Office of Information Technology Services

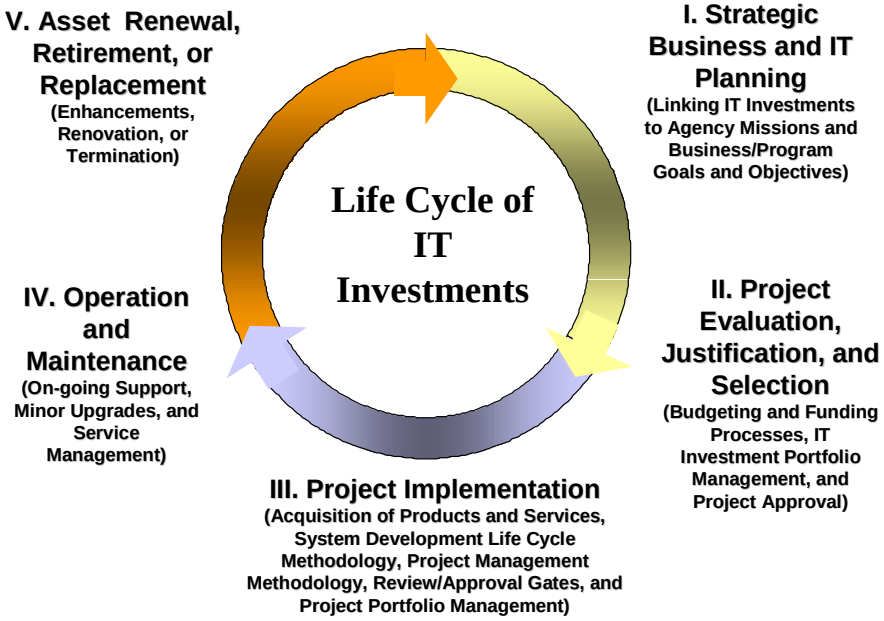
North Carolina State Government
State CIO

Project Approval, Progress Reporting and Quality Assurance Process

Implementation Framework for Statewide Information Technology Projects

Best Practices and Standards

Framework for Managing IT Investments



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Executive Summary

Information technology (IT) is an inextricable part of how North Carolina state government functions. It supports efficient business processes and effective program operations; enables new and improved services for citizens; and contributes to educational opportunities, public safety and welfare, and economic development (including prosperity and quality of life of citizens). Over the years, state government has invested billions of dollars in its IT infrastructure of computer and telecommunications assets. In addition, approximately $1 billion (out of the about $26 billion annual budget) is spent annually for operating its systems, maintaining its hardware and software investments, and developing new applications.

The state's unstable is forcing state government to closely manage costs, and citizens are demanding greater accountability for program performance and more rigorous proof that funds are invested wisely and effectively. Therefore, IT investments must be identified, evaluated, and selected so that those funded best meet agency missions, program goals, and business objectives by providing the best value and most benefits with the least risks and most economical costs over their life-cycles. Moreover, the state's IT implementation projects must be performed as effectively and efficiently as possible, so they are completed on time and within budget and deliver the expected results. Finally, the state's IT investments must be operated reliably, securely, and efficiently, and they must be retired or replaced when they are no longer cost-effective or risk-acceptable.

The primary purpose of this document is to itemize and describe the key factors that contribute to the success of statewide IT projects. These projects typically are highly visible, large-scale, significant-cost, and high-risk endeavors. They often are conducted in complex environments that include intricate business processes, diverse technical infrastructures, a variety of public policies, intricate organizational cultures, and multifaceted political contexts. Because of their high profile nature, they require special scrutiny and concerted oversight.

In addition to serving as a guide for assisting project teams and agencies to plan, manage, and accomplish statewide IT projects successfully, this document provides a framework for approval and oversight officials to develop and revise policies and procedures for approving these projects, monitoring their progress, determining their status, measuring their performance, taking appropriate action when required, and executing the associated quality assurance practices. Both the project management practices of agencies and the project review policies of oversight officials must be reviewed continuously and updated as needed to ensure that they remain effective, are cost-sensitive, and continue to be appropriate, given the rapidly changing nature of technology and the increasingly challenging and ever-involving circumstances of state government.

The concepts, principles, and philosophies stated in this material have been synthesized from a wide variety of experiences and a broad diversity of sources. A key input has been lessons learned from the long-term work performed by the staff of Enterprise Technology Services (ITS) in carrying out its project review responsibilities and functions. Another major area of contribution has been direct experiences from several major statewide projects recently completed or currently underway. Finally, many ideas and much information has been obtained from extensive research by ITS staff, including the reading and analysis of numerous documents produced by leading IT research and advisory services, newspapers, technical and business journals, and magazines.

For clarity of understanding, the major success factors for statewide IT project management are segregated into two classifications. The 15 that must be addressed in all projects, require focused action, and cover the full spectrum of the implementation life cycle are called best practices. These are listed in the general order that they would be addressed in the planning for and management of an IT project, and they have equal priority.

The remaining 35 (called standards) are important, but may not be equally applicable to every project, and they supplement the 15 best practices. They must be considered in every project; however, the extent of action taken to accomplish them may vary on a project-by-project basis, depending on individual circumstances and situations. They are listed in the general order in which they normally appear in a typical project implementation plan, and they have equal priority for consideration.

The 15 best practices are listed as follows:

1. Develop a sound business case
2. Secure senior level leadership
3. Assign an experienced, qualified, and capable project manager
4. Establish a Project Management Office (PMO) and manage projects through it
5. Develop an appropriate project organization structure and build an effective project team
6. Prepare effective bid documents, select qualified vendors, negotiate contracts well, and manage vendors closely
7. Develop a comprehensive management plan, and monitor, report, and manage performance
8. Anticipate and manage risks
9. Establish quality objectives and standards
10. Identify, document, and track business and technical requirements
11. Follow the enterprise approach by leveraging existing agency and statewide applications and taking advantage of statewide shared technical infrastructures and common technical services
12. Develop technical standards
13. Reengineer business processes
14. Design and implement robust issue, change, and configuration management programs
15. Anticipate project ending by planning thoroughly for production and operations and the transition from vendor personnel to state staff at project completion

The 35 standards are listed as follows:

- Research projects rigorously and plan them thoroughly
- Evaluate investments carefully to ensure funds are invested wisely and benefits are compatible with risks
- Ensure the project is within the agency's capacity for managing and completing it
- Exert sound and competent leadership
- Properly define and understand the business problems, challenges, or opportunities to be addressed
- Set clear and realistic purposes, objectives, and success criteria, and ensure their alignment with the business organizations served
- Provide for adequate and qualified staffing
- Recognize the importance or users, interest groups, and stakeholders
- Pay close attention to cultural and political issues
- Manage scope changes and control scope creep
- Shun lengthy schedules and avoid trying to deliver too much all at once or taking too long to provide any benefits
- Manage expectations
- Request and obtain sufficient funding
- Perform detailed planning and develop realistic intentions regarding milestone schedules, dollar expenditures, and personnel commitments
- Develop reliable estimates and employ adequate contingencies
- Recognize realities and adjust plans and schedules to reflect actual events and circumstances and realistic timeframes
- Identify appropriate checkpoints and perform independent outside assessments of project status, management, and deliverables
- Transfer knowledge from product vendors and outside implementers to state staff
- Prepare complete documentation for enabling project management and to support the design, operation, and implementation of the application
- Ensure the communications plan is complete in structure, inclusive in audience, and focused on important topics
- Provide sufficient amounts of high quality support tools
- Minimize modifications to purchased software (COTS or GOTS) packages
- Identify and accommodate security and privacy needs
- Provide for disaster recovery and business continuity
- Select and use the right technologies
- Ensure the application's technical architecture is complete and approved, supports the agency's business/program architecture, and fits the statewide and agency technical architectures
- Know and understand the inner workings and hidden mechanisms of technical operations
- Know the key technical components that impact the implementation and ensure the infrastructure is adequate for supporting the application
- Develop sound and comprehensive test strategies and test systematically and exhaustively
- Develop a detailed and complete conversion plan
- Provide for sufficient and proper training and other implementation support services
- Utilize pilot or initial implementation sites, if appropriate and useful
- Ensure code is satisfactory or applications are ready before release or rollout
- Provide superior customer service
- Conduct post-implementation assessments and develop lessons learned as a reference for future projects

Fifteen Best Practices (Proven Actions that must be Accomplished Proficiently for Project Success)

The fifteen best practices below have two primary characteristics:

- They encompass and are applicable to the entire project life cycle from beginning to end.

- They are absolutely the right things to do, they must be performed, and they must be accomplished in the right manner.

They are all very important (individually and collectively); therefore, the numerical order is not significant from a priority viewpoint. In a typical project planning and management scenario, they would generally be addressed in the order given; however, this sequencing is neither rigid nor mandatory for all cases.

1. Develop a sound business case – A business case is a comprehensive package of information, analysis, and recommendations. It presents a plain language statement of the issues to be addressed, problems to be solved, challenges to be overcome, and/or opportunities to be exploited. Data is provided to illustrate the public policy significance and the complexity and severity of the situation, with clearly stated assumptions, estimations, and other underlying statistics. Options available to decision makers are given, with comparable impacts on stakeholders, features, capabilities, costs, risks, and benefits. The recommended course of action is described, with a justification that includes strengths and weaknesses, advantages and determents, and benefits and costs. The business case answers the following questions for a project: what is the purpose (i.e., why it is being undertaken), what will be done, and what benefits will result from it.

   Additionally, the business case should indicate the clarity of purpose for the project (scope, objectives, expected results, etc.) and the strength of will in accomplishing it (leadership in it, sponsorship for it, fiscal and staffing resources committed to it, etc.). Without these absolutely essential prerequisites, the project will experience high risk of failure (or predestined to less than full success) from lost of sight of its business goals, scope creep, and/or lack of adequate resources, especially as times get tough through the implementation.

   The discipline of business case analysis is very helpful in evaluating options throughout the investment management life cycle (from assessing the value of investments and strategies and choosing from among alternatives to solicitation of funding, purchase, certification and

implementation, operation, and through retirement of assets). A key requirement of a business case supporting an IT investment is the investment must be clearly linked to the organization's overall goals, objectives, missions, and responsibilities and the strategies and initiatives for achieving them. The business case should tie to the agency's strategic business and IT plans, and it should be congruent with the agency's business continuity plan, as well as the statewide and agency's technology and security architectures and security policies, standards and processes.

Good business cases serve multiple purposes, and four primary ones are: 1) facilitate the investment evaluation, selection, and funding processes; 2) offer information to assist in bid preparation and vendor selection; 3) provide guidance for decision-making and the tracking of project progress and performance in subsequent project planning and implementation efforts; and 4) measure and confirm final results at project completion. First, they help management and funding authorities understand the business and political values of the proposed investments, and they assist funding authorities in deciding whether to fund them. Two, in addition to justifying investments, they guide the subsequent work and associated decisions to ensure the project is driven by the business/program goals and objectives to be achieved, and the expected benefits are delivered.

The business case should be succinct, complete, cogent, understandable, credible, and convincing. The logic and rationale of the analysis and conclusions should be straightforward and easy to follow. A presentation that is incomplete, disorganized, unclear, too technical, too detailed, or too long likely will be received unfavorably by funding, approval, and oversight bodies.

An executive summary may be helpful. Terminology should not be technical or esoteric, but may incorporate the everyday semantics normally found in the project management, public policy, accounting, economics, and financial management/investment disciplines. If applicable, an explanation should be included regarding the opportunities for collaboration and the sharing of information, business processes, and resources with other departments, agencies, programs, and governments, and the use of the state's common technical services and shared technical infrastructure should be described. If relevant, the increased availability of more timely, accurate, and complete information should be emphasized to allow for better decisions, more informed policies, and improved services by multiple programs, groups, and organizations. All shareholders, participants, and benefactors need to be recognized, and their roles, responsibilities, and positions should be described. The generation of stakeholder commitment is a major goal for business cases. Key success factors and key performance indicators for monitoring the implementation

of the asset and documenting its capabilities, benefits, and value must be identified and explained.

Some normally expected components of a business case are (a) statement of the challenge, opportunity or problem to be addressed (including linkage with the agency's strategic business and IT plans and statewide and agency technical architectures), (b) alternatives investigated, (c) costs, (d) benefits, (e) risk assessment, (f) performance measures for both the implementation project and the operation/features of the asset, (g) measures of economic value, and (f) justification. Where appropriate, a business case may contain a summary work plan, with timelines and major milestones. It also may include a high-level project management plan, with organization structure and names and roles of key managers and business/program and technical staff and other project management related material, such as summaries of communications and quality plans.

As appropriate, a business case may contain a procurement strategy, especially if outsourcing is involved (such as implementation or integration vendor, hosting, or application service provider). Also, it may include an assessment of the readiness of the agency or project team to accomplish successfully the project (including contract negotiation and vendor management during implementation) and operate the investment after implementation or manage the vendor(s) after outsourcing.

Project costs are usually expressed as total cost of ownership (TCO) over the life of the asset/investment – full costing. Both one-time implementation and recurring costs must be included. Ongoing costs include operation, staffing, software licensing, maintenance, and enhancement/upgrade expenses. If applicable and useful, fixed and variable costs should be enumerated. Retirement/disposal costs also must be considered. Where possible, both internal agency (including personnel) expenses and outside costs for purchased products and services should be given.

In the governmental arena, the value of IT investments may result not only from improvements in business performance, but from the impact they have on society and the well being of citizens. Businesses cases for IT projects and initiatives must enumerate clear and measurable objectives for the three areas of operational efficiencies and organizational effectiveness, constituent service, and political return. Potential benefits for each area are highlighted below.

- Operational efficiency and organizational effectiveness – changes in operations, including head count reductions or reassignments,

achievement of program policy objectives, and cost sharing or cost transfer arrangements.

- Constituent service (citizen-centricity) – changes in the way services are delivered/received, including greater availability of services, ease of use of services by presenting information in a way citizens understand rather than by the way government is organized, fewer interactions to receive services, single point of contact for services, and new or revamped services.
- Political return – impact on society as whole, including public participation in government, access to government electronically, economic impact, more and better information to constituents, greater accountability to the public, and more effective policymaking.

E-Government investments make use of Web-based Internet applications to enhance the access to and delivery of government information and services to the public, employees, businesses partners and other governments. Types of benefits accruing from e-government initiatives include financial through reduced cost of government and/or increased revenue collections, economic development, reduced redundancy through the consolidation and integration of government systems, the fostering of democratic principles, and improved services to citizens and employees.

The documentation of benefits is divided into two categories – intangible or qualitative, and tangible or quantitative. Payoffs must be expressed in government, business, and/or program values – not technology terms or appeal. While numbers are important, excessive and inappropriate use of them may obscure rapid and accurate understanding of the "why" and "how" of true business/program benefit and political value.

Intangible benefits are not measurable (or easily measurable), and they are defined as implementation-enabled strategic achievements that further a management direction, allow the state to better manage relationships, or allow the state to achieve qualitative improvements in processes and functions. Intangible benefits will broadly impact employees, elected officials, citizens, and/or business partners.

These benefits contribute to the public good; economic development; quality-of-life improvements; or societal welfare, security, and comfort. These may include statutory obligations; at-risk system replacements; more responsive, timely, and higher quality citizen services and increased public satisfaction; preparation for future growth; and improvements in the areas of environment, health, education, and criminal justice. Intangible benefits may be achieved by improving data accuracy; facilitating distribution of information and communication among departments, agencies, and programs; enhancing decision making and policy

formulation; improving services delivery/cycle times; providing more efficient/effective citizen services; and improving employee cross functional skills. It may be difficult to attach meaningful dollar values to such broad, transformational achievements related to intangible benefits.

Tangible benefits are measurable and are usually financial in nature (or are metrics that can be converted into financial terms). They are those potential benefits for which dollar results or measurements can be calculated. These include cost avoidance, cost savings/reduction, productivity improvements/operational efficiencies, and increased revenues/cash flow. Reducing operational expenses and decreasing the costs of providing services may achieve these. For tangible benefits, a firm estimate of dollar impacts may be attributed to the benefit based on a proper set of assumptions. Reasonable assumptions are essential for approximating benefits for citizens, such as the monetary value of greater convenience in receiving services or accessing information.

Financial justifications are quantitative in nature, and they can be expressed by cost/benefit calculations and/or by period (usually annual) cash flows that demonstrate standard measures, such as payback period, return on investment (ROI), internal rate of return (IRR), and net present value (NPV). Where possible, discounted cash flows (such as IRR and NPV), which recognize the time-value of money, should be included. Because of the pros and cons of each, multiple economic measures should be used. The table below highlights descriptions of the key ones mentioned above.

Measure	Format and Desired Outcome	Calculation Description
ROI	Percentage Higher the better	Total return divided by outlay (cost of implementation)
Payback	Month/Year Shorter the better	Time before outlay is paid back from savings, cost avoidance, etc.
NPV	Cash amount Above zero and the higher the better	Today's value of future cash flows (benefits and costs) at risk-adjusted cost of capital
IRR	Percentage Higher than risk-adjusted cost of capital and the higher the better	Rate of return of future cash flows (benefits and costs)

A risk analysis considers the impact and probability that specific factors will impede the achievement of the success of the project and the realization of the benefits and values of the investment. Common factors include events or situations that would create cost overruns and/or schedule slippages, requirements inflation (scope creep), critical staff turnover, technical over-complexity or obsolescence, leadership vacuum, specification misunderstandings, investments becoming misaligned with government priorities (political support), rejection of application by users or participants (unsatisfactory performance), security and privacy violations, unsatisfactory vendor performance, and/or inadequacy of funding. Major risks must be identified and analyzed, and a plan must show how they will be managed.

Financial justifications are often adjusted for two factors: (1) uncertainty of projections or calculations (errors in estimates for future events or circumstances), and (2) risks. There are two general methods or techniques for handling these adjustments (simpler and more complex). Both are summarized below.

One simpler method for calculating uncertainties or estimating tolerances is to develop 'what if' scenarios of alternative assumptions. Often three alternatives are used, such as best, worst, and expected cases; highest, lowest, and average estimates; or most optimistic, most pessimistic, and anticipated situations.

Another simpler technique to obtain risk-adjusted economic models is to calculate the normal financial indicator (such as NPV) and subtract a risk-based cost to obtain a risk-adjusted value (such as risk-adjusted NPV). The risk-based cost is determined by summing the total dollar value of individual risk factors. The dollar value for each individual risk factor is the product of the probability or likelihood of the risk occurring (0 to 100 percent) times the impact or degree of severity on the business if the risk does occur (0 to 100 percent) times the dollar value of the loss if the risk occurs and the business impact or degree of severity is 100%. The first two items (probability of the risk occurring and degree of severity of the risk) together are called the risk factor; therefore, the formula is (risk factor in percent x value of loss at 100% business impact in dollars) = risk value in dollars. A similar approach is described under High Level Approach for the Assessment of Project Risk in Appendix G (Sample Risk Profiles).

More complex and sophisticated techniques for performing both uncertainty- and risk-adjusted economic analyses use statistical and mathematical models to calibrate estimates and risks through the use of probabilities. One approach (called Monte Carlo simulation) involves the assignment of ranges of probabilities to individual cost and benefit elements to obtain a bell curve (probability distribution) of expected results

that objectively incorporates uncertainty, risk, and return. Another method (called decision tree analysis) assigns probabilities to a series of either-or situations. The sequential risks for following each path (or branch of the tree) are calculated to determine the probabilities resulting from following a several courses of action. For costly and politically sensitive projects, these two approaches are thorough and statistically valid ways to analyze uncertainties and risks and show the probabilities of possible outcomes. Risk analysis will not justify or kill an investment; however, it will describe the level of risk and the uncertainty of payoff. As Pliny the Elder (who died in 79 A.D.) said, “In these matters, the only certainty is that nothing is certain.”

In government, the investment is still financial, but the returns often are not economic in nature or they are difficult to measure. Many times, the returns are more political in nature, and they may not lend themselves easily to a financial analysis.

A final cost related consideration is opportunity costs, which are the costs or potential adverse or undesirable consequences of not funding or implementing the investment. Examples include forfeiture of revenue enhancements, savings lost, costs not avoided, deferred political objectives, increased security risks, possibility of decrease in or loss of public trust or citizen goodwill, greater potential for the interruption of services or the failure of the IT component of the service delivery infrastructure, perceived inability to meet constituent expectations, possible non-compliance with regulations (with resulting undesirable public relations or fiscal repercussions), etc.

The crafting of the business case is a key success factor for accomplishing technology projects effectively and efficiently and delivering satisfactory results for the following reasons.

- First, it is a means for ensuring that all parties know, understand and agree to the purposes, reasons, and objectives for performing the projects (or making the investments) and the key political and/or financial benefits or values to be obtained.

- Second, it explains the business model or business architecture that will be employed. This is necessary for ensuring the proposed applications technical architecture is congruent with the business/program goals to be achieved and functions to be enabled. It also ensures the asset provides for the collaboration among agencies, programs, and governments and the adequate sharing of information described in the agency’s strategic business plan. Inter-agency and inter-program collaboration eliminates investment redundancies, minimizes duplicative work efforts,

facilitates citizen interaction with government, and provides the cost-savings from economies of scale.

- Third, it links the asset's technology and technical design to the agency's IT plan, the agency's business continuity plan, and the statewide and agency's technical architectures, including security architectures. Also, it assures the investment is aligned with the statewide and agency's technical infrastructures.

- Fourth, through the evaluation of alternatives, it shows the research on what is done elsewhere and explains why the selected option is the best approach. Research should include other states and governments and outside technology research organizations, such as Gartner, Meta, and Robert Francis.

- Fifth, it begins the risk management process by accomplishing the following tasks.

  - Identifying major risks (events or situations that may adversely impact the project).

  - Analyzing each major risk to determine the potential impact (probability of occurring and severity if occurs).

  - Developing strategies and plans for addressing and mitigating the major risks (i.e., opportunities or actions for reducing the probability of occurring or minimizing the impact).

  - Considering whether the total risks are within the agency or state risk profile (i.e., the returns are commensurate with the risks and the risks are acceptable).

- Sixth, it enumerates implementation costs and operational expenses and achieves the agreement of all involved parties (prior to the investment of fiscal, personnel, and technical resources) that the benefits or returns are worthwhile given the risks and funding requirements.

- Seventh, it defines what success is – both for the implementation effort (project performance) and its results (asset performance). It prescribes the metrics for measuring the performance of the project team (adherence to schedule and budget and quality of deliverables and work results) and the asset after it is operational (features, capabilities, reliability, etc.). While related, the performance of the project and the success of the investment are two separate entities. The project may be performed on time,

within budget, and deliver the desired product quality, but the investment may not result in the expected value or benefits and vice versa. For example, a new application may be implemented in the time period and within its budget, and it may work as specified. However, if the business process was not reengineered as advertised in the business case, the anticipated operational savings will not materialize.

The post-implementation audit will use the metrics in the business case to assess the performance of the investment in achieving the desired values and benefits (such as cost savings or avoidance, improvements in citizen services, better decision-making and policy-formulation, etc.). Did the investment achieve what the people who funded the project and for whom the project was performed expected? The business case also is helpful in judging the success of management in taking the organizational restructuring and process reengineering actions promised in order to provide the savings or other benefits or values expected. These management actions may include reducing layers of management and supervision, streamlining operations, redesigning jobs, and/or reducing headcount.

- Eighth, it is the beginning of the formulation of the procurement strategy or plans necessary to purchase, implement, and outsource the investment, as applicable. Contract negotiation and vendor management are key considerations to be addressed.

- Ninth, it provides an opportunity to assess the readiness of the agency and project team to perform the procurement and other implementation activities successfully. Because the preparation of a business case requires the use of basic project management skills (such as identifying business/program needs, establishing scope, defining resource requirements, performing risk analysis, developing work plans and schedules, estimating costs, and creating performance measures), a business case assists in institutionalizing project management discipline throughout the agency. Equally important, a business case serves as a checkpoint for ensuring responsible persons in the agency are following acceptable and prevailing practices for managing and conducting projects and have the knowledge and skills to perform the work successfully. Finally, it verifies that the agency/state has the capacity and resources (fiscal, personnel, material, etc.) necessary for undertaking and completing the project, especially within the finite capacity constraints (staff numbers and skills, fiscal, etc.) of the agency and/or state.

- Tenth – it is a management tool that provides a governance structure for managing and evaluating a project as it moves through its life cycle. Project objectives and expected value and benefits, ties to agency and statewide strategies and initiatives, linkages to related projects and efforts, and key assumptions are subject to change as time passes and realities are experienced. A business case serves as the anchor point for refocusing efforts and reevaluating the project and its plans as events and circumstances vary from expectations and anticipations.

A simple and straightforward approach for the business case follows a three-pronged structure, consisting of a clear definition of the business/program problem or opportunity, the solution, and the metrics. The business problem statement captures the specific operational issues or opportunities to be addressed. It may describe the current state and the changes sought from the IT investment. It answers the question, "Why does the agency/program care about the project?"

The solution statement describes the investment's features and functions so reviewers can assess their fit with the business problem or challenge. It defines how processes, tools, and applications will change in specific operational terms, and it provides clear business expectations. It answers the question, "Will the investment solve the problem or take advantage of the opportunity?" The new business metrics are expressed in hard and soft objectives. These provide convincing detail that the project understands the quantitative and qualitative business/program changes it should enable.

Through the exercise of developing a business case, the purpose, objectives, scope, approach, benefits to be achieved, and other key elements of projects are defined at the beginning. These describe what success will look like, and they form the framework for managing the implementation of the investments and accounting their performance throughout their lives. Moreover, sound and complete business cases ensure diligent up-front planning to support successful project execution and delivery.

Gartner Research Note Is IT Worth it? Presenting the Public-Sector Business Case, gives nine key parts of a business case. These are:

- Develop a problem statement – Define the problem or need or opportunity to be addressed. Each technology initiative may address multiple issues.

- Describe how the initiative will have an impact on the future – Explain how the initiative will solve the problem or address the challenge or opportunity, including the operational impact of the project.

- Describe specific objectives of the initiative – Express the project's goals and key aims.

- Provide a description and rationale for the desired approach and explain why alternatives were discarded. Describe how technology would solve the problem. Include the specific solution, the participants, and the project's effect on constituents and critical stakeholders. Detail alternative approaches that were considered and explain why they were discarded.

- Describe and quantify the benefits of the proposed initiative. Benefits include monetary cost savings and revenue enhancements, as well as non-financial service delivery or political considerations. Articulate clearly both the tangible (financial) and intangible (public value) benefits.

- Quantify the business cost and identify the sources of funding. Costs should be "fully loaded" by including all elements of the project. Funding may be multi-sourced from federal, state, local, and other sources.

- Perform a cost-benefit analysis. Provide relevant data on costs and benefits to answer the question "Is the project worth doing?" Justification should be economic (quantitative). In some cases, non-financial (qualitative) values may be necessary or useful, especially in the public sector.

- Specify performance measures. Provide business/program level (not technology) performance measures to server as yardsticks of achieving project goals and objectives. These include improvements in program results, cost savings, revenue enhancements, etc.

- Perform a risk assessment. Acknowledge potential risks by analyzing the following risk areas: a) business (is the business reasoning sound) risk, b) organizational (will users accept it) risk, c) technology (will the technology work) risks, d) vendor (are the prospective vendors viable) risk, e) execution (will the project be managed successfully) risks, and f) concentration (will failure of this one project adversely impact others to produce extreme disadvantages or disruptions) risk. The greater the exposure to

risks, the greater the returns must be to offset the increased likelihood of failure.

Appendix R lists the review points for approving IT projects. The first criteria area covers the question of whether the investment is worthwhile from a business perspective. It offers several more detailed criteria for evaluating the proposed investment relative to how well it will help state government.

Appendix I compares and contrasts the business case with other related project management documents (project charter and project management plan) and concept/framework (project strategy). A solid business case addresses several of the basic tenets of project management included in the project charter and management plan documents and the strategy framework. These include project description, performance goals and measures, analysis of alternatives, risk management, and planning and control.

2. Secure senior level leadership – While leadership is important at all levels of the project organizational structure, superior executive sponsorship is one of the most important leadership positions in the endeavor. Typically, the project sponsor is a senior business/program executive with the scope of decision-making authority and persuasive influence within the organization necessary to guide and direct the effort to a successful conclusion.

   The obtaining of committed executive sponsorship is an absolute prerequisite for achieving project goals and objectives. From beginning to end, major projects must have full and visible commitment (not just involvement) and support from top-level management with the requisite authority (such as the authority to enforce compliance in project mandates; changes in policies, processes and procedures; etc.). Since these projects often lead to significant changes in organizational structures, business/program policies and processes, and relations with clients or citizens, executive leaders must convey the importance of the effort and set its cultural tone. Project sponsors are responsible for providing the clarity of purpose for the project and the strength of will for accomplishing it. Vagueness of reasons or uncertainty in intentions for undertaking it or reluctance to provide the necessary facilities and resources for achieving it will predestine the effort to failure.

   Most statewide projects involve multiple organizational layers or tiers, either within agencies or divisions within departments and/or among multiple governmental entities (e.g., federal, state, and local). The joining up of services and business/program processes across governmental jurisdictions is more a political and management challenge than a

technical one. Strong project sponsors are needed to overcome the challenges presented by the varying degrees of political friction encountered in these engagements. A clear focus must be maintained on the political, organizational, and process issues and changes associated with multi-governmental projects.

Project sponsors must lead the project while allowing others to share the benefits and the credits. They must clearly communicate reasons for the project, state its importance to the future of the enterprise, articulate its goals and objectives, ensure the project team has the time, training and resources (including funding) necessary to succeed, and remove political and organizational barriers to achievement. They must have a charismatic approach to laud project benefits and be able to motivate and inspire those working on the project and those affected by its results. In summary, project sponsors must ensure that (a) the project team's mission is clear and understood, (b) the strategy for a successful end is compelling and realistic, and (c) the resources are sufficient to achieve the desired results.

Potential project sponsors include people with:

- Direct operational responsibilities – they will benefit directly from the operational improvements of the project.

- A focus on service delivery quality – they will recognize the need for investing in improvements and the benefits of higher quality results.

- A quantitative mindset for using information and measuring performance – they can detect and appreciate changes in operational performance.

- An eagerness to understand operational issues – they want to learn how things work, how they should work, and what creates the gap between the two.

- An orientation for action – they want to implement improvements by changing processes, organizational roles, and the use of technologies.

- A project mindset – they can envision results with an understanding of how to marshal resources into teams that will achieve these results.

- A familiarity with technology and its application – they understand that technology cannot solve all problems, is not a substitute for other bold management action, and is challenging to implement

and operate at scale; however, it can provide dramatic and long-lasting benefits if applied properly.

Situations offering deeply embedded cultural and institutional resistance to change may require careful attention and forceful action. These include parochialism within agencies, departments, and/or programs; stove piped operations; and/or limited cross-organizational/jurisdictional communication, collaboration, and cooperation. Accordingly, project sponsors may be required to balance project needs against organizational imperatives and business/program requirements. Projects must fulfill business/program objectives, deliver expected value and benefits, and finish within budgets and schedules. However, it is the responsibility of project sponsors to ensure, to the extent possible, that organizational structures, working cultures, political environments, or business/program policies or processes do not complicate the design, implementation or operation of the application.

Unfavorable business/program environments, excessively complex operating requirements, or adverse organizational structures or cultures can lead to excessive development expenses, extended implementation timeframes, and unnecessary operating costs. For example, when implementing a statewide system in a governance environment offering a high level of autonomy in local decision-making and great flexibility in processes and procedures, it may be necessary to instill more discipline in policies, commonalities in processes, and standards in technologies to achieve a cost-effective and timely implementation of a new system or technology.

