technology initiatives.

Findings

The following findings are based on the twenty-four states that responded to the e-mail survey.

- States often invest in information technology for reasons of accountability and for complying with state and federal regulations.

- States typically develop business case metrics (which can be defined as measures, made over time, that communicate vital information about the performance of a process, or a system of performance measures designed to evaluate an entity's success) for specific purposes. The most common scenario is for agencies to obtain approval for information technology investments from a centralized body.

- A continuum exists among the states for approving information technology investments, ranging from a decentralized format where agencies use their budgetary process for project approval to a centralized format where agencies use an information technology oversight body for project approval.

- The approval of the technical architecture of an information technology initiative tends to be centralized among responding states.

- The approval of the business case analysis of an information technology initiative tends to be decentralized among states.

- Currently, there is wide variation among states regarding business case metrics, ranging from no requirements to very specific metrics for project approval.

- States that use business case metrics for making information technology decisions tend to rely on one specific measure for the approval process as opposed to a number of metrics.

- Some states not only require that agencies complete a business case methodology template when seeking approval for an information technology project, but also provide the specific worksheets used to calculate the selected business case metrics contained within the template.

- Some states require that information technology initiatives be tied to their strategic plans in addition to other requirements for project approval.

- Several states have a formalized tracking method for obtaining information on operational and financial performance of information technology initiatives during their complete life cycles.

PRIVATE SECTOR PRACTICES

An informal telephone survey was conducted with several large corporations to determine what techniques, models, and procedures were used when evaluating information technology investment decisions. Due to the proprietary nature of this information, firms are not specifically identified by name, however, key highlights and trends are reported. The organizations in this sample included sector leaders in applied technical and professional services, computer hardware, software, Internet connectivity, and electric power generation.

Methodology

The survey questions were general in nature, providing the participating companies with maximum flexibility. For example, firms were asked how information technology investment decisions were made organizationally, who made them, and what type of financial/quantitative analysis was deployed to determine the business value or return on investment? Were financial models used and if so, by whom, and to what degree? Also, how were intangibles measured and were hurdle rates (the cost of capital or the required rate of return) established for projects to be prioritized against?

Current Approaches

Existing economic conditions have driven corporate decision makers to ask challenging questions, such as: "Does an investment in information technology pay off, and if so, when, and by how much?" Private sector organizations continue to pursue the issue of how to best measure the success (or lack thereof) of the project investment once implementation is complete.

To place this issue into perspective for the private sector, information technology spending during the period between 1995 and 1999, according to the U. S. Department of Commerce, accounted for a full one-third of all real economic growth and half of all productivity growth in the United States. During 1999, U.S. corporations invested $762 billion in information technology. Managers and executives evaluated information technology investment opportunities and arrived at investment decisions prior to approving these enormous expenditures.

Participating firms in this survey reconfirmed the current trends identified at this time, as shown below:

- Information technology value must be measured against the value of the business strategy it is intended to support. *The Gartner Group*
- Companies are focusing on information technology initiatives that will generate better returns on investments (ROI). *Computerworld*
- Faster results are key. Firms are moving to three-year amortization schedules for information technology initiatives. *Computerworld*
- Total Cost of Ownership (TCO) is receiving renewed attention at a time when information technology managers are coming under increasing pressure to trim operational costs—service levels and business impact must be factored in. *Computerworld*

Selected Business Metrics

Private sector entities tend to use a combination of financial measurements to assess the attractiveness of given information technology investment opportunities. This approach allows decision makers to examine the opportunities from a portfolio perspective. While some projects may indicate strong financial results, others may show weaker returns but are approved for funding because they provide unique critical success factors to the entire portfolio of initiatives. Examples include infrastructure and integration improvements and initiatives that are required due to government and regulatory changes. The following provides a sample of metrics currently being used by private industry:

Net Present Value (NPV)

- Helps determine if the investment should be made.
- Recognizes time value of money.
- Negative NPV: implies that initiative should be avoided if it is directed at cost reduction.
- Positive NPV: implies that the assessment should include further risk analysis.

Internal Rate of Return (IRR)

- Determines the interest rate and then compares this rate to the "risk adjusted rate of return" and is useful in the ranking of IT investment initiatives.
- Because it is a rate or ratio it is very useful for comparing dissimilar initiatives.
- Best used in conjunction with net present value.

Payback

- Identifies the amount of time required to pay back the initial investment.
- Typically should not be used as sole indicator for an IT investment.
- Favorable results indicate lessening degree of risk with short payback period.

Benefit-to-Cost Ratio

- Determines dollars returned for every dollar invested.
- If the number is positive, the venture is pulling its weight.
- If the number is negative, the venture is not returning its investment.

Return on Investment (ROI)

- Evaluates the earnings derived from an IT investment as compared to the investment expended to complete the venture.
- Widely used as a key metric to sell IT investment decisions.

Applied Information Economics (AIE)

- Synthesizes a variety of techniques from scientific and mathematical fields (decision theory, financial theory, and statistics).

- Determines the value of information, methods for modeling uncertainty in estimates, and treating the IT investment as a type of investment portfolio.

Stages of IT Investment Evaluation

Organizationally, some firms tend to embrace a segmented approach to information technology investment decisions. This offers distinct advantages as it allows input and collaboration from several internal and external (outside of the requesting department) entities prior to funding. This may be referred to as a concurrent development model, involving three distinct phases of investment assessment prior to actual approval. First, the strategy and planning phase is completed. Next, the evaluation and assessment phase is completed. Finally, the recommendation phase provides the investment decision.

No clear trends were identified across the private sector that suggested a specific decision-making approach. Rather, private entities tend to use existing management structures to evaluate the attractiveness of particular investments, which systematically involves various management levels depending upon the cost of the proposed investment.

Contrast of Public and Private Sector Issues

Public entities are driven to utilize information technology to make governmental operations more efficient through economies of scale and to provide more services to citizens at lower costs. In comparison, private corporations are concerned about cost savings, efficiency, and customer relationship management. Non-public entities are also very interested in using information technology for competitive advantage—primarily as a differentiator. Private organizations also approach information technology investment decisions by analyzing many alternatives. More often than not, both public and private sectors share many of the same business priorities and objectives.