Project sponsorship does not have to be one person. There may be a need for at least three project sponsors – political, business/program, and technical. There may be more, depending on the number of different departments, agencies, programs, and/or interested groups or users involved.

Key attributes for project sponsors are commitment, self-awareness, and vision. Project sponsors must be dedicated to the effort and devoted to seeing its successful fulfillment. They must lead by action and example ("walk the talk") and have the will and persistence to push through any problem, regardless of the difficulty. They must be cognizant of their strengths, weaknesses, and capabilities; the surroundings and challenges; and the appropriate actions to address issues and solve problems. Additionally, project sponsors must have a picture of what the end will look like and a workable strategy (direction and vision) for how to get there. Finally, they must be able to employ sound judgments for making tough business decisions.

Two other attributes of project sponsors are resiliency and honesty (trustworthiness). They must be able to take the arrows as well as the credit. Openness, credibility, and believability are essential for obtaining and keeping the respect of others. Project sponsors also must show consistent integrity by always being willing to do the right thing, because it is the right thing to do. Self-confidence, character, and competence are further desired attributes. Confidence comes from being well grounded emotionally, being supportive of others, willing to put the organization or effort ahead of their self-interest, and having the freedom to fail. Character requires the ability to remain calm during conditions of stress, chaos, and rapid change. Competence comes from work, study, and experience.

In its 2001 edition of EXTREME chaos, the Standish group listed eight skills for executive sponsors:

- Visionary – Have a global view of the project and a consummate knowledge of how it fits into the organization's goals and how it benefits the organization. The executive sponsor must set the agenda, often arrange the funding, and articulate the project's overall objectives and worth.

- Champion – Be an ardent defender or supporter of the project.

- Responsiveness – Be active and responsive and available to answer, suggest, influence, and resolve appeals.

- Responsibility – Provide skillful and personal leadership and be personally accountable for project outcomes.

- Business – Offer understanding of the organization's businesses/programs to the project team.

- Technology- Have a fair (neither good nor poor) knowledge of technology, primarily enough to realize its potential for enabling and supporting business/program processes.

- Results – Know what the results of the project will be, with clear and concrete expectations of the end product.

- Process – Posses a good understanding of project management methodologies and the theories and concepts of project management.

One major reason for project failure is the sponsor does not have enough clout, credibility, or connections to get the difficult job done. Another is the

sponsor abdicates individual responsibility by giving it to subordinates or groups and 'dribbles' in and out of meetings for progress reports. Having sufficient influence and exercising appropriate responsibility are essential qualities for project sponsors.

In summary, project sponsors must display the courageous and bold distinctiveness described by the Greek war historian Thucydides. "The bravest are surely those who have the clearest vision of what is before them, glory and danger alike, and yet notwithstanding go out to meet it."

3. Assign an experienced, qualified, and capable project manager – Project management has been defined as the planning, organizing, directing, and controlling of resources for a relatively short-term objective that has been established to complete specific goals and objectives. The project manage is the person responsible for ensuring the project meets its cost objectives and delivers expected benefits/results on schedule. Superior executive sponsorship and top-notch project management are the two most important leadership positions in the project organizational structure.

   Successful projects have satisfied customers. Customer satisfaction requires setting clear expectations, managing those expectations, and meeting those expectations. Project managers are responsible and accountable for the successful delivery of services/products that are on time, within budget, and satisfactory to the client/customer. Successful projects result when project managers recognize, understand, and orchestrate the various components of projects so that they blend together. Project managers must have three key management attributes: project planning and implementation management, human resource expertise, and a thorough knowledge of the service/product being delivered.

   Project managers orchestrate the application of proven management processes, procedures, and standards within a scalable environment to fit the demands of the project. The project manager provides the vision, coordination, and development of a project roadmap to achieve specific benefits, enabling the measurement of success along the journey. The project manager is the implementer and coach of the management process, making sure the vision and the end objectives and results are never obscured from the project team.

   The project manager must be at a senior level individual and must take personal responsibility for the success of the project. The project manager is responsible for the project, accountable for project results, and must have the authority to execute the project to realize the intended outcomes. If at all possible, the project manager function should not be abdicated to an outside vendor (i.e., it should not be outsourced). In

addition, more complex, larger-scale, strategic, big-budget, and/or longer-term projects require a full-time dedicated project manager.

A superior project manager is absolutely critical to the success of the endeavor. Technology investments involve three areas – technologies, people, and processes. The project manager is responsible for coordinating these, managing fiscal resources (budgetary planning, execution, and control), developing plans and baselines and management controls, and reporting to project governing and oversight bodies. In addition, the project manager must align the project with the business/program strategy, convey direction to the project team that is consistent with the strategy, and keep the project team focused on business/program requirements and end user needs.

Project managers also must coach and encourage team members, make sure they have the resources they need, remove obstacles, and influence positively interested parties and other influential persons outside of the project team. Most important, project managers must see that the project proceeds at a 'sustainable pace' through actions such as, obtain adequate staffing, implement effective support tools, run interference on outside influences and eliminate internal roadblocks that inhibit productivity, establish reasonable expectations, and adopt appropriate work cultures and behavior norms for the project team.

In summary, project managers must organize and motivate project teams, prepare business cases and generate project proposals; develop project plans; define personnel, fiscal, and other resource requirements; set up project management procedures; select and implement project tools; track project status; resolve project issues; identify and mitigate project risks; manage project budgets; communicate with stakeholders at all levels; monitor project scope; enforce change control; determine and report project metrics; create and implement test plans; and plan and implement system rollouts.

Even with the finest plans and the best technical and business personnel, an ineffective or incompetent project manager will doom the effort. A good one will compensate for many problems and shortcomings in other areas.

The project manager is the person whose style and approach are focused on the management, processes, and the overall business/program values of the project. The project manager must:

- Take responsibility, including problem solving and decision making and ensuring that recognition is given when goals and expectations are met.

- Have a strong sense of purpose, as well as a clear understanding of why the project is being undertaken, how it will be accomplished, and what benefits should result from it.

- Have a good understanding of the business/program (as well as the political and financial) issues associated with the project.

- Be a senior reputable figure in the area of expertise needed for the project or program.

- Be actively involved in the project and the team, not a figurehead.

- Have sufficient experience and training to carry out the project manager responsibilities.

- Understand thoroughly the four project constraints (cost, schedule, scope, and quality), how they relate to each other, and how to manipulate and balance them to achieve the best possible outcomes.

- Accept the responsibility for resolving project issues, especially those that impact the four project constraints above.

- Recognize the need to say “no” and be willing to be a naysayer when required, especially when it may be necessary to take a position different from the common belief of influential persons or interest groups.

Some characteristics of a well-qualified and skilled project manager are:

- Strong sense of morality (right from wrong), ethics (fair from unfair), personal integrity, and professionalism.

- Stalwart personal character, which means doing and saying what is right, not just what is expedient or what others want to hear – even if it is at substantial personal risk. Character is necessary for credibility, and credibility is required for team building and gives weight to opinions.

- Good resiliency and strong problem-solving skills, because whenever there are problems (and there always will be), project managers must emphasize solutions rather than hurdles. Project managers must be capable of developing new approaches to work over, around, and through obstacles and setbacks.

- Keen focus on policies, processes and best practices for managing projects (i.e., thoroughly understands and diligently follows generally accepted and prevailing practices for managing IT projects, such as IEEE and PMBOK).

- Sound planner with the abilities to: develops plans with such details that there is no question of who does what and when; maintains focus on the end deliverables and the major activities that need to be done; dissects each activity into manageable pieces that include resource requirements, quality points, success criteria, risk areas, and the support of the delivery of sub-deliverables and the final deliverable; and explain the plan to stakeholders, interested parties, and oversight bodies.

- Competent manager capable of focusing on and positively influencing the areas of contract/vendor management, customer/client relations, deliverable timelines, financial reporting, and overall project status determination and reporting.

- Strong leader (with sound team building and personnel management skills) that understands the need to develop mutual trust and respect with team members, oversight bodies and stakeholders; is able to delegate responsibility while maintaining overall accountability for the effort; can plan work and organize personnel; provides team members with project priorities and clear guidelines on tasks; uses praise and constructive feedback to motivate staff; and manages the performance of and demands accountability from project participants.

Additional leadership attributes of proficient project managers are: maintains good judgment and a calm demeanor under difficult circumstances; bold and decisive but not impetuous; deals with adversity while maintaining a professional deportment; good listener and easily gathers information from others; strong analytical skills and performs thorough analysis, with logical reasoning and convincing persuasion; willingness to take necessary risks; citizen service driven, measurements oriented, and results focused; and provides an example for others to follow (practices what preaches in terms of values, beliefs, conduct, competency, professionalism, etc.). Leadership skills are especially important for project managers because the scope of responsibility usually is far greater than the breadth of authority.

- Proficient risk manager by anticipating potential problems and developing approaches for avoiding, transferring, or mitigating them, as well as preparing contingency plans where necessary. Challenges must be proactively addressed and resolved.

- Master communicator and persuasive speaker, with superb writing and presentation skills. Straight talker who deals with and explains the facts in an understandable manner.

- Good listener, with strong abilities in negotiation, persuasion, getting buy-in, and conflict resolution.

- Competent worker with people (strong interpersonal skills), including working in multi-functional, multi-cultural, and multi-personality environments.

- Dedicated commitment to deliver a successful project.

Three key requirements for project managers are:

- Know project team members. Identify talents and match them to the project's needs. Take advantage of each person's unique contributions and recognizing that everyone counts.

- Treat each member of the project team with respect, compassion, and consideration. Respond to their human needs first, and they will want to respond to you.

- Lead by example. Don't ask anyone to do anything you would not do, and treat users, vendors, and interested people the way you want your team members to treat them.

In its 2001 edition of EXTREME CHAOS, the Standish Group listed eight skills for the project manager:

- Business – The most important trait. It involves a consummate knowledge of the business/program objectives of the project.

- Technical – The ability to communicate between designer/developers and users/sponsors and envision system components and their incorporation into the whole.

- Project Management – The possession of basic management proficiencies, such as good judgment, diplomacy, and time management.

- Decision – The ability to make good choices and reach firm decisions.

- Process – The talent for planning, enacting and tracking a series of activities, tasks, and changes.

- Detail – The realization that features and functions must be considered individually and relation to the whole. The capability to take both detailed perspectives and big picture views.

- Organization – The aptitude for organizing project components into a working structure for meeting common goals and objectives.

- Communication – The ability to express and exchange thoughts and information clearly and succinctly. Communication must be understandable to both business and technical staff and executives.

Larry Sisemore, a Colorado Springs, Colo.-based management consultant at PM Solutions, divides project management into two parts: science (technical and planning skills) and art (people skills, communication, and negotiation). The larger the project, "the more skills required on the art side," he says. Although IT related managers could succeed on the science issues, the overall project management in large projects has to come from the business and art side.

In summary, project managers must be proficient in directing and supervising people, controlling budgets, and directing vendors. They must be accomplished team builders, motivators, coaches, and mentors. Key requirements of project managers are setting priorities, assigning the appropriate resources against those priorities, and delivering results on time and within budget, while meeting program goals and business objectives. The ideal project manager would be an eloquent and substantive speaker, a careful listener, a thoughtful strategist, and a leader and consensus builder of the first rank.

4. Establish a project management office (PMO) and manage projects through it – A PMO is necessary for supporting the effective and efficient management of multiple sizeable, strategic, and/or complex projects that are being conducted simultaneously. PMOs can be of different sizes and have differing roles, responsibilities, and scopes of work. Some may offer consolidated project reporting, standards development, and tools implementation, with eventual evolution toward more actively monitoring, training, and coaching project managers and teams. Additional expectations may involve the conduct of project audits and the intervention in projects when problems emerge, and they ultimately may become the home for all project managers.

In its full incarnation, the PMO is responsible for initiating, planning, executing, controlling, and closing all projects across an organization. It is a system of processes, technologies, people, and culture designed to manage and control projects throughout their life cycles. A fully functioning PMO provides the following services to the organization:

- Project inventory – including all envisaged, underway, and completed projects.
- Project process development – including processes, templates, and tools for more effective project management. These include life cycle, stage-gate system development and project management processes and associated workflows, as well as templates for each phase, activity, and/or stage-gate.
- People, especially project managers.
- Repositories of best practices and other prevailing and acceptable practices documentation.
- Status reporting and dashboards – including monitoring information on progress against timetables/schedules, budgets, deliverables/milestones, quality, and staffing utilization.
- Decision criteria – including project approval review, progress evaluation, and post project audits.

PMOs and their supporting portfolio management software tools are becoming increasingly popular in both the public and private sectors in response to: a) increasing experiences with important projects that are running late, not delivering desired results, or costing more than estimated; b) needs for more frequent, more actionable, and better information on project status (individually and as a portfolio); and c) desires for more formal and relevant decision-making criteria and analysis on which projects to undertake (make investments in), which ones are ready for starting (approved), and which ones are at risk or showing signs of getting in trouble.

PMOs offer (a) synergy from the consolidation of knowledge and experience; (b) economies of scale/scope by the reuse among all projects of supporting tools, such as project management software, estimating and risk management tools, etc.; and (c) quality by standardizing processes, procedures, standards, etc. In some cases, PMO staff may perform project administrative tasks, allowing project managers and team members to spend more time and attention on core project tasks versus administrative matters.

In some organizations, the PMO may exercise oversight responsibilities for the performance of projects and their results. In others, an executive board or committee may have that role, while the PMO serves as the staff to that group. The policies, procedures, practices, methodologies,

techniques, templates, etc. of the agency PMOs should align with those of the state PMO under the State CIO.

5. Develop an appropriate project organization structure and build an effective project team - The organization structure should include all affected groups and organizations, such as technologists, business/program representatives, user groups, stakeholders, oversight bodies, etc. Moreover an integrated project team is necessary to ensure all technical and business/program areas, disciplines, and skill sets are involved. Counties and local community organizations must be included, if appropriate. Active participation by all affected organizations is necessary to the necessary knowledge and understanding of the project and its scope, requirements, and results is obtained.

   The project organizational structure must delineate the reporting relations among major entities, and it should unmistakably define roles, responsibilities, duties, spans of control, lines of authority, and accountabilities. It has to be complete and unambiguous in defining missions, responsibilities and expectations. Clear lines of communications (as well as types and frequency of communications) must be established among all parties and representatives. For participants, time and duration of commitments must be given. Often, executive steering committees or senior leadership groups are used to oversee (direct and monitor) the overall effort. The roles, responsibilities, duties, and lines of authorities for oversight bodies must be included in the project organizational structure and governance processes.

   For projects involving collaboration and coordination among agencies, programs and/or jurisdictions, the organization structure may promote closer and better working relations. For example, broad representation on the governing and review boards may facilitate a feeling of equal ownership and direction setting. Establishing collaborative decision-making processes and reaching formal agreements on partner roles and responsibilities may achieve effective coordination with partners and stakeholders. However, as described below, project governance must be structured so that decision-making and oversight are not blurred across organizational boundaries or management entities.

   Project governance is defined as the authority, responsibility, and accountability for decision-making, including final decision-making authority. It is the framework for decision-making authority and accountability on how the project will be conducted to meet expectations for: a) its performance, b) the accomplishment of its goals and objectives, and c) the delivery of business/program value and benefits. Governance includes the project's organizational structure, scope of command and control of its leaders and managers, and its processes and procedures.

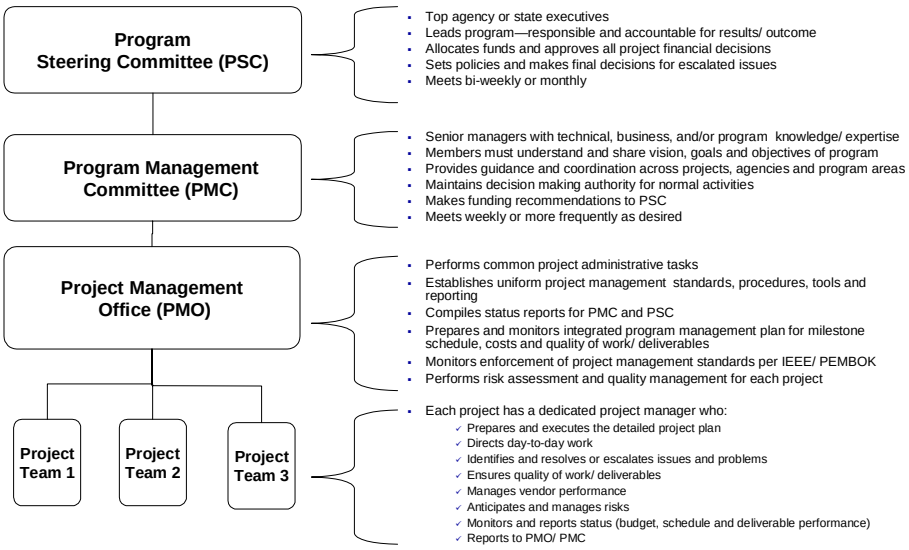
Project governance involves two major components. The first is a well-defined project organization that may include project owners/champions/sponsors, project steering committee, project management committee, and project office. The second is project management disciplines and practices that usually include project charter, policies and procedures for issue resolution and change control, project management and reporting standards and tools, and standards and practices for quality assurance. A key organizational rule is the people who accept the consequences of outcomes (accountability) must have the means to influence those outcomes (authority and responsibility). In summary, governance is how decisions are made, and management is making the decisions.

The discipline of project management must be instilled in the organization. A deep organizational knowledge of project management and implementation will facilitate the satisfactory progression of large, complex projects.

Governing and review boards must have sufficient expertise to oversee the project. If the necessary expertise is not available within the boards or their staffs, outside, independent consultants should be employed to assist in the oversight of the effort.

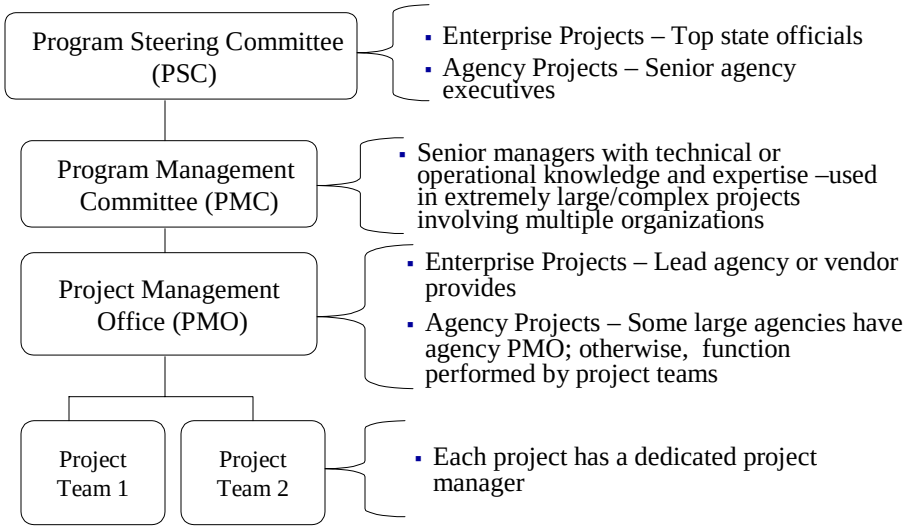
A potential project governance structure is depicted below.

Potential Project Governance Structure



An alternate presentation of the potential project governance structure follows.

Alternate Explanation for Potential Project Governance Structure



Successful projects require a strong project owner or ownership group. The owner(s) have the following characteristics:

- Responsible for the success of the project.
- Should be at the executive management level.
- Must garner and maintain the support of the highest levels in government for the project.
- Have the authority to build consensus among the various stakeholders.
- Have final decision-making authority with regard to project direction, scope, budget, schedule, quality, and issue resolution.

Major governance risks may include:

- Lack of qualified and experienced staff (i.e., the availability of sufficient strong project managers and skilled functional and technical staff may be limited).

- Inability to understand and address sufficiently pushback from cultural changes and institutional resistance to new organizational structures, revised business processes and program operations, and redesigned jobs.

- Inadequacy of budgets and lack of flexibility for targeting expenditures.

- Lack of management staying power and political will to see the program or project through to the end (successful conclusion).

Team building involves more than just the assembling of the right staffing in terms of representation, skills and numbers. A collaborative and cooperative working environment must be created, and the team must have clear, challenging, and consequential (importance to the organization) direction for its work. Team membership must be clearly defined, and size (not too large to be unmanageable) and types of members (diversity in membership is usually a plus for effectiveness) must be considered.

Communications within the project team is important. This may be more difficult for geographically dispersed team members, but it must be provided for. Communications must be regular (such as weekly leadership meetings), thorough (cover key aspects of the project), and inclusive (include vendors, users, and other key team members).

The five qualities of an effective project team are: (1) shared values (what do we believe in), (2) shared objectives (what do we want to accomplish), (3) shared activities (what is each member supposed to do to achieve the goals and objectives of the team, (4) team head leads the action (leadership skills are essential), and (5) individuals act as a group (order of priority is team, teammate, then self). Finally, project sponsors, managers, and leaders must understand that positive reinforcement and recognition boost morale and foster a desire to exceed personal and professional expectations. Good leaders recognize and applaud publicly good work and successful accomplishments by individuals and the team as a whole.

The composition of project teams should be developed from three key considerations. One, adequate representation from all involved parties must be achieved, including technical, business/program, etc. Two, the needed skills and experiences must be available. Three, the ratio of state to vendor staff must be acceptable (a minimum average representation of 50% state personnel is desired). Regarding the third item, insufficient state staffing will create extra implementation and operational expenses and reduce learning and educational opportunities for follow-on projects,

as well as create or exacerbate risks (such as inadequate requirements identification, incomplete testing, etc.).

People make a big difference in the outcome of a project. The following criteria may be helpful in selecting the members of the project team:

- Aptitude – No matter how hard a person works, or how much they study, if they do not have an aptitude (natural inclination or ‘”knack”) for the job, they will not be successful.

- Work ethic – Two considerations are important: 1) in the normal course of events, will the person put in an honest day’s work, and 2) when the circumstances require it, will the person do whatever it takes to get the job done?

- Versatility – Team members must be able to adapt to different circumstances and to learn new skills and jobs.

- Temperament – Disposition, attitude, or character (whatever it is called) makes a difference between enjoying camaraderie and synergism of a close-knot and functional group and dreading to come to work in the morning.

Experienced managers have learned that solid basic skills are important when selecting team members; however, attitude is an equally critical attribute. People can always learn new or better skills, but if they are not flexible, willing to communicate, and open to new ideas, they will not contribute to the team effort. Managing team membership also means moving people off the team when they create a dysfunctional environment. Additionally, remember, adding more people late in the project usually slows progress and depresses productivity, as the experienced team members drop their work to bring new people up to speed. As Fred Brooks said, “Adding manpower to a late software project makes it later.”

The project team must have the right combination of “types” of people. These include the (a) “eager beavers” who may have little experience, but makes up for it in sheer persistence; (b) “gurus” who know everything there is to know on subjects and are willing to teach others and share their professional knowledge to solve real problems; (c) “mother hens” who handle special events, extracurricular activities, etc. to maintain morale, provide team cohesion, and balance the professional with the personal; (d) “gadflies” who provide creative new ideas and challenge the status quo, when improvement is warranted; and (e) “leaders” who inspire other team members to accomplish their goals, as well as hold them accountable when they don’t.

Meeting control has become has become an increasingly important aspect of project team management. Because of the more complex, collaborative, and democratic project work environment, teams need meetings to share information, receive input, coordinate activities, and make decisions. While good, productive meetings will improve project performance by integrating peoples' perspectives, knowledge and experiences and developing creative decisions, poorly organized and improperly run meetings can waste significant amounts of time and money. Some general rules include: meet only when necessary, prepare well for each meeting with clear objectives and a time-delineated agenda, and closely control the activities (stay on course and stop unproductive discussions).

A Gartner research note dated July 6, 2004, and titled Organizational Chart is Falling Into Irrelevance states that in today's rapidly changing business and technical environments, the traditional organizational chart is becoming less important for job identity and accountability and as a tool for managing work. Traditional hierarchical structures with clear lines of authority, unity of command, and discrete accountabilities don't jibe with today's unstable, unpredictable, and ever-changing business and political situations and technical innovations and evolutions. Companies are turning to well-defined processes and 'rules of engagement' to manage both internal and external activities.

The traditional hierarchical organizational chare contains defined boundaries and relationships between distinct and 'siloed' functions, ascending levels of authority, and precise individual job roles and responsibilities. Today's dynamic work demands require matrixed structures that aggregate employees into diversified workgroups glued together by common purposes and processes, collaborative application tools, and knowledge repositories. This is a team-based, process-centric, constantly changing and adapting, and modularized organization.

Five prerequisite items for the more flexible and responsive organization are summarized below:

- Foster leadership throughout the organization – by stressing leadership, the management team can anticipate and rely on greater initiative, more-distributed decision making, and more-autonomous and –collaborative approaches to work assignments, rather than relying on job titles and employees' positions in the hierarchy.

- Establish and clarify organizational purpose – purpose, when clearly expressed and reflected by strong leaders, inspires ordinary people to do extraordinary things. Purpose resonates, drives

excellence, invokes people's passion and connects disparate people through a common bond. Purpose transcends mission statements, provides design goals for processes, and gives clarity and meaning to individual roles, responsibilities, and accountabilities in the context of planning and executing work assignments.

- Define the organization's core processes and key roles – Well-designed and –documented processes provide the pathways, road signs, and decision criteria for effective operations. They define the sequence of activities with the associated roles, responsibilities, skills, competencies, deliverables, and dependencies necessary to get work done. Individuals must know exactly how work flows, what roles people play, the interdependencies within and among teams and functional groups, and how and when decisions are made.

- Stress governance over hierarchy – Governance defines decision-making authority and accountability. Governance supersedes hierarchy by liberating the organization from the inflexibility of reporting structures, which frequently have little relevance to the critical decisions that typically relate to cross-functional and cross-organizational processes. Governance enables timely and responsive prioritization of work commitments and resource allocations.

- Build and sustain an organizational culture that aligns and reinforces the business/program culture – The attitudes, values, and behavior norms of the IT area or project teams must reflect those of the business/program areas. Furthermore, the capabilities and services of the asset/investment must be defined in terms (language) the business/program areas live by and understand – not in standard IT organizational and technical terms. Business/program areas are interested in things such as response times, number of concurrent users supported, turnaround speed, etc. – not number of servers, database sizes, firewall capabilities, etc.

In closing, remember the admonition of Roman general Gaius Petronius, who died in A.D. 66, in "Satyricon": "We trained hard … but every time we were beginning to form up into teams, we would be reorganized. I was to learn later in life that we tend to meet any new situation by reorganizing … and a wonderful method it can be for creating the illusion of progress while producing confusion, inefficiency and demoralization."

6. Prepare effective bid documents, select qualified vendors, negotiate contracts well, and manage vendors closely - With projects increasing in size and risks, technologies growing in complexity, and state staffing resources constrained by economic uncertainties and budget constraints, the state is becoming more dependent on outside vendors for the implementation and support of its IT investments. Given the international and local economic situations, competition among vendors has intensified and vendor interest in state IT activities has been magnified.

   Major reasons for failed vendor relationships include, inadequate internal agency planning; poor communication of project goals and objectives, milestones and deliverables; and lack of vendor understanding of and compliance with project requirements. Agreement must be obtained among the project team, users, agency technologists, and vendors regarding deliverables (numbers, types, quality, format for documents/templates, etc.), schedules, staffing, budgets, staffing assignments, performance measures, responsibilities, and other key mutual expectations.

   Often it is helpful to complete a planning project prior to developing a request for proposals (RFP) for the implementation effort. The planning work should be adequate for delineating clearly and specifically the business and technical goals and objectives, roles and responsibilities, participants, governance, requirements, timeframes, milestones, deliverables, scope of work, and other items necessary for drafting a RFP, selecting the 'best value' vendor, and negotiating a manageable contract that is well understood by all parties. Proper planning and sufficient preparation should assist in accomplishing the objective of the procurement process, which is: *obtain the best combination of capabilities and competencies to meet the state's needs, at the right price points for the desired outcomes.*

   Contracts should be performance-based. In an ideal situation, contracts will be the artifact of the partnership between the agency and the vendor. It will prescribe business arrangements, performance expectations, governance mechanisms, and organizational roles and responsibilities. The true objectives for the contract and the governance mechanisms for supporting it must not be lost in negotiations. In developing performance-based contracts, metrics (often embodied in service-level agreements) should provide the linkage of business, program, and operational results with vendor performance achievement. Performance attributes should be measured in the areas of processes, costs, schedules, milestones, deliverables, and client satisfaction, with appropriate analyses, incentives, and penalties. For example, payments (or a percent of payments) may be based on the providing of satisfactory (as determined by the state)

deliverables. Acceptance criteria or standards for each deliverable should be developed, agreed to, and documented as part of the contract.

In performance-based contracts, payment should be made only on the acceptance of satisfactory deliverables. To do this, each major deliverable must have a price value, and this should be specified in the contract. Also, an amount of the full contract price (say 10%) may be withheld until the satisfactory completion of the full project. Another approach is to pay a certain percentage (say 75%) on time and materials, withhold another percentage (say 15%) for each deliverable (based on the price of the deliverable), and retain a percentage (say 10%) for satisfactory completion of the full project. In summary, financial incentives and penalties (i.e., business models of contracts) must protect the interests of the state by minimizing the business/financial and technical risks to the state associated with the efforts by vendors to develop products of expected quality, by specified due dates, and within certain costs.

Vendors should be chosen through a rigorous evaluation and selection process, including completive bidding and a through due diligence. The latter effort is necessary to ensure vendors can meet project demands and that vendors are and will remain economically viable. Thorough reference checking (for both financial integrity and past performance relevance and acceptability) is an essential aspect of due diligence work. A vendor's viability should be analyzed by considering (as applicable): financial stability, technical competence, product development capability, quality of support, marketing and sales reach, alliances and partnerships, and management performance.

Some areas that may be important to judge prospective vendors include:

- Technology expertise of staff – IT formal education; experience with legacy and modern IT technologies; certifications in major technologies (e.g., Web services products, development languages, database management tools, LAN management tools, networking/internetworking products, directory tools, etc.); ongoing professional training; and experience with specific state, agency, and/or application technical infrastructures.

- Project management expertise – project process certification (such as SEI's Capability Maturity Model or ISO standards), project process methodology or approach, experience in variety of types and sizes of projects (e.g., from workgroup to enterprise scales), management tools (e.g., portfolio management, modeling, project planning and scheduling, version control and configuration

management, software quality, etc.), and project management certifications.

- Business-domain expertise and experience – knowledge of and experience with the agency's and/or governmental program's business processes, and depth and breadth of relevant general government experience.

Contracting should follow a methodical and disciplined process. Contracts should contain terms and conditions, statements of work, and key measurement criteria. Important areas are vendor selection, contract negotiation, vendor relationship management, performance monitoring, termination plans, and overall governance and management. Exit strategies (especially to accommodate the need to bid again the contract or bring in-house at the end its life) and termination contingencies (e.g., for vendor non-performance) are key components of the contract. Provisions must be provided for the orderly and timely transition of functions performed by the contractor to the state and/or another contractor should the contract be terminated (for whatever reason).

Project organizational structures and communications requirements among vendors, state/project management (including responsible state personnel), and others (such as interested parties, other government entities, etc.) must be clearly and comprehensively defined. Moreover, vendor staffing (numbers, skills, individuals, etc.) and staffing turnover (especially for key managerial, technical, and/or subject matter positions such as project manager) should be addressed (how much allowed, how done, approvals, etc.) in contracts, with adequate penalties for non-compliance.