Findings

- Private organizations use business case metrics for a variety of reasons when analyzing an investment in information technology, including the use of market analysis.

- While many organizations espouse the virtues of assessing qualitative benefits from information technology initiatives, most continue primarily to use traditional financial techniques and tools, despite their limitations, to evaluate and prioritize investments in information technology.

- Because information technology has thoroughly permeated organizations, measuring its direct contribution to the bottom line, project by project, has become more and more difficult. However, firms across the board are approaching financial analysis and evaluation of information technology investments more rigorously than ever.

- A clear process for decision-making and a clear articulation of how certain costs and benefits are to be accounted for is essential.

- Some organizations have created a "business value index" that is used after they have already performed a financial benefit analysis for the tangible benefits. For example, values between one and four would be assigned to intangible benefits on a scorecard. This approach allows executives to gauge one investment opportunity against another over time.

- Other situation analysis techniques were used to determine what the cost would be of not investing in a particular information technology project, including the evaluation and monetary impact of making similar investments in sub-optimal ways.

COST METHODOLOGY

A major component of implementing the business case methodology is constructing the cost templates required for calculating the business case metrics. The cost methodology is directly linked to the third general recommendation of this report: convening a task group chaired by a member of the Office of the State Controller to develop accounting reports/tools for calculating and tracking financial metrics. The accuracy, reliability, and comparability of the financial data used to calculate the business case metrics will drive the usefulness of the business case methodology for making decisions regarding information technology investments.

Governmental (fund) accounting is designed to provide financial accountability for public organizations. It is based on tracking revenues and expenditures within funds, allowing managers to make decisions based on their annual operating budgets. However, governmental accounting is often criticized for its inability to produce information in formats required for making decisions beyond that of budget compliance. An alternative is managerial accounting, a process of accumulating, analyzing, interpreting, and communicating financial and operational information in a format that assists with fulfilling organizational objectives.

Organizations often embrace managerial accounting for the benefits of cost accounting, tracking the total cost of service delivery. The difficulty of cost accounting is the time and the resources required to maintain a cost system in addition to a financial system for fund accounting. Therefore, organizations often create cost methodologies for specific purposes, using accuracy, reliability, and comparability as their guides for construction. The state of Tennessee, for example, focuses primarily on costs associated with personnel, technical architecture, training, and ongoing operational requirements when using its cost/benefits analysis for making an information technology investment decision.

Developing a meaningful and usable cost methodology for calculating the business case metrics associated with a proposed information technology investment is essential for successful implementation of a business case methodology. There are limitations to creating cost methodologies that are not based on total cost (direct, indirect, and capital). However, these limitations can be overcome with the following: (1) the methodology addresses the major areas of costs (personnel for example), (2) the methodology provides clear guidance on where to obtain the financial data needed for calculation, and (3) the methodology is used consistently within and across agencies.

RECOMMENDATIONS

The following recommendations underscore the importance of the entire organization's involvement in and understanding of the project or initiative. The development and evaluation of business case metrics should involve both business and technical talent, and not be assigned to technology or contract staff exclusively, for the sake of the IRMC project certification. Senior managers, line managers, and staff need to understand the utility and limitations of these methodologies when considering, approving, and implementing technology initiatives.

An implication of the findings contained in this report is the need for appropriate business case metrics to be developed and in place while an information technology initiative is being planned and before substantial work is completed. These tools should follow an initiative through its life cycle and into implementation, providing managers and policy makers with important information about the results of the investment.

The recommendations acknowledge that projects differ by cost and complexity. This prompted the suggestion that the methodologies be tiered as well, allowing

the cost and time involved in accomplishing the chosen business case methodology to be reasonable and not overly burdensome.

These metrics, and the processes used to create and track them, can serve the purpose of helping an agency to measure the relative cost and impact of a technology or business process change on the overall productivity of a business function. This ability to measure results provides an important tool for managers and policy makers to make the best use of constrained resources, and to evaluate the correctness of "fit" between business functions and their information support systems. This capacity allows an agency to describe in clear and credible terms to policy makers and the public the relative value of the proposed investment.

The general recommendations address the overall business case methodology. The specific recommendations build upon the current North Carolina process for project approval. Appendix D contains the definitions of the business case metrics presented for the methodology.

General

- Develop a three-tiered set of business case methodologies that are scaled to the size and complexity of an initiative. These methodologies should be Web-supported. Specific tools should include:

  Tier 1 (least complex/cost): Total Cost of Ownership;

  Tier 2 (middle/cost): Total Cost of Ownership, Payback Period, Benefit/Cost Ratio, Internal Rate of Return, and Return on Investment;

  Tier 3 (most complex/cost): Applied Information Economics.

- The tier requirements are phased to the initiative's life cycle, requiring that business case metrics be completed during the planning phase and refined as the initiative moves through the various stages of its remaining life cycle. Therefore, metrics provide intermediate accomplishments with measurable value, even if the initiative is eventually cancelled.

- Convene a task group chaired by a member of the Office of the State Controller to develop accounting reports/tools to more easily track the financial metrics identified by the business case methodologies.

- Develop an in-depth training program and technical assistance program for agency program, business, IT, and legislative staff on the adopted business case methodologies.

- Develop a training/orientation program for senior department and line/staff managers that include essential legal, financial/budgetary, IT architectural, and IT project management issues in effect in North Carolina state government. This orientation should be required for all agencies contemplating an initiative involving an information technology investment.

Specific

- Require business case analysis using a business case methodology template that takes into account scale and complexity of the initiative.

- Require that business case analysis be completed for all initiatives to be developed at least by the time the initiative concludes the planning phase of the information technology life cycle.

- Develop a business case methodology that integrates the information currently required by the Project Concept Document, Project Proposal Checklist, and risk assessment, and includes source documentation to allow for easier third party review, especially for the more complex initiatives.

- Especially for more complex (costly) initiatives, include the capacity to track the performance metrics articulated in the business case methodology from the planning phase until the end of the initiative's life cycle.

- Provide for independent support for agencies completing the business case methodologies and increase the scope of quality assurance (QA) review to include assessment of the business case methodologies for accuracy.

CONCLUSION

The overall project is designed to develop a business case methodology and process to determine the expected financial and operational impacts of information technology investments purchased or developed by governmental agencies. Business cases are used in conjunction with the theory of modern portfolio analysis, which involves the selection of the mix of investments from multiple options that best meet organizational goals and risk profiles given fiscal or other

constraints. This project is designed specifically for analyzing proposed investments in information technology.

This report represents the final step of Phase One of an agreement between the Center for Public Technology and the IRMC. It contains the mission of the project, an overview of the various steps conducted in Phase One, the results from reviewing thirty-six projects approved by the IRMC during 1999 and 2000, the findings of a national e-mail survey, the findings from reviewing private sector practices, and the recommendations for developing a business case methodology. This report also includes information on business case analysis and cost accounting.

The major finding of this report is that there is no "one best way" for analyzing an investment in information technology. However, the information collected and reviewed for this report provided the foundation for recommending a tiered business case methodology based on the life cycle of an information technology initiative and based on cost (the proxy for complexity and risk).

The scope of Phase Two of the overall project engagement will be to develop the specific business case metrics for each tier and to develop the process for calculating the metrics, including the design of a cost accounting methodology. Phase Two also will include the development of a training curriculum.

Phase Three will include the development of Web-based tools for using the business case methodology and the selection of three agencies for testing the process and business metrics. Phase Four, the final phase of the overall project engagement, represents statewide implementation and training.

A great opportunity lies ahead for the state of North Carolina. While the scope of Phase One has far exceeded all prior efforts on this topic, it should be noted that before beginning Phase Two, it is necessary to assess the critical success factors. For example, will sufficient resources be readily available to the IRMC and the Institute of Government to fund this initiative? Furthermore, exactly how will the timeline and project plan unfold for all stakeholders involved? Clearly, further collaboration and assessment by both entities are required to take full advantage of this initiative.

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APPENDIX A
Study Team

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Appendix B
North Carolina Projects

Number	Agency Name	Project Name	Project Description	Date Approved	Project Amount ($)
1.	Department of Health and Human Services	Enterprise Program Integrity Control System	Enhance the state's ability to reduce the number of fraud incidents.	02-Feb-99	5,100,000
2.	Department of Health and Human Services	Information Network Supporting Youth in North Carolina	To achieve better outcomes for families.	02-Feb-99	6,000,000
3.	Department of Health and Human Services	Common Name Database Service	Reengineer the common name database as a callable service.	02-Feb-99	1,800,000
4.	Department of Health and Human Services	Biometric Identification Reporting and Tracking	Provide the ability to detect fraud in welfare programs.	02-Feb-99	22,000,000
5.	Department of Transportation	Maintenance Management System	Improve management practices and support computer information systems.	02-Mar-99	5,369,731
6.	Department of Transportation	Fuel Tax Compliance	Assist in stopping the evasion of taxes for motor fuel tax revenues.	02-Mar-99	11,315,284
7.	Department of Health and Human Services	Identification, Tracking and Measurement Enhancement	To reengineer the North Carolina Medicaid management information system.	06-Apr-99	10,910,917
8.	Department of Health and Human Services	Fraud Abuse and Detection System	Replace existing system with Year 2000 compliant system.	06-Apr-99	2,300,000
9.	Administrative Office of the Courts	Magistrate Warrant Control Module	Automate the processing and handling of criminal cases.	06-Apr-99	8,900,000

Number	Agency Name	Project Name	Project Description	Date Approved	Project Amount ($)
10.	Department of the Environment and Natural Resources	Basin-wide Information Management System	Provide automated support for business functions.	01-Jun-99	3,422,500
11.	Department of Health and Human Services	Multi-payer client care process	A feasibility study to develop supporting processes to centralize claims processing.	07-Sep-99	1,279,151
12.	Criminal Justice Information Network	eCitation	To demonstrate the effectiveness of an electronic traffic citation system.	07-Sep-99	500,000
13.	Department of Transportation	Automated Routing and Permitting System	To automate the processing of applications for transport permits.	07-Sep-99	1,064,400
14.	Department of Health and Human Services	North Carolina Access Browser Lookup Environment	Implement changes to improve access to information to Medicaid providers.	05-Oct-99	3,828,167
15.	Department of State Treasurer	Warrant Truncation/Imaging System	Acquire an image storage and retrieval system.	05-Oct-99	738,000
16.	Department of Correction	Enterprise Business Improvement Project	Increase efficiency and product satisfaction while increasing product sales.	02-Nov-99	3,750,000
17.	Department of Health and Human Services	Healthcare Enterprise Accounts Receivable and Tracking System (HEARTS)	HEARTS is a Year 2000 replacement system for the legacy ARBS application.	02-Nov-99	11,000,000
18.	Department of Health and Human Services	Integrated Payment and Reporting System	Implement changes to create an integrated, multi-payer claims processing system.	02-Nov-99	4,765,095

Number	Agency Name	Project Name	Project Description	Date Approved	Project Amount ($)
19.	Department of Public Instruction	Textbook Warehouse Automation Project	Provide a warehousing and distribution process that ensures timely delivery of textbooks.	07-Dec-99	647,943
20.	Department of Justice	Statewide Automated Fingerprint Identification System	Implement live-scan fingerprinting devices throughout North Carolina.	04-Jan-00	2,500,000
21.	Department of Justice	Computerized Criminal History Redesign	Implement changes for timely access of centralized criminal history data by officers.	04-Jan-00	441,600
22.	Information Technology Services	Public Key Infrastructure	Provide state agencies with the capability to facilitate and manage digital signatures.	01-Feb-00	251,000
23.	Community College System	Community Colleges Data Warehouse Project	Migrate application system from the AS400 platform to UNIX platform.	01-Feb-00	2,017,570
24.	Department of Commerce	E-forms/Workflow Project	Provide state agencies with the capability to reproduce documents in electronic format.	01-Feb-00	19,305
25.	Department of Commerce	State Portal Project	Provide a single-entry point that brings together all governmental services.	01-Feb-00	210,000
26.	Department of Justice	Justice Mobile Data Network Project–Mobile Data Network	Expand the criminal justice information network to 25 new counties.	01-Feb-00	2,740,000