The Software Engineering Institute (SEI) has developed a Software Acquisition Capability Maturity Model (SA-CMM) that addresses an organization's acquisition management ability. The SA-CMM model defines organizational maturity according to five levels, and it specifies six process areas. The process areas are software acquisition planning, solicitation, requirements development and management, project management, contract tracking and oversight, and evaluation.

State agencies may follow a variation of the 'best value' concept for IT contracts that allows the trade off of costs versus value. (This approach contrasts the alternative one of 'low-cost that meets specifications'.) The best value practice allows the state to evaluate vendor proposals from a balanced perspective of both costs and benefits, to consider past performance in judging vendors, and to recognize and reward vendors for innovative and creative solutions to problems and challenges. Per state statutes, 'best value' is defined as "the selection of a contractor based on

a determination of which proposal offers the best trade-off between price and performance, where quality is considered an integral performance factor." As a result, the creation of good purchasing documents (such as Requests for Proposals), the ability to judge and grade vendor proposals proficiently, and the acumen for negotiating appropriate and cost -effective contracts have become increasing important attributes for achieving successful projects.

Today's IT project engagements and outsourcing services involve business, political, and technical complexities; critical business/program functions; and large expenditures. Therefore, teams for developing proposal requests, evaluating vendor responses, and selecting winning vendors must contain a variety of qualified personnel representing a wide range of disciplines. Specialists represented include lines of business or program, technical, procurement, negotiation, legal, and contract management. Technical and functional risks must be considered and evaluated formally and thoroughly. A solution offering good functionality but excessive technical risks (such as unproven technology) is unacceptable, as well as one presenting a technically elegant approach with high-risk functional capabilities (such as user pushback for key operating features).

Statements of work (SOW) and service level agreements (SLAs) are good tools for assisting in obtaining mutual understandings of requirements and expectations, the measurement and reporting of performance, and the accountability for results. SLAs must be sufficiently business-centric, realistic, and resilient to reflect business/program objectives and evaluate successes and failures in meeting the state's needs and expectations, current and future. Benchmarks must be specified and reporting systems must be implemented to monitor performance.

For IT projects, vendor management involves four major areas of managing (a) finances (cost versus budget), (b) system requirements from business and technical perspectives, (c) performance against plans (milestone or deliverable schedules), (d) quality of deliverables, and (e) project planning and reporting processes and capabilities (including performance reporting with cost and schedule variance analyses). Specific areas to measure and judge on a regular basis include:

- Attention to customer service.
- Capability of management.
- Understanding of business practices and standards.

- Use of advanced and appropriate technology and commitment to IT architecture and standards.

- Quality of services and deliverables.

- Accuracy of estimates and performance against budgets and schedules.

- Availability of adequate staffing relative to numbers and composition of people, with the requisite skills, expertise, certifications, and experience.

These items also may be used in questioning vendor references for performance on past projects for the state or other clients.

Where the required technical and/or project management expertise is not available within agency staffing resources (either in numbers of staff or skills/experience of staff members), outside, third party contractors/vendors may be used to perform independent verification and validation assessments of project status and the performance of the primary vendor. This expert evaluation of project management, progress of the effort, contract adherence, and work products provides an additional level of review and assurance that the project is progressing as envisaged and desired and the results will be as expected for costs, scope, schedule, and quality.

The larger, more expensive, and complex a project is and/or the less experienced state staffing resources are, the more important it is to incorporate independent verification and validation (i.e., seek expert opinion on the contractor's work) in vendor and project management. Independent, outside verification and validation should provide continuous and objective evaluation of project status, ensure project metrics are developed and followed, and make certain proper oversight is given (i.e., ensure the contractor is doing its job).

Legal staff should be involved in the drafting of all contracts, including the terms and conditions. Performance-based contracts are required, possibly incorporating incentives for superior results and penalties for missing deliverable specifications, expenditure budgets, or schedule milestones. Contracts should be comprehensive, specifying terms and conditions, responsibilities, deliverables, due dates, milestones, and prices. Time-and-materials contractual arrangements should be avoided and employed only in unusual and extenuating circumstances.

Contracts relating to software development and/or maintenance should contain a provision that the vendor should follow IEEE standards.

Requirements for meeting or exceeding a level of the Capability Maturity Model (CMM) of the Software Engineering Institute (SEI) should be used, as appropriate. Also, as appropriate, for software development, requirements to follow the statewide technical architecture (and agency architecture) should be incorporated. For project management, vendors should be required to follow IEEE standards, A Guide to the Project Management Book of Knowledge (BMBOK), and the 10 best practices and 35 standards of this document.

For the outsourcing of the processing of transactions to an outside service provider, bids and contracts should contain SAS 70 provisions. In summary, SAS 70 is an auditing standard of the American Association of Certified Public Accountants, and it addresses the controls over transaction processing and software development of outside service processors. The general practice for state government is the state must have the right to conduct by itself or contract with a third party to conduct SAS 70 audits on the outside service processor. Usually, the state pays for the audits; however, the outside service processor must cooperate in all respects with the reviews, including making documents and people available for examination and interviews. The SAS 70 audits should be conducted as often as desired by the state, and they could include controls and processes and procedures related to financial, security, information processing, software development, and other relevant areas.

Some contracts involve a work order arrangement where key provisions (such as deliverables, timetables, costs, responsibilities, etc.) are defined in individual work orders. While the work order concept provides flexibility, its ‘agreement to agree’ philosophy, entails increased risks of the overrun of the total budget, slippage of the overall schedule, and products and services not meeting quality or performance expectations. Therefore, formal documented processes and procedures for supporting the management of work orders should be crafted and followed. These should cover the specifying, approving, monitoring, and status reporting of work orders, and the inspecting, testing, and accepting of resulting products. Work orders should be performance-based (with due dates, budgets, and expectations of quality, value of products, or benefits of results), and vendor payments should be tied to the delivery of satisfactory products and services that are approved by responsible and cognizant state personnel.

Contract negotiation demands that deliverables (products and services) should not be paid for until accepted by authorized state personnel. Deliverables, with corresponding acceptance criteria, should be clearly defined and described. Acceptance evaluations and testing must be comprehensive and rigorous. Whenever possible, individual deliverables should be developed under not-to-exceed or fixed cost arrangements.

Vendor management requires that state staff members are responsible for inspecting closely and thoroughly deliverables for expected quality before accepting them.

For training, measurement techniques should be identified in the contract to ensure the training is of the quality desired. The evaluation and effectiveness of training should be the basis for accepting the work performed – not simply the delivery of the training class or computer based training (CBT) material.

There are three functions that the state cannot outsource or that an agency cannot abrogate responsibility for. These are vendor management, project management, and strategy formulation. The prime vendor concept is a must, so that one vendor is responsible for the management and performance of the project, regardless of the number and performance of subcontractors. Additionally, at least one-half to the project team should consist of state personnel to facilitate the necessary knowledge transfer, minimize implementation costs, and prepare for ongoing functional and technical support. If at all possible, the project manager should be a state employee. The following table highlights considerations in outsourcing skills or job functions.

Business/Program Knowledge	Technical Knowledge	Outsource Disposition
Low	Low	High potential for outsource
Low	High	If necessary, outsource by augmentation of state staff
High	Low	Low potential for outsource
High	High	Do not outsource

Hardware and software vendor contracts have to be managed to ensure that support, ongoing maintenance, and software upgrades are provided in accordance with the provisions of the contract. For outsourcing contracts, all business and technical activities must be identified and assigned to either the service provider or the state. The outsourcing vendor(s) must be managed to ensure it fulfills the performance levels prescribed by the contracts.

Implementation vendors and implementation services contracts required a detailed level of contract negotiation and vendor management. In addition to managing the vendor(s) to the terms of the contract, the state must also manage:

- Project scope – To ensure that the vendor delivers the full scope in accordance with the contract and the original project objectives. Also, to prevent or minimize scope creep, which generally leads to change orders and additional costs.

- Project schedule – As part of the implementation process, both the vendor(s) and the state will provide personnel and other resources and have responsibility to complete tasks. Delays in the completion of tasks on the critical path can result in project overruns.

- Quality and accuracy of deliverables – While it may be the vendors' responsibility to provide quality deliverables, it is the state's responsibility to review, approve, and accept these deliverables.

When purchasing software, as part of the acquisition decision process, the software should be tested to ensure that it meets security and other requirements before purchasing it. The National Institute for Standards and Testing (NIST) offers its Special Publication 800-23, *Guidelines to Federal Organizations on Security Assurance and Acquisition/Use of Tested/Evaluated Products*, which includes guidance on the benefits of testing commercial products against specifications.

For various reasons, purchased software and releases to software packages may contain serious errors. Vendors should certify that software code has passed internal quality tests, is stable, and contains no known errors that could limit or eliminate entirely the application's accessibility or functionality. Moreover, vendors should perform security checks such as adherence to the *Common Criteria for Information Technology Security Evaluation* from NIST. Adherence to software "quality of code" clauses means that vendors are certifying or guaranteeing their code, and they will be accountable if software code errors are directly responsible for downtime or failures that interrupt business. Software quality language (with amenities, penalties, and other protective clauses) should be part of every software related contract to mitigate the state's risks of bad code and exposure to serious coding errors.

There are several ways to define acceptable code quality. These include the following: code that has demonstrated to work under test conditions; code that has an updating or time-to-fix stipulation; code that is devoid of defects at one or more severity levels (application is not usable, application is useable, but major functions are malfunctioning, application has errors that inconvenience users, etc.); code that is documented for vendor maintenance and customer use; code that meets minimum customer performance and security requirements; code that meets

minimum functional specifications; and code that is table or variable driven and easy to maintain or modify.

It is a fallacy that problems only occur because of quality of code. Many other things can go wrong, and these must be addressed and managed. These include: the project team not employing proper project/change management policies and procedures, poor customer/vendor relations, inadequate definitions of requirements, incomplete and/or untimely communications between vendor and client, and trying to modify the code to meet unique or specific needs beyond its ability to be customized.

The selection of an inherently bad vendor cannot be overcome with any contracting vehicle or management organization, however detailed or sophisticated. On the other hand, the selection of a good vendor can be ruined by the failure to document mutual understandings, duties and responsibilities, and expectations of all parties and participants.

If a vendor is failing to meet contract expectations, early on, a cure letter should be issued to put the vendor on notice that its performance is unsatisfactory or deteriorating and demand a plan for improvement. In extreme cases, a back-up contractor may be retained when the vendor's performance becomes questionable, so the project may be completed in the event the original contract must be canceled.

Appendix E contains lessons learned from a large-scale acquisition. Appendix S covers considerations for evaluating, selecting, and managing vendors.

7. Develop a comprehensive management plan, and monitor, report, and manage performance – To have a greater chance for success, projects should be well researched, planned, and executed. The importance of sound planning cannot be overemphasized for complex, large-scope, and/or high risks projects. Due diligence is hard, but must be performed completely and well. The planning, estimating, and tracking activities involve two primary efforts, which are summarized below.

    - Create a well-conceived execution strategy - This is the documentation that explains the approach for implementing and managing the project. The strategy discloses a sufficient level of detail and scope of information for effective oversight and informed decision-making. It explains what capabilities and benefits are to be delivered, by when, at what cost, and how the project will be managed to meet these commitments, including management structure and responsibilities and accountabilities. It is the doctrine (or as the military says, 'rules of engagement') that describes how the project will be organized, managed, and accomplished.

Two primary documents are included in the project strategy: 1) the project charter, and 2) the project management plan. Appendix I provides details on these and other project planning and strategy documents and frameworks.

The project charter is used to authorize the project (internally to the department/agency/program and/or to oversight officials such as the SCIO) and to summarize key project information items. These include what will be done to accomplish it, how will it be accomplished, who will be doing the work and is responsible/accountable for results and who will be involved, why the project is being done, how much it will cost, how will agencies and others be involved, when it will be completed, and where does it fit in the larger picture of state government (where it is applicable, such as statewide, specific program, etc.). Key components of the project charter are: business/program need or problem/opportunity statement; description of end product or situation to be achieved; scope of work; major constraints (including time/schedule, budget/costs, and people and other resources); summary work plan; significant planning assumptions; major risks, with mitigation strategies; and major benefits (including strategic fit with agency missions and/or business/program goals and objectives, as well as financial results and/or public value).

The project management plan outlines the key elements for managing the project and describes how it will be managed. It focuses on the major items of project management methodologies, such as the management of planning and coordination, scope, time (schedule), cost, quality personnel/staffing communications, risk, and procurement (including vendor management).

The strategy involves a detailed and viable work plan that guides efforts and (1) specifies measurable goals, objectives, and milestones; (2) identifies needed staffing, funding, and other resources; (3) articulates timeframes; and (4) assigns clearly enumerated roles, responsibilities, and accountabilities for accomplishing well-defined tasks. In addition, senior management should approve work plans. The project must be allocated adequate personnel, fiscal, and other necessary resources; progress must be measured and reported against planned commitments on a weekly or monthly basis; and appropriate corrective actions must be taken in a timely manner to address adverse deviations.

After the project has been broken down into manageable components, the next two activities are to (a) identify the sequence of events and interdependencies among them, and (b) estimate the time for completing each major task/activity. A Gantt or bar chart can be created to show major tasks/activities that should be completed over a common time frame. Tasks are indicated on the vertical axis, and time is shown on the horizontal axis. Each major task/activity is a horizontal bar. While the Gantt (or bar) chart shows overall time-phased relations, dependencies are not portrayed.

Two different methods can be used to indicate dependencies among tasks/activities. These are Critical Path Method (CPM) and Performance Evaluation and Review Technique (PERT). CPM and PERT charts are often referred to as networking diagrams. Both give the critical path, which is a path that has no float and is the longest path through the project. Pert provides for probabilities, while CPM depends on exact data. For more complex work plans and schedules, software must be used to calculate the critical path. The intent is to identify the critical path and determine the amount of float or slack (latitude) in the non-critical paths. The shortest possible schedule is usually the one in which as many tasks as possible are done in parallel.

PERT requires confidence levels of estimates (optimistic, most likely, and pessimistic) for each task/activity. The formula is PERT Estimate = [optimistic + (4 x most likely) + pessimistic]/ 6. A statistical formula (not simple addition) is used to calculate the critical path and its probability. In fact, considering the probabilities, the PERT critical path may differ from the CPM critical path.

The work plan should follow a systems development life cycle (SDLC) and features tasks, work efforts, deliverables/results expected, responsibilities and due dates. A project management methodology (PMM) should be followed for managing the project. SDLCs and PMMs are described in further detail in Chapter 4. The project plan forms the foundation for the performance-based management system that is used to monitor progress against established cost, scope, schedule, and quality goals.

- <u>Set performance measures, create key metrics, and report and monitor status often and closely</u> – The project plan should be employed as a tool for monitoring and managing the project. This area addresses the processes and activities for measuring and monitoring progress to ensure that projects meet intended cost, schedule, scope, and quality and deliverable goals. The intent is to

ensure management is aware of current project status and future direction and that promised asset capabilities are delivered on time and within budget. Scheduling, tracking, and reporting mechanisms should involve results-oriented performance measures, established criteria, and rigorous monitoring procedures.

There are four reasons for performance measurement. One, It is a method for aligning the efforts of the project team behind the right tasks, allocate resources, assign and manage accountability, and measure outcomes against budgets, schedules, and other targets. Two, it maps strategy to plan – that is, translating the goals and objectives of the project charter or business case into tangible actions that can be assigned, and tangible benefits or value that can be measured. Three, the greater the quantity and better the quality of the information used to inform decisions, the more likely those decisions are to be successful. Fact-based decisions provide for fact-based management, which, in turn, inspires confidence and clarity of the actions needed to succeed. Four, a need exists to report on the outcomes of the actions taken by the project team. Reports communicate both the success of current activities and the results of changes implemented to improve project performance.

Contents and formats for status reporting and other key project management documentation must be developed, with frequencies of reporting and approvals. Throughout the project's life cycle, there needs to be milestones with performance metrics to measure the outcomes. Metrics enable the objective evaluation of project success with bottom line measures instead of subjective interpretations.

Review/stage gates should be established in advance for formally reviewing the status of the project and giving approval for proceeding with the effort. Moreover, stop gates and conditions should be identified up-front, where stopping the project should seriously be considered. That is, before beginning, projects should specify the conditions under which the continuation of their development should be critically evaluated – their "runaway conditions." These conditions may include X time or percent in schedule slippage, Y amount or percent of budget overrun, change in business/political environments, etc.

In summary, in order to manage a project, the status of four variables must be know precisely, including their status at the time or reporting and the estimates of their status at completion of the project. These variables are: cost, schedule, scope, and quality.

Status reports should be prepared frequently (weekly, biweekly or monthly, as appropriate). The general rule is the reporting frequency should be proportional to the length of the project, with longer projects having less frequent reports and shorter ones with more frequent reports. As a minimum, the status of the four variables described above (cost, schedule, scope, and quality) must be reported on current period, project-to-date and estimate at project completion.

Examples of key metrics include milestone achievement, personnel work effort (person-hours or person-days) status (such as actual staffing availability and productivity against plans and budgets and related variances or earned value calculations), critical path slippage, scope creep (changes), and risk factors. Appendix K explains some concepts and formulas for project status reporting related to personnel work efforts. Measures, variances, and percentages should be given on current period, project to date, and projection at completion bases.

Time overruns, milestone schedule slippages, budget busters (such as scope creep), unfavorable personnel staffing and productivity variances, changes in risk profiles, and quality (unsatisfactory deliverables) should be identified early and addressed quickly. Outstanding action items should be identified and the status of past items should be given, especially for items necessitating management attention. End of project projections should be prepared to highlight the repercussions of significant variances (especially adverse results) in key status report items. Items to address include estimated final costs (over/under budget), staff resource usage (over/under plan), milestone or deliverable completion dates (early completion/schedule slippage), and deliverables/investment capabilities/benefits (actual business/program value versus original goals and objectives).

In large endeavors, personnel time tracking capabilities/tools and project management tools are essential for developing work plans; assigning, scheduling, and managing personnel resources; obtaining performance metrics; identifying early potential and actual problem areas (such as schedule slippages and critical path extensions); and revising plans and schedules. Personnel time reporting by itself is not sufficient to recognize early potential schedule or deliverable slippages. Project team members should record (ideally daily or weekly) actual time for each detailed task of the work plan. Project managers should have the planned time for the week for the task, total estimated time for completing the task, and estimate to complete the task based on the original work effort

estimate, time-to-date spent on the task, and an estimate of what it will take to complete the task (not just original estimated work effort minus work effort-to-date).

Status reports should identify major problems and/or issues, especially those that require management attention. A detailed status (responsible person(s), due date, repercussions if not resolved by due date, action taken to date, etc.) of each of these should be presented, listing all outstanding ones. Risk management plans should be updated at frequent regular intervals, and the status of major outstanding risks should be given (format and data similar to the issues described above). The status of major activities planned and accomplished for the current period should be reported, as well as the listing of next period's activities and the status of outstanding items from prior periods. Summarized charts showing the sequence of major activities or events (called bar, network, or Gantt charts) may be useful, and an overview of the critical path and the current position on it should be highlighted.

Other key statistics that will assist in evaluating the progress of the overall effort and major phases or elements of the project must be identified. These may vary over time and by activity. For example, number of business processes documented; number of modules designed, coded, or tested; number of data items converted; defect arrival and removal rates, etc. are detailed statistics that indicate accomplishments against plan. Status reports and metric analyses should be standard to present a common and consistent picture of the project; however, particular items of interest and levels of detail for various stakeholders and oversight bodies should be considered in designing the uniform reports. Different reports, such as dashboard views, may be required for presenting the status of the endeavor to the diverse decision-making persons and oversight bodies, depending on desired levels of detail, varying perspectives, and specific areas of interest.

A rule of thumb is when a project is at 50% of the time line, it should be 80% complete for the work effort. If not, it will miss one or more criteria (budget, schedule, quality or user expectations). The following items on a typical monthly status report should raise "red flags" for project managers:

- **Number of revisions to the project plan** – A few may be acceptable, and these may show an attempt to reflect realities. More revisions may indicate problems in project management (bad planning and/or poor execution or both).

- **Staff resource utilization (actual person-hours committed versus planned)** - If the project is not getting the required staffing resources, it will miss the plan date, quality, or both. At some point, the addition of staff to compensate for past under-commitments only makes matters worse.

- **Work effort (person-hours) and dollar expenditures versus end targets** – For each assigned task (and roll-up to summary work plan), this is the computation of efforts (expenditures) to date plus estimate to complete and the comparison to the plan work efforts and dollars at project completion. Unfavorable variance indicates possible budget overrun and/or schedule slippage.

- **Deliverable status** – Reports by major deliverable the planned completion date versus the revised and actual completion dates. Late deliveries indicate possible schedule slippage or poor quality from the deliverables not deemed acceptable by state staff.

- **Risk management status** – Failure to update the Risk Watch List at frequent (usually monthly), intervals and/or numerous or serious high probability, high impact risks without viable mitigation strategies indicate potential project management problems.

- **Issues status** – Numerous, serious, and/or continuing and unresolved issues indicate project or project management problems.In planning for a project, project managers must leave open the possibility that it will fail. Therefore they must watch for signs that can indicate a potential failure and act appropriately to prevent small problems from becoming big ones.
Appendix J of the Framework document gives a template and metrics for identifying and handling a troubled project.

Project managers need to integrate key elements of the project to deliver it satisfactorily (on-time, within budget, and providing expected results/benefits) with available resources. Cost, schedule, scope, and quality control (along with configuration management and resource allocation) are inextricably intertwined in every project. By integrating these elements, project managers can understand how changes in one area can impact another and manage the project accordingly.

While the members of the project team must be treated as human beings and with respect and dignity, methods and discipline are important success factors. These two aspects of project management are complimentary of each other. Sun Tzu said in *The Art of War*: "…soldiers must be treated in the first instance with humanity, but kept under control by means of iron discipline. This is a certain road to victory."

8. Anticipate and manage risks - Potential risks are uncertainties that can significantly affect project outcomes. Risk management is the practice of continually assessing what can go wrong, determining what risks are important, and implementing strategies to deal with (prevent or lessen the adverse impact of) risks before they emerge as problems or developing contingency plans if they do eventuate. A further definition of risk management is it is the practice of identifying and evaluating risks and taking appropriate actions for reducing or controlling them to avoid or limit undesirable consequences. Controlling project related risks is necessary to the delivery of a successful project (on time, within budget, and meeting value/benefit expectations).

   The goal of risk management is to minimize project uncertainties and ambiguities. Key risk management practices include:

   - Risk management is a continuous process that begins with project concept and ending with asset/system retirement.
   - All participating organizations and personnel must actively participate in risk management.
   - Risks need to be identified and managed throughout the project life cycle.
   - All risks must be analyzed, prioritized (by likelihood of occurrence and potential impact if materialize), responded to (such as mitigation actions or contingency plans), and tracked (through an automated tool if possible.
   - The status of high priority risks needs to be reported to senior management on a frequent and regular basis.

   A risk management plan provides guidance to project management teams and requires them to proactively identify facts and circumstances that could increase the probability of failing to meet project commitments and take steps to prevent these from occurring. Risk assessment is defined as the basic process of identifying the types and severity of risks, by (a)

recognizing potential dangers, (b) evaluating the likelihood of their occurrence, and (c) determining the probable damage if they do materialize. Risk mitigation is defined as identifying what action would be appropriate for making risk factors less harsh or hostile or making them less severe or painful. Risk assessment and risk mitigation are part of the risk management plan, and they should lessen the impact of risks by reducing the probability of occurrence or the adverse impact if they do occur, or both.

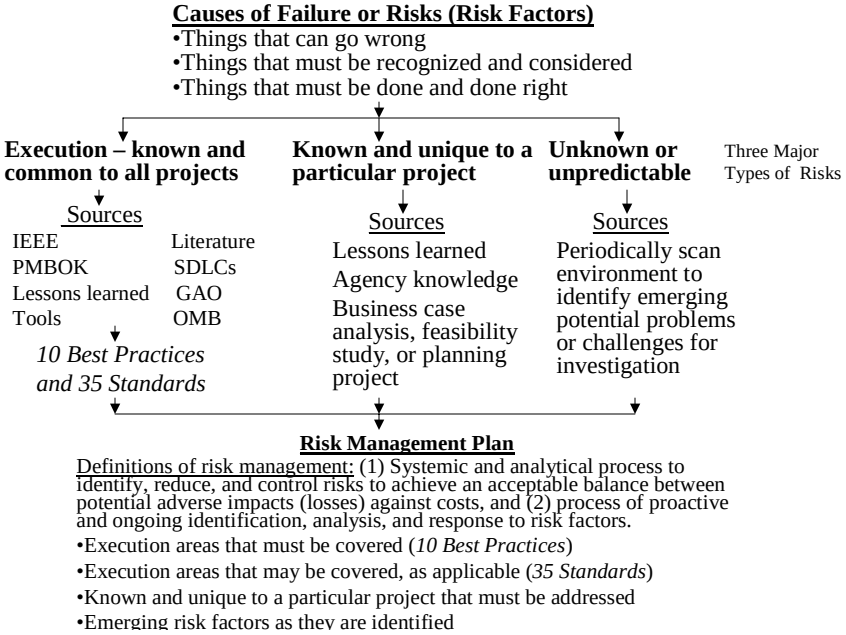
Risks to the project need to be recognized, prioritized (by determining the probability of their occurrence and assessing their potential adverse impact if they occur) and then matched to the most appropriate safeguards to mitigate or reduce them. In some cases, it may be too expensive or too difficult to transfer, avoid, or mitigate the risk. The only approach left is to accept the risk, hope it doesn't occur, and if it does, have contingency plans ready to respond to it.

Different risks can affect the project with varying severities, and some risks are more likely to occur than others. Known and foreseeable risks can be addressed with good project planning and well thought out prevention or contingency plans. On the other hand, unforeseen risks require continuous scans of the environment for emerging problems, quick action when potentially troublesome issues arise, and good problem solving skills for resolution. The latter risks can be the most harmful, because they are in the area of not knowing what you don't know, and what you don't know may hurt you.

Major elements of risk management consider the following three items: (1) threats – things that can go wrong; (2) vulnerabilities – factors or circumstances that make a project more likely to experience a loss or disruption from a threat, or make the adverse impact greater; and (3) controls – countermeasures or mitigations, including (a) deterrent (reduce likelihood of occurrence), (b) preventative (reduce vulnerability), (c) corrective (reduce loss or impact), and (d) detective (discover threat and trigger prevention or correction).

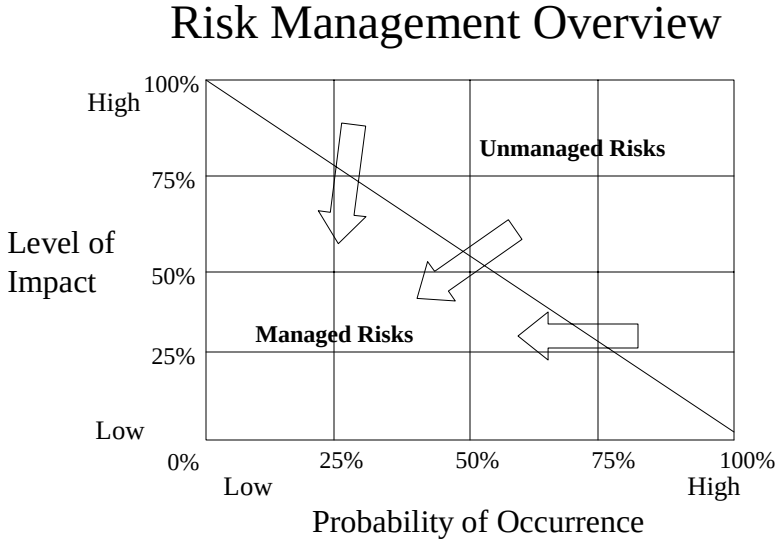
An overview of risk management is provided in the Risk Explanation Flow Chart below.

Risk Explanation Flow Chart



Risk factors must be identified, and an exhaustive and comprehensive risk management plan must be developed to address in advance all known and foreseeable risks. For each risk factor, the plan must describe the (a) risk, (b) probability of occurrence, (c) assessment of the potential adverse impact of the risk on the project if it does occur, (d) the degree of control of the project team for mitigating the risk, and (e) description of actions to diminish the risk. The latter item should include contingency plans, responsibilities, and due dates. The risk management analysis, derived from the information in the risk management plan, highlights the risks requiring the most management attention (i.e., those with a combination of the highest probability of occurrence, least control by project team, and greatest negative impact on the success of the project).

The concept of risk management is illustrated in the diagram below.



Overall Concept for Cost-Justified Risk Management – Identify project-critical risks and take mitigation actions to move them to as low likelihood of occurrence (avoid them) and/or as low level of impact (minimize damage or adverse repercussions if they occur) as practical.

The PMBOK defines risk management as the systematic process of planning, identifying, assessing, and handling project risks using the six processes of 1) risk management planning, 2) risk identification, 3) qualitative risk analysis, 4) quantitative risk analysis, 5) risk response planning, and 6) risk monitoring and control. Risk management planning is deciding on the methodology to use, who will be involved and what their responsibilities will be, and what techniques and practices will be used for the other five risk processes.

Risk identification involves the best ways to identify the key risks of a project. Qualitative risk analysis assigns a priority to each risk by evaluating the probability or occurrence and the magnitude of impact if it occurs. Quantitative risk analysis uses mathematical techniques (such as the multiplication of the probability of occurrence by the dollar value of loss) to estimate the numerical consequences of the risk. Risk response planning is the decision whether to avoid, mitigate, transfer, or accept the risk. If risks cannot be avoided or transferred, approaches must be developed for mitigated risks to reduce or control them. Accepted risks are those that no advance actions are taken; however, contingency plans must be developed in case they do occur. Risk monitoring involves the ongoing review of identified risks and the anticipation (look out) for new ones.

Sample risk profiles, formula-based risk assessment instruments, and additional risk management information are provided in Appendix G. Six major risk types are highlighted in the table below.

Risk Type	Description
Political	Governmental events and circumstances, such as degree of public visibility of project, extent of need to satisfy legal mandates; extent and type of interaction(s) with citizens, amount of involvement of other state or government entities or other stakeholders, and magnitude of change in department organization and/or business/program policies and processes.
Organizational	Sponsoring organization events and circumstance, such as level and influence of sponsorship executive(s), degree of management commitment and amount of business/program participation, number and types of stakeholders, and appropriateness of project organization.
Project Management and Project Execution	Project related situations and factors that affect the ability to implement the project on time and within budget and/or develop a workable solution that delivers the expected benefits, such adequacy of numbers and skills of project team members, project manager experience, types of vendor contracts and capability for vendor management, project length and schedule flexibility, size of project scope and number and complexity of objectives, and detail of work plan.
Technical	Technology related issues, such as detail and complexity of technical architecture and technical design, age and stability of technical components, security vulnerabilities, suitableness of technology, transaction volume patterns, flexibility in fault tolerance of processing, number and complexity of integration with other systems and data exchange requirements.
Operational	Business/program and other external factors, such as software development approach (COTS or custom), extent of privacy and confidentiality needs, complexity of disaster recovery/business continuity demands, amount and availability of infrastructure needs, and extent of dependency on other projects.
Financial	Budget and planning/approval related items, such as detail and credibility of business case, and sufficiency and dependability of funding streams.

The table below highlights types of actions for risks depending on probability of occurring and severity of impact.