Number	Agency Name	Project Name	Project Description	Date Approved	Project Amount ($)
27.	Department of Commerce	Credit Card Project	Provide the ability to process credit card payments for e-commerce.	01-Feb-00	250,000
28.	Administrative Office of the Courts	End User Technology Upgrade	Redesign existing infrastructure of the AOC to accommodate the end user connectivity solution.	07-Mar-00	2,267,000
29.	Department of Health and Human Services	Adult Care Homes Assessment Project	Provide a unified approach for screening, assessment, and care management.	06-Jun-00	1,000,000
30.	Department of Health and Human Services	Enterprise Provider	Planning stage to create a state operated provider database and information system.	06-Jun-00	600,000
31.	Department of Commerce	e-Auction Project	Establish an online auctioning function within the state portal.	06-Jun-00	62,280
32.	Department of Health and Human Services	North Carolina Fast Business Process Implementation	Planning stage to develop a new business model.	06-Jun-00	4,800,000
33.	Department of Transportation	Internet Registration Renewal	Provide online renewal of vehicle registration.	06-Jun-00	196,500
34.	Department of Transportation	Business Systems Improvement Project	Improve fiscal related processes and information with DOT.	11-Jul-00	40,000,000
35.	Department of Transportation	Rapid Deployment Project	New software to support bridge and roadway business processes, including online access.	11-Jul-00	406,408
36.	Department of Revenue	Sales and Use Electronic Filing System	Provide vendors with ability to report and pay sales taxes electronically.	01-Aug-00	233,000

Appendix C
State Summaries

Introduction

The Institute of Government conducted a national survey to review the approval processes of information technology projects, to determine the extent to which financial assessments are used and required in the processes, and to examine the specific components of methodologies contained within the financial assessments. Examples include the use of cost/benefit analysis, total cost of ownership, alternative analysis, and payback calculations.

The responses reveal an approval continuum for information technology projects, ranging from approval through an agency's normal budget review process to approval through a separate board or commission. Several states have a dual process, obtaining technical architecture approval from the chief information officer and funding approval from the budget office. An initial review of the financial feasibility modeling required for information technology projects reveals little consensus among the states on an appropriate methodology. Some states require only the identification of development and operational costs. Other states require benefit/cost analysis, including confidence factors for weighting estimates and levels of risk.

The following information represents an overview of the approval processes for thirteen states, including the state of North Carolina. The purpose is to provide a brief introduction of the various ways in which states make technology investment decisions and to highlight some of the methodologies used for analyzing technology investments.

State of Arizona
Project and Investment Justification

Project Authorization

The state of Arizona subscribes to a two-step approval process. Project approval must be obtained for all projects of $25,000 or more in development costs. Projects with $100,000 or more in development costs must include life cycle analysis with an analysis period of five years or less. The first step is for agencies to obtain project approval from the Government Information Technology Agency. The second step is for agencies to resolve any budgetary issues with the Office of State Planning and Budgeting.

The Government Information Technology Agency evaluates each proposed project by using selected criteria based on the amount of investment.

All proposed projects are evaluated according to

- Conformance with budget unit plans
- Conformance with statewide policies and procedures
- Reasonability of the business solution and alternative solutions
- Feasibility of technology
- Achievable goals and public value
- Substantial development costs

Projects requiring an investment of $100,000 or more are reviewed in terms of

- Measurable major deliverables
- Availability of technical expertise
- Adequacy of life cycle analysis and cost
- Specific funding timeline and source
- Acceptable overall risks
- Explicit connectivity diagram

Reviews of projects of $1 million or more include

- Project management timeline
- Recognizable and acceptable risks

Required Documentation

Each proposed project must contain the following information for a complete Project and Investment Justification Document:

Project and Technology Description–provides a project overview, including existing problems, proposed changes and objectives, proposed technology, viable alternatives, major deliverables, personnel roles and responsibilities, and project schedule.

Value to the Public and Benefit to the State–describes the improved management or performance that brings new value to the citizens, identifying the quantitative and the qualitative benefits that are gained by completing the project.

Financial Assessment–identifies the development and operating costs, as well as a return on investment, calculated by using total costs and economic benefits.

Risk Assessment–measures the impact of the project on the agency in six key categories, using a high or a low score.

Project Approval–provides a management review checklist and an area for the agency management to sign off on the Project and Investment Justification.

Project Monitoring

Agencies submit monthly project status reports to the Government Information Technology Agency oversight analyst by the tenth day of each month. Reporting continues until the Budget Unit issues a certification of completion, stating that the project is complete and is in compliance. Completion is usually determined by the success of a project and by evaluating the changes in customer service, productivity, performance, cost savings, cost avoidance, and economic benefits.

State of California
Project Management Planning

Project Authorization

The state of California subscribes to a dual approval process for projects involving information technology. State agencies develop and submit IT procurement plans to the Department of Information Technology and to the Department of General Services for their approval. Acquisitions prior to the dual approval of the IT procurement plan are prohibited.

The value of a project is determined by how it advances the state agency's mission and programs.

Required Documentation

Each proposed project must include the following components for approval:

Project Business Case–information on the problem to be solved, the prospective solutions, the rationale for any make or buy decisions, and a rank of alternatives.

Time Management–information on key action milestones with entrance and exit criteria metrics from project initiation through contract closeout.

Risk Management–information on the operational, technical, cost, schedule, and funding risks associated with the acquisition, including how risk will be mitigated.

Human Resources Management–information on the roles and responsibilities of key project stakeholders to ensure the success of the project.

Project Procurement–information on the proposed acquisition methodology, the tools to manage the contract, the provisions to protect the state's investment, and the monthly status reports.

Project Monitoring
The Department of Information Technology and the Department of General Services monitor IT procurement activities to ensure that projects achieve their expected outcomes as stated in the project approval documentation.

State of Colorado
Feasibility Study Report Guidelines

Project Authorization
The state of Colorado requires that a feasibility study be conducted for IT projects with a total cost equal to or greater than $500,000. The feasibility study is submitted to the Commission on Information Management for its review, ensuring sound investment of resources. The feasibility study must be approved before a request for proposal is issued.

The value of the feasibility study is to provide a clearly defined project, to create specific and measurable objectives, to review realistic alternatives, to provide technical and managerial capabilities of the agency, and to calculate the benefits and costs on the project's expected life.

Required Documentation
The feasibility study for each proposed project should be organized into the following five sections:

Executive Summary–a high level summary of the other four sections and a brief, clear, and concise description of the problem and technology solution.

Requirements Section–this section provides the background of the project, the problems and opportunities associated with it (cost reduction, cost avoidance, revenue increase, etc.), the objectives of the project, and the functional requirements that must exist in order to realize the benefits of the system.

Alternative Analysis Section–a summary description of any current method of operation, the baseline analysis (current operating environment in terms of costs and benefits), and a description of alternatives considered in selecting the project, including an economic analysis of the alternatives (costs, benefits, and risks).

Proposed Alternative Section–information on the primary alternatives, including the advantages and disadvantages of each.

Project Plan Section–information on the selected project.

Project Monitoring
A quarterly progress report is forwarded to the Information Management Commission once all oversight levels provide approval of the project. The report is used to provide a status summary and to demonstrate incremental progress.

State of Connecticut
Enterprise Architecture Strategies

Project Authorization
The state of Connecticut requires that proposed information technology projects obtain architecture compliance and review before implementation.

The evaluation process is found within the conceptual architecture and technical domain principles.

Required Documentation
Documentation for a proposed information technology project should adhere to the following principles (only ten of the twenty-three principles are provided):

Principle 1–information is valued as an enterprise asset, which must be shared to enhance and accelerate decision-making.

Principle 2–the planning and management of the enterprise-wide technical architecture must be unified and have a planned evolution that is governed across the enterprise.

Principle 3–architecture support and review structures shall be used to ensure that the integrity of the architecture is maintained as systems and infrastructure are acquired, developed, and enhanced.

Principle 4–the state should leverage data warehouses to facilitate the sharing of existing information.

Principle 5–IT systems should be implemented in adherence with all security, confidentiality, and privacy policies and applicable statutes.

Principle 6–the enterprise architecture must reduce integration complexity to the greatest extent possible.

Principle 7–the use of existing applications, systems, and infrastructure should be considered before investing in new solutions.

Principle 8–systems must be designed, acquired, developed, or enhanced such that data and processes can be shared and integrated across the enterprise and with our partners.

Principle 9–new information systems will be implemented after business processes have been analyzed, simplified, or otherwise redesigned as appropriate.

Principle 10–a total cost of ownership model should be developed for justification and evaluation.

Project Monitoring

The Enterprise Architecture Strategies did not contain information on project monitoring, project feedback, or project review.

State of Iowa
Return on Investment Program

Project Authorization

The state of Iowa adheres to a multiple review process for proposed information technology projects. Projects that involve pooled technology funds or reengineering funds, that cost $100,000 or more, or that represent non-routine expenditures must follow the review process. Proposed projects are submitted electronically to the Enterprise Quality Assurance Office of the Information Technology Office for an initial review. The Information Technology Council then reviews applications, and recommendations are forwarded to the Department of Management and to the Governor's Office. Project funding priorities are finally agreed upon by the governor and by the legislature during the budget approval process.

The applications are evaluated against the following criteria and are assigned a total point value based on a 100-point maximum:

- Statutory or other mandating requirement (15-point maximum)
- Customer service improvements (15-point maximum)
- Impact on citizens (10-point maximum)
- Tangible and intangible benefits (10-point maximum)
- Use of information technology (10-point maximum)
- Risks associated with the project (10-point maximum)
- Continued funding requirements (10-point maximum)
- Collaboration with other state agencies (10-point maximum)
- Maximizing resources (5-point maximum)
- Past performance on other IT projects (5-point maximum)

Required Documentation

The Return on Investment Program requires that each project funding application contain the following documentation:

Proposal–this section contains basic identification information, including the agency's name, title of the project, project manager, and the executive sponsor of the project. The rationale and project summary also are included in this section. The rationale includes any requirements mandating the proposed IT project. The project summary provides an overview of the project, including aspects that reengineer government processes, improve customer services, or assist with reconnecting citizens to state government.

Project Administration–this section provides the level of project management skills within an agency. It also includes a brief history of the IT project, expectations, performance measures, project participants, risk factors, security, and implementation schedule.

Technology–this section provides information regarding hardware and software components of current and proposed technology environments. Data elements are provided for any proposed databases.

Financial Analysis–this section requests budget information as well as other costs associated with implementing and maintaining the proposed project. The budget should clearly identify requested state project funds and financial support from other sources. The return on investment financial worksheet must be completed and included within this section.

Project Monitoring
The Enterprise Quality Assurance Office is responsible for periodically compiling and distributing status reports for funded projects. Additionally, it is responsible for performing final project outcome audits after project implementation. The office provides technical assistance to projects to ensure successful implementation.

State of Kansas
IT Project Planning Instructions

Project Authorization
The state of Kansas defines an information technology project as a major computer, telecommunications, or other information technology improvement with an estimated cumulative cost of $250,000 or more. The first step in the approval process is for copies of the completed documentation to be forwarded to the Division of Budget, to the Joint Committee on Information Technology, and to the Legislative Research Division. Agencies are then required to include a request in their annual budget submission for funding approval.

The evaluation process or the criteria used to rank proposed projects were not discussed within the planning instructions.

Required Documentation
Each proposed project must have an Information Technology Project Request Form, an Information Technology Cost/Benefit Statement, an Information Technology Project Costs Form, and an Architectural Statement. The Information Technology Cost/Benefit Statement is composed of the following:

- Project identification information
- Qualitative and quantitative savings explanation
- Qualitative and quantitative saving estimates, including cost avoidance, cash savings, or revenue generation
- Net savings and break-even point stated in months

Project Monitoring
The IT project-planning instructions did not contain information on project monitoring, project feedback, or project review.

State of Nevada
Technology Improvement Project Investment Justification

Project Authorization

The state of Nevada uses a forty-five day approval cycle for all proposed IT projects. State agencies are required to submit documentation for proposed projects of $50,000 or more to the Department of Information Technology for approval. The director of the Department of Information Technology issues a response letter to the agency indicating the results of the review. This approval represents technical feasibility only. It is the responsibility of the agency to resolve any budgetary issues with the State Budget Office.