Probability of Occurrence	Severity of Impact	Possible Mitigation Action
High	High	Highest priority, develop detailed mitigation plan to avoid or minimize consequences of risk (i.e., take actions to move this risk to the low-low category below by reducing likelihood and/or impact)
Low	High	Take steps to minimize impact of risk, such as reducing dependencies on other projects or outside events
High	Low	Take steps to reduce likelihood of risk (e.g., intensify testing, use pilots, or involve more outside reviews), or if not possible, reduce impact
Low	Low	Lowest priority, may elect to accept risk with little or no mitigation action

A risk watch list may be helpful. This matrix may contain the following items:

- Description of risk.
- General classification of the impact of the risk, such as cost, schedule, system performance, application acceptability, sustainability of the application, etc.
- Type of risk (actual or potential).

- Probability of experiencing the risk (1 to 5). For example, a 1 equals less than 5% chance of occurring, a 3 equates to 50/50 probability, and a 5 indicates nearly 100% likelihood of happening.

- Degree of consequence of the risk should it occur (1 to 5). For example, a 1 equals an isolated event with slight impact, a 3 equates to a widespread event with a weakened business model or program, and a 5 indicates a business/program wide impact with business model failure or program failure.

- Empirical indicator of the value of the risk, which is probability times consequence (25 is the greatest and 1 is the lowest).

- General type of corrective action required, such as avoidance; transfer; mitigation; acceptance (no mitigation action now, but develop contingency plans); further investigation, etc.

- Detailed actions to be taken with responsibility and due date.

- Current status, such as in process, completed, postponed, rejected, etc.

Risk factors must be monitored periodically (at least monthly) throughout the project, as well as when conditions change. Changes in risk levels must be evaluated for the potential impact on the following five project parameters: target date (schedule), scope, quality, cost, and personnel resources. Concerns should be escalated up the project chain of command, and appropriate corrective actions should be taken.

An area of consideration for agency-wide risk management is the number of business/program initiatives being pursued concurrently. The agency as a whole (or individual business/program areas and/or its technology group) can handle successfully only a finite number of projects, along with the everyday workload. When personnel (especially skilled and experienced functional and technical staff) are stretched too thin, delays are inevitable and schedule slippages and/or quality problems will occur.

E-government applications add two complexities to risk management. These are risks due to exposure to users and risks due to the infrastructures, architectures, and processes of e-type applications. Exposure risks can occur due to the look and feel of the user interface, the processing experience, and they involve the state's citizens, businesses, and/or employees. E-risks involve platforms, data quality, software quality, and other technical infrastructure items affecting site availability and processing reliability. These two e-government risks are experienced

in original system implementation and whenever there is a change in user interface, functionality, or technical infrastructure.

The table below highlights the additional risk considerations for e-government applications.

Exposure Risks (User Interface)	E-Risks (Infrastructure)	Possible Mitigation Action
High	High	Take action to reduce both by increased testing, prototyping, focus groups, low profile introduction of site or application, etc.
Low	High	Reduce e-risks by increasing testing scope to reduce risks of instability and volume overload, testing contingency and roll-back plans, etc.
High	Low	Increase testing to reduce risks of functional failures, provide mock-ups of screen design to user community, test on focus groups, etc.
Low	Low	No additional action

Responsibility for project risk management must be assigned to a senior member of the project team, and this person must accept full accountability for the performance of the risk management function.

The larger the project, the greater the chance for failure; therefore, the more effort you need to put into managing risks. Projects costing less than $750,000 have 46% of being fully successful, while those costing over $10 million have only a 2% chance of being successful. For bigger projects, it is essential to identify points of failure before they bring down the whole project.

Stoplight charts may be used as a means to report the specific status of problems and risks within a project. There should be two forms of these charts presented at project reviews: a problem chart or a set of problem charts and a set of risk charts. The problem charts should truly treat problems as red if they are affecting the project and have not been dealt

with successfully. Risk charts, on the other hand, should be treated somewhat differently. All risks are red unless successfully mitigated or adequately addressed or retired within the program. These risk stoplight charts should be defaulted to red unless the risk effects are successfully avoided.

A formula-based risk assessment should be completed for every project for several reasons. First, the risk assessment instrument (form, questions, methodology, etc.) will force the consideration of items that might normally be overlooked. Second, a uniform and formal risk assessment process ensures that all projects are viewed from the vantage point of uniform risk. For example, if many projects suffer from the same risk areas, these issues probably should be addressed from an organizational and/or enterprise perspective rather than an individual project view.

Appendix G contains several risk profiles, including four that are formula-based. Projects that present unusually high risks include those that involve experimental or newer technologies or are big, complicated implementations that cover multiple governing organizations; have long installation time-frames; integrate with several applications; promise significant financial, operational, or citizen service benefits; and/or require extensive end-user training.

Because of the increasing size and complexity of computer systems, the closer integration of applications, and the consolidation of business processes, there is increasingly greater opportunity for multiple small technical problems to create devastating and long-term business/program outages as applications are implemented or rolled out. In some situations, traditional risk management practices may not be a cost-effective way to address these potentialities. In fact, it may be riskier for project teams to protect against these situations through traditional risk management practices than to develop comprehensive and realistic business contingency plans.

Traditional project management is driven by budget and schedule; therefore, it may rationalize shortchanging key items, such as testing, training, data conversion, and site preparation. Moreover, too much emphasis on risk mitigation may cause projects to be ‘over-managed’, so that they drag on for too long.

Business contingency planning covers options for dealing with severe business disruptions during implementation, including manual processes for working around problems and reversion to the old system. A key requirement for addressing these potential business outages is to develop a transition plan that assumes the system will fail during

implementation/rollout. The transition plan must cover a conservative (worst case) time period that the system could be down.

In summary, a large part of risk management is about knowing yourself (strengths and weaknesses of the project team), knowing the enemy (being aware of every factor that could cause the project to fail), and employing project management disciplines and techniques to achieve success through this knowledge. Sun Tzu said in *The Art of War*: "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy not yourself, you will succumb in every battle.

9. Establish quality objectives and standards - Quality assurance processes and actions are essential to ensure the application executes flawlessly on a consistent basis (defect free) and delivers the promised value. Users have no tolerance for flawed code or poorly functioning systems. Gartner's definition of quality management is it involves the use of corporate and/or industry standards, methodologies, project models, standardized templates, project knowledge, and defined process efficiency measurements and metrics to ensure the quality, consistency, and efficiency of executed projects and their deliverables.

   A detailed and comprehensive quality management plan must be developed and followed. The plan must document the activities to verify and validate the quality of project processes and deliverables. It describes objectives, processes, tasks and responsibilities for ensuring that the system meets functional requirements and operates as specified.

   Quality must be built into the product from the beginning. The relevant statistics are clear and incontrovertible. Errors caught early in the system development process are much easier and more economical (by orders of magnitude) to fix than those identified later. Dependence on testing activities as the primary vehicle for finding errors will result in excessive costs and elongated time frames.

10. Identify, document, and track business and technical requirements – Developing requirements is about involving end-users in some structured way to give a sense of what they need and then executing on those needs within some set of constraints involving time, people, and money. Understanding business/program requirements and user needs and making sure they are fulfilled are not easy undertakings. Significant and important requirements and policies must be gathered, organized and documented. Otherwise, unanticipated extra time, efforts, and costs will be necessary to remedy errors and oversights from the lack of understanding of the functions, features, and performance characteristics

of the application essential to meet project objectives. Also, ensure fiduciary obligations, statutory regulations, and other compliance mandates are addressed in defining requirements.

The process of identifying and describing requirements is critical, because it is the foundation and key to completing successfully the succeeding phases of coding and testing software or bidding and selecting a package. For client-IT teams, creating the right software requirements is as important as developing or selecting the right software designs, and the first action is an absolute prerequisite for the second. Excessive and unnecessary expectations leading to unwarranted and complex requirements can lead to software that is too expensive, too technically complicated, and overly difficult to use and support. Conversely, incomplete and vaguely defined requirements can lead to software that does not meet business/program objectives, creates dissatisfied uses, and fails to deliver the expected value and benefits.

In an ideal world, users and their IT counterparts together should know what is wanted, what is needed, and how to define requirements in a way that makes both economic and technical sense. Since the ideal situation rarely exists, one way of developing the right set of requirements is through the prototyping of the application, with input from both client and IT team members. This leads to better client/user understanding of what the application can and should do, and it facilitates the 'sign-off' on the application's features and capabilities. A key point to remember is requirements gathering is a means to a bigger end – not an end in itself.

However, do not confuse wants (nice-to-have) with needs (have-to-have) when defining requirements. In times of tight budgets causing funding limitations and expectations for nearly instantaneous satisfaction from users leading to accelerated project timetables, dreams of system features, performance capabilities, size and complexities may have to be scaled back to reflect the realities of events and circumstances. The best approach may be to implement a solid technical structure that offers a foundation for the development of future additions, enhancements and expansions, as funding and time permit.

Experience has proven that errors are five to ten times less expensive to correct during the requirements phase than during the coding phase. For this reason and to recognize the importance of the requirements gathering activity, more modern development life cycles have redistributed more time to this phase, with approximately 40 percent of the total project effort coming from this work. The remaining 60 percent is split almost equally among design, construction, and testing.

User interface requirements are particularly important. Potential users must be consulted and deeply involved in requirements gathering, system design, prototyping, and piloting phases. Routine and critical tasks should not be difficult to perform. New systems should not be hard to use or more difficult to use than the ones they replace. It may be necessary for user interfaces to accommodate the multitude of technologies available and emerging to access data (PDAs, cell phones, etc.). Also, persons with disabilities must be considered in developing accessibility requirements.

In today's world of more complex business and operational environments, there are increasing needs for information sharing and application coordination. Cross boundary integrations among programs, agencies, departments, and governments are becoming more common, and this greatly impacts functional requirements and technical designs.

Be alert for requirements related to the needs for data from other applications/databases, the requirements of other applications for data to be provided by the new application, and the necessities for integrating/interfacing processing among applications. The identification of requirements for technical compatibility with infrastructure and other applications and business/program compatibility with other applications is essential. In addition, the needs for accessibility (variety of user interfaces and by disability), records management and archival functions, disaster recovery and business continuity, security of data and other assets, confidentiality of information, and privacy of individuals must receive close attention in the development of requirements. Particular attention should be given to providing accessibility for parties with unique requirements based on barriers caused by disability, language, or literacy, especially for e-government applications.

Functional requirements describe capabilities and features the users need for the application to work and meet its business/program purpose and objectives. Non-functional requirements represent characteristics that are required for the acceptance of the application by the users. Non-functional specifications are often called quality attributes, and these are listed below:

- **Reliability** – the extent to which the system will execute without failure for a specific period of time. An SLA of 99.5 percent and a Mean Time to Failure of at least three months are examples.

- **Availability** – The percentage of ‘up time’ during which the system is fully operational. Examples are the system shall be available 24 hours/day and it shall be possible to upgrade the system while it is running.

- **Security** – The ability to prevent and/or forbid restricted actions. Examples are each page shall authenticate the user, and users that are not allowed to view specific areas of the application will be redirected to the login page.

- **Performance** – The application's ability to meet latency, throughput, and resource utilization requirements. Latency is defined as the period of time that one component in a system is waiting for a response from another component. It is measured in units of time, such as seconds or milliseconds. Throughput is defined as the amount of data that is transferred from one component to another in a specified unit time. It is typically measured in requests per second, or bytes per second. Utilization refers to the usage level of system resources, such as memory or CPU. It is usually measured as a percentage of the maximum available level of the specific resource. Performance examples are all Web pages must download within three seconds during an average load, and five seconds during a peak load, and while executing a search, the system must be able to display 500 search results per page.

- **Usability** – The end user's ability to learn the system and complete tasks. Examples are the end user should be able to place an order within thirty seconds, and the end user should be able access any page within four clicks.

- **Scalability** – The system's ability to handle a large amount of growth, especially in data, transactions, and/or users. Examples are the system should be able to accommodate 1,000 users, and the system should be able to accept 100 requests per second.

The four types of requirements and the associated key considerations are highlighted below.

- Functional requirements – impact business/program processes:
    - Business/program functions
    - Reporting functions
    - Interface functions (including user interface and interfaces with other systems, applications, databases, etc.)
    - Security functions
    - Privacy and confidentiality functions

- Technical requirements – impact the system infrastructure:
    - Accessibility
    - Encryption

- Hosting
- Client environment
- Disaster recovery

- Operational requirements – impacts operations and support:
  - System performance (capacity, volume, throughput, and response)
  - Data archival
  - Audit and controls
  - System administration
  - Business continuity

- Transitional requirements – Impacts implementation
  - Data conversion
  - Release validation
  - Documentation
  - Training
  - Deployment

Well-formed business process models provide a specification of business requirements. The core concepts captured in business models include activities (or tasks), execution flow (or sequence flow), data flow (or message flow), decisions, and events. Activities (or tasks) are units of work that, when executed in the appropriate order, carry out an instance of a business process. Execution flow specifies the order in which activities will be performed. Message flow specifies the flow of data among activities.

If a system or an application is to meet business requirements, its architectural components should tract back to the core concepts used to model the business requirements – that is, they should trace back to the concepts in the business process model. Based on this concept, services and event handlers of the application and/or network should trace back to a logical unit of work in the business model. That unit of work could be a business process activity or an entire business process. System architects should be capable of interpreting business process models and establishing application architectures with service-oriented and event-driven styles that trace back to the requirements specified in those models.

Requirements must be testable, and the testing for the incorporation and understanding of requirements should be included in the project test plans. Procedures must be performed to ensure that all pertinent requirements are identified and documented, that requirements are not contradicting each other, and that requirements are detailed enough for design work to begin. An acceptance test plan (ATP) for requirements

must be drafted and performed to verify that the above three conditions are met. This should not be an onerous or too time consuming activity.

Requirements also must be traceable, from origin through change management, design, coding, and testing. A matrix tracing the history and disposition of all requirements may be useful in keeping track of them and providing a comprehensive, current, and accurate status. This audit trail will assist in ensuring that key requirements are actually incorporated in the system, as well as providing a beginning list of candidate enhancements after deployment for priority sequencing and eventual incorporation in the deployed software or rejection from further consideration. The matrix, with associated support documentation, also will be helpful in explaining to users and interested parties why certain requirements may not have been included in the initial release and what their priorities are for future ones.

The requirements trace ability matrix must be updated throughout the project lifecycle. New requirements must be added, and obsolete or rejected ones should be deleted. The matrix need not be complex – a simple spreadsheet should suffice for many projects. A four-step process is: 1) identify requirements to be tracked (too many may be too cumbersome), 2) determine responsibility for managing/administering the matrix, 3) create the matrix, and 4) keep it current and accurate.

A major source of project schedule slippages, budget overruns, and/or inability to achieve technical or business performance expectations is inappropriate or untracked requirements. Problem requirements are those that are excessive, too complex, incomplete, not clearly defined, not reflect true needs, and/or cannot be accomplished economically or technically.

Buying or designing software before knowing and understanding business/program requirements and developing associated policies (from business process reengineering) will lead to bad choices, resulting in unnecessary budget, timetable, and deliverable shortcomings. Throwing software at bad processes will not repair them; they will only become bad processes that are automated, which may be the worst of all possible situations. Requirements and policies (including considerations of organizational and process restructurings) must be developed early in the project life cycle, certainly before making significant software purchase or design decisions.

The current business processes should be reviewed to determine: (a) if there are changes that can be made to the present business processes to improve efficiency and effectiveness even before the new applications are

implemented, (b) if the business processes need to be changed to support the new applications, or (c) both of the above.

To maximize operational efficiency and organizational effectiveness, agencies should determine how the business/program should operate and perform under simplified business rules, streamlined work processes, redesigned jobs, restructured organizational charts, and/or integrated data and applications. Then it should develop requirements and specifications for software or packages. Technology is only a tool for accomplishing agency missions and business/program goals and objectives; therefore, by itself, it offers little value.

Often, major changes to existing processes, organizational structures, roles and responsibilities of personnel, and/or business models may be necessary to accrue full value and benefits from technology investments. The reduction of organizational intricacies and the minimization of processing complexities provide the greatest gains in production efficiencies and service deliveries. Root causes for high-cost and inefficient processes and services (such as burdensome, paper-intensive, and manual activities; multi-level organizational and decision-making layers; or lack of collaboration among departments, agencies, and programs) must be identified, streamlined, and restructured.

In summary, user requirements must be analyzed to ensure that they are complete, valid, and do not overcomplicate the solution. An article by Chad Dickerson in CTO Connection dated January 5, 2005, states: "Software expert Robert L. Glass notes in his excellent book Facts and Fallacies of Software Engineering that every 25-percent increase in problem complexity results in a 100-percent increase in the complexity of the solution." Incomplete or unclear user requirements may lead to an unsuccessful investment. Unnecessary or unjustified user requirements may make the investment unaffordable, extend implementation, and/or exacerbate ongoing maintenance and enhancement efforts – especially for COTS or GOTS packages. To eliminate or mitigate the effects of problem requirements, the project team should investigate the opportunities for changing the policies, processes, or other causes creating them.

11. Follow the enterprise approach by leveraging existing agency and statewide applications and taking advantage of statewide shared technical infrastructures and common technical services - The enterprise technical approach implies the use of central technical infrastructures and services and standard technical configurations, which are used by all agencies and their business/program entities. The use of a common, shared technical infrastructure that is adaptable, flexible, and scalable can reduce application development and operating costs, avoid unnecessary

duplication of expensive assets and services, simplify the meeting of security and reliability requirements, and facilitate the providing of disaster recovery and business continuity capabilities. It also can assist in the achievement of common business/program requirements for the sharing of information (in both a secure and non-secure manner), the integration of databases, and the interoperability of applications.

The enterprise approach takes advantage of economies of scale by spreading fixed costs over aggregated transaction volumes to achieve lower unit costs for all participants. The same results are achieved in purchases of outside services and vendor products by combining similar needs from multiple units (applications and agencies) to achieve volume discounts. Therefore, the enterprise technical approach offers the most cost-effective and reliable option for implementing and employing technology to support agency missions and strategies and business/program operations. Failure to follow the enterprise approach will result in excessive costs and more complex configurations entailing greater reliability and performance challenges as well as backup and recovery limitations.

Another pertinent consideration for using the enterprise approach is the use of shared technical infrastructures, uniform business models, and/or common technical services dramatically reduces implementation timetables. Shorter project schedules accrue tremendous advantageous, including reduction in implementation costs, less exposure to scope creep, fewer potential risks, and the delivery of value or benefits sooner (thus increasing financial or political returns).

Often, strong political will and leadership are needed to implement the enterprise approach. The selling and achievement of this concept is more of a political and management challenge than a technical one. Political friction among organizations giving up and receiving assets and resources must be addressed and managed.

If applications, components, infrastructure, and services are shared among multiple organizations, clear rules are needed to establish which entity is accountable for buying, implementing, running, updating, and maintaining the shared, common resources, including people, hardware/software, and communications equipment. The operation of centralized or shared assets and functions requires adoption of strict quality assurance, creation and management of service level agreements, and use of charge back mechanisms to ensure shared services or resources actually deliver what is needed to participating organizations at fair prices.

12. Develop technical standards – Systems must have clearly articulated technical architectures (or blueprints) that define how specific technologies will be used to deliver the envisaged capabilities and features. Developing, maintaining, and using an architecture is a best practice in information systems and other technological solutions, articulating, for example, application designs, interfaces, business rules processing, database descriptions and designs, communications, user interfaces, security provisions, backup and recovery capabilities, etc.

    The Statewide Technical Architecture provides an umbrella view for both the agency technical architecture and the detailed applications architecture. Detailed standards (such as design, coding, testing and conversion) must be created and documented, and they should follow industry best practices. Areas to include are communications, hardware/software configurations, databases and component modules of the system. Equally important, the application architecture for the system must be developed, thoroughly documented, reviewed and approved. The applications architecture must be congruent with the agency's technical architecture, which follows the statewide technical architecture and is in line with the agency's business/program architecture. Complete and well-documented applications architectures provide the following benefits:

    - Ensure the system advances the agency's missions and business/program goals and objectives and meets near-term and future functional requirements (complies with the agency's or business/program's business model and business architecture).

    - Substantiate that the system design meets technical capabilities (such as information collection, availability and presentation) and operational performance requirements and specifications (e.g., usability, uptime, response time, reliability, processing and data integrity, security, confidentiality of information and personal privacy, accessibility, disaster recovery and business continuity, etc.).

    - Demonstrate that the software design follows appropriate software engineering practices, such as n-tiered architecture and component based design, to cut development costs and improve dependability of the processing and code (i.e., minimize design and coding errors and reduce the amount of rework required to fix these).

    - Create a system that has no single point of failure.

    - Verify the system design minimizes future support costs and accommodates adaptability for future capabilities and features,

scalability for additional transaction volumes and users, extensibility for incorporating new technologies, and maintainability needs.

- Confirm the system design offers interoperability within programs, agencies, governments and other entities authorized to receive or submit (exchange) information.

- Minimize the use of proprietary products/components and use a standards-based development approach to enhance interoperability and provide for flexibility (products change faster than standards).

In summary, the documented application architecture should ensure the system would perform as desired to meet its individual business/program objectives and technical performance requirements. Moreover, it would work well, from both technical and business/program perspectives, with other applications within and outside the agency. Also, the application architecture should ensure the application is usable, scalable, reliable, secure, and can be operated, maintained, and enhanced (especially for incorporating newer and upgraded technologies) in a cost-effective manner.

13. Reengineer business processes – Reengineering is the reviewing of and changing to operational processes for the purposes of eliminating redundancies, unnecessary steps, and inefficient methods to reduce costs and improve the quality and responsiveness of services. Regardless of the amount of money invested or extent of sophistication of technology employed, operational efficiencies, revenue increases, cost savings and/or service improvements will fail to materialize unless business/program processes are reengineered and technical operations streamlined. Bureaucracies must be restructured, organizational reporting relations must be revamped, jobs must be redesigned, and business/program practices and procedures must be revised.

    Governmental strategies and initiatives and business/program goals and objectives are accomplished by the combination of people, processes, and technology. The human and process aspects of operations are as important (or more so) than the technologies employed.

    The full potential of government initiatives and associated technology investments will not be realized unless business process reengineering and organizational restructuring are enacted with technology implementations. Planning for a comprehensive transformation that removes organizational, process, and technology barriers is necessary to achieve maximum payoffs.

Successful process reengineering includes the difficult but worthwhile task of changing workplace culture and employee behavior. Even after processes have been successfully reengineered, they must be maintained and improved as needed. To truly succeed, a reengineering effort must be complemented by a culture of continuous improvement, cross-organizational teamwork, and collaboration and cooperation.

The current business processes should be reviewed to determine: (a) if there are changes that can be made to the present business processes to improve efficiency and effectiveness even before the new applications are implemented, (b) if the business processes need to be changed to support the new applications, or (c) both of the above.

Where possible, in buying software, change business/program processes and work flows to match the software rather than make extensive modifications to the package to meet present work steps and operating activities. If it is absolutely necessary to modify purchased packages, minimize changes to the 'base code' of these packages. Code modifications to packages will complicate the implementation of future enhancements and releases, as features and capabilities unique to the agency or business/program must be reinstalled in the newer versions of the base product. Over time, the modified software will become further out of synchronization with the commercial version; therefore, the implementation of releases will become more expensive and time consuming, resulting in increased operating and maintenance costs. If changes are required to commercial software, to the extent possible, make them outside of the package code.

Applications that link services and business/program processes across governmental layers or tiers bring the need for process reengineering to the forefront. There is little point in integrating inefficient processes that do not focus on or add value for citizens. On the other hand, there is always a risk of overdoing process analysis and reengineering. A balance must be struck between strategically reshaping processes, and tactically adjusting and integrating those that can lead to quick wins in efficiency and increased service levels.

A key question that must be asked regarding IT investments and systems implementations is whether there is reengineering of processes, procedures, and policies to provide more cost-effective and citizen-centric government. That is: are business processes streamlined, business rules simplified, jobs redesigned, organizational structures revamped, and/or data and applications integrated to maximize benefits from the IT investments and/or minimize modifications to purchased software? Particular attention should be paid to the opportunities to overcome government’s traditional structure and tunnel vision to deliver a seamless

set of services and integrate processes, systems, data, and applications across organizational boundaries and governance jurisdictions.

14. Design and implement robust issue, change, and configuration management programs – The conduct of an IT project involves continual, rapid, and unpredictable change. Changes in project plans are inevitable and they are necessary to manage expectations and provide valued deliverables. The key to project management success is to plan for change and ensure the appropriate processes address these changes.

    Continual and unregulated change, especially that leading to scope creep, and failure to prepare the involved organizations for the changes brought about as a result of the system or project are key potential causes of project failures. Change is a ferocious and resource consuming activity. Change is disruptive; therefore, resistance to any change is inevitable. Change management must recognize and accommodate the divisions between those that must bear the burden of the change and those that prosper from it. The following essential change and configuration management capabilities must be present:

    - Recognize and quickly recover from adverse situations presented to the project as it progresses (i.e., recognize problems or challenges early, react appropriately and solve them expeditiously).

    - Identify, collect, organize and resolve major policy or technology related issues (such as governmental policy; business/program policy, process, or functions; and/or significant system design or implementation considerations), especially those creating material scope changes. Rules, processes, and procedures must be developed and followed to handle the major policy or technology related issues, which will arise as the project progresses. Processing steps include documenting the issue, assigning level of criticality/priority, explaining action required, assigning responsibility, describing resolution, tracking progress and reporting status. Issue processing procedures should contain expected (mandated) timetables for completing each major activity. For example, the hours/days allowed for documenting, assigning responsibility, and developing a recommended resolution; the hours/days for review and approval by the project's management committee; and the hours/days for sign-off by the project's steering committee. The timely identification and resolution of major policy or technology related issues are essential for managing scope changes.

    - Identify, collect, organize and resolve system change requests, often called system investigation reports (SIRs). SIRS typically

involve system enhancements, modifications or bugs, and some may originate from the major policy or technology related issues described above. Policies, processes and procedures must be created and followed to handle SIRs. These include documentation of each change and its benefits, estimation of work efforts and costs, impact of change on the system or project, risk analysis of implementing the change, and opportunity costs from disapproval of the change. Other SIR related activities include priority determination and sequencing by type of change request, approval of changes (usually through a change control board or other overview body), bundling of changes into releases, scheduling releases, and tracking and reporting status. Like the major policy or technology related issue process described above, the SIR handling process should contain mandated and expected timetables for the completion of action steps. Only authorized changes should be made. A complete and effective SIR process is essential for managing scope and controlling requirement changes.

For efficient processing purposes, change requests should be assigned priority and severity codes. Examples for enhancement (not bugs) change requests are as follows:

- **Priority 1 – Critical**. A critical change request is considered to be imperative to the success of the project and/or satisfactory operation of the system and may have detrimental impact to the project if not addressed promptly. It is mandatory to be completed. **Severities**: **A** Legal or security mandates to be implemented within 6 months, **B** functionality to meet core operations, **C** data integrity with respect to database content.

- **Priority 2 – High**. A high priority change request is considered to be important to the success of the project or operation of the system. **Severities**: **D** Legal or security mandates to be implemented within 12 months, **E** Data integrity with respect to database content, **F** Data integrity with respect to database content add-ons to improve data quality, and **G** Analysis of user/stakeholder/customer feedback.

- **Priority 3 – Medium**. A medium change request has the potential to impact the project or system, but is not an immediate help or hindrance. **Severity H**: Improved process.

- **Priority 4 – Low**. A low priority change request needs to be addressed, if time and budget permit. These change requests are handled, as resources are available. An example is a cosmetic item.

The impacted organizations must be prepared for the changes created by the new application. System projects are business change projects, not just hardware and software. A frequent cause of project failure is due to the overlooking of the preparation of the 'people side' for the changes introduced by the new technology. The human aspects of implementing IT change must be well understood and accounted for.

Personnel must be trained and users and stakeholders must be assisted to understand, accept, and adjust to changes in organizational structures, performance measures, work expectations, job tasks, operational processes, and technical operations brought about by the new system. Experience has indicated that a key difference between successful and lower performing projects may be explained by organizational change factors. High resistance to change, insufficient training, low acceptance of technology, and weak communications are important factors in achieving maximum benefits from IT investments.

An organization's culture can have a large influence on change management. Culture modification may be a big issue for momentous changes in day-to-day work tasks (e.g., process reengineering and job restructuring) and organization reporting relations (organizational realignment), especially for applications impacting inter-program or inter-agency activities. In summary, this part of change management involves the planning, communicating, and executing of widespread changes, including the explanation of "why" changes are needed, "how" changes will be implemented, and "how" new processes and procedures will be performed.

People are the center of any change management initiative. Therefore, the staffing effect is the key to a successful organizational and/or business process transformation. Management must implement strategies to help individuals maximize their full potential in the new organization and/or process, while simultaneously managing the risk of reduced productivity and effectiveness that may result from the change for a period of time. A change management plan must be developed, and it should include provisions for communicating the need for the changes, identifying the impact of the changes on people and the organization, determining training requirements, identifying staff reassignments or reallocations, and developing a risk mitigation strategy.

Without appropriate change management, you can have a perfect IT system, with no one using it correctly and none of the expected benefits accruing. Proper skills are required to integrate technology with people and business processes.

Configuration management is defined as the process that identifies how various IT items (including hardware, software, communications equipment, service-level agreements, documentation, databases, policies/procedures, etc.) are linked and how they work together. The purpose of configuration management is to ensure that authorized configuration item relationships are known and that all alternations are planned, approved, carried out appropriately, and recorded. Configuration information (including inventories/repositories, components, versions, etc.) must be complete, accurate, timely, and accessible. Throughout a project, configuration management must include documentation (e.g., project, requirements, risk, and test management materials, as well as application design, security, and disaster recovery and business resumption documents). For project documentation, version control and change control are extremely important where there are many and/or large documents involved. In the latter phases, configuration management may also address physical technical components.

15. Anticipate project ending by planning thoroughly for production and operations and the transition from vendor personnel to state staff at project completion – A transition plan must be developed, and it accomplishes three purposes. First, it identifies the personnel, physical, and technical resources (staffing, platforms, operating systems, communications, etc.) of the production environment. Second, it describes how the application and project team will migrate from the development (or pilot) environment to the production phase. Third, it must recognize the need to transition from vendor personnel to state staff on an expeditious basis. Major areas to be addressed by the transition plan include strategies; schedules, tasks and activities; resource (people, hardware, software, facilities, etc.) requirements; acceptance criteria; management controls; reporting procedures; and risks and contingencies.

    The new application may have a significant impact on the state's business, program, and technical organizations. In many cases, the new application requires significant changes in both technical and business/program jobs, policies, processes, and personnel skills and competencies. This is especially true if new technology is introduced or outsourcing (business processing, hosting, and/or application service provider) is involved. An organizational impact study should be performed to identify the types of business, program, and technical personnel required to operate the new application, and a schedule of sources and uses of staffing must be prepared.

These items must be considered and incorporated in the training, as well as included in the transition plan. Help desk support must be organized and established. The ownership and organizational structure of the endeavor probably will change, so these items also have to be planned for and recognized. New project skills and competencies (possibly including vendor management) will be required for the production/support phase; therefore, new business/program and technical support organization structures and staffing needs are key items of the transition plan.

A service delivery plan also must be prepared. It is an extension of the transition plan, and it describes how the technical organization will support the application for its business/program owners. It should contain the following items:

- Define the types and levels of services.
- Explain how the levels of services will be measured and reported.
- Define roles and responsibilities of all involved organizations.
- Define SLAs and explain how they will be maintained or updated.

Typical services may include customer service, incident management, problem management, configuration management, change management, release management, capacity management, availability management, service level management, production control, security, network management, application maintenance, hardware/software inventory, business continuity and disaster recovery, system and configuration documentation, and SLA reporting.