The evaluation process is based on technical feasibility, objectives, requirements, alternatives, scope, cost, project plan, and schedule.

Required Documentation

Each proposed project report must contain the following sections before presenting the information to the Department of Information Technology:

Project and Requirements Description–provides an executive summary of the project, including the existing situation, problems, proposed objectives, and technical requirements.

Alternatives–identifies alternatives capable of meeting user requirements.

Risk Assessment–identifies the impacts and risks of the proposed alternatives.

Costs and Benefits–quantifies the costs and benefits of the current and proposed environments, compares the alternatives by calculating net benefits and returns on investments, and details the intangible benefits of the proposed alternatives.

Project Plan–indicates the alternative selected, the basis for selection, and the major deliverables; assigns personnel roles and responsibilities; defines the project schedule; and summarizes project funding.

Project Approvals–a management review checklist.

Project Monitoring
The Technology Improvement Project Investment Justification does not contain details on project monitoring. However, project testing is required along with documentation within the project's schedule.

State of New Hampshire
Strategic Information Technology Plan

Project Authorization
The state of New Hampshire requires that state agencies develop a strategic information technology plan that is consistent with the agency's strategic business plan, the information architecture principles, and the agency's biennium budget. Since the approval process of proposed projects is the biennium budget process, state agencies should use a cross-reference summary between the strategic information technology plan and the budget forms contained in the budget manual.

The evaluation process is the budget approval process.

Required Documentation
Each strategic information technology plan should contain the following:

Department Organization–explains why the agency exists, what services are provided, and how it is organized.

Strategic Business Plan–states the mission and vision of the agency, the business functions, and the program goals and performance objectives.

Information Technology Principles–describe how the agency applies the statewide IT principles and provides an overview of the agency's IT principles.

Analysis of the Current Environment–provides information about the department operating environment, the technical environment trends, and the strategic issues.

IT Resource Assessment–provides a complete inventory of IT technical resources, organization and personnel, and current IT architecture.

Future IT Architecture–contains organizational and procedural components, including data, application, and technical components.

Migration Strategy–discusses how logistical issues, change management, funding sources, and time frames impact the existing and future structures of the agency.

IT Operations–provides previous biennium projects and expenditures, current biennium projects and budgets, and proposed projects.

Statewide Strategic IT Plan Compatibility–highlights the agency's commitment to facilitate the electronic sharing and distribution of data and information between agencies, localities, vendors, and other agents.

Project Monitoring
The strategic information technology plan does not contain details on project monitoring.

State of North Carolina
IRMC Project Certification

Project Authorization
The state of North Carolina subscribes to a three-step approval process for information technology projects that cost $500,000 or more, that are strategic initiatives regardless of cost, that use new or innovative technology regardless of cost, or that are designated for certification by the Information Resource Management Committee (IRMC). The first step is for the project manager of the requesting agency to submit required documentation to the Technical Architecture and Project Certification Committee for review. The second step is for the project to be approved by the Office of the State Controller. The third step is for the information to be approved by the IRMC.

The criteria used to value the projects are description, scope, budget, expected benefits, and proposed delivery dates.

Required Documentation
Each proposed project must have a Project Concept Document, a Project Proposal Checklist, and a Technical Architecture Submission Template. The Project Concept Document contains the following items: goals and objectives, benefits, scope (schedule, budget, total life cycle cost, staffing, risks), technologies employed and/or application architecture, current status, and next steps. The Project Proposal Checklist is composed of the following:

- Project objective
- Project sponsorship

- Project cost/benefit analysis
- Project technology
- Project risk profile
- Project management and organization
- Project training
- Project support and logistics
- Project tracking and oversight
- Project testing

Each general area on the Project Proposal Checklist contains a laundry list of questions (yes/no) along with a cross-reference. Information on the template can be found in the Technical Architecture Submission Guide.

Project Monitoring

A monthly project status report is required during project implementation. The IRM staff may recommend project suspension if one or more of the following occur:

- The project fails to comply with IRMC policies, standards, procedures, and guidelines.
- Critical issues are not resolved, impacting the delivery of the required functions or capabilities within established budget or time parameters.
- The project fails to make progress towards its objectives.
- The project is unable to achieve the desired outcomes.

State of Oregon
Oregon Statewide IT Policies

Project Authorization

The chief information officer approves all project requests for services and goods in electronic form, providing that the proposed project is in compliance with the Department of Justice rules and the Purchasing Division rules. In some cases, the chief information officer delegates the authority for approving contracts to the agency with a service level agreement. Without a service level agreement, each agency submits an acquisition approval request to the chief information officer for project approval.

The purpose of the acquisition approval process is to ensure that investments in information system resources are prudent and cost effective, to document a project's costs and benefits methodically, to demonstrate the costs and benefits of a project over its estimated life cycle, and to address viable alternatives.

Required Documentation

Agencies shall perform a feasibility study and a cost/benefit study for major technology projects with an estimated cost of $50,000 or more. The cost/benefit study may be performed as part of the feasibility study or completed independently after the feasibility study is finished. The cost/benefit study must contain the following:

Project Narrative–contains the problem statement, the approaches considered, and the recommended approach.

Development and Operating Costs–includes all expenses, one-time and recurring, needed to develop and maintain the project for its estimated life cycle.

Costs and Benefits (Tangible and Intangible)–identifies tangible costs and benefits as measured with hard dollars and describes intangible costs and benefits that cannot be quantified in hard dollars.

Net Benefit and Present Value–provides the calculations for the present value of benefits and costs, the net benefit, and the cost/benefit ratio.

Risk Analysis and Alternatives Comparison–presents the risk analysis of the project, including economic risk, operational risk, and technical risk. It also presents an alternative analysis by presenting a comparison of life cycles, tangible benefits, total costs, net benefits, project hours, and risk determination.

Decision Summary–includes the study summary, the recommendations, and the endorsements.