The IT Infrastructure Library (ITIL) framework is a process-centric approach for IT service management, and it is being adopted by ITS ITIL consists of service management processes in two core areas – service support and service delivery. Service support is made up of service desk (a function, not a process) and incident, problem, configuration, change, and release management. Service delivery consists of the management areas of service level, financial, capacity, continuity and availability.

In summary, the project team must develop a post-implementation strategy. The strategy ensures quick assimilation of the system; streamlining of ongoing support costs, monitoring of system usage, and incorporation of best practices and benchmarking in both business processes and technical operations to ensure that the promised benefits are truly delivered and maximum value is obtained. The strategy also

encompasses follow-on items from the implementation project, such as enhancements delayed to meet project due dates, training and retraining necessary for users and technical staff to operate the system more efficiently, renewed emphasis on continuing business modeling and process reengineering to realize additional operational improvements and increased program outcomes, and the initiation of other related initiatives and projects to obtain synergies from coordinated and mutually reinforcing investments in IT infrastructures and applications.

The above 15 actions are absolute prerequisites for the completion of a successful project (on budget, on schedule and meeting business/program objectives). *However, they do not replace the need for a thorough understanding of and appreciation for the influential business/program, political, cultural, and technical environments and situations surrounding the project. As the depth and breath of understanding of these areas increases, the greater the potential for a successful project.* Completion of the above actions should assist in gaining the necessary degree of understanding of these areas and using that to effect the desired results.

Standards (Actions Essential for Achieving Superior Results)

The 35 standards below have the following characteristics:

- They supplement or add to the best practices enumerated above.
- They contribute significantly (both individually and collectively) to the successful outcome of projects.
- They absolutely must be considered in every project planning and management exercise; however, the extent to which they apply and the degree to which they must be incorporated in project activities may depend on the particular situations and specific circumstances underlying each individual project.

The standards are listed in the general order in which they would normally be addressed in a typical project implementation plan - not order of priority or importance.

1. Research projects rigorously and plan them thoroughly – To have a greater chance for success, projects should be well researched, thoroughly planned, and proficiently executed. Inadequate definition and planning of a project is the most common project management mistake that leads to project difficulties. A complete and comprehensive plan serves as the project's blueprint by giving everyone a clear, unambiguous understanding of the project's intent, expected results, scope, budget, estimated timeline, and identified risks.

   Defining and planning a project must be a deliberate and methodical process. What must be achieved is a complete and clear understanding among sponsors, users, stakeholders, and oversight and governance bodies of:

   - The purpose of the project.
   - The intermediate and final deliverables.
   - When the product or service will be delivered.
   - The benefits that will accrue.
   - The cost.

- What staffing, hardware/software, communications capabilities, and other resources will be required to deliver the desired product or service.

Valid approaches; appropriate technologies, reasonable work plans; and responsible estimates for costs, timetables, staffing requirements (skills and numbers), and other resources can not be determined without sufficient fact-finding, analysis of alternatives, and other preparation work. In many instances, due diligence is performed through planning projects, feasibility studies, or conceptualization efforts in order to gain sufficient knowledge for developing realistic implementation plans and schedules and budgets, identifying personnel and other resource needs, and preparing bidding documents.

The time and effort expended defining the project is dependent on the amount of detail and information needed. For smaller, simpler, and more straightforward projects, less time and regimentation may be needed. However, larger and more complex projects may require more time, effort, formality, and discipline. It may be desirable to break very large projects into separate unrelated smaller ones, or break them up into small, stand-alone projects under an overarching initiative or program.

The process of defining a project must identify:

- The project objectives and deliverables.
- Scope.
- Risks.
- Assumptions.
- Project team organization.
- Fiscal, staffing, and other resource requirements and who will provide them.
- Project costs.
- High-level timeline and work plan that enables the tracking of progress and effective scope management.

A good course of action for planning a project is to identify the deliverables, define the scope, list the assumptions, and develop the approach. Then, the processes of estimating the budget, effort, and duration can be addressed. These can be encapsulated into the project

charter, which documents the what, whom, when, and why of a project (i.e., a common understanding of the project). It provides a high-level baseline of the project time line and identifies major requirements, expectations, events, milestones, risks, assumptions, and deliverables. The charter assigns the project manager authority to manage the project and stipulates the project manager's role, responsibilities, and authority. In addition, the project team is identified, along with roles and responsibilities of major participants. It an agreement among all parties of what is to be accomplished, when, and how, and with what resources. The project charter is further described in Appendix I.

The development of the project plan should involve appropriate levels of management, sponsors, users and business/program staff, stakeholders, technical staff, interested parties, representatives from purchasing and contracting and other governance and oversight groups, etc. The intent is to set common expectations and gain consensus before the start of the project. This ensures support for the business/program requirements, a strong basis for resource estimates, the establishment of robust scope management procedures, and agreement for approaches to be followed and benefits to be expected.

The biggest risk of a planning project is the potential for making a wrong strategic decision whose effects will linger throughout the succeeding development and implementation projects and negatively impact them. On the contrary, right decisions for the right reasons will yield continuous benefits.

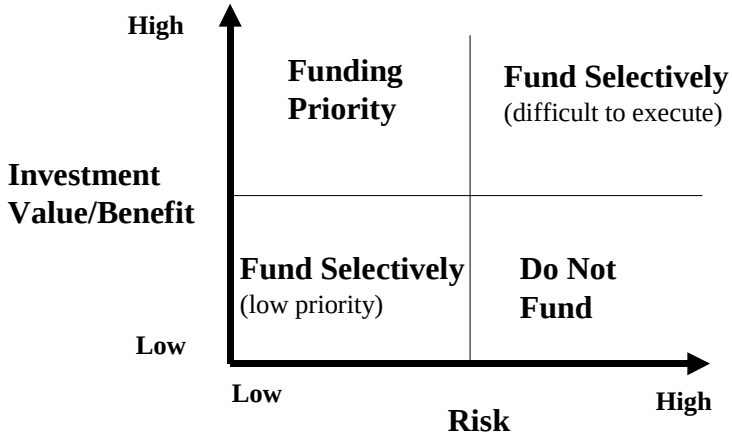
Through the project life cycle, it is important to gain the appropriate amount of information and knowledge before making decisions that impact investments in projects. Many projects encounter poor cost and schedule outcomes because the team had not gathered the necessary knowledge at critical junctures in the endeavor. Insufficient planning and/or failure to review and assess completely designs or other items at important check points in the project life cycle could lead to the making of less than optimal investment decisions. It is often desirable to spend a little money to ensure that a large amount of money is invested wisely.

2. Evaluate investments carefully to ensure funds are invested wisely and benefits are compatible with risks - Ideal investments are those with little risks, minimal costs, and large benefits; however, these conditions are rarely experienced in real life. Bad investment decisions result from attempting a risky or expensive project with few rewards. Underestimating costs, being overly optimistic in anticipating benefits, and/or failing to identify and evaluate the potential impact and probability of risks can create under-performing investments.

A risk profile plots the benefits of a project (x-axis) against its probability of receiving those benefits (y-axis). The intent is to remove from consideration projects that are either too risky (may potentially give large benefits but have a significant probability of failure), or not worthwhile (may offer low risks but present insufficient rewards). Projects with acceptable rewards and allowable/manageable risks are candidates for further evaluation, which may lead to selection for funding requests, approval of funding, and implementation.

The chart below illustrates the risk/reward considerations in developing funding priorities for IT investment projects.

Dimensions of Investment Selection and Funding Decision



3. <u>Ensure the project is within the agency's capacity for managing and completing it</u> – Individual projects do not exist in a vacuum, and agencies and the state do not have infinite capacities to perform them. Therefore, projects must be planned for and conducted within agency and state constraints for supporting them. At any given time, due to limited fiscal, personnel, and other resources (such as office space), agencies can manage and support only a finite number of projects, and this capacity becomes more limited as the number, size, and complexity of projects increase.

   A key tenet of Investment and project portfolio management is projects must be evaluated, screened, selected, and managed considering the following factors: benefits; costs; risks; and availabilities of limited and expensive staffing, financial, and other resources. Projects offering the

optimum mix of these factors are those that should be funded, approved, and performed.

Agency constraints in the capability to undertake only a finite number of projects can be caused by funding availabilities and/or limitations in executive, user, and/or technical personnel in numbers, time, or skills/experiences. Over commitments in numbers, sizes, types, etc. of projects can adversely impact all projects in the agency's portfolio. Pirating from one project to make up another's shortfall can have negative impacts on the donor project. Also, project timetables or benefits may be dependent on the schedules or capabilities or other in-process endeavors; therefore, slippages or incomplete implementations can have untoward ripple effects throughout the portfolio.

Comprehensive and thorough IT plans should assist in the selection and funding of the right projects (those offering the right composition of strategic fit, benefits, costs, risks, and within fiscal and personnel constraints). The methodologies and techniques of project portfolio management should help in achieving individual project and agency-wide objectives while staying within funding, personnel, and other resource limitations.

4. Exert sound and competent leadership – Organizations need strong leaders, with good, solid values, to function effectively. Leadership has been defined as setting direction, aligning stakeholders and resources (fiscal, personnel, etc.) to that direction, and motivating and reinforcing superior performance. Another definition is leadership is the ability to inspire individuals to fully apply their knowledge, skills, and abilities to accomplish an assigned task and to inspire others through the display of sound leadership traits.

   Leaders provide the goals, the vision and the strategy, and the values and principles that guide people in their pursuit of those goals. The degree to which leaders are able to effect change, develop consensus, sustain commitment, and guide people and organizations to places they need to reach, but may be afraid or reluctant to go, determines the success of any major initiative. Executive sponsors, project managers, team leaders, and other personnel with influence on the outcome of the project must exert strong and assertive leadership. Leadership can and must be exhibited throughout the project team.

   For knowledge organizations, such as project teams, not all leaders have high positions in project organization hierarchies. Leadership of the project and leadership of the technical and business knowledge may come from different people. Although project leaders and knowledge leaders may have different positions in the traditional hierarchy-based project

organization structure, the requirements of both types of leader are the same.

To understand better the meaning of leadership, it is helpful to differentiate it from management. Management is a matter of consistency and order - setting goals, laying out specific plans and budgets, organizing and staffing with qualified people, and controlling deviations (i.e., solving problems). Managers focus on execution, organization, planning, control, performance, and ensuring continual improvement. Managers sustain organizations and processes, and they perform “command and check” roles. Managerial roles are responsible for execution and for delivery of specific targets. They must respond to the scrutiny of such performance criteria as found in benchmarking comparisons, measurability, efficiency, and cost reduction. Managers plan, measure, monitor, and deliver results.

Leadership is about change, the management of change, and movement - perceiving the need for a new direction, figuring out where the organization needs to go, formulating a strategy to get there and motivating employees to make it happen. Leaders are concerned with vision, strategy, inspiration, motivation, values, and culture. Leaders often have to address problems of poor motivation, shortage of passion, and/or lack of clear vision and appropriate focus. The leader’s role centers on strategy, insight, high-level planning, and resource control. Leaders transform organizations and processes; articulate goals, visions, and strategies; and deliver drive, guidance, and inspiration to achieve success. Leaders focus on purpose, trust, and relationships. For IT projects, leaders must provide the clarity of purpose for pursuing them and the strength of will for completing them.

Leadership is recognized and appreciated when it is exhibited, but it is difficult to define. Styles and personalities vary but the basic role of a leader is to provide a vision for others to follow. Leaders organize, challenge, and create environments for achieving goals and accomplishing feats. Leaders inspire others with their belief in a cause and their ability to succeed even in the face of great obstacles. Leaders set the pace, establish the milieu, put an organization in place, and provide encouragement. They provide guidelines that are not too restrictive and that are perceived as fair and just. They maintain appropriate discipline, and they make others believe in the nobility of a cause. Loyalty and devotion on the part of those that follow flow from the integrity and strength of character of their leaders.

Leaders possess the highest levels of values, principles, and standards of behavior (accepted conduct). Their character is well tempered so it will stand the test of moral dilemmas, ethically questionable actions, and particularly difficult decisions in stressful times. They successfully resist

pressures to compromise their values or lower their standards of decency and morality. For state projects, core values must include integrity, stewardship (i.e., managing assets for others as if it were their own), and public responsibility.

Leadership is about what a person is (character) and what a person does (competence), and it must be sustained, focused, and demonstrable. This involves the following:

- Committing (i.e., being bound emotionally and/or intellectually to a course of action) to the endeavor and dedicating personal time and energy to it.

- Picking the right people for key jobs, supporting them with all the necessary resources available to the project, and following up relentlessly to ensure assignments get completed in a satisfactory and timely manner.

- Providing vision and getting others inspired by it.

- Interpreting the environment, comprehending the situation, and then acting decisively.

- Dealing with adversity by displaying a positive attitude and doing the right things for the right reasons.

- Telling the truth – always.

- Encouraging a results-based orientation, where success is expected – not just hoped for or anticipated.

- Granting decision-making authority in exchange for accountability for results.

- Conveying the priority and importance of the effort, motivating personnel, and ensuring the commitment of the organization, as a whole, to the success of the endeavor.

- Demonstrating confidence, expressing a sense of purpose and urgency, and serving as an example of tenacity and perseverance.

- Building an esprit de corps by clearly expressing and reiterating the purpose(s) of the endeavors so that team members know and feel

that their contribution and efforts are important to the greater good and that something of value is being created together.

- Being a caring, informed, and responsive evangelist for the project; showing empathy with interests and concerns of users and stakeholders; and visiting with, listening to, and responding to representatives of all involved parties and organizations.

- Attending to the training (skills building), morale, discipline, and working conditions of the project team.

- Giving inspiration and guidance to the project team, users and other personnel involved in the effort, especially as additional workloads and extra efforts are needed to accomplish tasks and reach goals.

- Offering time and attention to mentoring and attending to the growth in professionalism and skills of project team members.

- Providing the fortitude and stamina to drive the project throughout the organization and effect transformational changes necessary for its success.

- Demonstrating complete integrity, establishing clear values and living those values, displaying moral courage, and the highest moral (right from wrong) and ethical (fair versus unfair) conduct.

- Setting the example (walking the talk) of expectations in performance and behavior desired from others.

- Being honest, firm, fair, and selfless.

- Establishing and maintaining a working environment (including culture) where people can act with integrity (i.e., in an ethical manner).

Leaders recognize that their actions are visible, and that they set the standard for others. Leaders set examples by persevering, by being ethical, and by inspiring and encouraging others.

In addition to superb management skills, personal attributes of good leaders include possessing solid core values, especially relating to morality and ethics; excellent intelligence; exceptional common sense; outstanding judgment (particularly in understanding and evaluating people); uncompromising honesty and impeccable integrity; ingenuity and

innovative thinking; respect for people; robust endurance (physical and mental); indomitable spirit; sufficient stamina and energy; adequate emotional resilience; courage of convictions; and firm determination.

Good leaders are good listeners. Listening is often thought as a passive activity; therefore, it may be difficult for leaders to do. However, good listening skills can be obtained by turning listening into an active process. This can be done by not talking, repeating back what people say, opening channels for feedback (get out of the office), and asking questions. By employing active listening techniques, leaders can obtain greater understandings of situations, challenges, and most important, the people who look to the leader for inspiration, direction, and results.

A good leader (a) provides direction through actions and decisions, (b) is trusted because of honesty and straightforwardness; (c) takes the initiative (is a doer and self-starter); (d) shows good judgment; (e) is consistent in values and beliefs, (f) speaks with authority (based on confidence and knowledge); (g) strengthens others and treats everyone with consideration, dignity, and respect; (h) remains optimistic and enthusiastic; (i) never comprises on fairness, ethics, or morality; and (j) leads by example (out front and practicing what preaches).

Leaders are special people – visionary, responsible, passionate, inspirational, motivational, wise, charismatic, confident, influential, adaptable, risk taking, encouraging, positive, reassuring, creative thinking, goal setting, helpful, supportive, principled, honorable, patient, discerning, fair-minded, and open individuals. They stimulate ideas and they coax the best from, and give recognition to all those around them.

Often, decisions must be made quickly and decisively, especially in response to changes in project environments, situations, or performance, such as deteriorating results versus schedule or budget baselines. Both impetuous actions and timid responses can lead to bigger and more chronic problems later on; therefore, sensitivity to the timing of decisions and responsiveness of actions are essential attributes. Alertness to problems or opportunities and the exercise of wise judgment based on facts are necessary traits.

In spite of being bombarded with trivial, meaningless, and incorrect information, leaders display knowledge and wisdom. They are able to analyze information, organize their thoughts, and formulate logical conclusions. In all decisions, leaders separate needs from wants, important from trivial, facts from anecdotes or emotions, hard-nosed analysis from wishful thinking, realities from myths, and accuracy from misleading generalizations. In the final analysis, respect must be earned,

it must be shared up and down the chain of command, and leaders set the example for subordinates and peers.

In general, there are two basic styles of leadership:

- Autocratic, command-and-control, top-down, no-nonsense, and decisive. This is a results-oriented, tough, risk-taking, and bold approach to getting thing done. It is often hierarchical in decision-making and bestows lots of power on the leader him/herself. It may be effective in yielding significant short-term results, but can fail to generate long-term outcomes due to insufficient knowledge in making decisions, creating resentments, and not developing collaborative foundations necessary for obtaining broad and deep political support for actions. A charismatic and well-informed person with prerequisite experience and good judgment may be successful using this style, if everything goes well. The automatic trust of followers is short-lived, so support will fade if trouble arises.

- Benevolent, consensus gathering, bottom-up, collaboration, and persuasion. This is approach is more open, inclusive, seeks multiple perspectives, invites voices of descent, and lets knowledge and wisdom percolate to the top versus sending orders down. It is non-hierarchical and examines every aspect of a problem or issue before making decisions. This style is based on the belief that leaders cannot assume the automatic trust and respect of followers, but must earn these by soliciting views in advance of decisions. Broad political support is obtained by making everyone feel included. While additional time may be required to effect solutions or actions, political good will should buttress the storms of dilemmas and difficulties.

In the July 2003 edition of Optimize Magazine, General Wesley Clark describes his four pillars of leadership and decision-making:

- Vision – For any effort to proceed, you must be certain of what you want to accomplish. Then you can develop alternative strategies for reaching your goals, compare the advantages and disadvantages and costs and risks of each, make decisions, and move ahead. You have to be open to the facts and see your own situation clearly, minimize preconceptions, and honestly critique your progress.

- Courage – Courage can be defined as “faith in action.” Often, you can’t know everything. Occasions will arise when you must act in conditions of great uncertainty. But leadership means taking action, nonetheless.

- Perseverance – Difficult situations have no quick and easy fixes. Some ideas must be repeated many times to be understood, and some plans take considerable time to produce the desired effect or results. There always will be doubts and doubters along the way – often within your own team. A leader's responsibility is to listen and reassess ideas as often and as honestly as possible without wavering from the original objective.

- Teamwork – Success in almost any endeavor requires help from others, and that is even truer in difficult situations. The greater the stakes, the harder the issues are to resolve. Share information, exchange perspectives, and listen carefully, even to things you don't want to hear. The greater the stress around you, the more important it is to empower your teammates, maintain their privacy, and demonstrate your loyalty to them.

In the April 15, 2004 edition of CIO Magazine, Charlie Field describes four leadership qualities for building a great team and getting things done. They are:

- Character: Doing the Right Thing – Character has been described as ethical behavior, intellectual integrity, openness, and honesty. However, a more fundamental definition of character is what you do, not what you say. No matter what the issue or the struggle or the personal gain or loss, character is doing the right thing – always, not just occasionally. Do the right thing from all aspects, including business, economical, social, and philosophical. Leaders build trust by being open and honest always and by taking a stand regardless of personal risk.

- Leadership Development: The Most Important Task – One person seldom leads an organization by him/her self; therefore, the team at the top determines the environment and culture. The choice of the leadership team speaks volumes of an organization's character and agenda, so the single most important competency of a leader is the selection and development of the leadership team. Also, developing leaders requires the articulation of requirements and expectations in clear and thoughtful ways and the evaluation and giving of constructive feedback. Feedback must be sustained, not just a once or twice a year activity.

- Passion: The Organization Energy Level – Passion for the job is hard to manufacture, but when present, it is contagious. Enthusiasm from a leader enables people to sustain themselves

through demanding times. The energy level of an organization is set at the top.

- Influence and Persuasion: Better than Power – Leadership lies in spending time with subordinates to explain decisions, giving them perspectives, and helping them understand the 'why' behind directions. This is influence – the flip side of personal power. Leaders involve staff and subordinates in decision-making, as they realize others may have better ideas. However, the open dialogue does not relieve leaders of the responsibility to make the ultimate decisions and move the team on.

In the June 1, 2004 edition of Harvard Business School's (HBS) *Working Knowledge,* Martha Lagace documented the following comments from HBS professor Teresa Amabile regarding research on the contribution of team leaders to the creativity and productivity of project teams.

- Employees' perceptions of team leader support were more positive when the leader engaged in four types of effective behavior: 1) monitoring the work effectively (giving timely feedback and reacting to problems in the work with understanding and help); 2) providing socio-emotional support (showing support for a team member's actions or decisions; helping alleviate stressful situations for subordinates; socializing; keeping team members informed about stressful situations; addressing subordinates' negative feelings; and disclosing personal information); 3) recognizing good work privately and publicly; and 4) consulting subordinates about the work (asking for team members' ideas and opinions; acting on subordinates' ideas or wishes).

- Employees' perceptions of team leader support were more negative when the leader engaged in three types of ineffective behavior: 1) monitoring the work ineffectively (checking on the status of assigned work too often; displaying an inadequate understanding of subordinates' capabilities or work; providing non-constructive negative feedback on work done; checking on the status of assigned work for too long; and displaying lack of interest in subordinates' work or ideas); 2) failing to effectively clarify roles and objectives (giving assignments that are not appropriate for the team member; not providing enough clarity about an assignment; changing assignments or objectives too frequently; giving assignments that conflict with other management instructions); and 3) dealing with problems ineffectively (avoiding solving problems; creating problems).

- Consistent behavior of a good team leader in the study included: monitoring project progress at reasonable intervals (not making team members feel they were being monitored personally), monitoring own work and frequently reporting progress on the leader's tasks, consulting team members on their ideas and using them, acting as a champion for the project (selling it throughout the organization), gathering useful technical and tactical information and informing the team, and recognizing good work and giving credit in public settings.

- Consistent behavior of an ineffective team leader in the study included: micromanaging the work by narrowly defining assignments; constantly inquiring about individual progress, and trying to direct people's work; not championing the project or serving as an information-gathering ambassador for it; and rarely recognizing good work, and when done, doing so in a private – rather than public - setting. Micromanaging subordinates, kowtowing to upper management, and the negative monitoring of team members created ill will and angered team members.

The May 15, 2004 issue of CIO magazine contained an article by Patricia Wallington on leadership called The Ties That Bind. Four success factors for an effective leader are:

- Get the big picture. Don't miss the forest for the trees.

- Keep your finger on the pulse. Make sure things are moving in the right direction, but don't get personally involved in the detailed transactional level.

- Focus on what is important. Set priorities and concentrate on the key issues and initiatives.

- Treat time as the enemy. Control your time. Set limits and boundaries on what you do and with whom, and stick to them.

In the June 2004 edition of the Harvard Business Review, Peter F. Drucker has an article titled What Makes an Effective Executive. The eight practices are summarized below:

- They asked: "What needs to be done?" – They did not ask: "What do I want to do?" The one or two top urgent tasks are identified and addressed.

- They asked: "What is right for the enterprise?" – They didn't ask: "What is right for the owners, the stock price, the employees, or the

executives?" They know the others are important, but they also know that a decision that isn't right for the enterprise will ultimately not be right for the stakeholders.

- They developed action plans. Executives are doers, but before spring into action, the course must be planned. Action plans include results, timelines, restraints, future revisions, check-in points, and implications of how time will be spent. Action plans are statements of intentions, not commitments. They are not straightjackets, and must be updated and revised often. Without an action plan, executives become prisoners of events.

- They took responsibility for decisions. A decision has not been made until people know: the person accountable for carrying it out; the deadline; the people who will be affected by the decision, thus must know about it, understand it, and possibly approve it; and the people who have to be informed of the decision, even though they will not be affected by it.

- They took responsibility for communicating. They make sure their action plans and information needs are understood. They share their plans and ask for comments. At the same time, they make sure each employee gets the information needed to get the job done.

- They were focused on opportunities rather than problems. Problems must be solved. However, problem solving does not produce results. It prevents damage. Exploiting opportunities produces results. Change should be treated as an opportunity to be exploited, rather than considered a threat. Lastly, problems should not overwhelm opportunities in discussions or actions.

- They run productive meetings. Executives are in meetings over one-half of each business day. Meetings must be work sessions, not bull sessions. Good executives decide what type of meeting it is and prepare accordingly, don't raise superfluous matters (sum up and adjourn), and follow-up with action items.

- They thought and said "we" rather than "I." Executives know they have ultimate responsibility, which can be shared nor delegated. But they also know they have authority only because they have the trust of the organization. Lastly, executives *listen first, speak last.*

In the June 2004 edition of PM NETWORK Ken Blanchard described leadership in an article titled Commit to Greatness. Key points are highlighted as follows:

- Good leaders display integrity by encouraging ethical values and delivering ethical performance. Ethical is defined as doing the right things for the right reasons. Also, good leaders execute the right things at the right time by being timely with decisions, actions, and communications.

- Good leaders see the future by having a vision. Vision is defined as a customer/citizen/program-focused purpose, a picture of what success looks like, and an understanding of the values that drive the day-to-day behavior of the organization's leaders and its people.

- Good leaders build and praise a positive culture. They make sure people are clear on goals, catch team members when they are doing something right, and take time to redirect them when they get off track.

- Good leaders are committed, and commitment means caring about results. Committed leaders don't procrastinate. They see how poor decisions block good results, and they have a clear picture of what must be done to succeed.

- Good leaders are not "last minute" managers. They focus on priority, propriety, and commitment.

In summary, good leaders create great human organizations by doing the right things for the right reasons at the right times and exhibit personal commitment to making it happen.

The June 2004 edition of PROCEEDINGS published by the U.S. Naval Institute contains the winning essay by Lieutenant William Scotch Perdue of the Vincent Astor Memorial Leadership Essay Contest. The four qualifications of leadership are summarized as follows.

- Front – means lead from the front by setting the example. You must strive for personal excellence and be visible to the people you lead.

- Accept – means accept responsibility. You are responsible for everything the people under your command do. Rarely is there a quicker way to lose the trust, respect, and confidence of subordinates than to shift blame to them when you are in trouble. Alternatively, there probably is no truer test of loyalty than the visible willingness of a leader to stand up and take responsibility when things go wrong.

- Care – requires no further explanation. You are responsible for the success of your subordinates.

- Earn – means to earn the trust, confidence, and respect of the people under your command.

A survey of senior executives in the private sector by Economist Intelligence Unit (EIU) in late 2003 revealed the following desired business leadership qualities: strategic vision, excellent communication and people skills, the ability to manage across cultures, deep knowledge of market needs and operations, and openness to new ideas.

A Gartner research note dated June 30, 2004 on Moving From Manager to Leader listed three things that IT leaders must do:

- Set and communicate a bounded *direction* that establishes a sense of purpose, lays out priorities and defines opportunities for efficiency. Give the subject matter experts freedom to express their creativity and to choose how to do so. Encourage shared learning across the organization.

- *Align* IT vertically and horizontally to focus on areas of priority. Ensure that IT's structure and values are aligned both strategically and through formal and informal partnering of IT with the business. Create the right balance of business and technical subject matter expertise. Prepare or update mission, vision, and value statements and roll out to the entire organization.

- Lead with empathy and use intrinsic satisfiers to *motivate*. Recognize and reward achievers and performers in public.

An article in the June 2004 issue of Darwin magazine by John Baldoni describes the importance of humility as an attribute for leadership. Humility is a strand between leader and follower that underscores one common element: our humanity. A sense of humility is essential to winning hearts and minds. It is a visible demonstration of concern and compassion, as well as authenticity. Leaders who are to be followed must be leaders who understand the human condition, especially their own. People who are out of touch with reality put their own interests first, with unsuccessful results.

Humility is an approach to life that says, "I don't have all the answers and I want your contribution." It is an acceptance of individual limitations – I cannot do it alone – coupled with a resolve to do something about it – I will enlist the help of others. It is a sense that both leader and follower are in

this together, and it builds a sense of mutual trust, as well as self-confidence. Confidence is not simply about self, but can grow to embrace the entire team. Leaders can, and should, feel more assured that they would be successful, knowing they have the support and the resources of others with which to do the job.

Suggestions for communication humility are as follows:

- *Invite feedback* – however, make it safe for people to offer constructive criticism.

- *Encourage dissent* – dissent is a disagreement with the central point of view. It must be safe for people voice discordant notes and other perspectives.

- *Turn failures into lessons* – instead of covering mistakes up, publicize them – not for the sake of retribution, but for the sake of education. Turn mistakes into successes.

- *Expect humility in others* – humility breads humility. A sense of personal humility is a key to self-understanding that in turn leads to greater awareness of wholeness of life. If you show humility, you can ask and expect others to do the same.

The Fall 2004 edition of CIO Insight contains an article by Edward H. Baker interviewing John Kotter titled Hearts & Minds. Key summary points are:

- Leadership is essential to get changes done.

- Leadership is different than management. Leadership is much more associated with changing things. Management is more about keeping things under control, the way they are now.

- Given the way the world is evolving, the rate of change, the rate of complexity, internal inter-connectivity, what we need now is a lot more people, at a lot more levels, providing a lot more leadership. A critical part of people's jobs is leadership.

- For leading IT projects, you must get together the right team of people who have the skills and the clout to make something happen, you have to clarify where they are going and how they are going to get there, and you have to explain how things will look and work after they are finished. That is, you have to create and define clearly and understandably a vision and the strategy for achieving it.

Michael Feiner in his book “The Feiner Points of Leadership” describes some points of being a good boss. They include:

- Great bosses are fair, straightforward, ethical, and demanding – but compassionate.

- Leaders are about values, standards, and lead by example.

- Leadership isn’t composed of heroic gestures and brilliant insights, but about the old-fashioned work of building relationships, being committed to employees’ success, and holding them accountable.

- Great bosses believe their work – their company’s mission – is important, and they infuse employees with the same passion.

- Great bosses create high expectations and high standards, but not uncompromising or unrealistic. They challenge you to be better than you thought you could be.

- Great bosses have personal commitment to their employees. They care about the success of employees by giving them time, advice and attention. They know their employees, and always give positive and negative feedback (ongoing advice, not just at performance review time). Feedback is balanced, consistent with expectations, and very specific.

- Great bosses practice ‘tough love’. Tough love is painful to give, but demonstrates commitment to the employee. They let employees know what will happen if they fail to improve. This is not a threat, but an extension of commitment.

- Leaders are good coaches. They are good teachers, and they realize the need for this, regardless of the time it requires.

- Great bosses hold employees accountable. They not only inspire and encourage, but they hold employees and themselves accountable fro meeting expectations. Without measuring performance, the other leadership principles are toothless.

Rick Wilson, cofounder of the Leaders for the New Century Project, says: “People don’t really follow leaders, they follow a focusing goal that is promoted by the leader. When you have these focusing goals, your group aligns and partisanship melts away," he said, which tends to eliminate minor problems that can accumulate to ruin an organization. "Most organizations die a death of a thousand cuts."

An excellent example of leadership is contained in the following e-mail from a woman marine in Iraq.