Project Monitoring

Major system development projects typically promise significant benefits, but carry substantial economic, technical, and operational risks. The need for executive involvement, impartial scrutiny, and direction is proportional to a project's development time, visibility, cost, technical difficulty, and impact on system users and clients. The quality assurance review policy formalizes the chief information officer oversight of major IT projects. The program is funded by 4 percent of the project's funds for quarterly project reviews by an independent commercial evaluator and by 1 percent of the project's funds for quality oversight by the Department of Administrative Services.

State of Tennessee
Cost Benefit Analysis Methodology

Project Authorization

The state of Tennessee subscribes to a three-step approval process for large projects involving information technology. The first step is for the project sponsor and the agency's budget or fiscal officer to approve the proposed project. This step ensures that project funding is identified at project inception. The second step is to obtain approval from the agency's Management Advisory Committee, allowing prioritization of the proposed project in relation to the other competing projects for agency resources (the other projects are not necessarily IT projects). The final step is for the Office of Information Resources/Budget Review Committee within the Department of Finance & Administration to review the request in relation to requests throughout state government.

The value of the projects may be in cost containment, revenue production, or enhanced service delivery. Other important factors in the approval/review process are administrative priorities, availability of funding, and financial return on projects (cost benefit analysis) in comparison to all requested projects.

Required Documentation

Each proposed project must have a project proposal and a cost/benefit assessment. The project proposal contains the following items: functional description, business goal or objective, technical description, data description, risk assessment, service benefits, financial benefits, and explanation of critical dates (timeline).

The cost/benefit assessment is composed of the following worksheets:

> Cost assessment–identifies all costs anticipated during the course of the proposed project, including confidence factors to account for uncertainties and documentation for subsequent review throughout the life of the project.
>
> Benefit assessment–identifies all benefits that are anticipated as a result of the project that result in additional revenue or decreased cost in hard dollar values, and records all assumptions and calculations for subsequent review throughout the life of the project.
>
> Risk assessment–identifies the areas of potential risk, classifies each area as high, normal, or not applicable, and documents the plan to mitigate high risk areas. Potential risks include areas of management, project length, project manager experience, business plan, and system complexity.

Financial summary–provides the cost/benefit analysis by year, including a net present value and the payback period.

Project Monitoring
An essential concept is the need for a continuous update of the cost/benefit analysis as the project proceeds through its life cycle, including project initiation, planning and design, construction, and implementation. This model includes a post-implementation review but does not state whether a post life cycle review is used.

State of Utah
Cost Benefit Analysis Methodology

Project Authorization
The state of Utah subscribes to a dual process for approving all IT investment projects. It is the policy of the state that all planned or proposed IT projects in the agency's portfolio be approved by the agency's senior executive and the state's chief information officer before funds are appropriated to the proposed projects. Each agency must update its IT portfolio management information system on at least a semi-annual basis in order to comply with this policy, including a risk/value assessment model for each planned or proposed project.

The value of a project is based on the accomplishment of an agency's goals and objectives, the support of state strategic IT goals and objectives, the agency's technical architecture, controlled risk, value or benefit of the investment, funding support, planning and documentation, and adequate internal and external oversight.

Required Documentation
One of the primary components of the agency's IT portfolio is a statement of benefits, costs, and risks associated with all projects. Listed below is the information required to comply with this component of the IT portfolio:

Costs–a detailed list of recurring and non-recurring costs in the categories of up-front costs, on-going costs, and indirect costs.

Risks–includes project risks of size of investment, project length, and skills needed for project management. It also includes organizational risks and technical risks.

Benefits–includes both tangible benefits that can be explicitly quantified and intangible benefits.

Projects are then prioritized based on risk and return. The process involves comparing the costs, benefits, and risks against certain criteria for assigning scores and ranking the projects based on total overall scores.

Project Monitoring
An essential part of project implementation is project control. Senior managers are required to compare actual results against the projected costs, benefits, and risks, and to identify actual or potential managerial, organizational, and technical problems. An evaluation is then conducted after a system has been implemented to determine success or failure.

State of Wisconsin
Standard IT Costing Method Project

Project Authorization
The state of Wisconsin uses two processes for approving IT projects. The first is to approve projects within the agency's strategic planning process. Program staff members are responsible for completing and updating the agency's strategic plan and are assisted by IT staff members who are responsible for describing available technology, providing cost estimates, and evaluating the advantages and disadvantages of competing technologies. These projects may or may not receive funding. The second process is for projects to follow the IT project funding requests within the normal biennial agency budget process. Senior management and budget analysts are responsible for IT projects within this process, using IT staff members as consultants to determine if the projects are practical and worthwhile. All participants, regardless of role, should keep an enterprise perspective and an agency business perspective throughout these processes.

Project approval is based on project cost of implementation, savings, revenues, and cost avoidance over a five-year period (a payback period was not specifically indicated), productivity improvement (tracked by performance measures), full-time equivalent positions, assumptions for estimates, and cost/benefit analysis.

Required Documentation
Each proposed project must have an IT Project Funding Proposal Cover Sheet, a project funding proposal, and backup information for explanation. The cover sheet contains the agency's name, submission date, project name, project contacts, type of budget requests, and other general information. The project funding proposal contains the following:

Project name–a unique name among the agency's projects.

Description–the intended functions it is expected to perform and the problems it seeks to resolve.

Mission–the project's intended affects upon the agency's business operations.

Priority–how the project relates to the agency's strategic business plan, the agency's IT plan, any considerations of process changes, any published statewide plans and priorities, and any executive or legislative mandates.

Timetable–a project schedule, including the planned start date, estimated length of time to implement, noteworthy milestones, and the expected life of the application.

Technical features–any technical features of the project that utilize new technology, an understanding of how the development will function in the agency's IT environment, and conformity with the agency's architectural standards.

Costs–a table listing the project's cost elements, including the number of FTE positions with their costs.

Savings offsets–a list of offset savings in base expenditures and positions that will result from the project. Savings from the operation of a replaced system should be included.

Intangible benefits–benefits that cannot be measured in terms of dollar or FTE reductions but involve improved program operations and/or customer satisfaction.

Revenue impacts–list of revenue impacts, including the reason for gain or loss, the estimated amount of gain or loss, the assumptions used for calculation, and the basis of assumptions.

Other savings–list of productivity savings in base expenditures and staff time that are expected but that cannot be estimated with the same degree of confidence as with savings offsets.