From: Kane LCpl Jessica R
Date: November 26, 2004 3:13:33 AM EST
Subject: A Thanksgiving Story

Dear Mom and Dad,

I, as most would of thought, was expecting a very homesick Thanksgiving. Although I wish I could have been home, my Thanksgiving was filled with motivation and inspiration. To start off, the unit got together and the CO said a couple of words to the unit. He complemented us for our hard work, and was extremely impressed with the plans we have for the future. We then had lunch with some MRE crackers, popcorn, and SPAM. Afterwards, like we do most days, we prepared for the convoy into the city. It was a good convoy and all went well. While we were in the city, we were asked to get together because the General wanted to talk to us. The General being, General Casey, a four star General in the Army who is in charge of all Coalition Forces in Iraq. He again complemented us on the good work and sacrifices we are making. He told us that our hard work had paid off and there is no longer a safe haven for insurgents in Iraq. He then said something that would inspire the weakest of heart. He said, "The enemy was willing to die for there cause, and you gave them their wish". He told us that next year when we are home for Thanksgiving we will be truly grateful for all the gifts in our life. We can look back at this Thanksgiving and be proud of what we are doing. Filled with juice and energy, we convoyed back to Camp Fallujah. As we came to the first gate to the camp, I was in shock because a Marine Corps Major was stand at the post. Along with the Major was a 1stSgt. I reported to the Major what convoy we were and how many packs we were carrying. He told me to proceed and have a Happy Thanksgiving. As we came to the second gate, a Marine Capt and a SgtMaj were standing the post. There was not a PFC or LCpl to be found. None of the posts had young Marines at them; Officers and Staff NCOs manned them all. The command decided that the young Marines were going to have the night off to get some good chow. It was unbelievable, and a wonderful site. The leadership took charge and took care of the younger Marines. This filled me with a pride indescribable with words. I am so honored to be apart of an organization like this. Marines taking care of Marines with such unselfishness. As I went to Thanksgiving chow with my brothers and sisters, the IMEF Commanding General LtGen Saddler and the IMEF SgtMaj, SgtMaj Kent were serving chow. The amazing part was that

they were so enthusiastic about it. Everyone was in a great mood, and ready to take on anything. It makes you think that if a 3 star general in the United States Marine Corps can serve turkey to a bunch of 18-20 year old Lance Corporals, then you can suck up whatever you have to do and stop complaining. So, as I went to bed, I felt very Thankful and indeed blessed for a great life. Tomorrow, I am sure will be full of fighting and disaster, along with the added stress of little sleep and cold days and even colder nights. But for tonight it's Thanksgiving and everything is okay.

One Motivated LCpl

Jessica

LCpl Jessica Kane
4th CAG HQ S-6

The below Qualifications of a Naval Officer by Augustus C. Buell (in *Reef Points: The annual Handbook of the Brigade of Midshipmen)* is a succinct description of leadership by John Paul Jones, the father of the U.S. Navy.

> "It is by no means enough that an officer of the Navy should be a capable mariner. He must be that, of course, but also a great deal more. He should be as well a gentleman of liberal education, refined manners, punctilious courtesy, and the nicest sense of personal honor.
>
> "He should be the soul of tact, patience, justice, firmness, kindness, and charity. No meritorious act of a subordinate should escape his attention or be left to pass without its reward, even if the reward is only a word of approval. Conversely, he should not be blind to a single fault in any subordinate, though at the same time, he should be quick and unfailing to distinguish error from malice, thoughtlessness from incompetence, and well meant shortcomings from heedless or stupid blunder.
>
> "In one word, every commander should keep constantly before him the great truth, that to be well obeyed, he must be perfectly esteemed."

There is an old adage: "Tough times don't last; tough people do."

Leaders must not display wooden-headedness, as defined below by Barbara Tuchman in "The March of Folly".

"Wooden-headedness": "(A)ssessing a situation in terms of preconceived fixed notions while ignoring or rejecting any contrary signs…, acting according to wish while not allowing oneself to be deflected by facts….the refusal to benefit from experience."

Wooden-headedness may be described as the making of decisions from preconceived ideas of the situation, circumstances, or problem and the disregarding or denigrating of contradicting facts. It is the refusal to see reality and/or the conscious effort to deny it.

5. Properly define and understand the business problems, challenges, or opportunities to be addressed – There must be clear and direct linkages among the agency's strategic roles and missions, business/program's goals and objectives, and project's purposes and expectations. Projects exist only to satisfy a business/program need and/or address a governmental priority. The success of a project is not how well the technology works, but how well it supports agency missions and strategies and accomplishes business/program goals and objectives.

   The expected results, value, and benefits of projects are usually expressed as performance measures. Performance measures should be expressed in business/program terms – not IT measures. Examples of IT measures are response times, transaction rates, reliability factors (such as 99.9% up time), etc. For many IT projects, the satisfactory implementation of the IT asset (such as an application) is necessary but not sufficient for meeting the project's business/program goals and objectives. For example, the new application may work as technically specified, but if the organization fails to reengineer its business processes, sufficiently train the users, or accomplish other necessary non-technical requirements, the business/program expectations may not be achieved.

   Agency IT plans and project approaches and plans should link to agency business/program plans and strategies. The achievement of this alignment requires: 1) a deep and comprehensive understanding of business problems, challenges, or opportunities, and 2) the ability to match projects and technologies with business/program needs and requirements.

6. Set clear and realistic purposes, objectives, and success criteria, and ensure their alignment with the business organizations served – Uncertainty of purpose and ambiguous objectives will doom the best of efforts, regardless of intentions. The purpose(s) of the project must be clear and clearly documented. Objectives must be specific, clear,

measurable, accurate, realistic, time-bound, and agreed upon. Unambiguous and complete objectives are essential prerequisites for managing the scope of projects, including the identification and elimination of unnecessary changes in requirements as projects progress over their life cycles. Every individual involved in a project must have a clear answer to the following questions: What are we doing? Why are we doing this?

Criteria for success must be explicitly defined so that there is a complete understanding among all participants and interested groups of what success is and when it is achieved. Success criteria must have the same attributes as measures for objectives listed above, and the criteria must be specified for each phase of the project (including the end). In the heat of battle and the passing of time through the project life cycle, business/program goals, technical capabilities, and functional specifications may mutate and change (at least in some people's minds).

Success and exit criteria may serve the same or similar roles in projects. They are used to determine when a task or phase has been completed sufficiently (with acceptable results) so that work can begin on succeeding tasks or the project can proceed to the next phase. Defining success and/or exit criteria in advance and only changing these through a formal and approved process minimizes future unproductive debates and arguments. In addition to determining when the project is over and to what extent it has met its goals, objectives, and other performance measures, success/exit criteria may be particularly important for requirements, testing, and pilot phases.

7. Provide for adequate and qualified staffing - Project teams must be multidisciplinary and integrated, with representatives from all affected organizations. Appropriate and adequate experience, skills, and competence in types of staff and numbers of personnel are absolute prerequisites for project success. Do not embark on projects without enough qualified and experienced people to manage and perform them. Overwhelmed or inexperienced managers and staff make bad decisions and fail to recognize problems until they become acute. Ensure appropriate representation on the project team from users, state technologists, subject matter experts, vendors, etc.

   When employing technologies, methodologies, or tools new to the state or agency, if possible, have adequate staff experienced with them to smooth the learning curve. Experienced staff also will minimize risk of failure.

   Additionally, make sure there is adequate representation of internal staffing, including agency program and technical personnel. Insufficient internal staffing will increase costs, because shortages must be made up by more expensive outside personnel or schedules must be lengthened.

Also, due to the lack of knowledge transfer during the development of the application, staffing requirements for operating the system after implementation may have to be supplemented by more costly outside personnel. If necessary and possible, find replacements for internal agency knowledge experts to relieve them from day-to-day business/program operations, prior to the start of a project, to allow the knowledge experts to be able to devote more time to the project.

While part-time agency staff may be used intermittently for such tasks as testing, the core project team must be staffed by a sufficient number of full-time agency/program personnel. In many situations, part-time assignments are unacceptable and unproductive due to the inefficiencies created by changing jobs and roles multiple times over short time spans and by failing to acquire the complete range and depth of knowledge and understanding needed to perform project tasks satisfactorily.

Personnel resource constraints are key determinants for setting realistic project plans/schedules and the ultimate success of the project. Excessively optimistic assumptions on the availability of the numbers and/or knowledge/skill levels of staffing, especially for internal agency or remote site personnel, lead to overly ambitious schedules. Assumptions regarding the availability, skills, and use of staffing must be realistic, considering program/business cycles and day-to-day operating requirements.

Staffing plans should be developed, vetted through project governance structures, and approved by organizations obligating and committing personnel. Numbers, skills/experiences, and timeframe commitments should be enumerated. The time-phased staffing commitments and assignments should tie to project work plans, schedules, and milestones, to ensure the numbers and types of staff are available when needed and for as long as needed.

8. Recognize the importance of users, interest groups, and stakeholders - From its inception; the right people must be involved in the effort. The purposes and objectives of the project must be conveyed to all involved managers and the rank and file people who will be designing and ultimately using the new system. Build coalitions of participants, users, and stakeholders. Ideally, as many champions (believers and supporters) as possible must be converted or recruited from the ranks of managers and staff. The days of the isolated development team are over. Now development must interact with business/program people and technical staff to ensure proper development, deployment, and maintenance of applications.

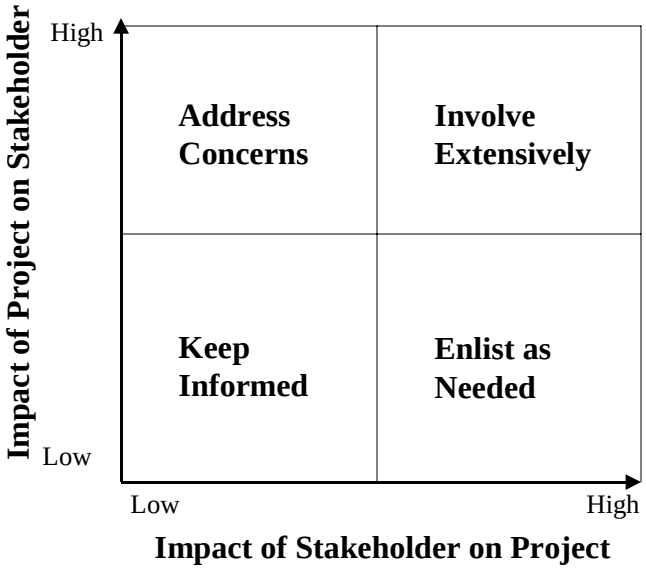
The importance of users and the significance of stakeholders in the outcome of the endeavor must be appreciated and well understood. Users are the people that are the most affected by the new application; therefore, they must accept it. A stakeholder is an individual or group that can impact or is impacted by the project. Insufficient stakeholder and/or user involvement can be a key cause of disappointing results from a project. Differences in types of users and perspectives of stakeholders must be recognized and accommodated through participation in various user groups, advisory bodies, etc. Collaborative efforts and the reaching of a collective consensus for important issues will be effective in gaining necessary buy-ins and overall support for the project.

Inclusiveness of all interested parties and individuals and tolerance for differences in opinions and perspectives are keys for successful projects, because the estrangement of individuals or groups will create divisiveness within the project and sour relations among the project and its affected parties. Sometimes, inclusiveness is difficult. It requires more effort, more preparation, more study, and more flexibility; however, the payoff is worthwhile.

Users are particularly important, and their considerations and extensive input must be incorporated in the gathering and documenting requirements, designing the system (especially including user interface design), testing, training, and piloting/rollout. Users are the humans that deal with the machines, and humans resist change and experience different learning curves. If the system is difficult to use or implement, the question of technology, training, or pains of learning something new must be addressed. The incorporation of users early and often in the project plans and activities will minimize the potential problem of unfavorable system acceptance by its intended audience.

The diagram below offers a concept for addressing stakeholders.

Concept for Addressing Stakeholders



Every involved user, stakeholder or interested party must have a clear and precise answer to the following questions. How will my advice or concerns be included in the decision-making processes? What's in it for me?

9. Pay close attention to cultural and political issues - Culture is defined as the assumptions, beliefs, values, attitudes and expectations shared by the organization. It is composed of human and political dynamics, and it is a product of the history, industry, and leadership of an organization. Corporate culture involves norms of behavior and shared values that allow employees at every level to work together successfully toward a common goal. Norms are what everybody does and how they act, and they can be observed. Shared values underlie the norms, and they are the fundamental shared sense of good and bad, right and wrong.

   The culture of an organization cannot be dictated, and it can be extremely difficult to change. Its evolution is a long, involved, hands-on process that requires extraordinary executive focus to accomplish. The informal and unofficial channels of storytelling, gossip, and myth often influence culture more than strategy, directive, or edict.

   The organizational, social, cultural, and political environments in all decision-making actions must be known, understood, and considered. All project management and system implementation activities should anticipate, recognize and accommodate organizational and behavioral implications. Unexpected organizational challenges, associated

distractions, and internal and external conflicts can require significant time and efforts to resolve. This is especially true for projects involving multiple areas, departments, agencies, programs, or governments.

Statewide implementation projects often involve multiple business, program, functional, and technical groups – many reporting to different organizations and governing bodies. Data and resources are required from these groups, and the political and organizational hurdles associated with getting their participation can introduce unanticipated impediments and delays to the project. Advance planning and astute leadership that anticipates and addresses these challenges can minimize the adverse impact of cross-organizational politics on the project.

Some areas of cross-functional/organizational challenges that may be important to address include:

- Gaining recognition that a strategic (statewide), cross-functional/organizational approach is needed, rather than a tactical (local or individual agency or program) and fragmented method.

- Agreeing on multiple (and sometimes conflicting) requirements, deliverables, and priorities.

- Defining standards to use (e.g., business rules, tools and platforms, etc.).

- Developing funding models and deciding who pays for what.

- Getting the commitment to use personnel and other necessary resources from multiple organizations.

- Establishing a cross-functional/organizational management model and governance process and creating accountability for resources and deliverables.

In some cases, political capital may have to be risked to do the right thing for the enterprise. In addition, don't underestimate the time and attention needed to train and prepare business/program personnel and technical staff for new business/program policies, models and processes; intra- and inter-agency reporting relationships; and technical operations resulting from the new application. Moreover, the timely and cost-effective implementation of technology on a statewide scale is facilitated by consistent technical standards/configurations and common business/program processes. If the present governance environment is one of autonomy for individual remote sites and flexibility in technical

operations and business/program processes, it may be necessary to demand more unification and consistency in the technical and business/program areas.

Many of the more serious problems in the implementation of systems or applications are rooted in the resentment of and resistance to changes technology brings. Social, cultural, and political issues strike to the core of people's identities, and work is part of their self-worth. Major projects fail because the reengineering of business processes and the restructuring of organizations changes the way employees do their jobs and their reporting relationships. Since their identity is linked to what they do, people are forced to re-evaluate who they are. Human issues and change management must be top priorities for project teams, especially for large-scale deployments affecting a lot of people.

In some cases, anti-IT attitudes may reflect the larger non-technical issue of business process change. Some percentage of users simply do not like changing the way they do things, and even when better systems are designed and implemented with their input, they may steadfastly refuse to admit that the implementation is successful and things are improved over the past. In times of uncertainty, there may be some comfort in finding fault with a new system as the winds of change blow around them.

John Kotter gives advice on changing culture in the Fall 2004 edition or CIO Insight. Some relevant comments follow. IT projects force people to operate in new ways. They involve people, processes, and technology. To address human needs, it is necessary to create the right team of people who have the skills and the clout to make something happen. A vision of what things will look like and how they will work and a strategy of how the transition will take place must be developed and explained in clear and understandable terms. That message must be given to the relevant people in such a way that they buy into it.

Barriers will originate from several sources, including culture, organizational structure, performance appraisal process, and managers fighting the change. These forces of resistance must be overcome one-by-one. Kotter says that the way to change culture is to get a group of people to behave in the new way, and if the new way works by producing benefits for them, and if it works long enough, then it begins to kind of seep into the blood stream of the organization.

As Niccolo Machiavelli wrote in "The Prince," "And let it be noted that there is no more delicate matter to take in hand, nor more dangerous to conduct, nor more doubtful in its success, than to set up as a leader in the introduction of changes. For he who innovates will have for his enemies all those who are well off under the existing order of things, and only

lukewarm supporters in those who might be better off under the new. This lukewarm temper arises partly from the fear of adversaries who have the laws on their side, and partly from the incredulity of mankind, who will never admit the merit of anything new, until they have seen it proved by the event. The result, however, is that whenever the enemies of change make an attack, they do so with all the zeal of partisans, while the others defend themselves so feebly as to endanger both themselves and their cause."

10. Manage scope changes and control scope creep – Scope changes can be good or bad – their true costs and impacts must be analyzed, and their disposition must be determined in a correct manner.

    Scope creep is a major risk to all projects, and it is an insidious disease that is a primary reason for budget and time overruns. Managing scope creep requires an understanding of it, including its causes and its adverse affects – not only on the project itself, but the performance of the organization as a whole in meeting its missions and strategies and business/program goals and objectives. Scope creep will never go away completely, and it has a wide variety of causes, including additional functional requirements, unexpected political or business/program issues, unanticipated risks, and enhanced system performance demands.

    It is important to measure the true costs and benefits of scope creep, because not all scope increases are bad. Some changes may be necessary, worthwhile, and offer value; however, even good creep cost something. As the project progresses in its development cycle, accommodating increases in scope becomes increasingly expensive, with the changes in the latter phases of the cycle costing much more than those earlier in the project. Scope changes must be described clearly, and they must be analyzed accurately regarding the impacts on the project and the organization and the consequences from accepting, deferring, or rejecting them.

    An effective change management process is essential for managing scope by identifying changes to project plans, risk factors, and requirements and evaluating their impacts on work efforts, timetables, personnel resources, and costs. In some instances, a mini business case must be developed to analyze the risks and values of potential expansions in project parameters due to scope changes and to determine whether the benefits are worth the costs (in increased dollars, extended timeframes, etc.). While small or minor changes may not impact project schedules and budgets when considered individually, from a cumulative perspective, they can be devastating by leading to visible and unacceptable cost overruns and time delays.

When determining the true cost of scope increases, two items are often erroneously left out. One is the lost value of project benefits due to schedule slippage, since the benefits will start to accrue later than originally planned. That cost is calculated by the multiplying the dollar benefits per month by the number of months the project is extended by the change request. The other is the cost of the increased cancellation risk due to the elongated project timetable. It has been estimated that the risk of project cancellation is 1.2% per project-month. For a 10-month $500,000 total cost project ($50,000 cost per month), a change in month 5 that would extend the project duration by 2 months would incur a $6,000 cancellation cost. That is ($50,000 x 5 x 12 x .012) – ($50,000 x 5 x 10 x .012).

As a project progresses over time, there is a natural tendency to revise requirements and refine designs. This comes from good intentions reflecting desires to incorporate the latest changes in business and technical environments and to take advantage of lessons learned from previous work. It has been estimated that requirements grow by two percent a month over the original scope, so project length alone will create scope creep. For long-term projects, the impacts from scope creep can be minimized by focusing on achieving business/program value and the expected benefits of the project as early as possible by breaking the project into multiple short-term phases. Lower priority or lesser value changes can be incorporated in future releases, and the more rapid pace of development will give less time for scope changes to be identified and requested.

In summary, additions or changes to requirements must be carefully reviewed and evaluated. As the project moves away from the original goals and objectives, it is difficult to deliver against the original requirements, making the measure of success tricky, if not impossible. Perceptive project managers plan for scope creep, applying basic principles such as specification changes, change management control, and formal acceptance (sign-off), and communicating schedule and budget changes or expected variances.

11. Shun lengthy schedules and avoid trying to deliver too much all at once or taking too long to provide any benefits - Steer clear of long-term implementations, especially those involving 'big bang' endings. If long-duration endeavors are absolutely necessary, use the 'building block' (iterative delivery of benefits) approach by configuring the schedule to feature phased deliveries that provide incremental benefits, with some coming early in the effort. This sub-project or incremental milestone approach will enable the project team to realize partial victories and the client (user) to see advances. Shorter projects will facilitate project management; reduce risks of project failure, which increase in an

expediential manner with project duration; and maintain user interest and enthusiasm. Also, this approach should improve financial return calculations that involve the time value of money by delivering some rewards sooner.

Ideally, a system should be developed and delivered in controlled increments that increase the chances of achieving workable solutions not dependent on any subsequent increment in order to perform primary functions and deliver key benefits. Quality should be the top priority; therefore, one way to maintain the integrity of long-term schedules and total project costs, while ensuring the quality of products, is to manage the delivery of functionality by providing necessary capabilities first and nice-to-have features later.

Another approach for avoiding the overextension of support resources and to prove the investment incrementally is to install it (or parts of it) in one unit (or a small number of units), such as division, section, remote site, etc., at a time. This may delay the delivery of the maximum benefits of the investment, but it may minimize problems and troubles, and these are what users and participants remember whenever everything is done.

For follow-on capabilities, the project team must obtain user and stakeholder approval for priorities of enhancements and fixes, group these into releases, plan the releases, advertise and obtain consensus on the release schedule, and adhere to the due dates. Report frequently to users and stakeholders the priority of change requests and the status of their implementation.

Another pertinent consideration is design and pilot efforts that last too long expose the project to technology obsolescence and/or business/program irrelevance. Technologies change rapidly and political initiatives and mandates rise and wane overnight. Therefore, extensive delays before statewide rollout increase the potential for the implementation of outmoded technology and/or the satisfying of outdated political priorities.

If possible, schedule project tasks or activities that are prone to uncontrolled delays (such as reviews and approvals by outside bodies over which the project has little or no control) as early in the project as possible to allow for appropriate slack (built-in lag) times. Also, be alert to tendencies of outside organizations (e.g., federal oversight bodies) to force the project into a long term, drawn out (bid bang) endeavor. In addition, recognize the increased risks of funding reductions or cut offs (budget constraints) from long-term projects before they are finished.

Major projects often are undertaken to further policy initiatives or priorities. However policies change in the face of external events and political

decisions. The structuring of projects in incremental releases that can stand on their own reduces the exposure of projects to ever-changing priorities.

In summary, short timetables and quick wins build support, minimize the possibility of imparting superceded technologies, and show value. For projects with longer schedules, the implementation approach that offers multiple time-phased releases reduces project risks, sustains momentum, increases user buy-in, and improves return on investment.

A rule-of-thumb is projects should start delivering benefits within six to nine months. Some ways to do this include leveraging as much as possible existing or statewide infrastructure and keeping an unwavering focus on value, so that benefits are offered as early as possible and in any way possible.

An article by Frank Hayes in the June 7, 2004 edition of COMPUTERWORLD titled Big IT: Doomed says big IT projects are OK, just run them as a series of small ones. The article described the approach for $100 million, four-year project to rebuild the Sabre reservation system. The project was successful because it was reduced into a series of small steps where each major component was restructured as an individual effort. Small steps allowed a response to changing technology, provided for the iteration of each component before moving forward to ensure the technology worked and the user was satisfied, and accommodated needs for changing direction as the effort progressed. Key characteristics of big projects that were eliminated included the grand, detailed plan, the divide-at-the-start and integrate-at-the-end strategy, and the years-before-it-goes-live schedule.

As Sun Tzu said in *The Art of War*: “Cleverness has never been seen associated with long delays. In war, then, let your great object be victory, not lengthy campaigns.”

12. Manage expectations – Do not over commit and under fulfill. Be careful of over-promising timetables, capabilities or costs. System features and benefits usually don't arrive all at once. Even after a successful pilot, additional capabilities and performance enhancements typically are scheduled for later time periods. Manage expectations by clearly defining features, capabilities and benefits and openly communicating when they will be delivered. Acceptance criteria must be defined clearly, reviewed by users and key participants, and approved in advance.

    Regarding pilots and initial implementations, careful attention to the proper management of expectations is especially crucial. User participants may not 'sign off' on the application until it is fully featured, thinking that is the

only way they can guarantee complete and full delivery of all expected capabilities. If this results, the application and project team may become unintentional hostages to these demands, which may unnecessarily delay the statewide rollout of an acceptable system.

Equally important, unfavorable publicity, with adverse repercussions, will result if the application fails to meet the quality or feature expectations of the pilot or initial implementation sites. Recognizing that "perception is reality", the project team then must overcome an additional hurdle in statewide acceptance, which could be avoided by offering a flawless product with the features anticipated by the pilot users.

In summary, the project team and users (customers) should agree to project goals, deliverables, budgets, and schedules. All participants should share a single vision for success. If the expectations of all parties are aligned, the cooperation and mutual support of all parties to achieve the common goals should result. If expectations differ, there is a greater chance of dissatisfaction with some or all parts of the project, which increases the chance of the project self-destructing. Expectations must be realistic, and deviations from plans and agreements must be communicated quickly, clearly, fully, and honestly.

13. Request and obtain sufficient funding - Get full commitments for adequate funding at the beginning. The budget should be realistic and in line with project timetables; system requirements, features and capabilities; and user expectations for service levels and operating performance. If adequate funding is unavailable, expectations for costs, schedules and deliverables should be adjusted accordingly, or the project should not be attempted.

    Potential sources of funds for projects include state appropriations; federal funds; grants; local funds; special funds (e.g. highway, bond proceeds, etc.); and public/private partnerships for sharing costs, savings, or revenues. Funds to cover the complete IT investment life cycle may come from a variety of sources. For example, a combination of expansion budget and continuation budget funds (especially for salaries for internal agency staff participating in the project) may be used for the implementation phase. Continuation budgets often are used to support system operations and maintenance after implementation.

    In some cases, a prudent approach may be to request funding for pilot or 'proof of concept' work. If the results are successful, it may be necessary to request and perform statewide rollouts on a phased basis, depending on funding availability over time.

For some statewide efforts, a single source of funds may not be adequate for covering all costs. Local funds may be necessary to provide for implementation and ongoing operating expenses at remote sites, including equipment (such as PCs), Internet communications charges, overtime for staff training and data conversion efforts, etc. The need for and magnitude of local or other necessary supplemental funding should be determined and communicated. The availability of funds may impact the pace of and timetable for statewide rollout, especially if local financial or personnel commitments are involved.

14. Perform detailed planning and develop realistic intentions regarding milestone schedules, dollar expenditures, and personnel commitments - Thorough planning is absolutely essential for project success; however, plans and actions must have the flexibility necessary to accommodate unanticipated events and unforeseen realities. Remember the Law of the Six Ps – proper planning prevents pitifully poor performance. An often-cited problem with project plans is the inability to define detailed work. By defining and documenting details, project leaders, the project team, and approval/overview bodies will know what can and cannot be accomplished within the budget, schedule, scope, and quality constraints. Be aware that there will be demands to short sight planning when there is a push to get results fast, but the outcome will be excess costs, elongated schedules, and less than optimum results.

    A full understanding of the project's size and complexity is an absolute prerequisite for developing plans (i.e., identifying personnel and other resources, preparing budgets, and determining delivery dates). A true understanding of the project's complexity is necessary for enabling the development of well-designed and detailed management plans. These plans require that each project task and discrete work elements are fully evaluated and documented.

    Moreover, the detailed plan will enable the appropriate level of review of performance for monitoring the progress of the project and accurately reporting and assessing its status. As a minimum, on an appropriate recurring periodic basis (weekly or monthly), projects should report actual results compared to plan for costs, schedule milestones (deliverables or accomplishments), and usage of personnel resources (staffing person-days). Staffing and efficiency variances should be calculated by task and summarized to top level work plans. Detailed project plans enable the calculation of dollar, efficiency, and staffing variances for periodic status reports on current period and project-to-date bases. Appendix K gives concepts and formulas for key personnel use and cost metrics for project management.

A work breakdown structure (WBS) should be used to develop detailed project plans. The WBS is a task oriented family tree of phases, activities, and tasks that organizes, defines and graphically displays the total work to be accomplished. Major efforts should be broken down into detailed tasks of limited duration (less than 80 person-hours). Each task should have a beginning and end date, responsibility assignment, defined output or deliverable, specified inputs, and process employed to achieve the desired outputs.

The project's milestone schedule, fiscal budget, and personnel resource (staffing) commitment must be realistic and achievable – not politically correct or wishful thinking. According to some research, the vast majority of projects that experience cost overruns also have scheduling problems, and this leads to increased risk and cost. "Predetermined schedules", which are dictated by imposed and unrealistic deliverable deadlines and project end dates should be avoided. Schedules should be reasonable and valid, based on the availability of personnel, fiscal, and other essential resources and project scope.

Personnel resource constraints and business cycles/schedules may enforce practical limits for project timetables. For example, the training approach (such as train the trainer) may not be realistic in environments where trainers do not have the time to train others. Another common pitfall is an over ambitious implementation schedule (training, data conversion, equipment delivery and set-up, etc.) for remote sites, especially when external factors such as annual business cycles, daily/monthly business schedules, geography/location, personnel availabilities (e.g., vacation timeframes), and/or weather patterns (especially winter in the western part of the state) constrain the installation timetable.

Assumptions underlying all estimates should be thoroughly documented. This will improve the reasonableness and believability of estimates, give audit trails of projections, and help explain variances from realities. Estimates will turn out to be wrong, primarily because of change. The impact of changes on budgets and schedules can be explained more easily and revisions justified better if they can be traced back to differences from assumptions. However, do not become a victim of the 'assumption train' where succeeding assumptions are built upon preceding ones and individual uncertainties associated with each assumption increases the magnitude of the total resulting uncertainty. If this happens, the veracity and validity of the estimates for total work efforts, cost, and schedule become unreliable.

In summary, a project's success or failure can be established before the project starts. The key is to position the project in the best possible (most

risk-free) manner before beginning work. Expectations must be well understood, and plans must reflect realistic schedules and milestones, as well as funding and staffing requirements.

Sun Tzu in *The Art of War* said: “The good fighters of old first put themselves beyond the possibility of defeat. What the ancients called a clever fighter is one who not only wins, but excels in winning with ease. Hence his victories bring him neither reputation for wisdom nor credit for courage. He wins his battles by making no mistakes. Thus it is that in war the victorious strategist only seeks battle after the victory has been won, whereas he who is destined to defeat first fights and afterwards looks for victory.”

15. Develop reliable estimates and employ adequate contingencies - Develop the best possible estimates for costs, personnel requirements, and timetables, and if possible, make use of more than one approach or methodology to obtain them. If possible, do not develop project schedules until the tasks are well defined. Also, whenever possible, try to commit numbers only for one phase at a time; however, funding, governing, and oversight authorities may not allow this luxury. The four project constraints (budget, schedule, scope, and quality) should be balanced against each other (e.g., schedule agrees with the other three) to verify the reasonableness of estimates.

    Although experience is the best source of projections, there are commercial tools for assisting in the preparation of estimates, and these should be used whenever possible. The avoidance of good commercial tools and proven techniques for preparing software estimates results in high risk projects, with critical financial implications. Cumulative (bottom-up) estimates based on detailed work tasks generally are more precise than high-level, order of magnitude approximations based on similar situations. Bad estimates lead to unmet due dates, cost overruns, and disappointing system features and performance. Never underestimate complexities that must be considered and allowed for, including organizational, technical, business/program, staffing, scheduling, timing, political, etc.

    All estimates have uncertainties in bases, resulting in margins of error; therefore, provide for adequate contingencies in plans and schedules to allow for unexpected conditions and unpredicted circumstances. Thinking too optimistically or pessimistically can create problems. Delusional optimism can result in unachievable milestones, unattainable quality goals, and/or inadequate budgets, leading to troubled or failed projects. Chronic cynicism, while overestimating timetables, budgets, and staffing and other resource needs, may provide a secure cushion for errors, but

this also may prohibit a project from ever being considered or funded, so that the benefits are never realized.

The schedule and budget must be congruent with the risk management plan, which consists of risk identification, assessment, and mitigation, of the project. Risks cannot be avoided (bad things do and will happen); however, risks can be anticipated and mitigated. Allowances for anticipating and mitigating risks must be included in project plans, schedules, and budgets.

The estimation process must provide a way to use contingency factors in a consistent way. Contingency is a way of providing for the degree of confidence that the estimators have in the estimates. Contingency factors are proportional to confidence levels; therefore, higher confidence levels have lower contingencies. Contingency factors should not be added more than once, and they may be tied to project risks. In reality, project risks are risks that the baseline estimates may be incorrect. Contingencies may be applied at various levels of the project work plan, depending on the type and size of project and the approach for managing it. In any event, the use of contingencies over the life of the project should be closely monitored, approved, and documented. In project bookkeeping and status reporting, avoid using contingencies in one area to cover overruns in others. Each area should report its true status on its own merits.

16. Recognize realities and adjust plans and schedules to reflect actual events and circumstances and realistic futures – It is virtually impossible to anticipate all project requirements, dependencies, and interdependencies during planning, development, and even into user acceptance testing. Change is inevitable; therefore, change must be managed and accommodated. Therefore, efforts must be re-planned and schedules updated (i.e., re-baseline the project) when it becomes evident that original estimates and projections are not viable. This is necessary to manage, report and account for fiscal and personnel resources in light of actual events and circumstances. Also, it assists in identifying problems caused by imperfect estimating versus those resulting from substandard performance.

    End of project projections of dollar and scheduling variances can be predicted by two methodologies. One is to review realistically the status to date versus the plan and develop a rational estimate to complete for all outstanding tasks (including the addition of newly recognized tasks not in the current plan). The trick is to be realistic – not overly optimistic - in forecasting the need for additional dollar and staff resources and estimating the time and costs to complete remaining work.

Another approach is called earned-value management (EVM). The most important tracking metric in EVM is the cost performance index (CPI). The CPI is the relationship between the values of work accomplished (the "earned value"), and the actual costs, staff resources, and/or time incurred to accomplish that work. Dividing the total planned budget by the current CPI gives an estimate of the end of project status. If you are on budget and schedule with the planned staffing resources, the CPI is one, and the current project budget is the realistic end of project budget. If you have earned only ½ of the value of work done to date, the projected end of project budget is twice the current total project budget.

An important point is to identify and report variances in cost, schedule, scope, or quality as early as possible. Management hates surprises. If an adverse variance becomes apparent, identify root causes (use of estimating assumptions may be valuable), identify corrective actions and alternatives, and make adjustments to plans and schedules as necessary.

When reacting to a late project, it is important to remember Fred Brooks' Law, which states: "adding manpower to a late software project makes it later."

17. Identify appropriate checkpoints and perform independent outside assessments of project status, management, and deliverables - Schedule checkpoints for and conduct independent third party quality assurance reviews and assessments of the project, including its management processes and the quality of its products or deliverables. Qualified personnel should perform these reviews on a regular basis (especially at critical checkpoints). These assessments will assist in:

    - Confirming the validity of the business case.
    - Corroborating the soundness of business/program requirements.
    - Verifying project status against plans (including budget and schedule) and performance in achieving deliverable milestones and quality.
    - Identifying problems or risks unrecognized by the project team.
    - Assuring the integrity of project processes and system deliverables, including project organization and management, technologies employed, and products delivered.
    - Offering suggestions for improvements.

18. Transfer knowledge from product vendors and outside implementers to state staff – From the inception of the project, plans must be made and procedures carried out to ensure that project and product (hardware, software, etc.) knowledge is transferred in a timely manner from vendors to state staff. This is necessary for many reasons, and it is a key responsibility of the project manager.

    Assuming the project precedes in a successful manner to completion, at the end, the state's technical and business/program staff members will have sufficient knowledge and competencies to run, support, and use the application. Otherwise, excess costs will be incurred or unrealized benefits will be sacrificed due to prolonged participation by outside vendor personnel or the under-performance of the asset arising from deficient training. The best times for learning the intricacies of the application are while it is being designed, coded, tested, etc. – not just before rollout or after it is implemented.

    Moreover, contingencies must be made for the situation where vendor problems arise during implementation, resulting ultimately in the replacement of a vendor or a decrease in vendor participation. Without appropriate and complete knowledge transfer to state project staff as the project progresses, excessive time and costs will be incurred bringing a new vendor or additional state staff up to speed. Complications caused by insufficient knowledge of the project or its technical components limits options by the state for dealing with vendors in cases where their performance is called into question (i.e., vendors may hold the state hostage due to their monopoly on knowledge).

19. Prepare complete documentation for enabling project management and to support the design, operation, and implementation of the application - Proper and complete documentation is essential for managing the project; designing, operating and maintaining the application; and implementing new business policies and processes. Documentation should follow the systems development life cycle and the project management methodology used in the endeavor. A common virtual 'project workplace' should be established so that key project management and system design and implementation documentation is made available to all participants. This capability should provide timely, complete and useful information to all project team members and other parties involved in the effort, and it is especially helpful if participants are geographically dispersed.

    Failure to document work plans, policies, requirements, issues, risks, architectures, test conditions/results, training materials, change requests, work flow processes, etc. will lead to misunderstandings, inadequate communications and excessive errors. These will cause rework efforts, additional costs and elongated timeframes. Version control and change

control are extremely important where there are many and/or large documents involved. All involved parties (project team, vendors, etc.) must agree upon formats and contents of documents, templates, reports, etc.

However, project leaders must balance the value of documentation with the time and effort needed to create it. The development of excessive documentation of little or no worth is an unproductive use of scarce project staff and budget resources and can exacerbate risks of schedule slippage and budget overruns. Useful documentation of good quality is invaluable, but unnecessary information of little benefit is a waste of time and money and a drain on project team morale.

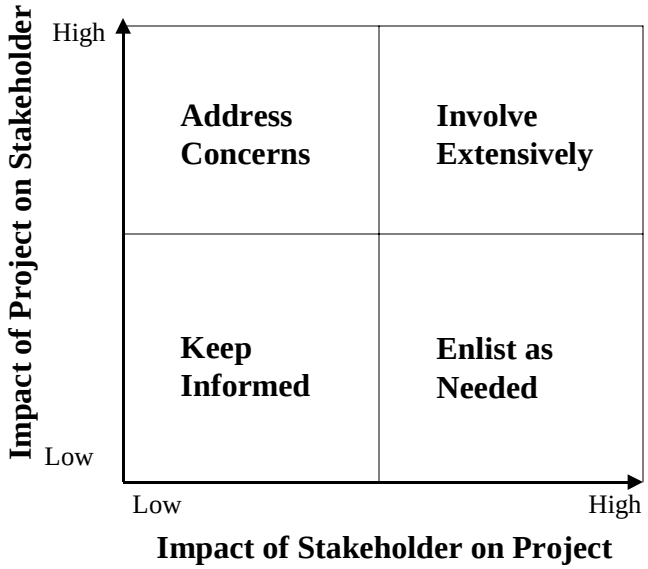
20. Ensure the communications plan is complete in structure, inclusive in audience and focused on important topics - Communication is paramount to project success, and it is important to keep users, interested parties, stakeholders, oversight and funding bodies, etc. involved and aware and the project team informed. Communications must be early, often, useful, and honest.

    Within the project organizational structure (including communications with senior management, oversight boards, and vendors), communications must be timely, clear, and understandable, so that appropriate decisions can be made and necessary and effective actions can be taken. All personnel involved in the communications events must mutually understand terminology, language, format, and meanings of information exchanged.

    Everyone associated with the project needs to fully understand its purposes and goals, their individual roles, and how their actions affect the project. Most major projects impact and involve multiple organizations. Therefore, the project manager must constantly communicate project goals and status to senior managers and other involved managers and personnel. Full and fluid communication will mitigate unforeseen issues caused by uninformed individuals.

    A complete, far-reaching and two-way communications plan must be developed and followed. Information must be targeted to the intended audience (marketing mix), informative, meaningful, truthful and useful (for the users, stakeholders and interested parties, as well as the project team). The communications plan must answer the following questions. What individuals or groups will be impacted by the project or influence its outcome? How should the project communicate with them? The diagram below illustrates this concept.

Concept for Addressing Stakeholders



Key elements of a project communications plan include:

- Approach and processes for collecting, organizing, maintaining and disseminating information, including fact verification, proofing and release approvals.
- Formats and major contents for reports, news releases, information bulletins, status of disposition and progress for key items of interest (such as change requests originating from user groups), etc.
- Media to be used (e-mail, newsletters, Web site, etc.)
- Schedules and frequencies for collecting and releasing information.

21. Provide sufficient amounts of high-quality project support tools - Support tools are essential for the implementation of systems in today's complicated technical, business, and administrative environments. Some experts believe that the lack of use of tools and techniques for estimating schedules and resources may account for 50 percent of software development risk and increase project related variances (time and money).

    The proper alignment of application development or system implementation efforts with the organization's mission requires extensive collaboration between developers/implementers with business/program

areas. Tools support collaboration and alignment by enabling the management of the complete application life cycle from requirements gathering, business logic capture, and application design through coding, testing, deployment, and then maintenance.

The number and types of necessary tools are many and varied and cover the majority of the technical, functional, and management planning and administrative aspects of modern system implementation projects. Equally important, technical infrastructures, such as telecommunications (e.g., LANs and Internet access), hardware (e.g., workstations, printers, and servers), and operating system and support software must be available to run these tools. Also, adequate staffing support must be provided for the tool-based infrastructure.

More restrictive cost constraints and time limitations and increasing quality expectations require the use of good tools to the maximum possible extent in managing projects and completing work tasks. Example areas for which tools may assist (especially collaboration tools for geographically distributed project staff) include project management, (estimating, tasking, scheduling, budgeting, calendaring, risk management, charting, reporting, etc.), testing, requirements, issues, coding and debugging, timesheet and time reporting, modeling, version control, configuration, training, help desk, quality, and asset inventory and management.

Advantages of project management tools include the following:

- Estimation of task, activity, and project duration.
- Estimation of overall project costs and comparison of estimated costs against actual expenses.
- Determination of the skill sets, work hours, and number of resources required for completing a project.
- Ability to identify key tasks and activities or phases critical to the on-time, on-budget completion of projects and to track project progress against the critical path using Critical Path Methodology (CPM).
- Ability collect and apply actual work performed against project plans and compare results against project estimates, both in terms of time and cost, for projects governed by a formal project plan.

- Ability to save and store completed-project plans and actual results for retrieval as a reference and resource for project knowledge when creating new projects.

- Ability to identify and create project issues and to resolve such issues through re-planning and re-estimation of the project.

Project planning tools, such as the analysis of a project's critical path are necessary for larger, more complex undertakings. The calculations of reliable time and resource estimates, and other parameters, such as earliest start, latest finish, and allowable float, are difficult or virtually impossible for unfamiliar types of projects (which all statewide projects are) without the appropriate tools.

Project management toolsets come in enterprise and desktop versions with several vendors in each space. Project management is not just about planning, estimating, and tracking, but also about supporting the communication and documentation of project activities while they are being executed. Tools should provide a central place to store and maintain project related structured and unstructured data, such as notes, comments, risks, issues, and charters.

Other attributes to consider in evaluating and selecting project management tool suites include open database connectivity and architecture, workgroup capabilities, network flexibilities, ease of use, project scheduling methodology, project task/field features, base lining and tracking progress of the project, resource features, calendar features, cost management features, risk management features, project reports, and management reports. Real-time project status reporting is facilitated through the collection of data through web-based technologies, especially on work efforts, task accomplishments, and time expenditures.

The term portfolio and project management (PPM) is being used to describe a comprehensive set of tools that extend from the traditional project management (PM) tools to the automated assistance in evaluating and prioritizing prospective IT investments (projects). Functions included in PPM may include those of portfolio management and the nine management processes of the Project Management Institute's (PMI) The Project Management Body of Knowledge (PMBOK). A full set of functions contained in PPM suites may include: pipeline management, scope management, time management, resource management, cost management, procurement management, communication management, quality management, risk management, and integration management.

A class of tool sets called professional services automation (PSA) offer a combination of project management and project portfolio management

capabilities. These address comprehensive project management and cooperate governance. They provide the visibility and insight for IT and business executives to balance staffing and dollar resources among competing projects, as well as keep abreast of individual projects to ensure budgets and milestones are being met. Key project stress points (such as costs structures, project flexibilities, staffing and other resource constraints, and risk mitigations) can be understood and managed from an enterprise perspective.

PSA tools have capabilities such as budgeting and planning, contract management, financial management, project accounting and charge-back, project scheduling and tracking, project reporting and analytics, staffing and other resource management, and time and expense reporting. Senior management can allocate and track major resources, including corporate knowledge, finances, people, and time to their projects and other initiatives and activities. By tracking projects individually and across the enterprise, senior managers can address project related concerns, such as appropriately allocating resources (dollars, people, etc.) on current and future projects, determining which projects are offering the best value or most benefits, and determining why budgets are overspent or milestones late. In summary, these tools support enterprise portfolio management, project management offices, and individual projects. PSA vendors include Mercury Interactive, Niku, OpenAir Inc. Primavera, Tenrox Compuware Corp., Lawson Software, Oracle Corp. PeopleSoft, Inc., SAP AG, and Siebel Systems, Inc.

An effective help desk is essential for statewide IT projects to succeed. Help desk tools are available to improve the quality of support for pilot and implementation rollout sites and increase overall user satisfaction. For effective management of the help desk function, metrics (such as number of calls, first call resolution, and call duration) must be developed, reported, and monitored. The help desk is a convenient place to identify problems by type and degree of severity and recognize opportunities for providing better training, improved user manuals, and more complete on-line self-help capabilities.

Software development tools may be useful in creating code and compiling the code into machine-readable language to improve the productivity of designers and programmers. Newer tools provide capabilities so that programmers do not have to know or understand the underlying technology. Tools have limitations in what they can do and how things are done functionally and technically. Also, they may constrain future modifications and changes because the code generated may be tied to the tool (the tool is the only thing that understands the code, so the tool must be kept for the life of the code).

The right software development tools must be used for the right things and the right reasons. Two key considerations for employing software development tools are (a) the output of the tool must be well understood and acceptable for the technical approach and architecture of the application and agency, and (b) the tool must perform effectively (i.e., capable of generating the desired code and providing the required functionality).

Requirements identification and tracking tools have a big impact on the success of a project. These tools can have enormous benefits if they are used to assist in communications among all stakeholders, such as executive sponsors, users, and outside interested groups.

Version control and configuration/change management tools are essential for large-scale software developments and hardware and software deployments. Hosting and client configurations and particular versions of application, operating system, database, middleware, and other software must be known from complete, accurate, and up-to-date information repositories. Changes must be well planned, monitored and tracked, and implemented thoroughly and prudently.

Representative risk management tools are listed below.

Vendor and Tool Name	Web Site
C/S Solutions – Risk+ for MS Project	www.cssolutions.com
Palisade - @Risk	www.palisade.com
Pertmaster – Risk Expert	www.pertmaster.com
Monte Carlo – Primavera	www.primavera.com
Risk Trak – Risk Services and Technology	www.risktrak.com
RMC Project Management – various	www.mcproject.com
SmartOrg – Portfolio Navigator and Decision Advisor	www.smartorg.com
Welcom Software Technology (WST) - WelcomRisk	www.wst.com

22. Minimize modifications to purchased software (COTS or GOTs) packages - If possible, a commercial off-the-self software (COTS) or government-off-the-self (GOTS) package should be purchased rather custom designing software. For both COTS and GOTS, the enhancements or modifications to the package should be minimized. Some pros of COTS and GOTS packages are they offer economies of scale in costs/prices for development and support through the aggregation of demand from multiple customers, proven reliability and integrity of processing, vendor support and upgrades through patches and on-going releases, and the adoption of best business practices. Cons include the inability to support all business/program requirements without customization, creation of a dependency on the vendor, forcing of change to the state's business/program processing, mandated software upgrades, and possible lock-in of long-term maintenance and upgrade costs.

    Ideally, there should be no modifications to COTS or GOTS packages; however, it may be unfeasible to change incompatible state business processes, obtain relief from conflicting statutory regulations, and/or reform contradictory organizational structures or governance protocols. Therefore, the practical concepts are (a) minimize all changes and modifications to purchased software, and (b) if necessary to customize packages, do so in a manner that is least disruptive to the acceptance and implementation of future on-going patches and vendor upgrades (releases). Moreover excessive customization will have a negative effect on the project's budget and schedule.

    A rule of thumb is the COTS or GOTS package should provide 80 percent of business/program functionality, with no more than 20 percent requiring custom development. Otherwise, the project should not be conducted as a COTS or GOTS modification, but as a custom development effort, which means a higher cost and longer schedule. Excessive customization brings into question the reason for selecting a COTS or GOTS package in the first place, which is the need to build and maintain a custom system.

    Code modifications to packages will complicate the implementation of future enhancements and releases, as features and capabilities unique to the agency or business/program must be reinstalled in the newer versions of the base product. Over time, the modified software will become further out of synchronization with the commercial version; therefore, the implementation of releases will become more expensive and time consuming, resulting in increased operating and maintenance costs. If changes are required to commercial software, to the extent possible, make them outside of the package code.

    In summary, COTS or GOTS packages should not be customized. If it is absolutely necessary to customize packages; ensure that all decision

makers in the chain of command know and understand the extent, costs, and short- and long-term ramifications of them; minimize the magnitude or scope of modifications; and modify them in ways that minimize changes to the core system supported by the vendor. Additionally, package vendors often provide tools to facilitate modifications, and these should be used where appropriate and beneficial. Another approach is to persuade the vendor of the COTS or GOTS package to include the customized features in the standard version of the software, obviating the need for ongoing modifications to the customized code for accommodating new releases of the package.

A major problem resulting from the implementation of COTS or GOTS packages is often they are modified beyond their abilities to be customized from technical, economic, and/or ongoing support perspectives. Thereby, all benefits from using them are eviscerated.

An article by Chad Dickerson in CTO Connection dated January 5, 2005, states: “Software expert Robert L. Glass notes in his excellent book Facts and Fallacies of Software Engineering that every 25-percent increase in problem complexity results in a 100-percent increase in the complexity of the solution. Smart IT shops should limit unneeded complexity at every turn, choose their customizations carefully, and turn a deaf ear to the siren song of the perfectly customized solution.”

23. Identify and accommodate security and privacy needs – Today’s world presents the compelling threat of physical and cyber terrorism. Several factors are influencing how the processes and IT infrastructures of applications must be designed to deal with security and privacy issues. These include the emergence of legal mandates and compliance requirements (such as HIPAA); ever-growing presence of cyber crime (hackers, identity thieves, and malicious pranksters); needs to link previously secure internal systems with less secure external systems to meet real-time business needs; security demands of new technologies (such as wireless network devices and Web services); and requirements for integrating disparate multiple application packages. Accordingly, the needs for providing robust and effective security for assets and protection of privacy of individuals and confidentiality of data are immense and increasing dramatically. Failure to meet security and privacy requirements can result in political embarrassment, additional and avoidable costs to taxpayers, loss or diminished citizen services, and public distrust and dissatisfaction.

    Privacy deals with the use and abuse of authorized information access. Security involves controlling and preventing unauthorized information access. Privacy and security are distinct business concerns, and the methods required to address each are different.

Information assets must be evaluated and classified, and protective controls must be assigned. These controls should be commensurate with potential threats and established values of the assets. Appropriate security measures, including policies and procedures, must be in place to protect information assets from accidental or unauthorized use, theft, modification, destruction, and to prevent the unauthorized disclosure of restricted information. These measures must ensure the confidentiality, integrity, and availability of information assets.

Security and privacy considerations must be integrated into all phases of the project life cycle in order for them to avoid becoming afterthoughts. These phases may include: business/program requirements, applications architecture, applications design, construction/coding, testing, implementation, post-implementation, and retirement.

Security controls and privacy protection must be risk-based, threat- and vulnerability-focused, and cost-effective. Adequate security and information protection must be commensurate with the risk and magnitude of harm resulting from the loss, misuse, unauthorized access to, and/or modification of the application or information stored or flowing through the application and associated systems. Specific methods and capabilities must be available and used to continually access and understand the risks and potential for loss or damage. Steps must be taken to maintain risks at acceptable levels, and procedures must be in place to ensure that controls are implemented effectively and remain effective over time. Special attention must be paid to applications that promote or permit public access, other externally accessible applications, and those applications that are interconnected.

The identification and assessment of business, program, and financial risks is an essential step in determining what IT security controls are needed and what resources should be invested in these controls. Risk assessments determine the value of agency information assets and identify the threats that could affect those assets in terms of the size of the impact and the likelihood of the threat occurring. Vulnerability assessments locate weaknesses in the state's and agency IT security infrastructure. It includes the identification of applications behind in security-related patches, as well as penetration testing. Mitigating actions should be taken to address threats to high-value assets that have a high probability of occurrence, high adverse impact if they occur, or both.

With respect to privacy and confidentiality, the collection of information that identifies individuals must be limited to that which is legally authorized and necessary for the proper performance of agency functions. In addition, the sharing of information that identifies individuals or contains

proprietary information must be limited to that which is legally authorized, and appropriate conditions must be imposed on its use where a continuing obligation to ensure the confidentiality of the information exists. In summary, information must be protected against unauthorized use, disclosure, modification, damage, or loss.

Key elements of security include identity management (identification, authentication, and authorization); non-repudiation; audit trail creation and analysis; cryptography management (encryption); virus protection; fraud prevention, detection and mitigation; and intrusion prevention and detection. Areas to address for cyber security include desktop, data, applications, networks, threats, vulnerabilities, business continuity, and privacy protection. While most security efforts historically have been focused on infrastructure and operating systems vulnerabilities, security design and coding principles must be incorporated in the construction of applications from the outset.

The increasing strategic usage of and reliance on telecommuting and Internet-connected applications are exacerbating security problems and threats related to malware, phishing, scams, viruses, worms, and Trojan horses. Combinations of preventative measures - such as intrusion protection and detection systems (IPS and IDS), firewalls, virtual private networks (VPN), anti-virus software, updated patches, and policies and procedures - are necessary to thwart the more innovative, ever-increasing, and more destructive threats to applications, operating systems, and platforms. The integrity and confidentiality of data should be protected through encryption techniques appropriate to the business/program and security requirements of the system. Sensitive, confidential data should only be transmitted via secure methods when submitted through public facilities. Depending on risks and vulnerabilities, encryption may be needed for either or both electronic communications and databases.

Patch management and the timely application of patches is a key element of ongoing operational security practices. The National Institute of Standards and Technology (NIST) offers Special Publication 800-40, *Procedures for Handling Security Patches*. A thorough inventory of hardware, operating systems, and applications is necessary for effective patch management. This inventory assists in determining the items that are vulnerable and require remediation, locating them and identifying their owners, and prioritizing those to be patched based on a risk assessment.

In late 2003, NIST released the initial public draft of NIST Special Publication 800-53, *Recommended Security Controls for Federal Information Systems* (NIST SP 800-53). The pending standard will be required for most US federal systems in 2005. NIST 800-53 and the related standard FIPS 199 may provide guidance for state applications.

NIST's Information Technology Laboratory recently published NIST Special Publication (SP) 800-35, *Guide to Information Technology Security Services, Recommendations of the National Institute of Standards and Technology,* which provides guidance to help organizations negotiate the many complexities and challenges in selecting information technology security services to maintain and improve the security of their IT systems. The foundation for the selection of IT security services (whether obtained from internal sources or external vendors) is a comprehensive information security management program, including risk management procedures that are applied throughout the system development life cycle (SDLC). NIST SP 800-35 describes the roles and responsibilities of the people within an organization who select, implement, and manage the IT security services life cycle, and it provides an overview of the life cycle and describes the issues to be addressed concerning security services. Appendix A of NIST SP 800-35 contains a list of references of publications and Web pages. NIST special publications can be found at http://csrc.nist.gov/publications.

A security risk assessment must be completed. As a minimum, it must document compliance with statewide and agency policies and standards and architectures, and it must address physical security, application control security, data transmission security, and business continuity. The risks of non-compliance with privacy and security laws, regulations, and policies must be understood and assessed. Asset management capabilities are necessary to inventory and control technology assets within high security zones with the greatest risks of security breaches. Without the appropriate levels of security, the state may risk financial loss; business/program disruption; destruction, loss, or misuse of sensitive data/information; property loss; political embarrassment; and loss of citizen trust and public goodwill.

In summary, over time and with experience combating a multitude of cyber attacks, organizations have learned that perimeter firewalls, anti-virus software, and intrusion detection systems are not enough to protect them against these outside threats. A vulnerability management program, consisting of a set of processes and technologies, must be implemented. The program includes the: (a) establishment of a security baseline; (b) discovery, prioritization, and mitigation of vulnerabilities; (c) establishment of security controls; and (d) elimination of root causes.

Finally, the system and infrastructure must be tested to ensure they are not vulnerable to hackers or misuse. Intrusion for unauthorized penetration and other security related testing must be included in the test plan.

24. Provide for disaster recovery and business continuity – Since the events of September 11, 2001, disaster recovery and business continuity have become more visible, and plans and provisions for performing them are receiving extra scrutiny. Disasters may originate from many sources, including natural events (such as hurricanes, floods, tornadoes, etc.), human error, industrial accidents (e.g., leaking water pipes, fires, electrical blackouts, etc.), physical terrorism (e.g., bombings, arson, use of chemical, nuclear, or biological agents, etc.), and cyber terrorism (e.g., worms, viruses, Trojan Horses and other destructive programs).

    Traditional disaster recovery (DR) focuses on ensuring a "business as usual" state in the event of an emergency. This type of strategy includes backing up and recovering all IT systems, applications, resources, and data, usually through an alternate site or provider.

    Business continuity (BC) is a more extensive operational imperative that defines critical business functions an organization must recover within a predefined time frame to maintain viability. A BC plan identifies potential risks and mitigating steps for resuming critical business functions. Key objectives for a BC plan include:

    - Limiting potential economic loss.
    - Minimizing the extent of disruption to critical business/program functions.
    - Maintaining regulatory compliance, contractual mandates, and/or public image and trust.
    - Identifying immediate recovery resource needs.
    - Coordinating effective recovery and restoration tasks.

    There are two occasions for developing DR/BR plans. The most prevalent and traditional one involves the recovery from a problem with the application after it is implemented and is operational. The other one covers the plans for dealing with and recovering from problems that may originate during implementation (such as during rollout). Each is addressed below.

    Traditional DR/BC

    The recovery from potential disasters and the continuation of business activities are essential operational capabilities for both individual applications and the supporting technology infrastructures. Requirements regarding and adequate provisions for disaster recovery/business

resumption must be accomplished in the planning for, design, and implementation of the application - not waiting until it is operational.

During the planning for and design of the system, business/program staff must be consulted to determine key criteria that will drive the applications technical architecture and the disaster recovery/business resumption plan. Questions to be answered include the acceptable period the application can be unavailable without adversely impacting critical business delivery and the amount and type of data loss that can be tolerated. Recovery point objectives (RPO) and recovery time objectives (RTO) must be determined. The RPO is the acceptable transaction loss when recovering from a disaster (such as recover from the last backup that is 24-hours old). The RTO is the desired time to recover an application (such as recover and be back on line in 24- or 48-hours).

Business continuity and disaster recovery (BC/DR) planning for a specific application must be an integral part of the state's and agency's overall business continuity management (BCM) program and plans. A risk assessment must be performed to determine potential vulnerabilities, and investments in BC/DR resources and capabilities must be proportionate to the business impact and plausibility of risks. The integration of business processes and governmental programs often have resulted in a complex web of tightly coupled interdependencies of applications, databases, middleware, and other technical infrastructure components. Therefore, considerations for BC/DR must include hardware, communications, software, operational processes (especially change management and configuration management), and personnel (right people, right place, and at right time).

Standards for information security and business continuity include Control Objectives for Information and related Technology (CobiT), Disaster Recovery Institute International, and International Organization for Standardization ISO/IEC 17799:2000 Code of Practice for Information Security Practice. N.C.G.S 147-33.9 Business Continuity Planning requires agencies to develop, continually review and update a business and disaster recovery plan with respect to information technology.

Mission critical applications and infrastructure components must be identified and plans for protecting and recovering them must be developed. Attributes for determining the criticality of applications or infrastructure include functionality (is it necessary for health or safety of citizens or involves large dollar or significant transactions), scope (how many citizens served), connectivity (used by other systems, programs, agencies, or governments), and irreversibility (is the asset replaceable/recoverable if damaged or destroyed).

Applications also can be classified by risks. High-risk systems involve large dollar or significant impact transactions, or contain highly confidential or sensitive data, or impact a high percentage of the population, or are multi-organizational because they can impact the risks to interconnected systems. Medium-risk applications have moderate or low dollar value transactions, or contain data items that could potentially embarrass or create problems for the parties involved, or impact a moderate portion of users/citizens/customers. Low-risk systems are stand-alone, and publish generally available public information, and impact a relatively small portion of the population.

A business/program impact analysis should be conducted to ascertain time-sensitive business/program processes (those that can not withstand a long outage), financial exposures and operational impacts. Risk assessments must be performed to identify potential unwanted events, their likelihood or occurring, and their extent of impact if they occur. Backup, recovery, and replacement strategies and plans must be developed for the time sensitive, mission critical applications and components. These plans must be updated continuously and tested frequently to validate their efficacy.

Plans and procedures must be developed and tested to ensure that all components of critical applications and their underlying infrastructure can be recovered and made operational in a timely manner in the event of a disaster. The policies, practices and procedures for disaster recovery and business continuity are key components of the service delivery plan, which covers ongoing operations after the application is implemented.

Also, backup and recovery capabilities are required for major tools, software and databases used in the project. Therefore, disaster recovery and business continuity for the project itself must be accommodated in project plans and work efforts.

DR/BC for Application Implementation

As projects encompass more integrated/interfaced code and more dependent and closely coupled business processes, there are infinite combinations of small technical problems that can have devastating effect on business/program operations. In many cases, these potential problems cannot be cost-effectively addressed through better project management practices, such as more intense or expanded risk mitigation efforts. In some cases, the best (and often the only practical and/or less risky) way to deal with these is to develop adequate contingency plans for managing situations where the business/program processes have been significantly interrupted or stopped.

Typical contingency plans involve procedures such as developing manual workarounds, reverting back to the old system, etc. These plans and actions keep the business/program going (even under difficult situations and employing undesirable practices) until the problems can be resolved and the application recovered. The transition plan must assume the system will fail during implementation (such as during rollout). The important point is contingency planning cannot be viewed solely from an IT perspective – it must be addressed from an integrated approach of IT and business/program processes.

25. Select and use the right technologies - Ensure the technologies are appropriate for solving the business/program problem, challenge or opportunity. The following questions are examples of those that must be answered. Do they comply with state and agency technical architectures? Do they lead to proprietary lock in? Is state/vendor staff capable of implementing and maintaining them? Are they compatible with the current agency and state technical infrastructures, or do they require sufficient reinvestment in new infrastructures? Do they allow for scalability (increase in volumes of data, transactions, and/or users) and extensibility (introduction of new technologies)? Do they support security and disaster recovery/business continuity? Do they allow for information exchange among applications in a secure manner? Do they have long-term economic and technical viabilities (vendor and industry support)? Are they free of bugs? Are they ending their life cycles or becoming obsolete? Are they proven and reliable or too new to judge? Do they require too much time and cost to implement (make it work) and support – total cost of ownership concept?