Avoided costs–expenditures that would have to be made above base as a result of projected workload growth or similar factors in the absence of the project.

Cost/benefit analysis–the annual costs minus the annual benefits, including a time period to show the break-even point.

Project Monitoring

Program, IT, and administrative staffs are responsible for a post-implementation review and an ongoing evaluation. The materials provide only a limited discussion of the post-implementation review. The ongoing evaluation is a component of the productivity improvement criterion to evaluate the project's merit. Performance measures are created to track the benefits and the costs of the project for meeting the objectives of project implementation.

Appendix D
Definitions

Net Present Value (NPV)

The process of finding the present value of a future cash flow is called discounting. To determine the desirability of a given investment, one must first discount the stream (cash flow) of expected annual cost reductions to its present value. This is a simple but useful process, which is characterized by a commitment of funds today in expectation of receiving some future benefit or future return through additional cash inflows or lower cash outflows. First, one determines the period of the investment's useful life. To perform the calculation, one multiplies the amount of annual savings times the required minimum percentage return established for all project assessments. The minimum percentage return may be referred to as the opportunity cost of capital or OCC. By way of illustration, an annual savings of $1,800 on an investment of $5,000 with a 20 percent required return would produce a present value of cash inflows of $5,384 (using a present value table to determine the 20 percent OCC factor). The net present value would equal $384 ($5,384–$5,000). When the net present value is zero or greater, the financial return is acceptable because it promises a return equal to or greater than the required rate of return. When the net present value is less than zero (negative) then the project is not desirable based upon a financial return expectation. For simplicity, the potential impact of inflation is typically not factored into this calculation. The net present value technique also allows one to adjust for risk by scaling the required return percentage accordingly.

Internal Rate of Return (IRR)

The internal rate of return method determines the interest rate and then compares this rate to the risk-adjusted rate of return. If the calculated return is greater than the risk-adjusted rate of return, then the investment decision indicates that the project should go forward. For example, a decision maker may consider a safe information technology investment of $100,000 with an expected annual return of $40,000 for four years. Because the investment was classified with minimum risk (a safe project), an acceptable IRR may be deemed as twelve percent. This percentage (12 percent) would represent the risk-adjusted rate of return. To compute the IRR promised by the project, it is necessary to find the discount rate or factor that causes the net present value of the project to equal zero. In this example, one must divide the investment required by the net annual cash inflow ($100,000/$40,000 = 2.5) to yield the factor. Finally, the factor of 2.5 is then located on a present value table to see what rate of return this represents. The OCC or relevant interest factor translates to a 22 percent return on a present value

table. Thus, one observes that 22 percent is greater than the acceptable IRR of 12 percent, and therefore, is considered acceptable. One of the greatest strengths of this business metric is that it allows a user to quickly compare the projected results of a project to the organization's cost of capital or hurdle rate that is required for information technology initiative. If an initiative's IRR does not exceed the cost of capital threshold, then the project is not considered financially attractive.

Payback

The payback method is a measure of time in the sense that it indicates how many years will be required to recover (or pay back) the original investment. This technique is appealing because of its simplicity; however, it also is a weak metric because it does not allow for the time value of money, thereby treating short-term and long-term investments the same. The payback period is calculated by dividing the initial investment by the cash inflows through increased revenues or cost savings. Projects that demonstrate the shortest payback periods are highly desirable because they suggest greater risk reduction and higher liquidity.

Benefit-to-Cost Ratio

The benefit-to-cost ratio calculation determines the dollars returned for every dollar invested. Simply stated, if the calculation results are positive, the investment is attractive. Likewise, if the calculation demonstrates a negative number, the investment would not produce a return. The formula used in this calculation is as follows: dollar benefits/dollar costs = benefit-to-cost ratio. For example, if the dollar benefits of an IT project were $48 million and the dollar costs were $24 million, the benefit-to-cost ratio would be $2.00. In other words, for each dollar invested in this project, two dollars would be returned.

Return on Investment (ROI)

The return on investment metric is widely used because it is presented as a percentage return for each dollar invested. One can conceptualize this analysis in three ways. First, if the calculation yields a result of zero percent this means that the investment has reached a break-even point and the dollars invested have been fully recovered. Next, should the result indicate a return of less than zero percent, the investment has not paid off. Finally, if the return yields a percentage greater than zero percent, the investment has fully paid for itself and earned even more. To begin the calculation process, one determines the dollar amount of net benefits. This is performed by identifying the dollar benefits and subtracting the dollar costs, resulting in the net benefits figure. The remaining calculation involves computing the ratio of the net benefits as compared to the dollars of cost that are

intended to be spent in order to derive the project's benefits. The formula is expressed as (net benefits/dollar costs) x 100 to equal the ROI percentage.

Applied Information Economics (AIE)

Through the practical application of mathematical models by using the tools of economics, financial theory, and statistics, one can clarify, measure, and identify the most highly desirable recommendations for a variety of information technology investment decisions. This approach provides the necessary methodology for use in calculating the economic value of information while viewing information technology investments from an investment portfolio perspective, and allowing for uncertainty, intangibility, and ambiguity.

Typically, due to the complexity of this approach, this collection of techniques is recommended for large risk and high dollar initiatives and will require a "one on one" relationship among stakeholders to achieve desired results.

Total Cost of Ownership (TCO)

TCO is defined as the present value of all costs associated with an information technology investment that is incurred over its expected life. Examples of costs include the purchase price, acquisition costs, usage costs (including opportunity costs), and end-of-life costs. To effectively compute TCO, one must construct a model to ensure that all costs are captured. First, map the process and determine the TCO categories. Next, determine the cost elements for each category and decide how each cost element is measured. The most difficult step comes next, involving the gathering of data and the quantification of costs. A cost timeline also is constructed for the length of the life cycle and all costs are brought to the present value, which allows decisions to be made on present dollars.

Balanced Scorecard

The balanced scorecard is a performance measurement system that allows both financial and non-financial objectives to be assessed for making strategic decisions. Overall, the scorecard fosters a balance between otherwise disparate strategic measures. The tool allows organizations to make decisions based on structure, communication, objectives, and feedback.

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