    New technologies often offer great opportunities for meeting business/program goals and objectives and/or governmental initiatives in a cost-effective and citizen-centric manner. However, new technologies often present technical, operational, and vendor risks. On the other hand, old technologies present legacy problems of decreasing vendor support, scarcity of staff support, inability to meet new and emerging business and technical requirements. New applications should not be developed using old or outdated technologies. Investigation and analyses must be performed to balance risk versus reward and if selected, to develop an appropriate risk management strategy and plan for adopting the technologies.

    In calculating the reliability, availability, and serviceability of an application, its entire technical ecosystem must be considered. It is only as strong or secure as its weakest link (component), and it should not have a single point of failure. Therefore the capabilities and characteristics of multiple technologies (hardware, software, and communications) must be evaluated.

Major technological risks are: a) risk that the technology does not live up to expectations, and b) risk that the technology is not well suited for its intended use. Do not be enamored with the technology, rather make sure the technology will meet business requirements, enable the satisfaction of program goals, and lead to the achievement of the benefits and objectives of the project.

26. Ensure the application's technical architecture is complete and approved, supports the agency's business/program architecture, and fits the statewide and agency technical architectures - The business/program architecture is an overview description of the business/program and how it works and accomplishes its goals and objectives. It includes major policies; business rules, functions and events; assets and processes to execute them; information flows; interactions with other business/programs; and management principles. It may describe both the current situation (as is) and future (to be or desired) models of operation. Business/program architectures are often influenced by governance roles and structures. These involve areas such as reporting relations; duties, responsibilities and accountabilities; operational flexibility; funding sources and flexibility; centralization versus autonomy; etc.

    The application technical architecture, with other supporting system technical documentation, describes from a technical perspective how the system (a) will accomplish its purposes and objectives and (b) will perform in the manner desired. The application technical architecture must fit within the statewide and agency's technical architectures and enable the agency's business/program architecture. Discontinuities or incompatibilities among these architectures will lead to excessive costs and sup-optimal operations. Moreover, the application technical architecture must ensure that the asset can operate efficiently and function effectively within the statewide and agency's technical infrastructure, including the use of statewide common technical services and shared technical infrastructure.

    Well-formed business process models provide serve as guides to establish application architectures whose service-oriented and event-handler components have a high degree of affinity with the business processes. System architects should be capable of interpreting business process models and establishing application architectures with service-oriented and event-driven styles that trace back to the requirements specified in those models. This trace ability of architecture components to the business processes or business events supported by them is important for ensuring the technical architecture accomplishes all business requirements and does so in an efficient and easy to maintain manner.

Wherever possible, open architecture computing and communications environments should be employed. Openness decreases design and operating costs, enhances connectivity among subsystems and components, and facilitates future technology upgrades.

Users must be involved in the system design, particularly the design of user interfaces. The user interface is the all-important gateway between the user and the machine. If it is not well conceived and designed, training problems will be exacerbated, system acceptance will be much more difficult, and benefits or values will be delayed in accruing or never achieved.

Architectural problems must be identified and rectified early as possible in the system design process. A formal review process should be used to catch and resolve all architectural issues. Key items to verify include database design; telecommunication bandwidths; response time capabilities; reliability, availability, and serviceability (RAS) features; ease of use; information exchange processes; security functions; and backup and recovery facilities.

An application is only as good (reliable, secure, etc.) as its weakest link (component); therefore, the entire technical ecosystem must be considered in its architecture. Also, there should never be a single point of failure. An Advisory Note from the Robert Francis Group dated July 29, 2004 gives the results on the Cause of Data Loss from a study of Horison Information Strategies as follows:

Cause of Data Loss	Percent
All hardware components	44%
Human error	32%
Software	14%
Virus, security breach	7%
Natural Disaster	3%
Total	**100%**

This indicates that the overall reliability of the technical infrastructure is more important than any single component in the design of an application. All of the potential causes or vulnerabilities must be considered.

System designs must be completed and approved before proceeding to subsequent implementation steps. Failure to do this is analogous to starting to construct a building without complete blueprints.

Agency technical architectures follow the statewide technical architecture and consist of principles, best practices, standards and infrastructure assets that comprise the technical blueprint for the agency as a whole. It is an integral part of the agency technology plan, which links to the agency's strategic business plan. In concert with the statewide technical architecture and the state's shared technical infrastructure and common technical services, the agency technical architecture ensures the agency's technical assets and infrastructure will support its information needs and business/program operating requirements.

The agency technical architecture describes how:

- Individual applications will work together and information can be shared effectively and efficiently and in a secure manner both within and outside the business/program and the agency (i.e., intra-program, inter-program, intra-agency, inter-agency, and among governments).

- Applications are scalable, meet operating performance and integrity requirements, are adaptable to changes in operating needs, can incorporate new technologies, and can be maintained economically over their useful lives.

- Statewide and agency common shared services and infrastructures can be used to the maximum possible extent.

- Proprietary systems and components and long-term vendor or technology dependencies are minimized.

- Security, privacy, confidentiality, accessibility, and disaster recovery and business resumption needs are accommodated.

- The agency's technical infrastructure (hardware/software configurations, communications, databases, etc.) can respond easily to new business/program requirements (adaptability) and accommodate new technologies (extensibility).

In general, a typical agency technology plan outlines the present technical architecture and infrastructure, describes the future direction for major components of the technical architecture and infrastructure, and summarizes the strategy for progressing to the desired position. Major

areas addressed in the agency technology plan may include data/information, computing/platforms, telecommunications, security, accessibility, e-government, business continuity planning and disaster recovery, management of distributed IT assets, personnel, major applications, project management, and software development.

A potential cause of project failure is the application by itself works well and supports the business/program objectives for which it was designed. However, it is incompatible with the overall agency or state business/program processes and/or it does not integrate or work with other applications necessary to meet agency strategic missions or the goals and objectives of other business/programs. In today's complex business/program and technical environments, where mutual support and information sharing are essential requirements, it is necessary that individual applications work well individually and meet specific business/program needs. However, it is not sufficient that they perform satisfactorily as lone entities. They must work with others, from both business/program and technical perspectives.

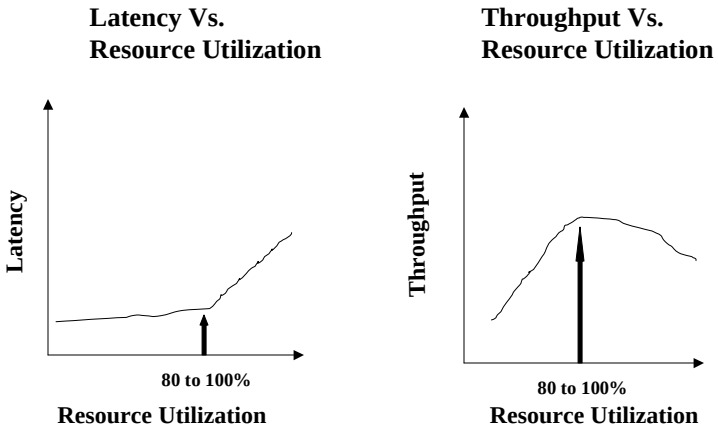
27. Know and understand the inner workings and hidden mechanisms of technical operations - Many of today's systems are complex amalgamations of components that must perform satisfactorily individually and work well together. Performance of the system often depends on the capabilities of the weakest part or the slowest telecommunications link.

    Every part must work as designed and function as specified, and each component must work well with the others. The component compatibility requirement may be the most difficult technical challenge to overcome. Incongruity of components and/or technologies will create excess complexities leading to increased development and maintenance costs and minimal performance of the application.

    Before coding and testing, detailed and complete applications architectures must be developed to prove on paper that the systems would meet business objectives and fulfill requirements for technical operations. Eliminate or minimize single points of failure, and ensure the applications will work reliably and with integrity under both normal and exceptional operating conditions, including disaster recovery.

    System performance is defined as it ability to meet three key concepts: 1) latency, 2) throughput, and 3) resource utilization. These are highlighted in the diagram below.

Key System Performance Concepts



Latency is defined as the period of time that one component in a system is waiting for a response from another component, and it is typically measured in units of time, such as seconds or milliseconds. Generally speaking, latency increases slowly in a linear fashion. However, once a system resource approaches 100 percent utilization, latency increases dramatically, as illustrated in the diagram above. A sudden increase in latency during performance tests usually means at least one of the system resources is utilized at or near maximum capacity. Because a resource is over-utilized, components that depend on this resource cannot keep up with requests; therefore, they cannot respond immediately to other components. As a result, the components waiting for a response just sit and wait. If overall latency is a problem, latency must be measured between each component to identify the root cause. Low bandwidth (network latency) and/or component (application latency) may be the problem area. Latency may be solved by:

- Optimizing components that create the traffic jam. For example change server configurations to handle more threads during peak loads.

- Minimizing the number of requests whenever possible. Requests are double-edged swords. One, each request increases aggregate network latency. Two, requests require resource utilization, which creates bottlenecks if over utilized.

- Scaling the system horizontally (adding more servers, etc.) or vertically (adding power to each server, etc.). If resource utilization is the problem, throwing more resources (CPU, memory, load balancing, etc.) at the system will improve performance; thereby, reducing latency.

Throughput refers to the amount of data that is transferred from one component to another in a specified unit of time, and it is typically measured in requests per second or bytes per second. Measuring throughput is necessary to identify performance bottlenecks and to determine hardware and network requirements (i.e., capacity planning). Like latency, throughput is dependent on resource utilization, As long as resources are adequate, throughput will increase linearly along with the user load. However, once resources approach their maximum capacity, throughput will plateau and perhaps decrease as resource utilization approaches 100 percent. System resources are not always the cause of a throughput plateau. Specific technologies frequently have throughput limitations because of the way they are designed. An approach for measuring and refining throughput follows:

- Measure the throughput for each system component. Measuring the throughput for the overall system will not pinpoint problem areas.

- Test each component with an average load, and increase the load until the required peak load is reached. Simply testing the system under an average load will not guarantee that it will work satisfactorily under peak loads.

- Eliminate bottlenecks by modifying system configurations, minimizing round-trips, and scaling the system horizontally or vertically.

Resource Utilization refers to the usage level of system resources such as memory and CPU. It is typically measured as a percentage of the maximum available level of the specific resource. Increasing throughput generally utilizes more system resources. When throughput plateaus, it is likely that a system resource has reached it maximum available capacity. As a result, it has become a performance bottleneck. It is possible for resources, such as CPUs, to adversely impact latency or throughput even though they are only at 80 to 90 percent capacity. The only way to identify resource bottlenecks is to run performance tests while increasing the capacity of one single resource. If the performance of the system increases by adding capacity to that specific resource, the problem area has been identified. Otherwise, upgrade the next suspected resource, and run the performance test again. There are two options for resolving

problem resources: 1) upgrade the specific resource with a higher capacity, or 2) modify the application to limit the use of the specific resource. While the first option may be the easiest, it may be the most expensive; therefore, not acceptable to users or oversight organizations.

28. Know the key technical components that impact the implementation and ensure the infrastructure is adequate for supporting the application - Statewide rollouts involve the competent management of diverse technologies and broad-based infrastructures. Most applications take advantage of and leverage hardware (e.g., PCs), software (e.g., browsers), and communications resources (e.g., Internet service providers, wireless technologies and providers, etc.) that already exist in or serve geographically dispersed remote sites. Current, accurate and complete inventories or repositories of essential hardware and software and communications equipment, components and capabilities are necessary to plan and support large-scale rollouts.

    An asset management program is useful for collecting, storing, maintaining, and reporting information on distributed technology assets. Asset management is an integrated approach for controlling IT assets throughout their life cycles, and it involves management processes, strategies and supporting tools. Repository tools consolidate physical, financial and contractual information. Auto-discovery tools automatically collect physical data on networked assets. Software usage tools report usage trends of distributed applications.

    In addition to knowing the state of technical readiness (availability of or access to types and capabilities of technologies) at remote sites, the state of user readiness must be ascertained and documented. This includes technology awareness, staffing availability for training, degree of self-sufficiency to solve problems, etc.

    The technical infrastructure must be adequate for supporting the application. Steps must be taken to ensure the hardware, software, and communications infrastructure will support performance and growth requirements. This is especially true for statewide common technical services and shared technical infrastructure. Requirements in the areas of communications speed (bandwidth), application response, security (such as encryption, authentication, authorization, and protection against other vulnerabilities), storage and retrieval, system availability, etc. must be accommodated.

    For Web-based applications using Internet communications, bandwidth alone is not a sufficient measure. Latency is another key measure. The number of pieces of equipment (e.g., routers) that the IP packets have to pass can create high values of latency, which negatively impact

performance. IP packets must be examined by each piece of network equipment; therefore, overhead time increases as the communication networks become more involved or complicated by the addition of devices to the path or by circuitous routes.

Another area of potentially serious problems is the application is not technically compatible with the multitude of hardware and software products and configurations and communications capabilities located in remote sites and necessary for its use. For example, PCs may be undersized; reliable and fast speed Internet connections are not available, or browser versions are too old. Incompatibilities or deficiencies in the technical components required to operate the application will reduce system performance, create user frustrations, elongate implementation schedules, increase project costs, complicate problem isolation and resolution, and increase maintenance expenses.

29. Develop sound and comprehensive test strategies and test systematically and exhaustively - Application implementation projects involve four primary activities. You must define what must be done (requirements), describe how to do it (design), do it (custom code, modify package, etc.), and ensure it works (test). While the first three are usually accomplished in a linear sequence (maybe multiple times in an iterative manner for some system development models such as spiral and rapid application development), testing should be a pervasive part of all the stages.

    You can never test too early or too thoroughly. Develop complete and detailed test plans. System requirements must be tested to make sure that they are accurately defined, and tests must be developed to ensure that no significant requirements are missing. System and program designs must be tested to ensure that they will work and accomplish what they are supposed to from business/user perspectives.

    The building of master test configurations may be useful. Unit, integration, system, and acceptance tests may be required. Performance testing is a must, and this includes load testing (behavior under expected conditions), stress testing (behavior under extreme conditions), and scalability testing (performance profile under gradually increasing loads).

    Testing involves identifying what to test (conditions), how to test (cases), building the tests, executing them, evaluating results, checking completion criteria, and reporting status. In addition to testing that a system does what it is supposed to do, it must be tested to ensure it doesn't do what it is should not do. This involves testing for security problems from outside attackers trying to exploit common vulnerabilities and testing for unpredictable behavior by authorized users. Additional rigor must be

applied when testing integrated/interfaced applications or components from multiple vendors or sources.

Testing should provide a knowledge and understanding of the behavior of the system and its limitations, especially its operating envelope for operating performance items such as throughput, concurrent users, etc. Results of testing should give key statistics regarding resource utilization, such as memory usage, CPU load, database connections, network saturation, disk utilization, etc. As part of the testing effort, measurements should be taken of significant items affecting user satisfaction, including times for log on, responses, screen refreshes, printing, etc. Areas of unsatisfactory operating performance should be identified, root causes found, and problems corrected prior to pilot or rollout.

Public-facing Web applications are created to provide satisfaction to constituents; therefore, they should be designed to offer ease of use, reliability and speed. Capacity prediction and load testing are essential functions for these high-visibility or mission-critical Web-based systems. Embarrassing experiences with citizen self-service applications can result in long-lasting and negative impressions that can damage the state's credibility, raise doubts about the security and trustworthiness of it business processes, and undermine user confidence in online services.

The testing of any large-scale application is a complex and resource-intensive challenge. A robust infrastructure of tools, hardware facilities, and communications resources is required for testing these applications. Likewise, the staffing for the testing effort must be sufficient in number and skills of people, and the organizational structure must include appropriate management processes and procedures.

When testing integrated systems (e.g., ERP applications with multiple components/sub-systems) or applications that interface with others, the test plan must include end-to-end processing of transactions among the components/sub-systems of integrated packages and among interfaced applications. This is the only way of determining that the data (format, content, timing, etc.) expected to be exchanged is, in fact, the data that is exchanged.

Performance tests are executed to gather latency, throughput, and utilization metrics. These are defined in a previous standard. The most common performance tests for distributed systems are called **load testing or stress testing**, and it is one where the workload is increased gradually until peak load is reached. The first test is the minimum or introductory load, four or five intermediary loads are applied, and the last test is the peak load. Too few load tests will not allow bottlenecks to be identified, and too many will be an inefficient use of time and resources. The

purpose is to measure the impact of an increasing workload on the system. The system's configuration and network topology must be kept constant for all tests, because that is the only way to conclude a cause-and-effect relationship between a workload increase and a change in the system's performance. Load testing also helps to identify bugs that manifest themselves only under high load conditions.

While load or stress testing requires the recording of latency, throughput, and utilization metrics while gradually increasing the workload, **scalability testing** requires the measurement of the same metrics while keeping the load constant and modifying the configuration of one component at a time. N-tier architectures usually make use of several technologies and components. Consequently, anyone of these tiers may become a bottleneck, and each should be thoroughly understood and optimized. Another form of scalability testing includes experimenting with scaling the system horizontally (adding more resources) or vertically (adding more power to present resources). For example the system may respond better to the addition of servers to the existing cluster or load-balanced environment or the increase of processor capabilities (CPU speed, memory, etc.).

Thus, load/stress and scalability testing are useful for bug fixing, performance tuning, and capacity planning. This latter activity consists of deciding how much computing resources are need given expected workloads.

In summary, major types of tests include subroutine or unit, new function, regression, integration, system, usability, acceptance, stress/capacity/load, error-handling/survivability, disaster recovery, security, and viral/worm/Trojan Horse protection. Processes, procedures, and organizational structures must be designed and in place to support testing activities. These include the forms and practices for the orderly identification, classification, research, and remediation of problems.

Remember two important points. One, the earlier errors are detected and fixed, the less cost, time and effort to correct them; therefore, deliverables (requirements, designs, code, etc. should be tested as soon as they are created. Two, defects caught before releases have no impact on the user - those arising in production or pilot are highly visible.

30. Develop a detailed and complete conversion plan - Although the main focus of the conversion plan may involve data, processes and procedures also must be included. Data conversion often is one of the most important, time consuming and difficult implementation tasks. Integrity of the data must be preserved in transitioning to the new system and technical environment. Conversion plans must include objectives,

approaches, tasks, responsibilities, due dates, and other information necessary to plan, monitor and report status of this effort. They must identify and consider the amount of data that must be cleansed, validated, converted, and moved, as well as the number and skills of personnel resources and types and sizing of hardware/software facilities required to accomplish data conversion in a timely fashion. Data conversion can be expensive and time consuming.

31. Provide for sufficient and proper training and other implementation support services - Training is essential, and the needs of the users must be a key consideration. A comprehensive, responsive, and cost-effective training plan must be developed and implemented. It must include who will be trained, how they will be taught, what they will be expected to learn, when training will be done, and assessment processes or capabilities to determine performance of the plan. It lists detailed work tasks, responsibilities and due dates. The training plan must meet the following requirements:

    - Realistically estimates time, materials and work efforts.

    - Employs efficient and effective approaches (methodologies to consider include computer based, Internet based, classroom, practice capabilities, etc.). Generally, the more options offered trainees, the better.

    - Delivers the right amount of training at the appropriate times (need to provide in amounts that can be assimilated and near the time of use).

    - Makes adequate provisions for ongoing or refresher training to accommodate turnover of user and support staff.

    - Assesses the performance of the training effort. How is it working? What needs to be added, deleted or changed?

    Personnel availabilities, the business/program annual cycle, day-to-day operations, and other considerations may be key factors in determining the training approach and the training schedule. For example, the train-the-trainer approach may not be feasible if the trainers do not have time to train others. Agency and/or remote site operating schedules may offer limited windows of opportunity for conducting training. The training plan and schedule must be realistic in light of the personnel, program/business operating, technical, political/governance, and other key environments experienced by the project.

In some cases, users may not be happy with the new system or able to gain the most benefit from it because they simply do not know how to use their computers or other technical devices. Non-technical users often do not have rudimentary technical skills. Basic training in the usage of the operating system (such as Windows pull-down menus and other basic functions) or the workings of PCs and networks, other technical devices or other core software (such as word processing, spreadsheet, etc.) may be necessary.

The users must be involved and considered in determining the amounts and types of training. Many factors impact user training approaches and time requirements. These include, user familiarity with the technology; amount of change in processes and procedures and system operations from the old system; the complexity of the new system; the degree of understanding of the underlying business/program concepts, methodologies, and disciplines; complexity of tasks performed; etc. Training plans must respect that change is difficult for humans and learning curves can vary by individuals and groups.

Sufficient implementation support services are essential for a successful installation. This is especially important for the first few days of operation or the completion of the first new operational cycles of a new application. Implementation support services include an effective help desk with sufficient and well-trained staff and adequate numbers of knowledgeable personnel on-site to provide timely and ample assistance to users, as they become more familiar with the new businesses processes and the features and capabilities (and idiosyncrasies) of the application. Satisfactory help when needed creates confidence by users in their capabilities to operate the application and faith in its integrity and accuracy, and it fosters good will to facilitate the quick acceptance of and agreement with the new order of things.

32. Utilize pilot or initial implementation sites, if appropriate and useful - Pilot or initial implementation sites may serve as proving grounds for verifying requirements, features and capabilities; confirming system performance; and ensuring the system is ready for statewide deployment. The number, location and types of sites should be evaluated carefully, and a variety of considerations must be accommodated. These include, representation of different sizes, types, and geographical locations of remote sites; wiliness of management and operating staff to participate as pilots; experience and skills of pilot personnel; resources of project team to support pilots; political implications; and funding availability.

    A key consideration for selecting pilot sites is the decision on the number of sites. One consideration is to have as few sites as possible to limit the amount of time and support required to bound the adverse impacts of

problems identified. Another factor is the desire to obtain as full of representation of the operating environment as possible by covering the complete spectrum of sizes and types of remote sites. The trade off is the risk of unwanted consequences from trying to support too many sites and having too many sites with system/operating problems versus the risk of not identifying all key problems before beginning statewide rollout. A compromise approach may be to have a phased pilot, where the software is installed in a very few pilot sites for a period of time, and if proven acceptable under limited pilot use, extend the number/size of the pilot sites gradually. While this approach may extend the project schedule, it minimizes the pilot failure risk.

33. Ensure code is satisfactory or applications are ready before release or rollout - Do not release code or rollout systems with known problems that degrade performance below acceptable limits, create user dissatisfaction, or impede the delivery of benefits. The release of software that contains major defects will not only harm the relationship with the users, but also significantly increase operations and support costs. Studies suggest that fixing a bug in the field costs more than 10 times more than fixing it in the development process. Also, major bugs increase support workloads for help desk and other support functions.

    Identify the 'show stopper' problems, find root causes, and fix them. Unacceptable system performance is not acceptable. Before release, the application must be stable (operate effectively under expected conditions and within tolerance parameters) and satisfactory in the following areas:

    - Functionality (suitability, accurateness, interoperability, legal mandates and regulatory compliance, business continuity and disaster recovery, privacy and confidentiality, and security).
    - Reliability (maturity, fault tolerance, recoverability).
    - Usability (understandability, learn ability, operability).
    - Efficiency (time behavior, resource behavior).
    - Maintainability (analyzability, changeability, stability, testability).
    - Portability (adaptability, install ability, conformance, replace ability).
    - Scalability (ability to handle increased transaction volumes, additional users, more installed sites, additional data elements, etc.).

- Extensibility (ability to incorporate new technology and/or technical components).

- Adaptability (flexibility to meet changing business/program requirements and to be modernized by re-architecting the structure of the application)

- Resilience (providing rapid recovery from disruptive events and/or providing a level of certainty that transactions will be processed accurately and timely; thereby, leading to higher transaction confidence rates and minimum downtime).

The ideal system should: be easy to use by a diverse set of users, be accessible by a wide variety of technologies, require little or minimal training on the part of users, coexist with integrating/interfacing applications and the other components of the agency/statewide technical infrastructure, and be simple and inexpensive to maintain and upgrade. In addition, documentation to support system maintenance and operations must be complete, approved, and available.

For most situations, the fastest rollout schedule is made possible by implementing proven, full functioning, and reliable software, rather than knowingly installing problem software with shortcomings that must be rectified during or soon after the rollout. This approach minimizes support resources (such as help desk staffing), provides for better user acceptance, and facilitates the transfer of the system to an operational status (ongoing maintenance and support personnel will not have to start with a long list of critical patches or near-term releases to correct bugs and other shortcomings).

It is important to have a feel for or knowledge of the quality of software before releasing it. Thoroughly testing it, maintaining a comprehensive log of defects, and employing a defect tracking process are essential prerequisites for achieving the required level of understanding or realistic assessment of the software's status. A determination must be made of which defects need to be addressed before releasing the application and which ones can wait until a maintenance release or patch.

34. Provide superior customer service - If serious problems arise after rollout, employ a 'no hassle - no fuss' policy towards the users or sponsors. Fix major or key user problems immediately. User expectations regarding software quality must be managed, but the project team must be honest about the quality of the product or service.

35. Conduct post-implementation assessments and develop lessons learned as a reference for future projects – Post-implementation assessments

(PIAs), sometimes called closeout reviews or postmortems, are necessary to assess the outcome of the project, as well as the performance of the project team and the performing organization. PIAs are top-to-bottom evaluations of the hard and soft benefits derived from a project, the security of the asset, and the project management process for deploying it. They are useful in proving the value of IT investments, collecting statistics for planning future endeavors, and documenting lessons learned.

PIA evaluations determine whether the project delivered expected benefits and value on time and within budget. This is accomplished primarily through soliciting and evaluating feedback from users, project team members, and other stakeholders. A key purpose of the assessment is to document best practices and lessons learned for use on future projects. Key project metrics are also captured to compare and evaluate performance measurements across projects and to develop better estimates for work activities in succeeding projects.

An additional objective of the PIA is to take anthropological field trips among the users to see how they are using the system and what they are doing with it. The intent is to see if the application or asset is delivering maximum value, and if not determine why and how to improve the results. One approach is to determine if all the features and capabilities are being used and what new ones may be worthwhile adding. Resistance to change and hesitancy by executives and managers in implementing organizational structural and/or work process changes may delay or prohibit the achievement of expected cost savings or other benefits and should be identified.

Other important objectives of the PIA are to determine if the asset is, in fact, implemented (project is complete) and does the agency have the personnel, technical infrastructure, processes, organization, etc. necessary to operate the asset in a cost-effective and secure manner. Findings in these areas must be documented and pertinent recommendations made.

Lessons learned may be defined as a good work practice or innovative approach that is captured and shared to promote repeat applications or an adverse work practice or experience that is captured and shared to avoid a recurrence. Another description is: A lesson is learned when the lesson has been validated, based on observable experience, and it actually results in a change of behavior. Documented lessons learned (good and bad) provide advice and assistance for the leaders and participants in future endeavors to avoid the problems and shortcomings experienced in the past and/or take advantage of the successful ideas and actions of past work. In addition, positive and negative experiences with processes, techniques, and concepts for addressing problems and challenges are

helpful for dealing with the same or similar issues in the future. Successes and the reasons for them should receive the same level of attention as mistakes and the experiences gained from them. Lessons learned documentation gives 'institutional memory' to the organization, and should be referenced frequently by succeeding projects for guidance and counsel.

Particular importance should be given to how well the project met its metrics for a) project management (e.g., budget, schedule, scope, quality, deliverables, etc.), b) asset operational performance, and c) business/program objectives. The key reasons for the results being favorable or unfavorable should be determined and documented.

The functional and technical performance of the delivered asset and the business/program benefits, values, or objectives should be determined and compared/contrasted to the expectations in the project justification documentation, such as business case or project charter. "Root causes" for good and bad results should be identified. Common or recurring problems should be addressed on a department or statewide basis, as appropriate.

A key part of each PIA is the calculation of the actual return on investment (ROI) or other financial, benefit, or value measures achieved and the comparison/contrast with the ROI or other measures used for justifying the project in the business case, project charter, or other documentation used in the evaluation, selection, and funding, and approval processes. The return may be a financial calculation (such as ROI, payback period, net present value, internal rate of return, etc.); a cost savings or avoidance measure; a revenue enhancement contribution; and/or a more intangible value (such as citizen service enhancement, economic development opportunity, better assurance of security for public property/records, political initiative achievement, etc.).

A successful PIA requires attention to three items: engaging the right people, timing of the assessment, and making use of the right documentation. If possible, an independent authority or person should lead the assessment. Members of the PIA team should include both IT and business/program personnel. A range of involved people (users, IT, project team members, other stakeholders, etc.) should be interviewed. Timing has to be long enough after implementation to allow for benefits to be recognized, but not too long so that key people have been dispersed or useful information lost to memory lapses. Documentation that should be examined includes material that outlines the investment's expected costs; benefits; functional and technical requirements; project's work plan (including timeline, milestones, deliverables, and other metrics); a record

of the security and financial controls; and a compendium of the changes to the application and project plan.

In summary, the PIA answers one primary question and provides three major benefits. It determines if the taxpayers got what they paid for and expected and why or why not. It documents metrics that will be useful in estimating resource needs for succeeding projects, it determines if adjustments must be made to the business process or application itself so the investment can deliver as promised (e.g., additional modifications, expanded training, follow-up reengineering efforts, etc.), and it collects and records lessons learned to assist in ensuring that future endeavors deliver expected value and benefits in the most cost-effective manner to the state's citizens, businesses, and employees.

The table below lists some potential questions for key topic areas that may be appropriate for a typical PIA.

Area	Questions
Organization, Governance, and Communication	1. How well did the various components of the project's organization structure function, and what could have been done better or should be emulated by other projects? 2. How well were decisions identified and made, and how timely and good were they (i.e., how well did project governance work and why or why not)? 3. How well were communications requirements met (was there a plan, was it adequate, was it followed, was it successful)?
Change Management	1. How many and what kinds of changes were introduced? 2. How well were they administered, tracked, evaluated, priority sequenced, resolved, and implemented (i.e., was there a process or processes and how well did it or they work)?
Risk Management	1. How well was risk managed (was there a plan; was it followed; was it kept current; were risks identified, analyzed, tracked/monitored, etc.)? 2. How many anticipated and unanticipated risks actually emerged and how well were they handled? 3. What risks should be handled on agency or statewide bases, instead of a project-by-project, basis based on lessons learned from this project?
Project Management	1. How well were budget, schedule, scope, and quality managed? 2. What was actual performance versus plan for the four above items and explain the root causes for favorable or unfavorable deviations? 3. Were status reports useful, timely, and accurate? 4. Was extensive or frequent re-baselining necessary, and if so, why?
Planning and Execution	1. How well does the asset perform against expectations and what are the reasons for exceeding them or shortcomings? 2. How well does the investment meet its business/program objectives, benefits, or values and explain plus or minus deviations?

For failed projects (those never completed), the following additional questions may be appropriate for the PIA.

- Is the fallback plan really workable?
- Was the initial concept and scope of the project valid?
- What, if anything, can be salvaged?
- Were the initial assumptions validated? How well did the validation process work?
- Were stop gates determined upfront? Were they appropriately sequenced or realistic?
- Were the needed people and skills assigned to the project?
- Where did the project management and project portfolio management (project selection, approval, and implementation monitoring) break down? Was it a tool(s), process, or people issue? Were the sponsors effective? Was the project management methodology mature enough to handle the project?

The following quotations may be appropriate for the use of experience and lessons learned.

“Good judgment comes from experience, and experience is gained from bad judgment.” Author unknown.

“Experience is a good way to learn, but a hard way to be taught.” Author unknown.

“History is not a schoolmistress….She is a prison matron who punishes for unlearned lessons.” Vasily Klyutchevsky, Russian historian.